PHASE 4 REPORT

(non-confidential)

BIOMASS FEASIBILITY STUDY

Submitted to

SCOTTISH ENTERPRISE BORDERS

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1.0 EXECUTIVE SUMMARY

Scottish Enterprise Borders (SEB) is seeking to encourage the development of biomass-based energy in the Scottish Borders and to encourage the development of local forestry.

Phase 1 of the study involved a literature review of existing research and reports relating to biomass opportunities. Further investigation of the available biomass resource in the Borders region has identified general areas which would be viable for biomass projects. The study also assessed potential fuel supplies, which may become available, if short rotation biomass crops are established, but concluded that these crops will not be planted until there is certainty about the market.

The supply chain for biomass has been investigated and it was concluded that the existing setup is weak. The current level of activity is low and, for logs in particular, could be described as 'cottage industry'. Investment is planned to supply biomass outside of the region to the Lockerbie power station, which is now being commissioned. The supply chain is unlikely to develop further unless additional demand is created.

A market assessment was undertaken by writing to all major energy users based on information supplied by Scottish Enterprise Borders. The response was poor and required considerable follow up. However, the market assessment quickly concluded that the market in the Borders was very limited. Demand, so far as the Borders is concerned, should be developed to accept good quality wood chips. Pellet production in the Borders, in the absence of a major source of sawdust, is unlikely.

Demand for logs is growing slowly but anecdotal information suggests that many consumers with multi-fuel stoves switch to coal due to problems securing dry logs, and storage issues.

Demand for chips in the Borders is low, though some chips are being supplied to Lanarkshire and Midlothian. A questionnaire was to be sent to 200 sites but only 60 potential biomass users were identified and only twelve replies were received, despite several follow up telephone calls. The general conclusion is that demand is not being developed due to a lack of supply of quality wood chips and the high capital cost of wood chip boilers compared with oil or gas boilers.

Initial assessments also identified a lack of opportunity for developing combined heat and power (CHP), due to the absence of major heat users in the Region. Surveys of directories, discussions with Scottish Enterprise Borders, Council officials and a postal questionnaire failed to identify any suitable location for a CHP plant based on existing heat loads.

It is believed that responsibility for kick starting the market will lie with the public sector. This is happening with, for example, biomass being specified as the preferred method of heating in new schools. Other possible opportunities for biomass heating lie in new commercial and

residential developments. However, the impact of these developments will be virtually insignificant in terms of creating jobs and displacing fossil fuels. A new idea is required.

Consideration of the available options concluded that a large-scale plant was not practical but that small scale dispersed generation was a technical and practical option. A constraint on the development of small-scale power generation is the need to find a suitable use for the heat. If a suitable use for the heat cannot be found then the option of creating a heat-using business to operate along side the power plant must be considered, and this is being investigated. The obvious compatible business is the production of good quality biofuel (dry wood chips). Another critical factor is the availability of suitable sites, so this aspect was investigated at an early stage. Without a suitable site development of the concept would be pointless. Investigations revealed that several locations were available in the Borders, although no specific site was identified.

The concept of a CHP plant producing small-scale power (in the range 250kW_e to 3MW_e) is believed to be financially viable and would receive support from investors, if the right conditions were created.

It became clear early in the study that the industry was in a pre-self-developing state and therefore a conventional project identification approach was not appropriate. A more proactive approach to stimulate the development of the industry was required. A workshop with stakeholders was planned in order to initiate the development of a project thus maximising benefits within the context of 'the measure of success'. The project team would concentrate on the development of a concept which would generate power, encourage the development of the supply chain and facilitate the development of biomass heating through the local supply of good quality wood chips.

The first stakeholder workshop was held on 6 February 2007 and the main findings of Phase 1 were presented. The presentation, which covered the markets and the development of the concept as referred to above, is posted on www.bordersbiomassstudy.com. The concept was received favourably but the main constraints were the location (suitable heat load) and markets for the quality biofuel (woodchips).

The development of a successful distributed power plant in the Borders would kick start the use of biomass in the Borders for both heat and power, would provide markets for low grade wood, help bring some neglected woodlands back into management, create some employment and create an exemplar which could be replicated within the Borders and further afield.

Phases 2 and 3 of the Study have identified two specific opportunities for the development of biomass power plants which are considered to be worth developing as they meet the basic criteria for a potentially successful project. These are:

a) An embedded biomass CHP plant at Hawick Knitwear Ltd, Hawick, producing 500kWe for use within the factory with any excess exported to the grid and the heat being used for process and space heating within the factory.

b) A stand alone project either at Galalaw Business Park, Hawick, or at a site near Newton St Boswells, exporting power to the grid with the heat being used to dry wood to manufacture pellets which would be used for heating projects throughout the Borders. The preferred site is the one near Newton St Boswells as the area is larger and the development potential greater. The site at Galalaw would be suitable but later expansion beyond the original target of 3MWe and 30,000 tonnes of pellets would be curtailed.

These projects would act as proof of concept for small and medium scale biomass technology. They would generate dispersed power close to both the resource and the final consumer with a high proportion of the heat being recovered, thereby creating combined heat and power (CHP). The second project would also stimulate the development of biomass fired heating in the Scottish Borders Region.

Both projects are expected to be able to attract private finance, although some development finance from the public sector will be required. Project completion dates of 2008/9 are considered achievable if decisions are made quickly. Both projects would comply with National and Scottish policy objectives of increasing electrical power generation from renewable sources as well as stimulating employment and investment in biomass growing and supply chains.

In neither case would there need to be major investment in infrastructure. For the larger project the main infrastructure cost would be connecting to the grid system.

It is recommended that the following be actioned:

Small Scale Project

- SEB should contact the management of Hawick Knitwear to discuss progressing the project, provide financial and practical assistance during the project development phase and application for planning permission and assist with the application for financial assistance (such as from any second round of the Scottish Executive Biomass Support Scheme). The funding gap for project development through to a point where a project can be implemented (technical assessment, planning, full business plan, etc) is estimated at £100,000. It is anticipated that additional public sector funding will be required to implement the project and this funding gap will be determined when the detailed project proposal and a business plan is completed.

Medium Scale Project

- With the preferred site near Newton St Boswells not within the control of either SEB, another Public Sector body or a developer the site should be secured through an option to lease or purchase for the development of a biomass to energy plant and pellet producing facility. It would be preferable for a private developer to take control of the site through the option but if this is not forthcoming then the public sector should consider taking the lead. If the site near Newton St Boswells cannot be secured then development of the site at Galalaw should be considered.
- The organisation with the option should then take the lead in obtaining planning permission with, if it is a public sector organisation, a view to selling the asset (option with planning permission) to an investor/ developer. This would be attractive to a developer as the risk and effort of securing an interest over the site and obtaining planning permission is removed.
- As the project would be eligible for Regional Selective Assistance, SEB should submit an application.

As both projects are projected to make acceptable financial returns as well as bring wider economic benefits, but are less attractive than investing in other areas/regions, it is suggested that the Public Sector help support the further development of these projects to expedite their implementation in the Borders.

The projects at Hawick Knitwear and Galalaw/near Newton St Boswells are not the only possible projects in the Scottish Borders but are the only two which have emerged in the course of this study which can be progressed immediately and have a good possibility of coming to fruition if support is provided for the early project planning stages and obtaining development consents.

2.0 INTRODUCTION

It was apparent from comments made at the Borders Energy Summit held in Galashiels in January 2006 that the public perception is that renewable energy equals wind. Scottish Borders Council and Scottish Enterprise Borders therefore recognised the need to broaden the scope of public knowledge into other areas of renewable energy. Amongst the projects aimed at both improving that public perception and delivering renewable energy on the ground was the commissioning of a study into an integrated biomass plant in the Scottish Borders.

The background and context of the study was set out in the invitation to tender. The main objective of the first phase was to establish both current and potential demand for biomass, and the current availability of useable biomass, by geographical location.

In the domestic sector, the use of log fuel is developing and no intervention is considered necessary. Commercial companies are offering pellet stoves and there is some evidence that these are being installed, though, with no pellet production in the Borders, the pellets are being imported. Pellets are now a commodity, sourced from the cheapest supplier.

The small scale-heating sector (plants between 50 and 500kWth) is developing slowly and mainly driven by local government initiatives, but a major constraint is the poorly developed supply chain and the lack of good quality chips. This is a classic “chicken and egg” situation.

The generation of electrical power from biomass in the Borders on a large scale is not practical, economically feasible nor environmentally acceptable. The constraints on the development of a large scale project are several including lack of suitable sites with the necessary supporting infrastructure and insufficient density of biomass to support the plant without excessive transport distances for the fuel. A large scale plant would also be less profitable than smaller scale biomass plants generating distributed power.

However the generation of electrical power from biomass on a medium scale (sub 5MWe) is considered feasible if the waste heat can be used. Because the development of a biomass combined heat and power (CHP) plant is understood to be a matter of urgency, the heat demand must either already be in existence or else required to be a new venture under the control of the project developer.

The importance of identifying a specific site on which to develop a biomass plant (because of the impact of the site on the economics of the project) has led to the conclusion that Phases 2 and 3 should be undertaken simultaneously so, with the agreement of Scottish Enterprise Borders, the project methodology was modified accordingly.

A significant development which has occurred since the commencement of this Study has been the publication by the Department of Trade and Industry of the White Paper on *Energy:*

Meeting the Energy Challenge May 2007. The following is an extract from the White Paper which is a summary of the biomass strategy:

The Strategy identifies significant potential to increase the domestic supply of biomass, through the more efficient utilisation of agricultural land, unmanaged woodland and waste. Our analysis shows a hierarchy of use in terms of cost of carbon saving, with biomass heating as the most cost efficient use for energy. The Strategy is intended to realise a major expansion in the supply and use of biomass by:

- *providing targeted support in key areas, such as expansion of energy crops and biomass heat installations, through direct grants and other measures such as the schools building programme;*
- *sourcing an additional 1 million tonnes of wood from unmanaged woodlands;*
- *increasing land used for production of perennial energy crops by some 350,000 hectares;*
- *increasing the utilisation of organic waste materials; and*
- *stimulating technology development.*

Some of the above points are directly relevant to the Scottish Borders in the short term. For example Scottish Borders Council has already made the decision to convert the heating of Council buildings from fossil fuels to biomass.

The White Paper also refers extensively to encouraging the development of distributed power. A specific encouragement to the development of renewable energy from biomass is the proposal to introduce from April 2009 “double ROCs”. ROCs, (Renewable Obligation Certificates) are the mechanism by which the Government encourages the development of renewable energy. A generator of renewable electricity can issue the equivalent number of ROCs to the amount of electricity generated, which are currently valued at around 3.5p/kWh. The latest Government proposal is that biomass will attract these at twice the rate of more commercially developed technologies, for example onshore wind.

The White Paper is timely in that the intended direct outcome of this Study is the development of biomass power generation. This will, in turn, encourage the increased supply of biomass from local forests and woodlands with particular emphasis on unmanaged woodlands which will have low quality wood which, though not satisfactory for some end uses, will be perfectly suitable for energy generation. It will also encourage farmers to plant short rotation biomass crops and encourage the expansion of traditional forestry on underutilised upland areas. Though this is not covered in the White Paper, the encouragement of more traditional forestry in the Borders, where there is ample land suitable for traditional softwood forestry, will benefit the Region. Any development of

biomass power stations, subject to the choice of technology, would also create an economic outlet for embedded biomass in the waste stream (in line with the objectives of the White Paper), which will offer the opportunity to the local Council and local businesses to reduce waste management costs. The small and medium scale projects which are identified in this Study would be suitable for the use of developing technologies such as gasification – an advanced thermal process eligible for ROCs.

3.0 BACKGROUND

For many years, the UK Energy Market was characterised by large scale plant and capital investment utilising economies of scale and linked to the National Grid. These characteristics applied to all main energy sectors, including fossil fuel powered, nuclear and renewable (i.e. mainly hydro-electric). In recent years, the market has become more fragmented particularly in relation to renewable energy as the latter has fostered both capital intensive platforms connected to the Grid and local/community solutions.

The UK Government White Paper published in 2003 set targets for reducing CO_2 emissions. More recently, the Scottish Executive set more demanding targets for Scotland providing an agenda for sustainable energy growth. The Scottish Enterprise Energy Industry Strategy 2005/2010 identified renewable energy as one of the future growth areas as Scotland has the resources to capitalise on sustainable energy generation.

Given this background and ever-increasing energy prices, the diversification of energy supply models is likely to continue with more solutions in future aimed at single settlement, farm or industrial estate consumers, particularly in rural parts of Scotland.

3.1 Energy Sector Representation in Scottish Borders Area

Analysis of ONS data from the Annual Business Inquiry 2004 is presented below. Table 3.1 shows the regional and national importance of the Energy sector within the SEB area.

Table 3-1: Energy Sector Representation 2004*

Area	Employees		**Businesses**	
	Number	SEB %	Number	**SEB %**
SEB	76	100	5	**100**
SE Area	35,254	0.2	427	**1.2**
Scotland	**38,163**	**0.2**	**600**	**0.8**

*SIC 2003 Divisions 10, 11, 12, 23, 31.1, 31.2 & 40. Source: Annual Business Inquiry. Office for National Statistics, 2005.

Table 3.2 demonstrates the relative importance of the Energy sector within the regional and national economies. It is apparent from this analysis that current sector representation and employment within the SEB area is insignificant in both regional and Scottish terms and that the region has no pre-existing specialisation or competitive advantage within the traditional energy sector. To underline the degree of under-representation: if the sector had the same representation as in Scotland as a whole it would have 9 times the number of employees and 3 times as many businesses as recorded currently through the ABI.

Table 3-2: **Energy Sector 2004 – Relative Intensity**

Area	Employees			**Businesses**		
	Sector	Total	% of Total	Sector	Total	**% of Total**
SEB	76	41,646	0.2	5	4,489	**0.1**
SE Area	35,254	2,131,944	1.7	427	147,844	**0.3**
Scotland	**38,163**	**2,330,851**	**1.6**	**600**	**168,002**	**0.4**

Source: Annual Business Inquiry. Office for National Statistics, 2005.

There are obvious reasons why the region is under-represented in this sector. These include:

- There are no fossil fuel reserves;
- There is low demand for energy services which are directly related to the incidence of population and industry;
- The region is primarily inland and so no water supplies for cooling and steam generation; and
- There are no major refineries and natural gas processing plants to provide access to piped or bulk-handled supplies.

3.2 Long Term Performance

Analysis of employment levels in the period between 1998 and 2004 at the Scottish and Borders level is provided in Table 3.3

Table 3-3: Energy Sector 1998 2004 SEB and Scotland

Area	Employees			**Businesses**		
	1998	2004	% change	1998	2004	**% change**
SEB	136	76	-44.1	5	5	**-**
Scotland	**45,132**	**38,163**	**-15.4**	**497**	**600**	**+20.7**

At the Scottish level the data suggests that whilst employment has fallen, the number of workplaces has increased. This could be the result of a combination of phenomena including:

- De-regulation and increased competition in the energy supply and distribution markets;

- Changes in the balance between fossil fuel production and exploration, as reserves are depleted and/or exhausted;

- More efficient production techniques involving a shift from labour to capital intensive activity;

- The expansion of the renewables sector in response to regulatory and fiscal provision and technological advances.

3.3 Summary

- The energy sector has not in the past been a significant employer in or contributor to the Borders economy.

- The relative under-representation of the sector in the region can be attributed to the fact that traditional energy plant has not located in the Borders as the region lacks the natural resource (fossil fuel) and population.

- It is expected that, within the traditional energy markets, there is unlikely to be an improvement in the competitive advantage of the region.

- Any future opportunities within the sector are most likely to occur in relation to renewable energy provision which draws on the regional environment or natural resource base.

- Government policy combined with the natural assets of the Borders region in terms of wave, tide and wind power means that the region will be more likely in future to win investment in renewable energy platforms.

3.4 Scottish Enterprise priorities and activity in the Energy Sector

3.4.1 Sector Prospects:

SE has recently prepared a strategy for the sector over the period 2005-2010 indicating that:

- Annual North Sea Oil production is forecast to fall from current levels of £7.5 bn to £4.5 bn by 2010.

- The renewables market is forecast to grow to £1bn by 2010 with employment of between 6,000 and 12,000 FTE.

- There should be an ongoing £1bn of annual output in conventional power generation.

3.4.2 Scottish Enterprise Energy Industries Strategy:

The strategy has ambitious targets for growth to be achieved by 2010. These include:

- to maintain Scotland's share of the UK oil & gas, power generation and renewable energy expenditure levels at around £9 billion per annum, by offsetting the projected decline in offshore oil & gas with growth in renewable energy, offshore and nuclear decommissioning

- to maintain Scottish employment in the domestic energy sector at around 100,000, growing in new sectors to balance the expected decline in North Sea Oil production

- to build overseas sales from Scottish oil & gas companies, growing from £2.7 billion in 2002 to £5 billion per annum by 2010.

3.4.3 Opportunities for Sector Development

Initial work into the opportunities within the Scottish Borders area, conducted by an internal working group, identified the expanding renewables sector as having potential for development. The SWOT analysis presented below examines this sector.

Strengths within the SEB area include:

- Availability of renewable energy sources including potential wave, tidal and wind power sites.

- Primary agricultural and forestry skills and land-based resources which may be applied to the production of alternative fuels.

Opportunities identified for development of the sector within the SEB area include:

- Proximity to soon-maturing forest products locations both within the region and in north Northumberland (Kielder)

- Potential for strategic partnering with SE Dumfries and Galloway in the identification and realisation of alternative energy opportunities.

- Opportunity to use domestic, commercial and industrial waste as a potential energy source by advanced thermal treatment.

- Evidence of a small number of local renewable energy focused businesses which would benefit from progression along the product value chain.

In addition a number of weaknesses and threats need to be acknowledged and addressed if these opportunities are to be realised.

Weaknesses which may restrict opportunities for development include:

- No recognised private or public sector research and development capability within the region (although these could be accessed through Heriot Watt and Sistech)

- No significant engineering company base to exploit product development opportunities.

Threats to the development of the Renewables sector in the region include:

- Emerging interest and capability in the renewables sector from across the SE Network. Although there is no single dominant area, early-mover advantages could see significant competitive advantage established outside the region.

3.4.4 Scottish Borders Sustainable Energy Forum

In January 2006 an Energy Summit was held in the Scottish Borders to discuss energy supply/conservation issues and potential renewable energy options for the region. Following the Summit, the Scottish Borders Sustainable Energy Forum was established with approximately 20 members from the Private and Public sector. The forum's objectives are to devise and implement a Sustainable Energy Strategy and Action Plan for the Scottish Borders area. A number of potential projects have been identified by the Forum, including a proposal for an Integrated Biomass Plant, which led to this Study.

The main objective of this Study is to explore the opportunity for an integrated biomass plant in the Scottish Borders, and to assess the economic, social and environmental outcomes of any proposition using both quantitative and qualitative measures.

Findings from this research will be used to:-

- Develop our understanding and knowledge of the sector.
- Consider whether an integrated biomass plant would be a viable option in the Scottish Borders.
- Promote any commercial opportunities to potential investors, operators, users and suppliers.
- Inform and share learning with the Scottish Borders Sustainable Energy Forum, and other stakeholders.
- Assist strategic planning around the renewable energy agenda.

4.0 BIOMASS RENEWABLE ENERGY DRIVERS AND IMPLICATIONS FOR THE SCOTTISH BORDERS

4.1 Drivers

There are a number of important drivers that will influence the development of an integrated biomass CHP plant in the Borders. These include rising fossil fuel prices, security of supply, the Renewables Obligation, a planning push, green credentials, an alternative to wind, economic development opportunity and grants.

4.1.1 Rising fossil fuel prices

Fossil fuel prices have been rising steadily for over 20 years. The year 2006 saw significant increases in the price of oil and gas supplies, although the following year the price fell back slightly. Nevertheless long term tends are still upward. As the majority of the UK's electricity is generated from fossil fuel sources, the electricity price has followed suit. Energy intensive businesses have reacted to increasing fossil fuel prices by implementing energy efficiency measures and looking at renewable energy (particularly CHP systems) as an alternative energy source. Currently the uptake of biomass CHP is small because of the high capital cost compared to gas or oil but it is only a matter of time before the higher capital costs are offset by lower operating costs. Note that in some cases companies have cut back operations and/or changed to less energy intensive operations in response to higher energy costs and a desire to avoid the capital cost of changing to a lower cost fuel.

4.1.2 Security of supply

An issue coupled to rising fossil fuel prices is security of supply. The world's fossil fuel sources are shrinking, whereas demand is still growing. In addition, world politics, terrorism and wars can disrupt supplies. Consequently, not only do prices rise but also the possibility of shortages for end users, particularly at the end of long supply lines, becomes a real threat. Renewable energy technologies and biomass in particular, because it utilises local resources, are much more secure than fossil fuels. The biomass resources could potentially be under the control of the same organisation that requires the energy, thereby insulating them from external world events and guaranteeing them a sustainable fuel source.

4.1.3 The Renewables Obligation

The Renewables Obligation, through the issue of Renewables Obligation Certificates (ROCs) is the primary economic driver for the implementation of renewable energy policy in the UK and is based on specific installed capacity targets being met by 2010, 2015 and

2020. For Scotland, the Scottish Executive has set targets of 19% of electricity consumption by 2010 and 40% by 2020. Unlike the rest of the UK, these targets have not been disaggregated across individual regions or counties. There is therefore no specific target for the Borders region but if it is going to 'pull its own weight', it needs to install at least enough renewable energy generating capacity to meet 19% of its electricity consumption by 2010.

Despite significant investment in wind and other renewables, these targets are still a long way off, although perhaps Scotland is closest to achieving the 2010 target. The value of ROCs is still high and will remain so until the targets are met thereby maintaining the economic pressure to implement renewable energy projects. The Renewables Obligation is currently being reviewed. One suggestion is that the value of a ROC for onshore wind will be reduced and the value for other technologies, e.g. biomass and wave, will be increased, thus providing an even bigger incentive to develop biomass projects.

4.1.4 Planning push

The development of land use planning policy is generally through the publication of planning guidance and advice. This will direct local planning authorities to produce development plans that take account of the need to ensure that government policy, in the field of renewable energy for example, is properly implemented on the ground. In Scotland this guidance takes the form of NPPG 6 (currently being superseded by SPP6), Renewable Energy Developments (Revised 2000) supported by PAN 45 (Revised 2002). NPPG 6 is remarkably short on substance. It refers to the potential in Scotland to produce energy from biomass (particularly forest wastes) but then devotes only a single short paragraph (paragraph 39 on page 14) to this resource. It does, nevertheless, suggest that biomass has the potential to support the rural economy, maintain employment and skills in agriculture and forestry and possibly provide the basis for local farm or estate based CHP. This is clearly an important recognition of the role that such developments could play in a rural area such as the Scottish Borders. The Region is not only populated by many such farms and estates but also well endowed with the resources to fuel such developments. PAN 45 does, however, warn (in paragraph 148 on page 51) that a power plant using biomass is an industrial development and, whilst bringing secure skilled jobs to an economically depressed rural community, it could have adverse impacts.

NPPG 6 is currently being revised and Draft SPP 6: Renewable Energy has recently completed a consultation stage. As a renewable technology, biomass fares only marginally better than before meriting two paragraphs (paragraphs 36 and 37 on page 10). It does however refer to the economic costs of transporting feedstock material and refers specifically to sawmill co-product and forest residues as being a source of fuel that could be accessed immediately. The Scottish Borders has an abundance of readily available material within a short distance of sites with potential for biomass plant development.

Recent changes in planning guidance across the UK, for example PPS22 in England and TAN8 in Wales, are increasing the pressure on developers to include on-site renewable energy generation in their commercial and housing projects. Biomass is one of the few technologies that can be implemented almost anywhere and so should be a prime contender for this type of application.

4.1.5 Green credentials

Another driver for companies and other organisations to implement renewables is their need to demonstrate corporate responsibility. Although often paid lip service by companies, the green credentials generated by pursuing a zero carbon strategy (e.g. M&S) can pay off for the organisation and for renewables in general.

4.1.6 An alternative to wind

Although large-scale wind has made the largest contribution to renewables in the UK and is the main focus of the utilities, it is fast running out of sites that are suitable and, particularly in Scotland, connection capacity on the high voltage (33kV+) grid. Biomass, which is less site dependant and potentially more suited to lower voltage local connections could exploit niches where wind is not currently viable. Overall it is unlikely to compete with wind as the most significant renewable energy source but there are still local opportunities to be exploited, particularly in regions like the Borders with abundant forestry resources. The sector shows a lower rate of return than wind and is seen as having higher technical risks so is not expected to attract the same level of investment until the development constraints on wind (such as planning and connectivity) constrict the rate of development and the economic benefits of biomass improve relative to wind.

4.1.7 Economic development opportunity

Renewable energy has been recognised by most regional development agencies as a powerful tool for economic development. Unlike wind where most of the employment opportunities are transient, i.e. only in the construction phase, biomass requires an ongoing fuel supply and plant operations staff which leads to permanent employment throughout the power plant's 20-25 year life.

4.1.8 Grants

In Scotland the Scottish Community and Household Renewables Initiative (SCHRI) offers a 30% grant on new heating installations based on renewable energy subject to a cost ceiling and provided it is installed by an authorized installer. The recently announced Scottish Biomass Support Scheme has a fund of £7.5m to support applications for biomass initiatives. This fund has now closed to new applicants. The Scottish Executive is undecided if there will be further funding under this scheme.

Interest free loans of up to £100,000 are available from the Carbon Trust under certain circumstances. The applicability of these grants to the type of project, which is emerging, is to be investigated when the project is defined more closely.

Planting grants are available for forestry including short rotation crops provided the planting is within 40km of the end user and there is a contract available to purchase the crop.

4.1.9 Technology development

Although biomass fuelled steam turbines are an established technology, they have poor electrical efficiencies (~20%) unless implemented on a very large scale (+20MW) and their waste heat is produced at fairly low temperatures (~100°C). Biomass gasification and pyrolysis coupled to spark ignition engines is a relatively new technology that offers improved electrical efficiencies (~30%) and high temperature waste heat (~400°C) at small scale. Costs are reducing as the technology develops, however there are still only a very few systems commercially available that offer process warrantees, without which project finance would be difficult to obtain.

4.2 Supporting Strategies and Programmes

The use of renewable energies is one of the most important alternatives that can be implemented to reduce greenhouse gas emissions and ensure a sustainable energy supply and the EU has committed to a 12% target for renewable energy by 2010. Biomass is already the major renewable energy source in Europe, providing two thirds of the total energy produced from renewables, and meeting 4% of the total EU's primary energy consumption in 2003. However the EU is so concerned that rising biomass consumption may start to have damaging effects on the environment that the European Environment Agency has developed a set of environmental criteria that must be met in order to minimize additional pressure from biomass production. The Agency also recognizes that it is crucial that Europe manages any rise in production of biomass in line with other EC policies and objectives especially those aimed at protecting biodiversity, and intends to produce guidelines to that effect. These will impact on planning policy at Scottish, and subsequently at local level.

In 2004 the Royal Commission on Environmental Pollution published a report entitled "*Biomass as a Renewable Energy Source*", which concluded that, not only was there sufficient resource to initiate development in the sector, but that biomass conversion technologies are particularly adaptable in terms of the scale, type of fuel, and heat to power output. This means that local distributed generation in response to both local supply and local demand can develop a real sense of community ownership. Small rural communities,

such as those in the Scottish Borders are, therefore, ideally placed to benefit from these advantages.

In October 2005 the Biomass Task Force set up by the UK Government, and led by farmer Sir Ben Gill, reported that the unique property of biomass as the only widespread source of high-grade renewable heat was effectively being ignored in the development of renewable energy policy. The report pointed to the development of biomass heat systems and networks overseas, in industry, commerce, government buildings and local housing developments and proposed that the Government Estate was ideally placed to set an example for the UK. The Government in its response (April 2006) announced a number of new measures to apply in England and Wales. Measures are already underway in the Scottish Borders to demonstrate the willingness of local government to play its part.

In his recent government-commissioned review into the economics of climate change, former World Bank chief economist Sir Nicholas Stern reported that the "technical potential of biomass could be very substantial". The burning of biomass could generate the energy equivalent of between 4.8 and 12 billion tones of oil equivalent a year by 2050 (22% – 54% of anticipated energy demand). Of this total a substantial amount would come from forest outputs. This will further justify action at UK level, which will trickle down and influence policies and actions at Scottish level.

Indeed, much policy support is already being given to biomass in Scotland. To better inform it of the role of biomass, the Scottish Executive Environment and Rural Affairs Department commissioned a Review of Greenhouse Gas Life Cycle Emissions, Air Pollution Impacts and Economics of Biomass Production and Consumption in Scotland, which reported in June 2006. Amongst its conclusions were the findings that small scale commercial and industrial heat applications using biomass offer the best economic returns of all renewable fuels. Also, in areas away from gas supply, wood fuel already competes well with fossil fuel alternatives on a life cycle basis. Both these conclusions are applicable to the Scottish Borders where rural communities are remote from mains gas and most businesses tend to be small-scale in nature.

If there are gaps in policy in relation to land use planning, these are more that adequately filled by the Scottish Executive Enterprise and Lifelong Learning Department's publication of a draft Biomass Action Plan for Scotland which fully recognizes the economic growth and diversity of energy supply that a commitment to renewables can provide. The Plan is drafted in the context of the EU Biomass Action Plan and focuses on the role that biomass can play in the delivery of significant carbon savings from the efficient production of heat and will be used to inform the development of a Renewable Heat Strategy for Scotland. Biomass supply is a key issue in Scotland where the development of supply chains is less well developed than in Europe. Forestry Commission Scotland is looking at ways to boost supply,

particularly of forest residues, and there would appear to be no better place to start than in the Scottish Borders.

At local level it is clear that a major thrust for a greater focus on renewable energy in the Scottish Borders is coming from Scottish Borders Council. This is evident primarily in planning policy and the strategies, assessments and projects that support it.

Set in the context of National Planning Policy Guidance (NPPG) 6: Renewable Energy, and recognising the considerable potential for renewable energy in the region, Scottish Borders Structure Plan (2001) Policy I19 supports the development of renewable energy sources provided these can be developed in an environmentally acceptable way. Policy I21 encourages proposals for small-scale renewable energy technologies including biomass. Draft Scottish Planning Policy (SPP) 6: Renewable Energy issued for consultation in 2006 expects planning authorities to make positive provision for renewable energy developments by supporting a diverse range of renewable technologies and encouraging the development of growing and new technologies. In relation to biomass the draft requires development plans to confirm that the development of new biomass energy plants will be supported provided they meet a range of environmental criteria. Scottish Borders Council, in its response to the draft, expresses support for these broad policies and is particularly supportive of proposals that ensure that certain new developments include on-site renewable energy equipment that reduce annual CO_2 emissions by a minimum 10%.

Likewise, Scottish Borders Local Plan (Finalised 2005) Policy D4 is supportive of renewable energy development proposals provided they can be accommodated without unacceptable impacts on the environment. Policy G1 expects new developments to demonstrate that they have maximized the efficient use of energy including the use of renewable energy. To complement Local Plan policies Scottish Borders Council has recently published (December 2006) Draft Supplementary Guidance on Renewable Energy aimed at developers, householders, community groups and planners to ensure that they all aware of their responsibilities towards energy conservation.

Where biomass is concerned, Scottish Borders Woodland Strategy (2005) provides both policy guidance and a planning tool. The Strategy's first Strategic Theme is for woodlands to contribute to the sustainable development of the Scottish Borders economy. Key Actions are to develop and expand wood processing capacity at strategically located sites; encourage the procurement and use of Scottish Borders timber for construction, furniture, fencing and fuel as a sustainable alternative to materials imported into the region; and encourage the production and competitiveness of "value added" products. Wood energy is seen as having very significant potential for contributing to sustainable rural development in the Scottish Borders by providing employment and fostering new skills. It would, furthermore, offer an alternative outlet for small roundwood that would otherwise leave for markets outside of the

region. A Wood Energy Strategy is to be developed by the Council to ensure that this happens.

To inform the development of the Strategy, Scottish Forest Products Mapping – Borders Local Area Modelling Assessment was carried out in 2003 by IBI Group. This study identified infrastructure developments that would be required to improve the transportation of timber throughout the region and established optimal locations for a sawmill and railhead, taking account of the internal forest road network. The Assessment recommended that:

(i) more detailed work is done to assess the long term viability of transporting timber via railheads at Hawick and Kielder

(ii) any new sawmill, possibly in the Hawick area, should be rail connected and consideration given to its being serviced by sea from Eyemouth

(iii) greater use is made of Agreed Routes and the Internal Forest Road Network for the transport of timber to reduce the impact of increasing tonnages on heavily used roads.

However, it isn't just in the development of policy that Scottish Borders Council has been active – it is taking the lead and implementing its own policies on the ground. The 3HS (Three High Schools) programme at Duns, Eyemouth and Earlston and 4PS (Four Primary Schools) programme at Lauder, Peebles, Clovenfords and Denholm) will all incorporate biomass heating. The Council also plays a leading role in the recently established Scottish Borders Sustainable Energy Forum.

It is also apparent that local people, and their political representatives, are committed to a renewable energy future for their region. At the Borders Energy Summit held in 2006 it was suggested that new housing development programmed for St Boswells presented a unique opportunity to do something different in energy terms and act as an excellent demonstration project to kick-start the move towards renewables. Due to public uncertainty over the implications (especially price) of being plugged into a district heating scheme, awareness and confidence had to be raised especially where house builders are going to have to be required, as a condition of planning permission, to incorporate renewable energy into a proportion of their developments. The summit advocated a step-by-step approach and warned that community involvement was vital. Jeremy Purvis MSP declared that he wanted an energy strategy for the Borders that is radical and ambitious. The final plea from the Summit was "All we need now is the investment".

The focus of this study and the measure of its success is the delivery of a project.

4.3 Implications for the Borders

To capitalise on the opportunities, the Borders must consider biomass as a mainstream energy source. This will require joined up thinking at all levels of local government and include local agencies, the local health board and further education institutions. Investment in biomass plant must be supported in order to kick start the biomass supply chain.

In order to create a demand for biomass as a fuel the local planning authority will need to rigorously apply the "10% renewable energy rule" to all new developments and encourage developers to incorporate biomass heat mains infrastructure especially into new housing and industrial estates. At the same time the public sector must embrace renewable energy wholeheartedly, and biomass heating in particular, in the negotiation of PFI contracts for new schools, for example, and in major school refurbishment. Biomass heating and CHP should be promoted to industry currently present in the Borders.

For non-public sector the main driver is cost. Increased use of biomass at a domestic level will also depend on the feel-good factor of burning wood and the increased availability of dry logs in a convenient form and the increased availability of pellets imported into the region. For larger units the economic argument will be to the fore, affecting both the user of the biomass and the development of the supply chain.

The key factors that will have an impact are:

- Competition for resources (from wood processors, environmental conservation areas and power plants outside the area
- Biomass price to producer (without an economic return the wood land owner is unlikely to manage the existing woodlands well, so losing potential production, let alone plan new wood lands or forests)
- Fossil fuel price (oil now £329 per tonne (1117 litres at 29.5p/litre)
- Ergo dry wood is worth £131 per tonne (40% of oil price)
- Wet wood £82 per tonne (25% of oil price) as at 4th Feb 2007 delivered
- Price to producer significantly less
- Wood burning plant capital cost is ten times that of oil burners of similar capacity
- Long term paybacks
- Government pressure and incentives will have some impact on the rate of take up
- Development of markets for the biomass

5.0 AN ASSESSMENT OF BIOMASS RESOURCE & SUPPLY CHAINS IN THE BORDERS

5.1 Current biomass resource

In general there are two forms of biomass that can be used to generate energy – wet biomass which is suitable for anaerobic digestion and (relatively) dry woody biomass, which is more suited to combustion or gasification.

Significant quantities of cattle slurry are available in the Borders but it would need to be matched 50-50 with bio-digestible food waste (producing gate fees) to be economic. A minimum economic size for an anaerobic digestion plant would be 1MWe, which would require approximately 40-50kt/y of slurry and an equivalent amount of food waste. There is currently no pressure on farmers to divert slurry away from land spreading and there is unlikely be sufficient food waste in the Borders even for the minimum size plant and it would, in any case, be too dispersed to be an economic proposition. Consequently, wet biomass has been excluded from this study.

In terms of the dry biomass resource there is some straw in the east of the region but as this is incompatible with other woody biomass fuels and combustion systems (low ash melting temperature) it would be better suited for farm scale heating and not CHP applications.

There is a large existing forestry industry in the Borders, possibly producing more than is currently required to satisfy demand. The primary biomass fuel resources therefore being considered in this study are forest residues and potentially some the lower grade timber, e.g. roundwood or slabwood as fuel. Sustainable yields of forest residues are around 2dte/ha/y. These are primarily thinnings during the growth period of the plantation and brashings and thrashings from clear felling, when the timber is harvested. For lower grade timber, 20% of potential production (1.5dte/ha/y) is assumed to be a feasible amount to divert into wood fuel without significantly impacting on existing timber markets.

Forested areas were identified from the national woodland and tree imagery dataset. The resource area included a 40km buffer around the Borders region, from which it is considered economic and environmentally sustainable to transport material into the Borders region. For the purposes of this study forested areas under 5ha were ignored as it is considered an unreliable source of biomass as a basis for investment decisions. This produced a total resource catchment area of 299,959ha. Figure 5.1 shows the distribution of forested areas used in the resource assessment.

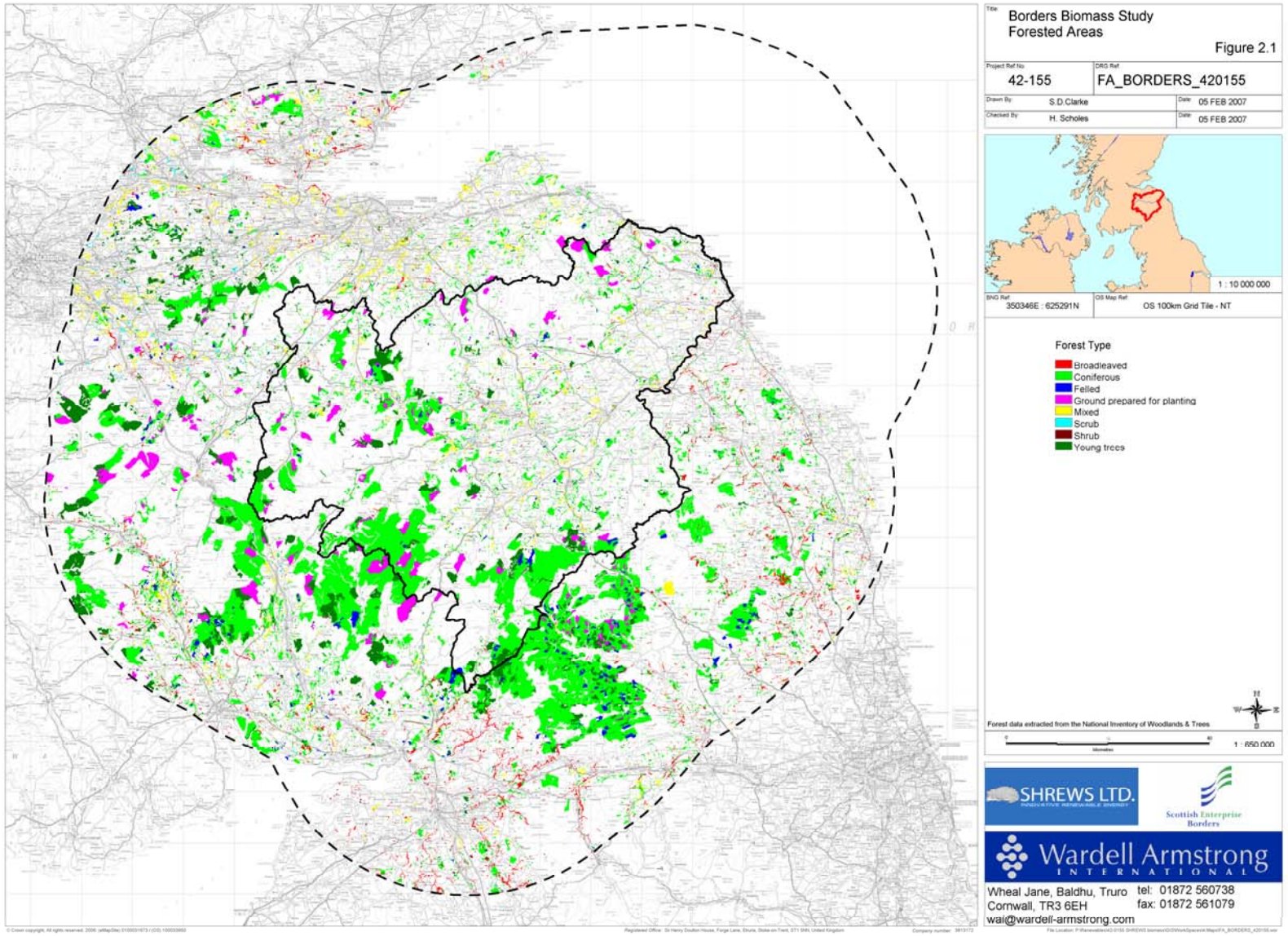


Figure 5-1: Distribution of Forest Areas

The estimated total annual resource of primary biomass @2dte/ha is therefore 599,918dte. Using a conservative estimate for the amount of wood required to fuel a $1MW_e$ power plant at 20% conversion efficiency (8,000dte/y), this corresponds to a potential installed capacity of $75MW_e$ and 2-3 times that in useful heat. Figure 5.2 shows the resource density distribution of primary biomass based on a $5km^2$ grid.

The estimated total annual resource including 20% of lower grade timber is 1,049,857dte, which corresponds to a potential installed capacity of just over $131MW_e$. Figure 5.3 shows the corresponding resource density distribution. These amounts are unlikely to be achieved in reality, as not all of the forested areas will be in full commercial production. However, even if only 20% of the resource was available as fuel, if would still be sufficient to support a significant sized biomass power plant or several smaller ones. See Appendix A for the detailed resource assessment methodology.

5.2 Potential Resource

Energy crops are potentially another source of fuel for biomass power plants in the Borders. Climatic conditions would favour Short Rotation Coppice (SRC), e.g. willow or poplar. This resource is effectively farmed and would compete with other crops for the available agricultural land. How much of this would be converted would depend on market forces, however previous studies (for example ALTENER, (An Assessment of Agro-Industrial and Economic Factors Effecting Energy Crops in SW England, CSM Associates Ltd, 1994 - Funded by the CEC ALTENER programme, local government, regional utilities and NGO's)) have suggested that 5-10% of the agricultural land (i.e. set-a-side land) would be the likely uptake. SRC takes at least three years to establish and is only harvested every 3 years or so. The forest residues identified above will therefore be critical in kick-starting any biomass power plants with subsequent expansion fuelled by an increasing amount of energy crops.

It is difficult to assess how many farmers would be willing to convert to energy crop production, how much of their land would be involved or in what timescale. Consultations with a few farmers known to be interested revealed that until there were sound economic reasons to convert to energy crops, i.e. a high enough ex farm price, a better understanding of the costs to the farmer and an acceptable long term contract available with a specific power plant, they could not comment on how much land they would convert. Two scenarios were therefore assessed; 5% uptake that was considered the most likely uptake that could be achieved and 10%, which was considered the maximum achievable under favourable, economic conditions bearing in mind competition for land with conventional crops and potentially crops for transport fuels.

The energy crop resource was estimated from the Scottish land cover dataset and agricultural land class data for England. Arable farming areas over 5ha were identified within the Borders region and in a 40km buffer around it. These are shown in Figure 5.4.

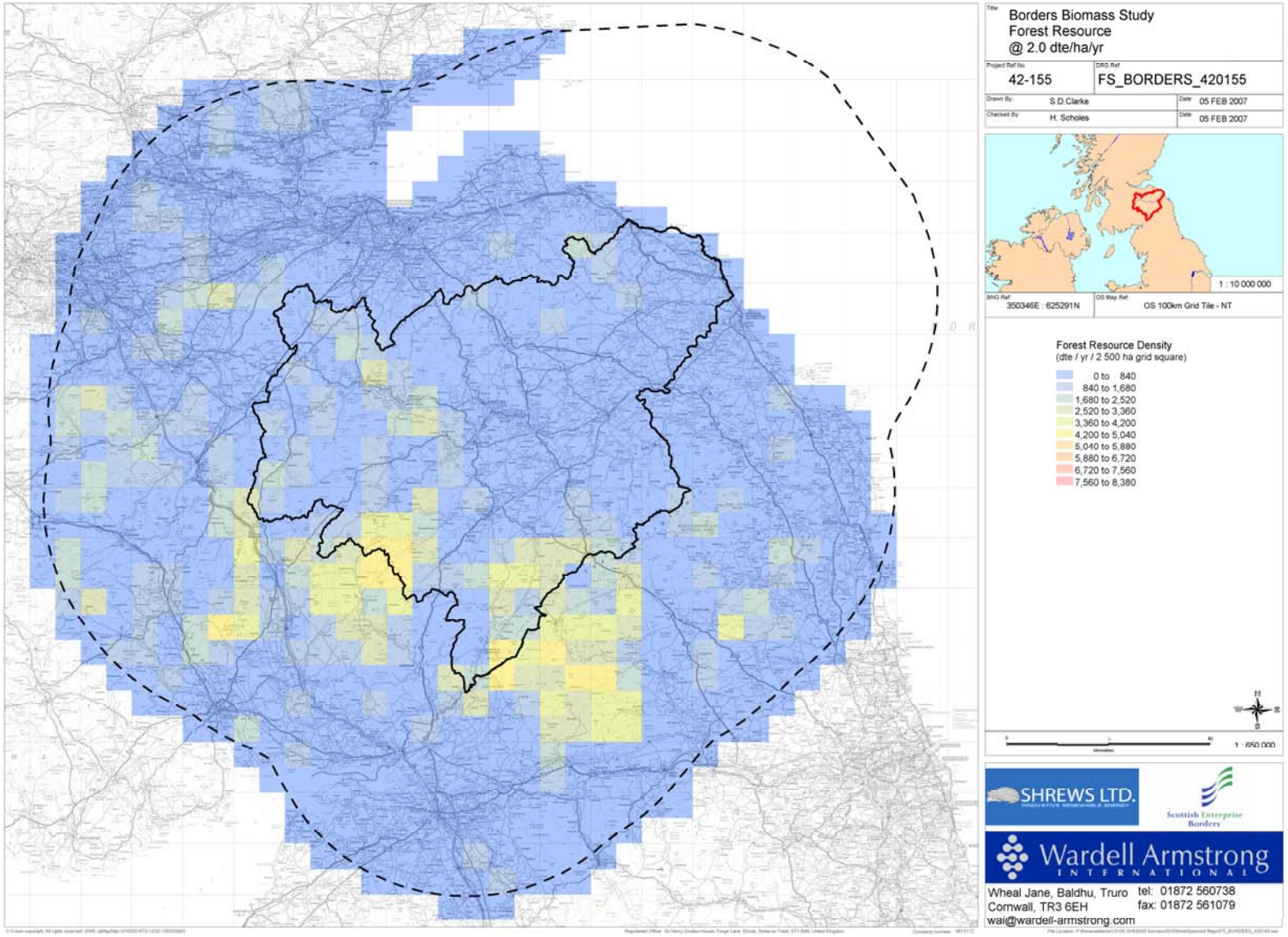


Figure 5-2: Resource Density Distribution of Primary Biomass

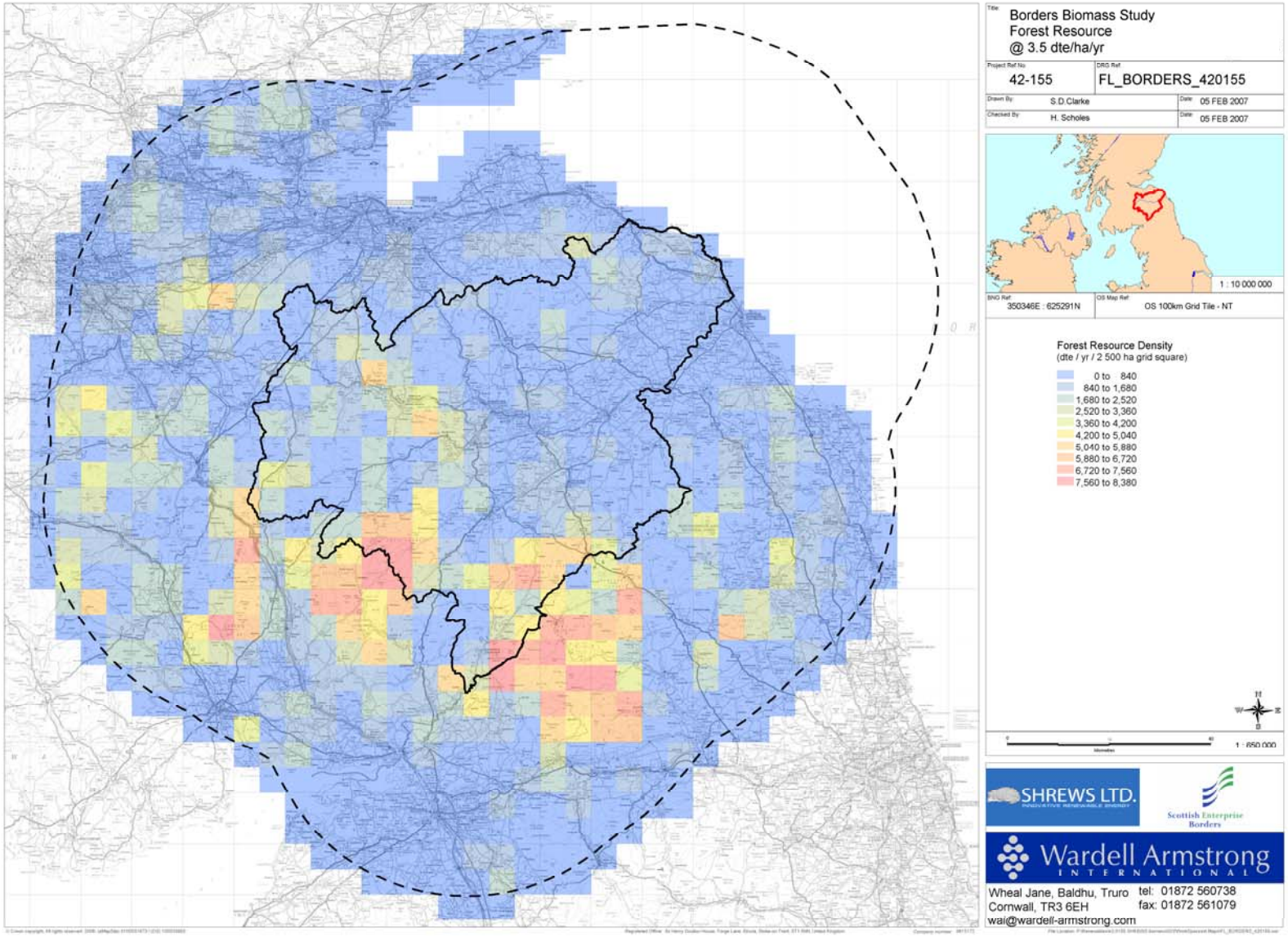


Figure 5-3: Resource Density Distribution Including 20% Lower Grade Timber

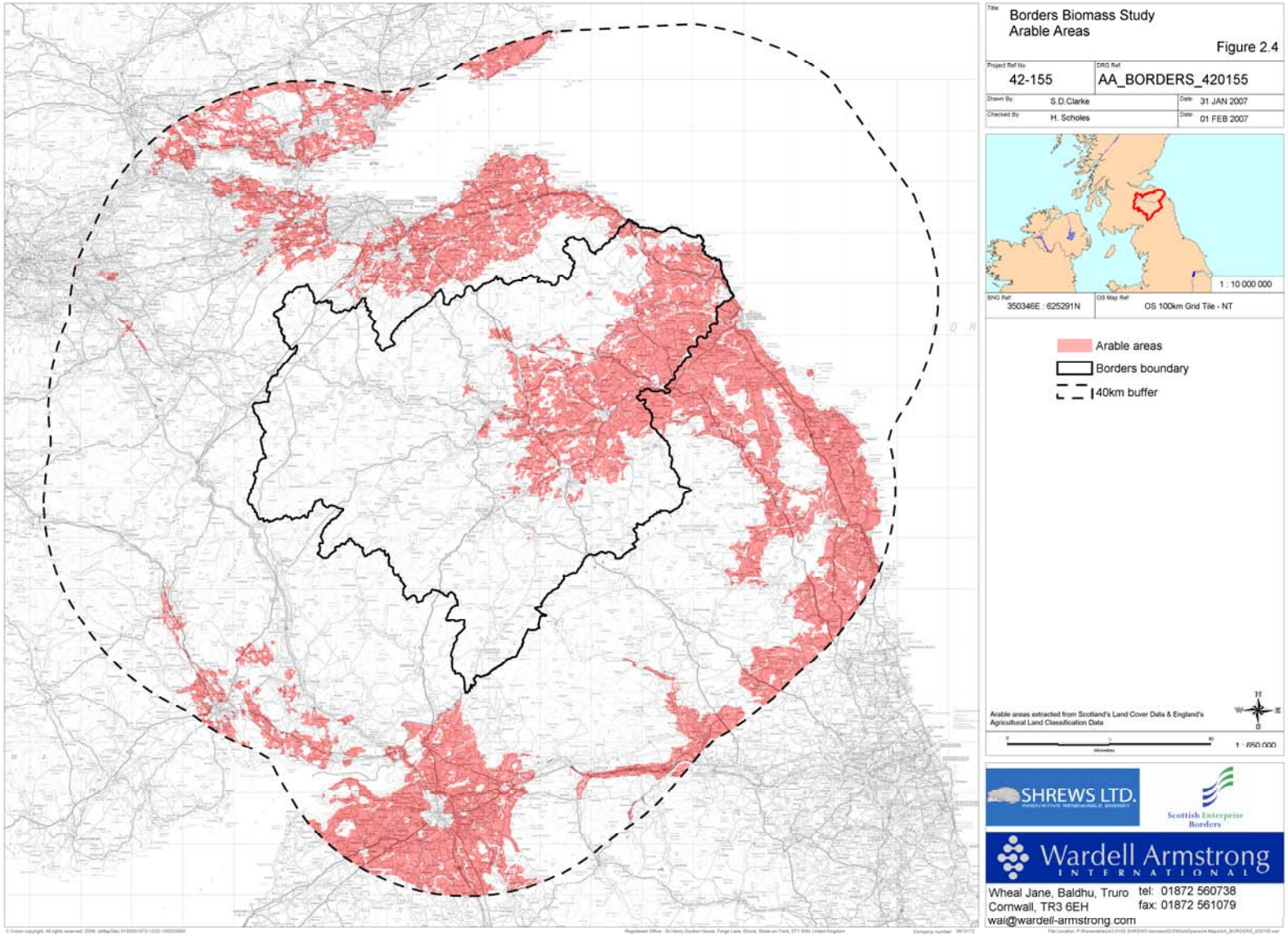


Figure 5-4: Arable Farming Areas in Vicinity of Borders Region

This produced a total energy crop catchment area of 411,002ha. A typical yield of 8dte/ha/y was applied to these areas. This was then factored by 5% and 10% to produce potential resource estimates. The estimated total potential annual resource at 5% uptake is 164,401dte. This corresponds to a potential installed capacity of 20.6MW_e. Figure 5.5 shows the resource density distribution based on a 5km^2 grid.

The estimated total potential annual resource at 10% uptake is 328,802dte, which corresponds to a potential installed capacity of 41.1MW_e. Figure 5.6 shows the corresponding resource density distribution.

It should be noted that even with a firm contract on offer from E.ON to supply the plant at Lockerbie, which is being built the uptake by farmers for planting SRC, is reputedly below expectations by the developers. It is understood that the achievement of the 20% supply from SRC will be behind schedule.

See Appendix A for the detailed resource assessment methodology.

5.3 Biomass in Waste Streams

The study recognises that there exists a biomass resource within the Borders derived from the 40,000 tonnes/yr embedded biomass in municipal solid waste (MSW). In addition, there is biomass discarded by the construction industry and others in the form of packaging, pallets and used chipboard. These sources of biomass will be the subject of different types of contract and are consequently outside the scope of this phase of the study.

5.4 Supply chains

An issue which affects the biomass industry is the lack of supply chains for the delivery of biomass. There are a number of biomass suppliers and these are listed in Appendix D. Those that were interviewed by phone are indicated with an asterix.

There are individuals or small companies who are supplying logs for domestic stoves, such as Treeline of West Linton, providing these as part of ongoing arboricultural work. The logs are supplied fresh cut and in small loads, such as up to one tonne or in one cubic metre disposable woven polypropylene bags. The bags are usually recovered non-returnable bags from the building supply industry. Prices are about £60 per bag, equivalent to about £180 per tonne wet. The logs need to be stacked by the buyer to dry, which restricts the use of logs to householders who have storage areas. Some of the householders will also have chain saws and will clear roadside trees or fallen trees by agreement with the farmer or land owner.

Some dry logs can be bought in 10kg bags from shops or garages. These are normally sold for £3.00 to £3.50 per bag, or equivalent to £300 to £350 per tonne for dry (about 20% moisture content). These are imported into the region, some from as far as Worcestershire.

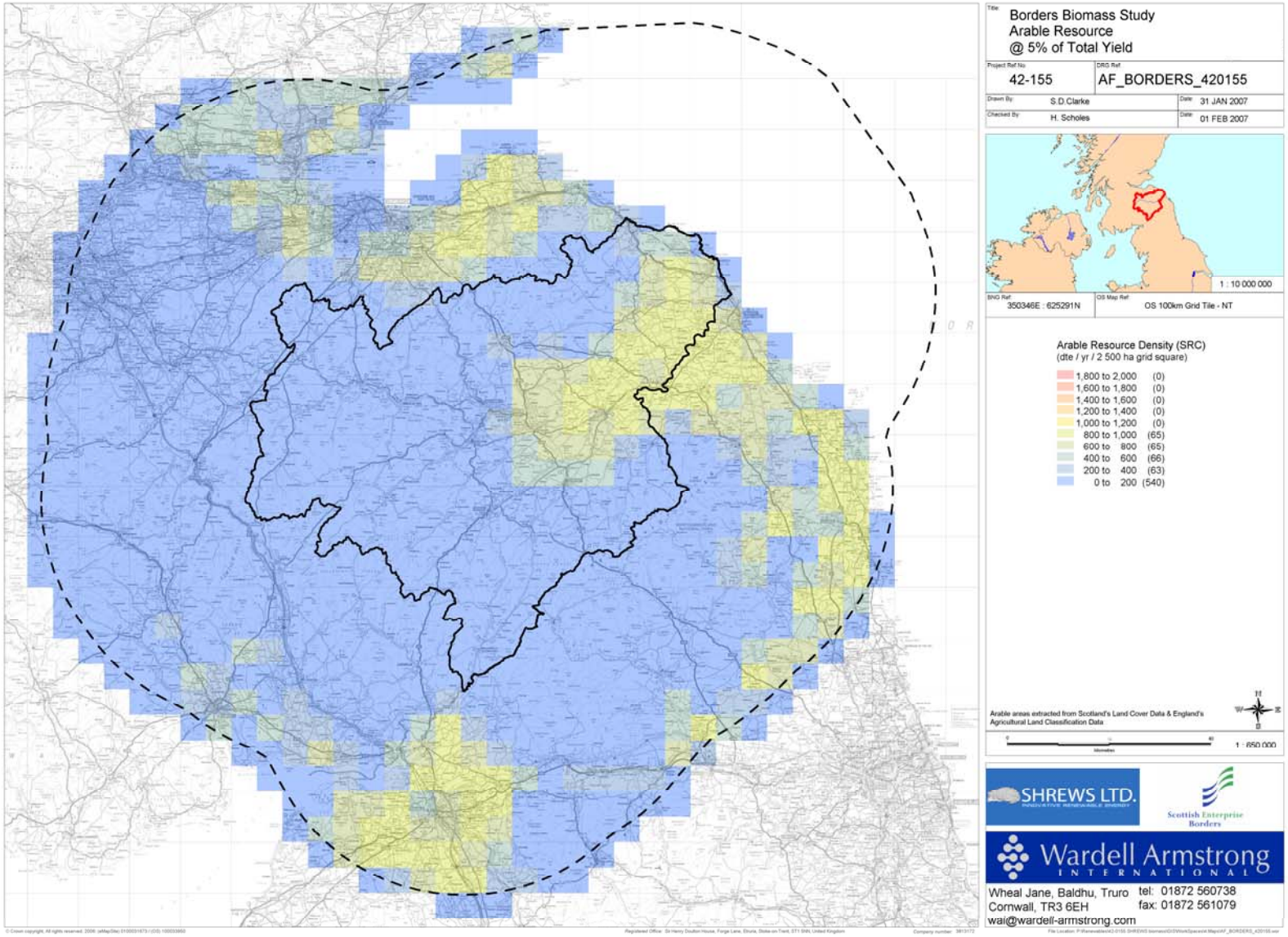


Figure 5-5: Energy Crop Resource Density Distribution

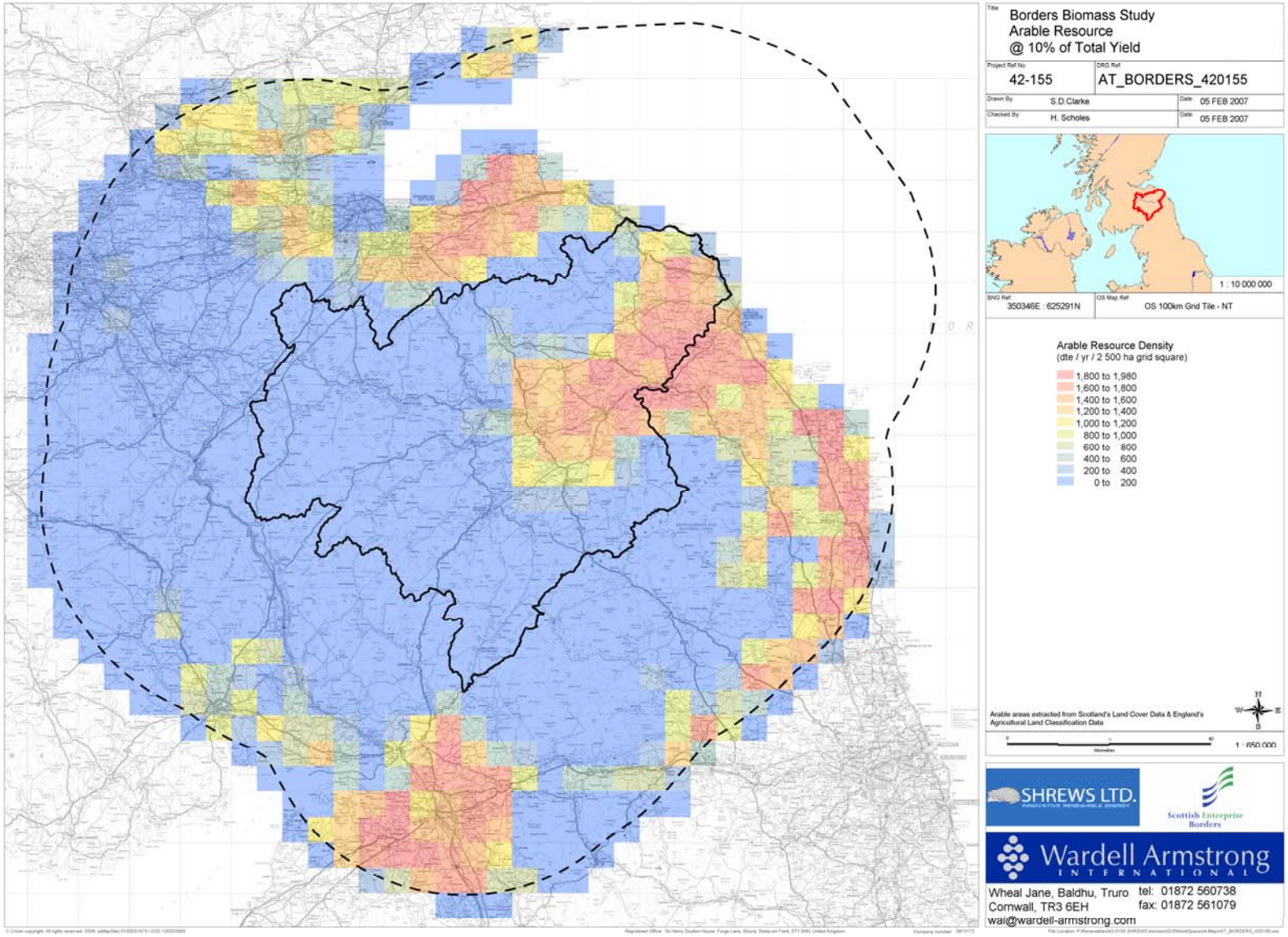


Figure 5-6: Resource Density Distribution of Total Resource at 10% Uptake

Many users of wood burning stoves thus mainly burn wood for atmosphere rather than for economic reasons.

Another source of biomass for domestic stoves is pellets. There are no local suppliers of pellets, so these are either bought from Balcas in Northern Ireland or imported, usually from the Baltic States. There is one distributor in the Borders.

Supplies of woodchips for large scale domestic use or small scale commercial use are currently being made by Buccleuch Estates to chip boilers in Lanarkshire and might be interested in supplying wood chips to projects in the Borders.

The problem of lack of local markets is major constraint on the development of supply chains

5.5 Long term log supply potential

The production of roundwood timber in the Borders is expected to increase from 640,000m3 per year currently to about 950,000 m3 per year, with the main increase being in the production of saw logs and much of the increase coming from privately owned forests.

Fibre production is difficult to predict in the Borders as the region is split between two Forestry Commission Conservancies.

The following tables are a summary of forestry in the Borders taken from the 1999 Forest Survey. Additional information about the potential for small woodlands is available in the South Scotland Small Woodland Project 2001.

Table 5-1: Summary of Areas by Ownership

Ownership	ha	% woodland
Forestry Commission	25788	32
Other	55350	68
Total Area of Woodland	81139	100
% Woodland Land Cover		17.1

Table 5-2: Size Class Distribution of Woodland

Size Class(ha)	Number of Woods	Total Area(ha)	Percent of Total Area	Mean Area of Wood(ha)
0 - < 2	13	6	0	0.5
2 - <10	1335	5713	7	4.3
10 - <20	230	3176	4	13.8
20 - <50	138	4332	5	31.4
50 - <100	45	3211	4	71.4
100 - <500	62	13494	17	217.6
500 and >	21	51394	63	2447.3

Table 5-3: Types of Woodland by Area and Percentage

	ha	%
Conifer	63586	78.4
Broadleaved	5370	6.6
Mixed	2749	3.4
Coppice	52	0.1
Coppice with Standards	0	0.0
Windblow	116	0.1
Felled	1947	2.4
Open space	7318	9.0
Total	81139	100.0

Note about 70% of conifers are sitka spruce and main period of planting was in 1970's

Table 5-4: Ownership Type by Area and Percentage

Ownership Type	Area(ha)	%
Personal	40450	49.9
Private forestry or timber business	4341	5.4
Other private business	8787	10.8
Local Authority	0	0.0
Other public body (not FC)	0	0.0
Forestry Commission	25788	31.8
Charity	131	0.2
Community ownership or common land	0	0.0
Unclassified	1642	2.0
Total	81139	100.0

Assuming there is no major sawmill development in the Borders, (Hawick has been identified as a possible site for such a development), the major demand will continue to come from industrial developments outside the region, such as the sawmill at Lockerbie and the biomass power plant there.

It is understood E.ON propose to bring fuel from as far afield as Cumbria and Lanarkshire. Sitting on the A74(M) corridor this may make sense. Bringing timber west from Castle O'er, Craik and Keilder forests may be more difficult but it still poses a threat to potential biomass development at Hawick, for example.

The location of forests is one issue but the problem of the movement of forest products is also an issue. The principal supply routes for forestry in the region are shown in Figure 5.7.

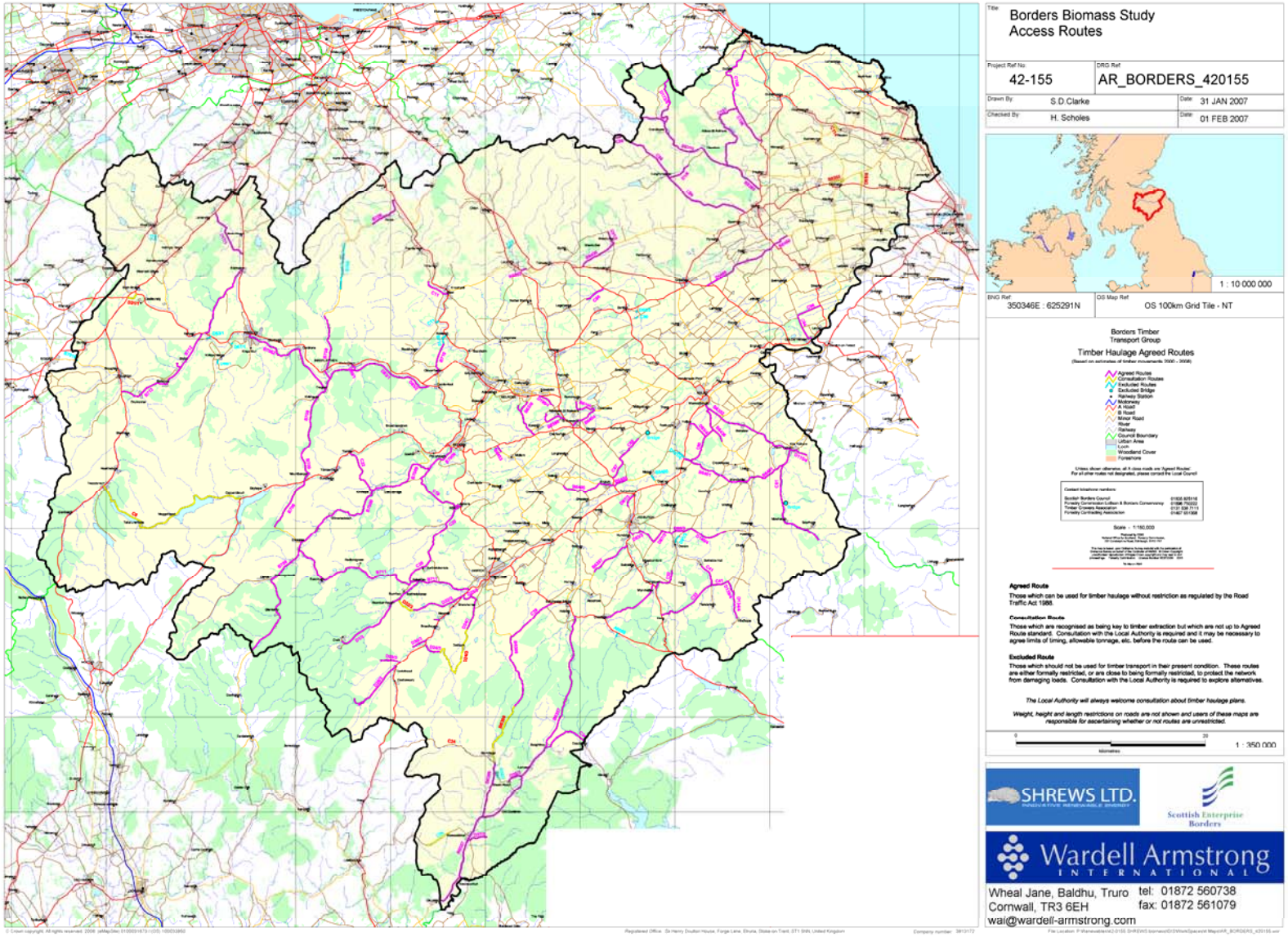


Figure 5-7: Agreed Timber Haulage Routes within the Scottish Borders

The location of any biomass energy plant is also constrained by connectivity to the power distribution grid. The major power lines and areas for connection into the major system (33KV and above) is limited both by capacity and location. The advantage of small scale projects not only reduces the transport of biomass but being able to connect into the 11KV grid network greatly increases the number of possible locations. The power, which can be connected into the grid, is subject to specific local network conditions but would normally be considered to be 6MWe. The network is shown in Figure 5.8

Within the Borders biomass for energy is still undeveloped. Small-scale logs suppliers are unlikely to expand, and although pellets are becoming increasingly important for domestic use, their production is likely to continue in locations outside the region. The major developments taking place for woodchips and forest residue recovery are being undertaken by Euroforest who are investing in two mobile chippers to recover forest residues post logging. The investment is based on a long-term contract to supply through Jenkinsons who have a contract to supply E.ON at Lockerbie. Sawmill co-product is unlikely to feature in the supply chain until such time as a major sawmill emerges in the region although some recycled wood may appear in response to disposal problems within the wood using industry.

In response to these weaknesses, the Forest Industries Cluster is trying to encourage the development of producer groups to maximise the benefits of entering the supply chain.

The long term supply potential for biomass is essentially governed by the price of energy and the expectation that fossil fuel prices will continue to rise. The determining factor in supply will be (a) the price of biomass to the producer and the extent to which competition amongst energy generators, such as E.ON at Lockerbie, Scottish Power at Longannet, and Egger at Hexham and (b) competition between alternative land uses especially for energy crops. Natural catchment areas for major competitors for the Borders biomass are shown in Figure 5.9, based on a 40km radius. Some plants, such as Lockerbie power plant will be drawing biomass from a much wider area than 40km.

If fossil fuel is currently say £329 per tonne, this makes dry wood (at 40% of the oil price) worth £131 per tonne delivered and wet wood (at 25% of the oil price) worth £82 per tonne delivered. To be factored into this is the higher start up and maintenance costs for a wood fuelled boiler and the longer term paybacks before determining the price to the producer. However these costs will reduce (and consequently the price to producers will increase) as Government pressure continues to be applied, incentives kick in and the market for biomass develops.

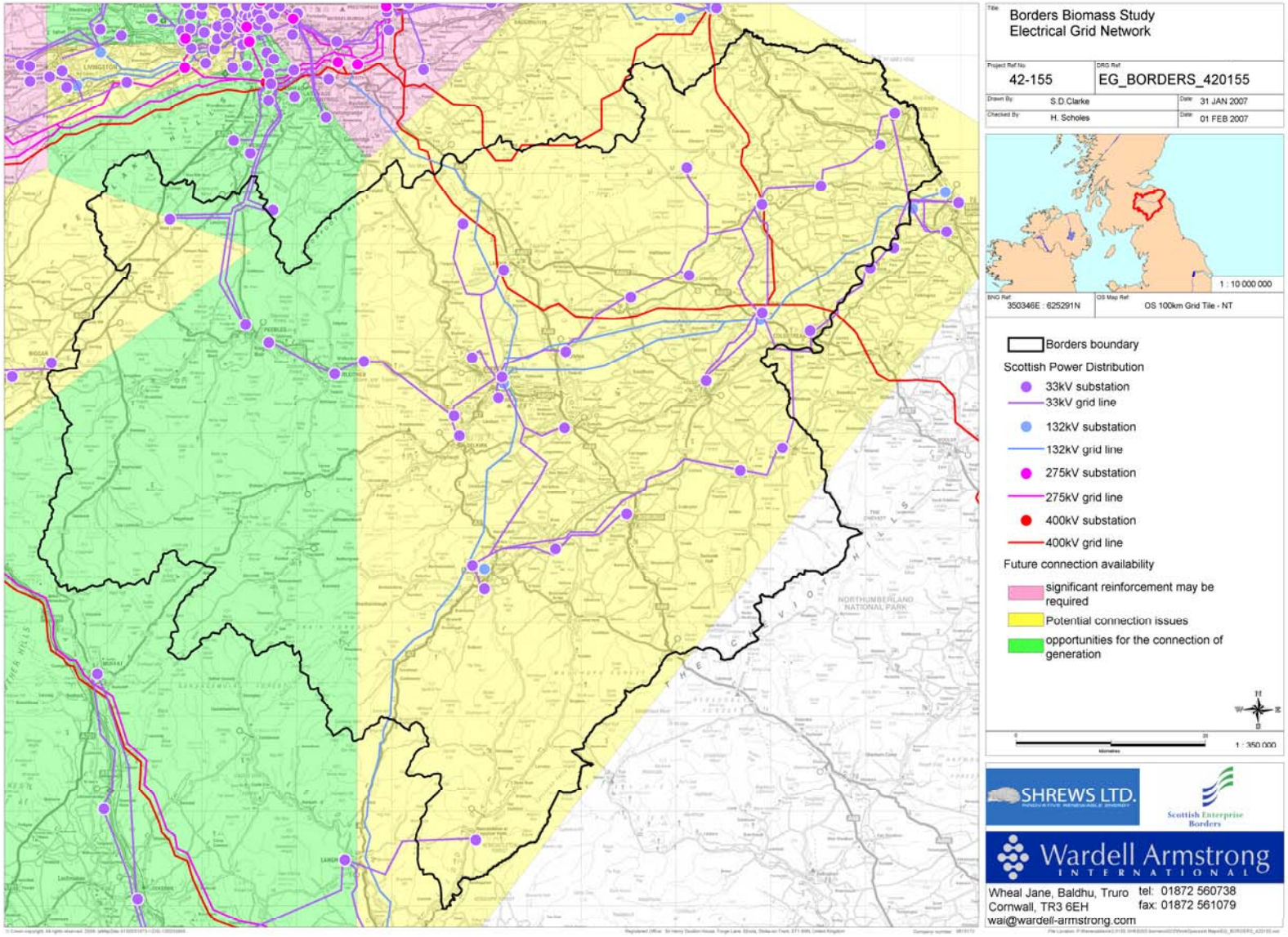


Figure 5-8: Electrical Grid Network

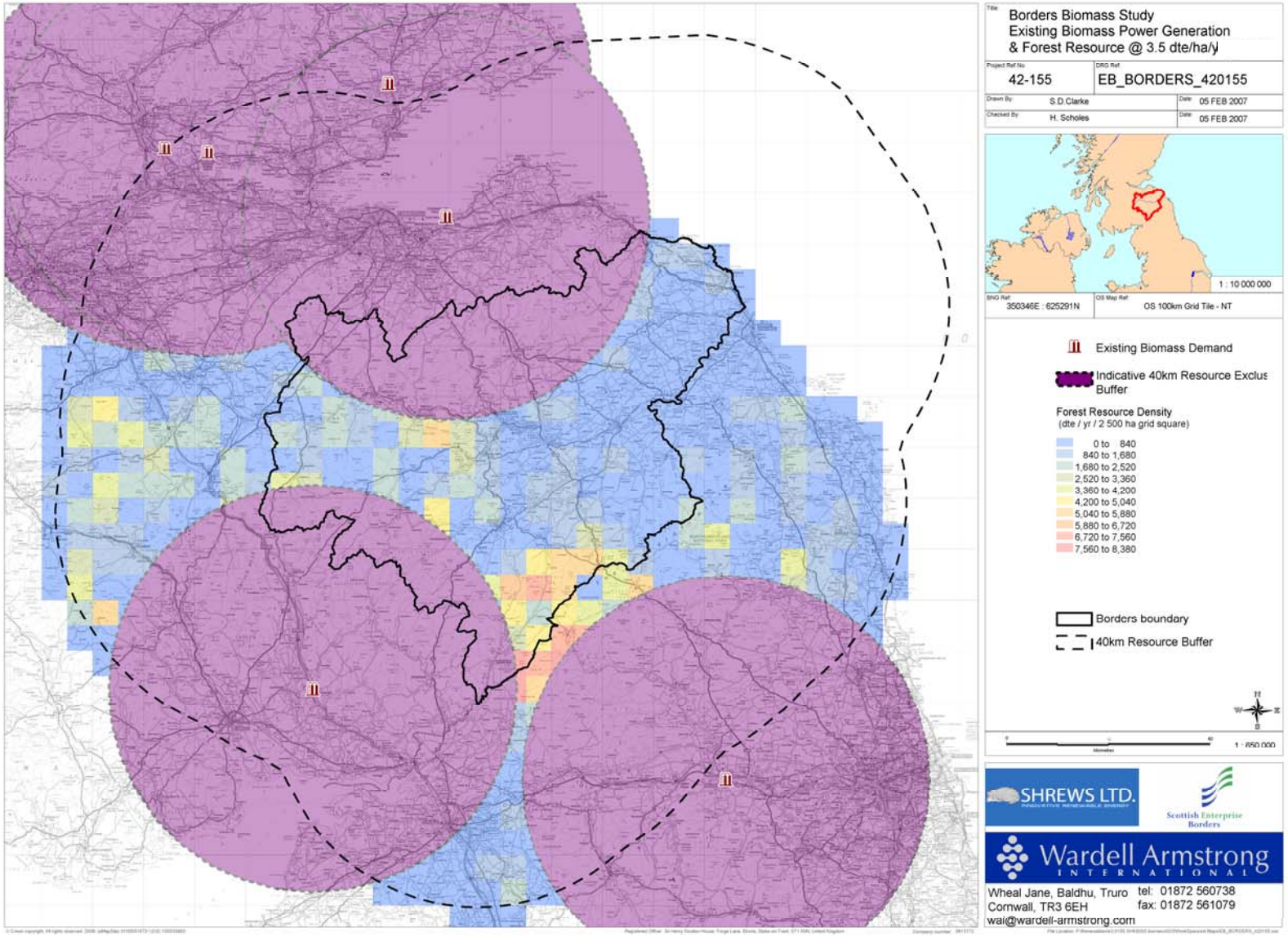


Figure 5-9: Catchment Areas for Competing Biomass Uses

6.0 MAJOR ENERGY USERS IN THE BORDERS, THEIR FUTURE PLANS AND POTENTIAL NEW HEAT DEMANDS

The availability of suitable heat load(s) close by will be a critical factor for the economic viability of a biomass CHP plant. There are also benefits from being able to supply electricity direct to the end user and avoiding "use of system" costs. With this in mind, potential major energy users in the Borders were identified from SEB address lists. Initially details on some 200 organisations were made available by SEB. This was reduced to approximately 60, who were considered likely to have heat loads in excess of 100kW. These included schools, local government, hospitals, and commercial and industrial organisations. Figure 6.1 shows their locations.

A questionnaire was developed (see Appendix B) and faxed out to over 60 organisations requesting information on the type and size of their energy loads. The questionnaire had two primary purposes, to identify those organisations to which a biomass CHP plant could supply heat directly and to identify those with smaller heat loads that could be satisfied by boilers fuelled by wood chips dried at a nearby biomass CHP plant.

Excluding the response from schools, which was coordinated in one reply, only 6 replies, i.e. 10% of the fax out, were received prior to the Phase 1 stakeholder meeting. In direct mail terms, this is a typical level of initial response. Subsequently the remainder were contacted by telephone to progress responses. In a significant number of cases, the relevant person was not available at the time of the phone call or they had mislaid the original fax message or the contact had left the organisation. A second round of chasing phone calls was undertaken.

6.1 Schools

Scottish Borders Council responded with information for 12 schools. Of these Peebles High School, Galashiels Academy and Hawick High School have heat loads in excess of 1GWh per annum and electrical energy consumption of approximately half that. The majority of this will be in the winter months and predominantly between 8:00am and 6:00pm. Assuming an annual load factor of 2000 hours per annum, average capacities during this period are detailed in Table 6.1.

Table 6-1: Heat & Power Consumption for Local Schools

School	Electrical load (kWh/y)	Electrical capacity (kW)	Heat load (kWh/y)	Heat capacity (kW)
Peebles High School	904503	452	1851445	926
Galashiels Academy	1249541	625	1117965	559
Hawick High School	836882	418	1912953	956

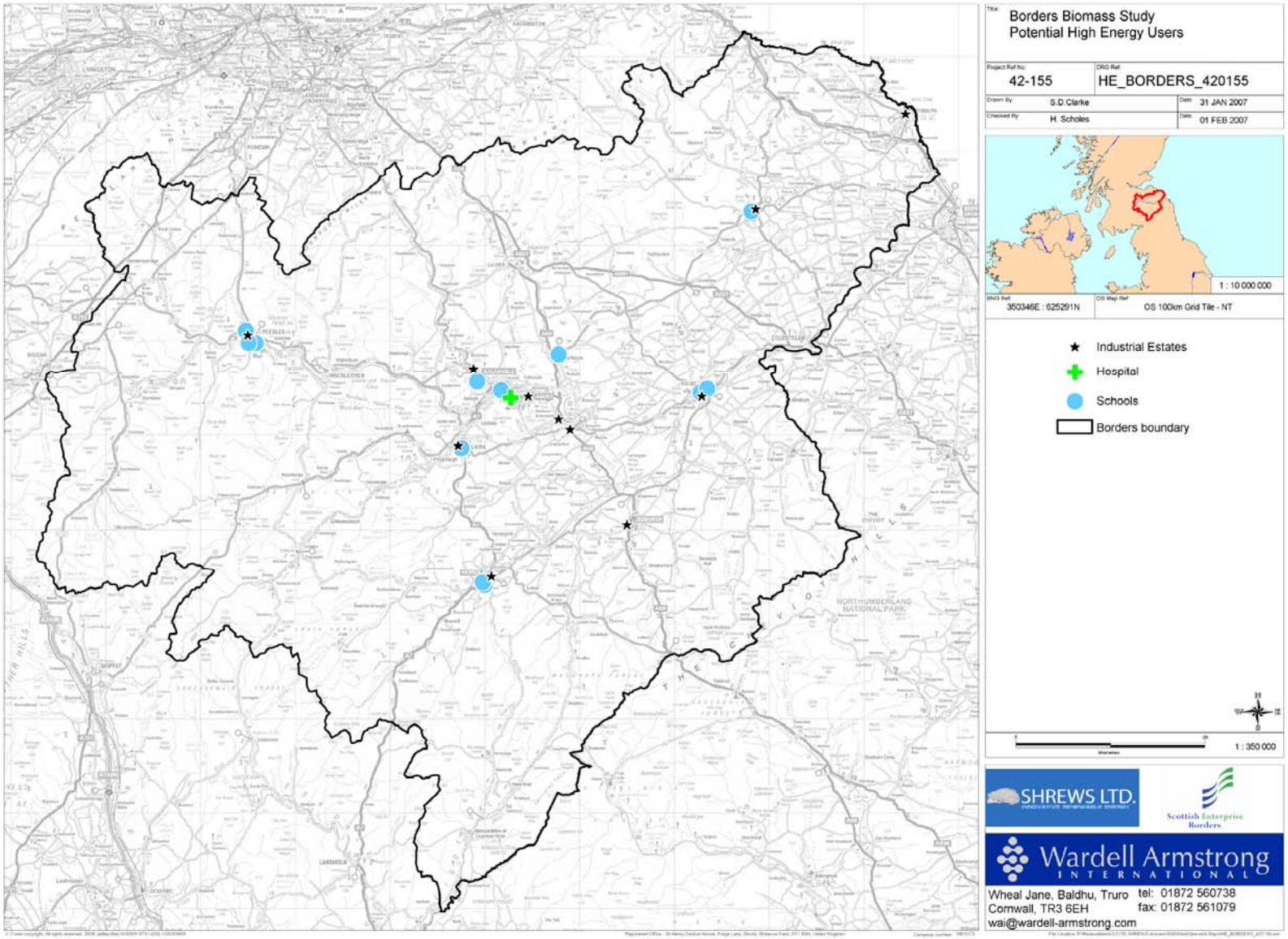


Figure 6-1: Potential Major Energy Users in the Scottish Borders

The implication here is that biomass CHP plants located at or adjacent to these schools could supply most of their energy requirements and, at the same time, have sufficient spare capacity (approx 6000hrs/y and most nights) to dry wood chips to supply other schools in the region.

6.2 Hospitals

There is only one hospital of any significant size in the Borders, which is located at Melrose. Its annual heating demand is in excess of 20GWh per annum, which could potentially be satisfied by a $1MW_e/2MW_{th}$ biomass CHP plant.

6.3 Commercial and industrial organisations

As at the date of this Report only four questionnaire responses were received from this type of organisation. Of these one had an electrical load of approximately 500kW but no heat requirement and two had heat loads over 1MW and significant electrical loads. These latter two may be suitable locations to co-locate a biomass CHP plant.

6.4 District heating and energy parks

Another opportunity to exploit the heat from a biomass CHP plant would be by using it in district heating systems. Although commonplace in Europe, there are only a few examples of these systems in the UK. However leading public authorities like Woking are pioneering these systems in conjunction with private wire networks. District heating systems are really only cost effective when implemented as part of a new housing development and can be particularly effective in a social housing context. Scottish Borders Council has identified a number of locations for future major housing developments most notably at St Boswells/Newtown St Boswells. The possibility therefore exists to design district-heating schemes for these developments, which could be coupled to a biomass CHP plant. Depending on the circumstances, it may also be appropriate to implement a private wire connection to them for electricity supply. The heat demand for district heating systems can be expected to have a similar profile to the schools above, i.e. highest during the winter, but with an extended afternoon/evening load. Nevertheless, a similar rationale can be applied in that the spare capacity could be used to dry wood chips for smaller projects.

An alternative option that could provide a constant 24/7, and therefore more economically viable heat load, would be to establish energy parks where new high energy industrial users could be located. These could be located on new or existing industrial estates with sufficient space. A biomass CHP plant with its associated heat distribution infrastructure would obviously need to be part of the development. A concerted campaign by the various

economic development organisations in the Borders would be required to attract this type of industry. Figure 6.2 shows the locations for these potential new heat loads which, interestingly, coincide with the resource distribution, resulting in lower transport impacts.

Additional information received from Scottish Community and Household Renewables Initiatives (SCHRI) and Forestry Commission is to be assessed along with the complete information from the questionnaire when all returns are received.

Chip burning boilers are not practical or economically viable at small scale and so not suitable for households. They only become viable at a larger scale such as school or hotel; even then only make practical and environmental sense if dry chips are available. Burning wet chips is not efficient unless a fully condensing boiler is used which is not practical at small scale.

6.5 Wood Chip Drying Plants

These would be dispersed across the Region and supply dry woodchips for heat only boilers. Sold into the wood chip market this would be the key to kick starting it, stimulating a market push and at the same time enabling joined up thinking. The development of drying plants would require access to a source of waste heat, which is not otherwise used.

6.6 Wet Chips

Wood chips can be conditioned naturally to reduce their moisture content. But this requires storage and proper management or decomposition losses and health risks from fungal and mould growth will result. This is clearly not an option for domestic users but may find an outlet in small industrial estates or in farm and rural estate applications.

6.7 Domestic Markets

Household demand was assessed by discussions with suppliers of logs, suppliers of multi-fuel stoves and coal merchants. Wood burning, or more accurately multi fuel, stoves are becoming increasingly popular. The demand for logs is being satisfied from existing suppliers (a list of suppliers is attached in Appendix D) who are small scale and largely opportunistic in entering and leaving the market, depending on price. The problem of lack of supply of dry logs and problems of storage of logs lead many people to convert to coal or smokeless fuel.

The domestic demand was not explored further as the market will adjust to demand without any intervention and will not create any significant employment opportunities. The use of more sophisticated boilers for households is restricted to the use of pellet stoves.

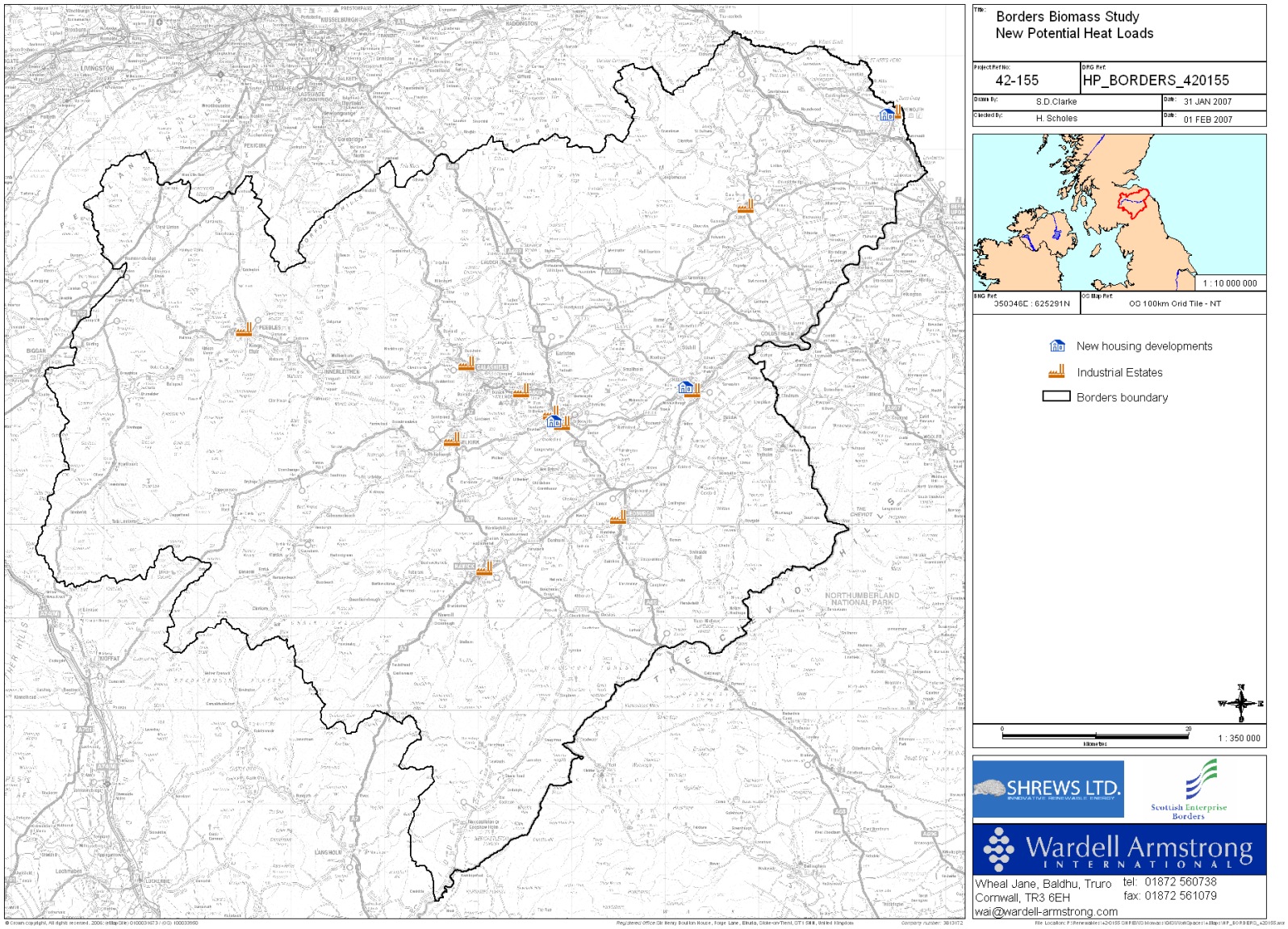


Figure 6-2: Potential New Heat Load Locations

7.0 LEADING PRACTICE EXAMPLES

Excluding coal fired power stations co-firing with biomass, the number of biomass CHP plants operating in the UK is relatively few. Several have failed to acquire planning permission, e.g. Winkleigh in Devon, Ambient Energy/ESD in Wiltshire, some have had difficulties raising finance, e.g. Eccleshall, and some that have been built, e.g. ARBRE in Yorkshire, have failed because of plant/fuel supply problems. These plants have ranged in size from 2 or 3MW up to 25MW and have had various types of technology involved, steam turbines, gasifiers and CCGTs (combined cycle gas turbines). In almost all cases, the projects were privately funded ventures with a significant proportion of the capital cost, i.e. up to 35%, grant funded. There would appear to be no one distinct reason why these plants failed. The fact that so many aspects of most of these biomass CHP projects were only marginally viable, e.g. environmental impacts, secure supply chains, technology track record, financial returns, debt coverage ratio and 24/7 heat loads, meant that a small under achievement in one area was enough to kill the project.

There has been much more success in Europe particularly in Scandinavia and Austria where district heating systems are common and local government more involved. However the experience is not transferable to the UK because the social, legislative and financial environments are very different. Some examples of the few currently successful UK CHP plants are given below.

Balcas Enniskillen - CHP plant based at sawmill using sawmill residues and forest residues and integrated into sawmill operation and production of wood pellets.

Input Biomass ≤ 59% m.c. 15MW. Stepped grate.

Steam 32 bar 380 °C

Output Electricity 2.7 MWe. 4 stage back pressure turbine

Kiln heat 2.2 MW average (5.0MW peak)

Dryer heat balance

Pellets. 6.2 tonnes /hr x 8,200 hr/year

Furnish 180,000 tonnes /yr

Potential Pellets output + 60 - 80% at low additional cost

Electricity + 10% for 1,000 hrs

CAPEX €13m

Biomass Engineering http://www.biomass-uk.com/

- Ballymena, Ireland, 75kWe case study
- Farm Project, Lancashire, 250 kWe, grid connected in 2005
- Manor Farm, Oxfordshire, 250kWe
- Little Woolden Farm, Culcheth, Lancs
- Wildshausen, Germany, 270kWe
- To be commissioned in 2007
  - Stoke, UK, 3MWe
  - Okoenergie, Germany, 250kWe
  - 4 x 1MWe projects in the UK

Rural Generation www.ruralgeneration.com
Brook Hall Estate
Commissioned: (reconstructed):1997 (2002)
300 tonnes willow chips consumption per year, typical moisture content is 8-10% plus 10,000 litres of diesel fuel (5 litres per hour of operation, 2000 oper. hours)

<u>Nominal capacities & efficiencies:</u>

Thermal input, biomass & waste:	0,43 MW
Total thermal input, incl. fossil fuels:	0,5 MW
Gross electrical output:	0,12 MWe
Net electrical output:	0,096 MWe
Heat output:	0,32 MJ/s
Electrical efficiency, gross:	32 %
Electrical efficiency, net:	28 %
Overall efficiency, gross:	72 %

Pentland Plants Ltd

Loanhead

Commissioned in 2006

Reka 2MWth biomass boiler supplying heat to green houses processing about 2,000 tonnes of both recovered chip wood and forest residues and small roundwood. Is planning on installing own chipper to process forest residues and small roundwood due to problems of supply from existing suppliers.

Large-scale projects are being developed such as Lockerbie, Ayr (CHP at a pulp/paper mill) and Fife (CHP at paper mill).

Additional information is being compiled.

The biomass projects identified in Scotland are given below in Table 7.1. As can be seen, they are heat only projects or co-firing of coal fired power stations

Biomass power projects have been developed successfully on the Continent but the main reasons for this are:

- Established tradition of using biomass as a source of energy
- Higher guaranteed power prices (e.g. in Germany the guaranteed price is €0.2 KWhr on long term contract
- Opportunities to supply heat to established district heating schemes

Only two projects in the list below, OH16 and OH 37 are in the Borders. The below list does not include Pentland Plants Ltd at Loanhead. In addition there are 7 SCHRI funded household biomass projects in the Borders.

Table 7-1: Operational Projects.

				Virgin Fibre Scale (odt)	Imported Fibre (pellet) Scale (odt)	Recycled Fibre Scale (odt)	TOTAL
	MAJOR INDUSTRY						
MI1	Scottish Power (Cockenzie)	update	cofiring		80,000		
MI2	James Callander & Son (Falkirk)		heat	1,200			
MI3	Norbord (Striling)	update	heat	33,743		33,743	
MI4	Norbord (Dalcross)	update	heat	32,727			
MI5	UPM Caledonian Paper (Irvine)	update	heat	15,000			
MI6	BSW (Kilmallie)		heat	5,000			
MI7	Scottish Power (Longannet)	update	cofiring		100,000		
				87,670	180,000	33,743	**301,413**
	OTHER INDUSTRIAL AND COMMERCIAL HEAT ONLY		Boiler (KW)				
OH1	Forestry Commission Scotland (Huntly)		31	41			
OH2	North Coast Leisure Pool (Bettyhill)		150	100			
OH3	Kinlochleven Community and Sports Centre		120	49			
OH4	National Trust Scotland (Glencoe Visitor Centre)		120	49			
OH5	Lochalsh Leisure Centre		100	49			
OH6	Duror & Kentallen Community Centre		60	49			
OH7	Lochgilphead Swimming Pool		200	*97*			
OH8	Whitegates District Heat (Lochgliphead)		460	*222*			
OH9	Post Office (Acharacle)		30	*14*			
OH10	Russwood Sawmill Ltd (Newtonmore)		120	70			
OH11	Alness Leisure Centre		150	150			
OH12	Edinburgh City Council (Haymarket)		360	750			
OH13	Wood Recyclability Ltd (Pitmedden)		360	*174*			
OH14	SHN(Aviemore)		60	*29*			
OH15	Winton House (Pencaitland)		250	200			
OH16	Bowhill Estate Office (Buccleuch)		100	100			
OH17	Monteith House Nursing Home		460	*222*			
OH18	District heat (Glenshellach Oban)		480	*232*			
OH19	Shore Road District Heat (Campbeltown)		480	*232*			
OH20	Broadford Hotel (Isle of Skye)		150	*72*			
OH21	Greshornish Hotel (Isle of Skye)		100	*48*			
OH22	Edinbane Hotel (Isle of Skye)		100	*48*			
OH23	Holiday Cottages (Glencoe)		60	*29*			
OH24	Green Welly Stop (Tyndrum)	Some doubt	150	*72*			
OH25	Dunlossit Estate (Isle of Islay)		60	20			
OH26	North East Enterprise Trust (Inverurie)		120	60			
OH27	Murray and Murray (Glenrothes)		150	50			
OH28	Highland Birchwoods (Munlochy)		30	19			
OH29	Raddery Sawmill		60	*29*			
OH30	Vogrie Country Park (Dalkeith)		330	90			
OH31	Palacerigg Country Park (Cumbernauld)		80	37			
OH32	Colzium House (Kilysth)		80	27			
OH33	Drumpellier Plant Nursery (Coatbridge)		320	61			
OH34	Calderhead High School (Shotts)		700	308			
OH35	Taylor High School (Motherwell)		700	235			
OH36	Central Scotland Countryside Trust (Shotts)		40	15			
OH37	Woodschool Ltd (Jedburgh)		22	*11*			
ADDED JANUARY 2006							
OH38	ILM Highland (Alness)		70	30			
OH39	Dorback Estate (Nethybridge)		85	30			
OH40	Wood Recyclability Ltd (Pitmedden)		200	140			
OH41	Atholl Estates (Blair Atholl) (Missed last year)	only part operting	300	150			
OH42	EMAUS (Glasgow)		?		?		
	OTHER INDUSTRIAL AND COMMERCIAL HEAT ONLY		7,998	4,411			
	brought down - MAJOR INDUSTRY (>5000ODT/YR)			87,670	180,000	33,743	
	TOTAL OPERATIONAL WOOD FUEL USE			92,081	180,000	33,743	**305,824**
				Virgin Fibre	Imported Fibre (pellet)	Recycled Fibre	

Source: Hudson Consulting Ltd for Forestry Commission

8.0 THE NEED TO BREAK THE CYCLE AND THE OPTIONS AVAILABLE

To break the cycle two things need to happen. Producer groups need to be formed to bring forward the supply of biomass in sufficient quantities to fuel the proposed plants. At the same time the market needs to be stimulated to accept the supply coming through.

There are two options available. One is the development of a large-scale plant capable of taking say 250,000 tonnes/yr or more. There is no doubt that there is sufficient biomass resource to fuel such a plant. However, it would be difficult to integrate into the existing grid infrastructure, as the site would need to be close to one of only a few 33KV connections in the region. Furthermore, it would be necessary to find a sufficiently large user of heat close by, and the plant would need fuelling with large quantities of biomass, which would require haulage over relatively long distances. Any development of this scale would impact on the landscape and local amenity and would, therefore, encounter public resistance.

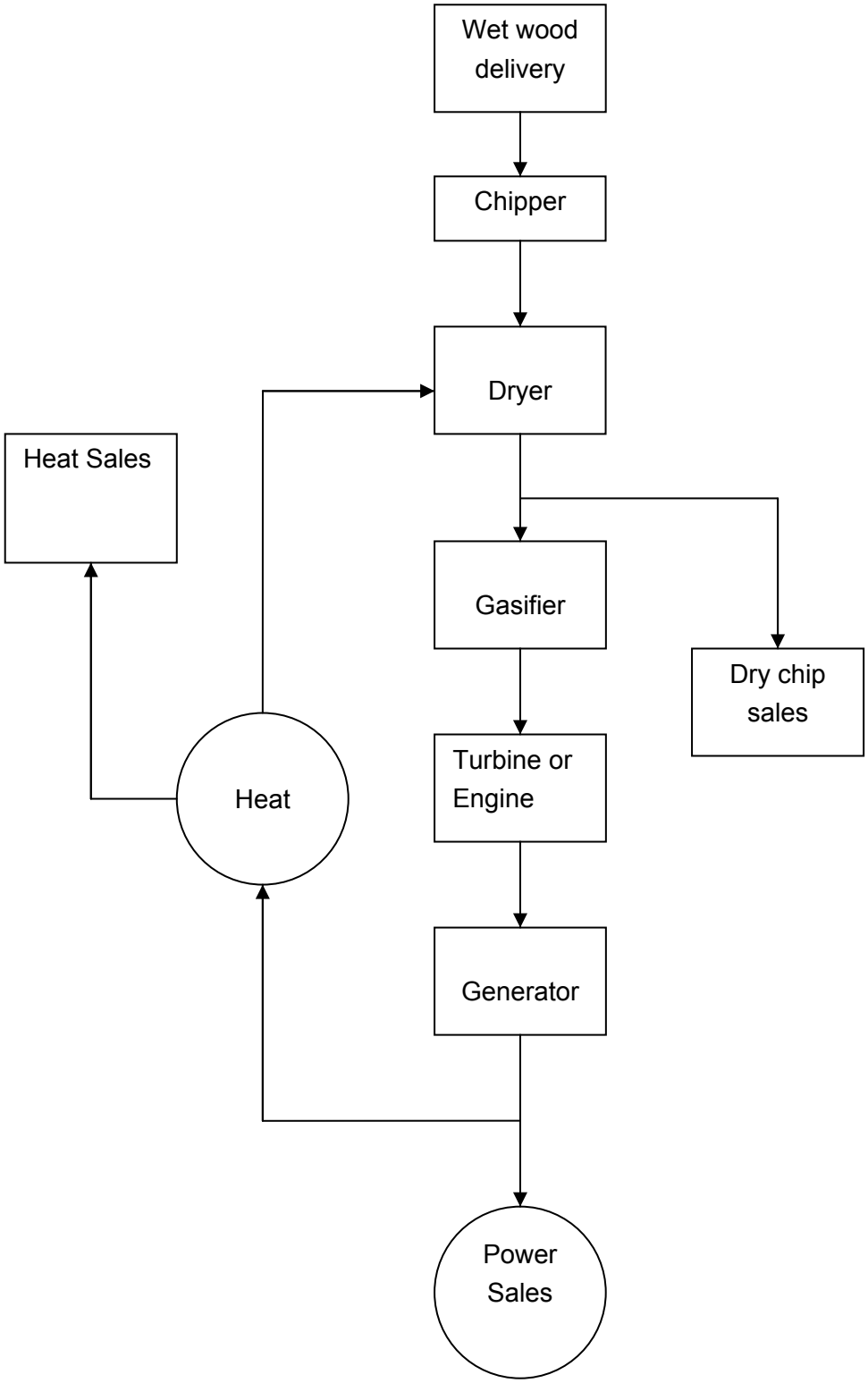
The second option is the development of a number of smaller scale plants, perhaps in the range of 15,000 – 30,000 tonnes/yr dispersed across the region. Connection to the grid would be through one of numerous 11Kv transformers. Potential users of heat would be relatively easy to find, and the supply of biomass would be derived from local producers, which would reduce the road transport impact. Also, since the plant would be sited in a small shed or open yard, it would have little impact on the landscape or local amenity and would, therefore, meet with much greater public acceptance, especially if a local public building was the outlet for the heat.

9.0 CHP CONCEPT AND ITS POTENTIAL FUNDING

The concept being considered for combined heat and power is set out below. This model produces electricity on a small scale up to say $3MW_e$ so the plant feeds into the 11KVA distribution network, which is more extensive in the Borders. An important factor is that the plant recovers sufficient of the heat to qualify for a “good quality CHP” certificate, which enables 100% capital allowances to be claimed by the investor in the first year.

The possible locations for the recovery of all of the heat are very limited in the Borders and therefore a facility, which uses the heat, has to be created alongside the power generation plant. The obvious uses for the surplus heat are the production of high quality dry chips for use in wood burning boilers. The project concept is set out in Fig 9.1

Figure 9-1: Project Concept of Integrating Dry Chip and Power Production

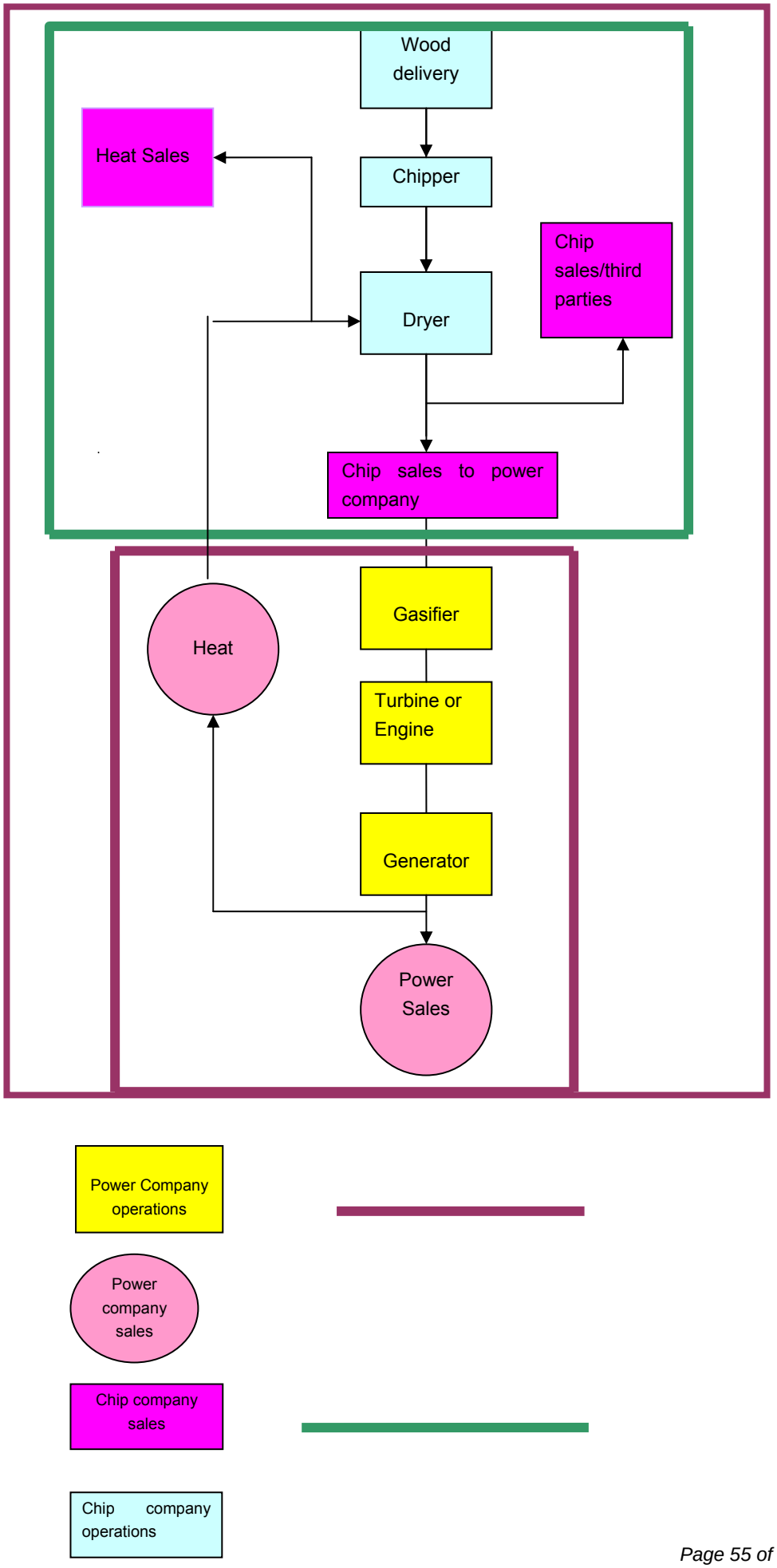


If there were no offtake for a substantial part of the heat from a third party, which would ensure the project would qualify as “good quality CHP”, then the operation would probably be structured into two separate companies, one producing power and the other a biofuels company which produced chips for both the power generator as well as companies/ organisations which operate biomass boilers. See Fig 9.2

Investors in this concept are likely to be venture capital funds and high net worth individuals for example Rockland Capital, Power Capital Ltd and Impax Capital Corporation Ltd., Climate Change Capital, ESD Ventures, Renewable Energy Generation. Triodos Bank and Co-operative Bank are also looking at this sector as well as a number of German (e.g. Nord LB) and Dutch (e.g. NIB) banks. However, a definitive list will not be possible until a final project has been defined, the investment requirement determined and the likely returns estimated. Each organisation has its own investment criteria and will not usually invest unless these criteria are met.

Clearly there are risks associated with projects of this type so the ability to fund is easier if there are contracts to purchase some of the heat and also a high proportion of the woodchips (biofuels) produced. There would also be advantages if power offset arrangements were made with a major power user to improve the revenue from power sales and also reduce costs for the buyer of the power.

Figure 9-2: Company Structure for Power Generation and Biofuels Production



10.0 STAKEHOLDER COMMITMENT

It is clear from attendance at recent events and on local forums that there is considerable commitment locally to the concept of renewable energy. For example delegates at the Borders Energy Summit in 2006 included representatives from the Scottish Parliament, Berwickshire Housing Association, Scottish Borders Council*, Scottish Borders New Ways Partnership, South East Scotland Local Energy Support Programme, Borders Construction Industry Forum, Southern Uplands Partnership, Scottish Enterprise Borders*, Berwick-Upon-Tweed Community Development Trust, Borders Machinery Ring*, Eildon Housing Association, Emtelle UK Ltd, EarthEnergy Systems, Heriot Watt University, MEB People & Places, Miller Dreams Ltd, National Farmers Union Scotland*, Patience & Highmore, Tweed Horizons Centre and Ofgem, Members of the Scottish Borders Sustainable Energy Forum include representatives from those marked * above, BFRS, RRC, Eildon Enterprise, Scottish Rural Property & Business Association and Changeworks

11.0 SWOT ANALYSIS FOR AN INTEGRATED BIOMASS PLANT

Analysis of the options for developing the use of biomass for energy lead to the conclusion that the only practical and possibly economic route was the development of small scale distributed power generation plants. As this is the only viable route the SWOT analysis for this option only is reported here.

Strengths	**Weaknesses**
Substantial local resource, mostly spruce but also some hardwoods, both of which suitable as fuel. Small woodland areas for which few existing markets and would be available for biomass for fuel (see weaknesses) Established wood harvesting business Support for biomass from local Council Wood currently competitive with alternative fuels Biomass being exported from region Lack of embedded generation means that opportunities exist to supply to the local grid, especially if small scale and supply into the 11KVA system	Supply chain not developed for biomass from forests and small woodlands The need to bring into the supply chain a large number of small woodlands will increase uncertainty (see strengths) Few opportunities for developing CHP with good heat offtake so need to create own heat use industry The CHP plant integrated with wood chip drying would oversupply the wood chip in the short term Local production for logs and chips (which restricts the market for small scale biomass uses) Wood (unless using pellets) higher "hassle factor" than other fuels, needing more storage and supervision External demand for Borders biomass from established plants promotes price inflation (though this is good for forest owners not good for consumers) Lack of local saw milling industry which provides co-products
Opportunities	**Threats**
To expand use of biomass for power production Expand use of biomass for heating Use more wood grown in the Borders in the Borders Bring into management areas of forest which are currently under managed or have little commercial value as there is no market for the products Create local employment Reduce the use of fossil fuels in the Borders Region Create a model for small scale disaggregated power plant, which could be replicated elsewhere in the Borders and Scotland. Council is committed to using biomass for heating and this could become the means by which biomass industry developed.	Imported biomass in the form of pellets undermines local market (export price Latvia €80/tonne ex mill) Councils do not deliver on promises to support development of biomass heating Markets for dry wood chips does not develop quickly enough to provide revenues for CHP plants External demands for biomass (in the form of logs) for processing into manufactured forest products so co-products arise out of the area. The developments at Lockerbie and Ayr exhaust local supplies and so put additional demands on Borders forests. Additional pressures will arise if co-firing is expanded at Longannet and Cockenzie power stations to use locally grown biomass.

Options for integrated plants are constrained by a number of factors, mainly connected with infrastructure and the ability to connect to the power grid and find useful outlets for the heat.

12.0 PARAMETERS FOR MINIMUM-SIZED, DEVELOPABLE BIOMASS PLANT

Preliminary analysis indicates that there is an opportunity to develop a small-scale power generation plant based on existing resources. For this plant to develop it will be necessary to confirm:

1. Availability of biomass. We can conclude that there is sufficient biomass in the Borders already available to support one or more small-scale biomass power plants.
2. Supply price of biomass and security of supply. This will require the development of a supply chain and this is being encouraged by the development of a large demand at Lockerbie. The price at Lockerbie will determine the price for the region in the short term but a small local plant will have advantages of lower transport costs. At small scale wood supply is not an issue and brings with it opportunities for supply to increase
3. Ability to connect into the 11KVA grid network. This network is extensive over much of the Borders creating several options for locating a plant.
4. Technologies for small-scale distributed power are now available and others are coming onto the market. These technologies are being supplied with performance warranties which eases the securing of funding
5. The biomass projects will qualify for Renewable Obligation Certificates (ROCs) which provide a financial incentive to the generator but are not sufficient on their own to justify investment without additional revenue sources
6. The recovery of the heat is essential both from the requirement of the revenue from the sale of the heat and from the need to secure a good quality CHP certificate. Securing a good quality CHP certificate allows the investor to claim 100% capital allowances and benefit from increased revenue. The use of heat can either be from an existing user or through the development of a new product or operation.
7. One option being considered if a major heat user is not identified who is willing and able to make use of the biomass powered CHP plant is the production of an intermediary energy project, namely dry wood chips, for use in the market for heating.
8. Sources of funding for such investments are likely to be venture capitalists with a high equity involvement in the projects and so the projects must be structured so they are attractive to venture capitalists who can secure maximum capital allowances and underwritten by secure long term power and heat offtake contracts and/or for the sale of the dry woodchip.

Options for small scale, in the range 250KWe to 3.0MWe, have been investigated. An illustration of the possible outline energy balances and power and biofuel output for two example plants are given below. In Table 12.1

Table 12-1: Pyrolysis & Gasification Process

Wet wood inputs and power and dry chip outputs				
Tonnes of Wood Per Year (as received)	3,125	2,841	12,500	11,364
As Received Moisture Content (dry basis)	67%	52%	67%	52%
Hourly flow rate (O.D. Tonne/hr)	0.25	0.25	1.00	1.00
Energy Flow Rate (MW)	1.3	1.3	5.2	5.2
GROSS Electrical Energy Generation (kWe)	300	300	1201	1201
Woodchip Dryer				
Heat Available for use (MW)	0.174	0.208	0.694	0.833
Tonnes of Wood Per Year (as received) (T/yr)	7,518	12,206	30,072	48,824
Tonnes of Wood Per Year (dried to 20%) (T/yr)	5435	9706	21739	38824
Total Tonnes of Wood Per Year (as received)	10643	15047	42572	60187
Total Tonnes of Wood Per Year (O.D)	*6373*	*9900*	*25294*	*39597*

Assumptions:

1/ Plant Operated 24/7 7/7 for a total of 7500hr/yr

2/ Lower Heating Value of O.D. woodchips = 18.8MJ/kg

There are a number of possible UK technology suppliers, which have been considered and include, with no recommendation or endorsement:

Biomass Engineering Ltd

Compact Power PLC

ITI Ltd

Keld Energy Ltd

13.0 THE POSSIBLE SCALE OF AN INTEGRATED BIOMASS PLANT

Current economic models would indicate that plants with a power generation of 0.5MWe to 3.00MWe with full heat recovery are a viable option. The capex for such a plant would be in the order of £1 to £6 million and produce electricity and dry wood chips. The project would probably have to be undertaken through an Enterprise Investment Scheme (EIS) or through a Limited Liability Partnership, which can claim tax relief. Without the tax relief returns relative to risk are too low.

As indicated above the key is the market for heat. The obvious buyer is the Council and the aggregation of their biofuel demands into a central region wide contract would provide the necessary scale to facilitate a project proceeding. The benefits associated with including power sales in one contract, along with inclusion of biofuels (either in the form of dry quality wood chips or as heat from an energy supply company who also operate the individual boilers) needs further consideration.

14.0 FIRST STAKEHOLDER WORKSHOP

A stakeholder workshop was held on 6th February hosted by Scottish Enterprise Borders at Galashiels. The presentation is loaded onto the project workshop website www.bordersbiomassstudy.com .

Feedback was given in both the meeting and through the request to supply written responses. The conclusion that the lack of markets for biomass was restricting the development of the supply chains and the lack of supply of good quality biomass in a useable form was restricting growth in demand was accepted. The proposal that the "chicken and egg" situation could be broken by the creation of small-scale power plant, which used the waste heat for industry, if a suitable heat load could be identified, or through a dedicated chip drying plant, was supported. The potential for generating revenues for landowners from biomass sales where there is currently none and the consequent poor levels of management in existing small woodland, and employment in the supply chain was recognised. The benefits to support industries, such as equipment supply and maintenance was also recognised.

15.0 DEVELOPMENT SCENARIOS

Current activity in the wood harvesting sector is directed at encouraging the use of biomass based on wood, which has been allowed to dry naturally, to be supplied to the heating market. This has the benefit of not requiring any significant capital investment but does involve building stockpiles of wood, usually in the forest, to allow it to dry. The growth of demand and supply though this route is likely to be slow and, because of uncertainties over the final condition of the wood chips at the point of delivery, is unlikely to be attractive to potential major heat users. There is a predominance of small companies without major resources in the Scottish Borders and therefore it is unlikely that a major development will be forthcoming from a local company. Thus “business as usual” or natural growth of the market is unlikely because of the lack of local capital and expertise to result in the level of increase in wood use and employment which is being sought by the Public Sector. Specific intervention to encourage and promote an investment in the production of fuel, be it chips or pellets, is thus required. The development of a supply industry will be tied to the development of demand.

The Borders figures lowly in respect of project opportunities due to poor infrastructure (roads, railways and grid network, availability of biomass or the opportunities to import biomass, low prices for embedded biomass in waste compared with the major cities and opportunities for the use of heat) and therefore any major investor will look to other areas for project development in biomass before looking to the Borders

It is also believed that without specific intervention in the sector there will be no electrical power generation from biomass, which will constitute the main demand pull for the production of biomass in the Scottish Borders within the immediate future. However with intervention and encouragement there is the possibility of both power generation and, where there is no existing heat demand, use of the spare heat for drying wood for large scale production of a prepared biomass fuel.

15.1 Development Criteria

For a successful development the following criteria must be fulfilled:

a) A suitable site with access and title by way of freehold or lease;

b) Proximity to an electrical sub-station to allow for the export of power. As a generalisation (as each project is case specific to local conditions) up to 4MWe output needs a connection to the 11KV power system. Above this, connection to the 33KV system, which is far more extensive, would be required;

c) Opportunity to use the heat and so obtain additional income and a "Quality Combined Heat and Power Certificate" (QCHPC) – see Appendix M for further details;

d) Proximity to a sustainable fuel source at an economic cost;

e) Availability of a suitable technology which will operate economically at the required scale and is acceptable to funders and the permitting authorities;

f) Acceptable environmental impacts from the project;

g) Planning permission likely to be granted;

h) Adequate return on the investment;

i) Where there is an existing heat demand an interested and willing management to consider the options for developing an alternative heat supply; and

j) Identifiable project developer.

The need to fulfil the above criteria limits the options for development. The lack of a large heat demand in the Scottish Borders limits any CHP project based on existing heat load to a small scale project. In the course of the study only one scenario emerged, based on responses received from a questionnaire sent to all major heat users. There may be others but they failed to respond and so failed the "willing management" test (i).

Options were considered for stand alone projects. The stand alone project must be a dual development of generating electrical power and developing a use for the heat. Effort was expended to find a suitable site. This involved contacting the Scottish Borders Council, Scottish Enterprise Borders, Forestry Commission and private land owners. Only one site was forthcoming where the area is sufficient, the access is suitable, there is the possibility of power connection, there is proximity to the raw material, the land owner is interested in discussing the lease/sale of the land to the project and it is considered that there is a good possibility of securing planning consent.

For a stand alone project on this site, scale is thus the issue. Small scale projects of less than $1MW_e$ were considered but these would only be attractive to an existing timber harvester and would not be suitable to the land owner of the identified site as land use and rent payable would not make the operation worthwhile. The development of a project of this size would require a "Project Champion" to be identified. Discussions have been held with one potential "Project Champion" who is considering the options and with the assistance of the Consultants is looking for a potential site. Until a site is identified and the "Project Champion "decides to progress matters, this option can not be developed.

The term "Medium Sized" is obviously a term covering a wide spectrum of sizes. Consideration was given to:

- The characteristics of the site and the rent expectations of the land owner
- The availability of biomass, both for energy and secondary products
- Local grid connections
- Characteristics of the equipment which could be used.

Within the above parameters two projects have been identified and defined which it is believed can satisfy all of the above criteria immediately or in the near future. These projects are:

- A small scale project embedded in an existing factory to supply heat and power. This project would be developed at Hawick Knitwear in Hawick, and
- A medium scale project as a stand alone project with a secondary development to use the heat. This project would be at either:

a) Galalaw Business Park, Hawick, or

b) Near Newton St Boswells.

These are the preferred sites but the possibility of locating the project at an alternative site has not been ruled out.

15.2 Development Assumptions

It has been assumed in the financial models developed for the project scenarios set out below that conventional project finance (equity investment coupled with bank debt finance through a special purpose project company) will be the mode of financing. There are other funding options which could be followed if private finance from individuals is forthcoming (e.g. Limited Liability Partnerships or LLPs) but these have not been analysed in this Study as they are very specific to the finances of the investing individuals. The projects have however been deliberately structured to ensure that a QCHPC can be obtained, and the associated enhanced capital allowances claimed.

15.3 Small Scale

Small scale projects in the context of this Study are projects with a power generation capacity of less than 1MWe. In Phase 1 of this Study a questionnaire was circulated to all large employers in the Scottish Borders Region. The only response which has so far led to the possibility of a company converting to biomass CHP for the supply of the heat and power was from Hawick Knitwear Ltd, an established producer of knitwear in the Borders. Full details of the company are listed in Appendix G.

The Company currently operates two gas boilers for process heat and space heating and buys in electrical power. Energy usage for 2006-2007 is given in Appendix H. A number of different sized plant options were considered based on the size and variability of the demand for electricity, process steam and space heating.

It is proposed to install a 500kWe biomass gasification plant and gas engine. This is the only option which meets the demands of the factory and can be located on the site allowing for access storage and plant area requirements. Heat from the gas engine's exhaust would be used to generate around 500kW of steam for process heat. A similar amount of heat from the gas engine's water jacket would be used to dry the incoming wood fuel. Additional waste heat from the gasifier's gas cooling system would be used for space heating when appropriate. For further details see paragraph (g) below. Approximately half the electrical power would be used internally and the remainder supplied to the grid through the sub-station on site. The gas boilers would be retained on site in operational condition for peak demand lopping and back up during maintenance.

An evaluation of the site indicated:

a) Suitable site with access and title by way of freehold or lease.

The site is owned by the Company and has direct access off Slitrig Crescent, a B class road, which is already used for the delivery of raw materials to the factory and export of finished articles. This regularly includes articulated and heavy goods vehicles. The road to the North goes into Hawick town centre and the road to the South goes directly to Keilder Forest. The land where the plant would be sited was previously used for a staff canteen and workshops and is now derelict. The buildings have already been demolished due to their poor condition. A site plan is included as Appendix I.

b) Acceptable environmental impact of the project

The environmental impact of any biomass energy project is a function of the scale of the project, the technology employed and the nature of the fuel used coupled with the sensitivity of the local environment. A combination of these factors will determine the type and scope of the environmental impact assessment (EIA) and pollution prevention and control (PPC) submission that the relevant planning and permitting authorities will require to be undertaken before approving the development. The Environmental Impact Assessment (Scotland) Regulations 1999 set out the requirements for an EIA. For example an EIA is mandatory for a thermal power station of more than 300MW. Installations for the production of electricity, steam and hot water on sites of more than 0.5 ha and installations for the disposal of waste by incineration (with a throughput of less than 36,500 tonnes per annum) may, at the discretion of the local planning authority, require an EIA. Although the site at Hawick Knitwear falls below the threshold

for an EIA and the proposed plant is not intended to process waste wood, a prudent developer would accompany any planning application with a report on the environmental impact of the development. Such a report might include:

- Project Description
- Renewable energy legislation and relevant planning policy
- Best available technology (BAT) assessment
- Emissions control
- Management systems
- Wastes (to air, ground, water and disposal of solid wastes)
- Air quality issues
- Noise level predictions
- Transport issues
- Ecological impact
- Visual impact
- Mitigation measures

For PPC purposes a plant with a net thermal input of less than 20MWth does not need a permit provided the fuel does not comprise waste. The definition of waste can be a tricky one. In the case of Hawick Knitwear the fuel for the plant will comprise virgin timber in the form of small roundwood which is not, by definition, a waste. The rules for permitting therefore do not apply.

The scale, fuel type and technology of the proposed development are not expected to produce any significant environmental impacts that will prevent it gaining planning permission and permitting.

c) Planning permission

It could be argued that the proposal falls within the permitted development rights conferred by Class 24 of the Town and Country Planning (General Permitted Development) (Scotland) Order 1992. Class 24 permits the installation of replacement plant or machinery on industrial land for the purposes of an industrial development provided it does not affect the external appearance of the business premises nor exceed a height of 15 metres (or the height of anything replaced whichever is the greater). If this is the case planning permission would not be required although a prudent developer would seek the opinion of the local planning officer before proceeding with any development.

If however planning permission is required the Local Plan would support the development of a proposed biomass plant on the grounds that the site is zoned for employment use, is currently derelict and the Company's reduced reliance on fossil fuels would safeguard existing jobs. Although the additional lorry traffic that the proposed development would generate is only some two per day, there are two traffic

related issues that would need to be addressed in any application for planning permission. The principal constraint on development is the narrowness of both the site itself, sandwiched between the River Slitrig and Slitrig Crescent, and the extent to which Slitrig Crescent is narrowed with the parking of cars. This could be addressed by the provision of a new and better aligned access. A further major constraint is the bottleneck at the junction of Slitrig Crescent and the High Street which makes it preferable that timber lorries travel either to or from the site from the South.

Another issue that might need to be addressed is the extent to which the site could flood as the Slitrig Water is becoming increasingly prone to flash flooding. However, the Company is confident that the site is well protected from flooding and this should not preclude a biomass plant being located at the site.

d) Proximity to a sub-station to allow for the export of power

There is an 11KV substation on site. A definitive view from Scottish Power will be necessary and will only be provided when a system study is undertaken and the necessary fee paid but an informal view is that there should be no impediments to connecting a 500kWe generator to this substation for power export.

There are a number of options for selling the excess power on to the grid. With a 500kWe plant there will almost always be sufficient capacity to service the internal power demand, however there will occasionally be times when it will be necessary to import power, for example, during maintenance periods. As Hawick Knitwear's current supply company will lose considerable electricity sales because of the embedded biomass CHP generation, the cost of this 'back up' electricity will be expensive. The best way forward for Hawick Knitwear would probably be to come to an arrangement with their current supply company which allows Hawick Knitwear to sell any excess power to them whilst still importing a small amount of power when required. They would be paid on a net basis and there may be some additional costs associated with the use of system charges that the distribution network operator (DNO) may levy on the exported power. Hawick Knitwear could then sell the Renewable Obligation Certificates (ROCs) associated with all of the power generated by the plant on the open market to the highest bidder. An alternative option would be 'sell green buy back brown' where the supply company would purchase all of the green electricity and the associated ROCs generated at a combined price and sell back 'brown' electricity at a discounted price. The value of the ROCs is likely to be less in this case, however, it might produce the best overall deal if the supply company is below its requirement for supplying power from renewable sources and looking to acquire ROCs in the market place.

It will be necessary for Hawick Knitwear or the Energy Supply Company (ESCo) which develops the project to become an accredited generator with the Office of Gas and

Electricity Markets (Ofgem) (renewable@ofgem.gov.uk 0207 901 7442) so they can claim the ROCs. The ROCs are sold separately from the power generated and can be sold through any one of several traders, such as (for example only) Smartest Energy (www.smartestenergy.com).

The final decision on the mode of sale will have to be concluded during a more detailed feasibility study than can be undertaken in this Study. In the financial analysis, the assumption is made that the power is sold to a power distributor and used as offset. Scottish Power have informally budgeted the connection charge at £50,000.

e) Opportunity to use the heat and so obtain a "Quality Combined Heat and Power Certificate" (QCHPC)

The heat from the biomass plant would replace the output from the two gas boilers now used. The boilers would be retained as back-up for the site in the event of any technical problem with the biomass plant and for use during maintenance periods. No significant issues are foreseen for connecting the biomass plant to the main steam and heating systems for the factory to operate in parallel with the gas boilers.

Additional information about QCHPCs is given in Appendix M.

f) Proximity to a sustainable fuel source at an economic cost

The plant is expected to require some 3000dte (dry tonne equivalent) of wood chip fuel per annum. The Phase 1 resource assessment suggests that there is over 25,000dte/y of forest residues available within a 15km radius. Figure 15.1 shows its distribution. The technology envisaged requires the feedstock to be large chips or chunks so there will be a predominance of wood recovered from small roundwood from forests and woodlands and less reliance on forest residues and brash.

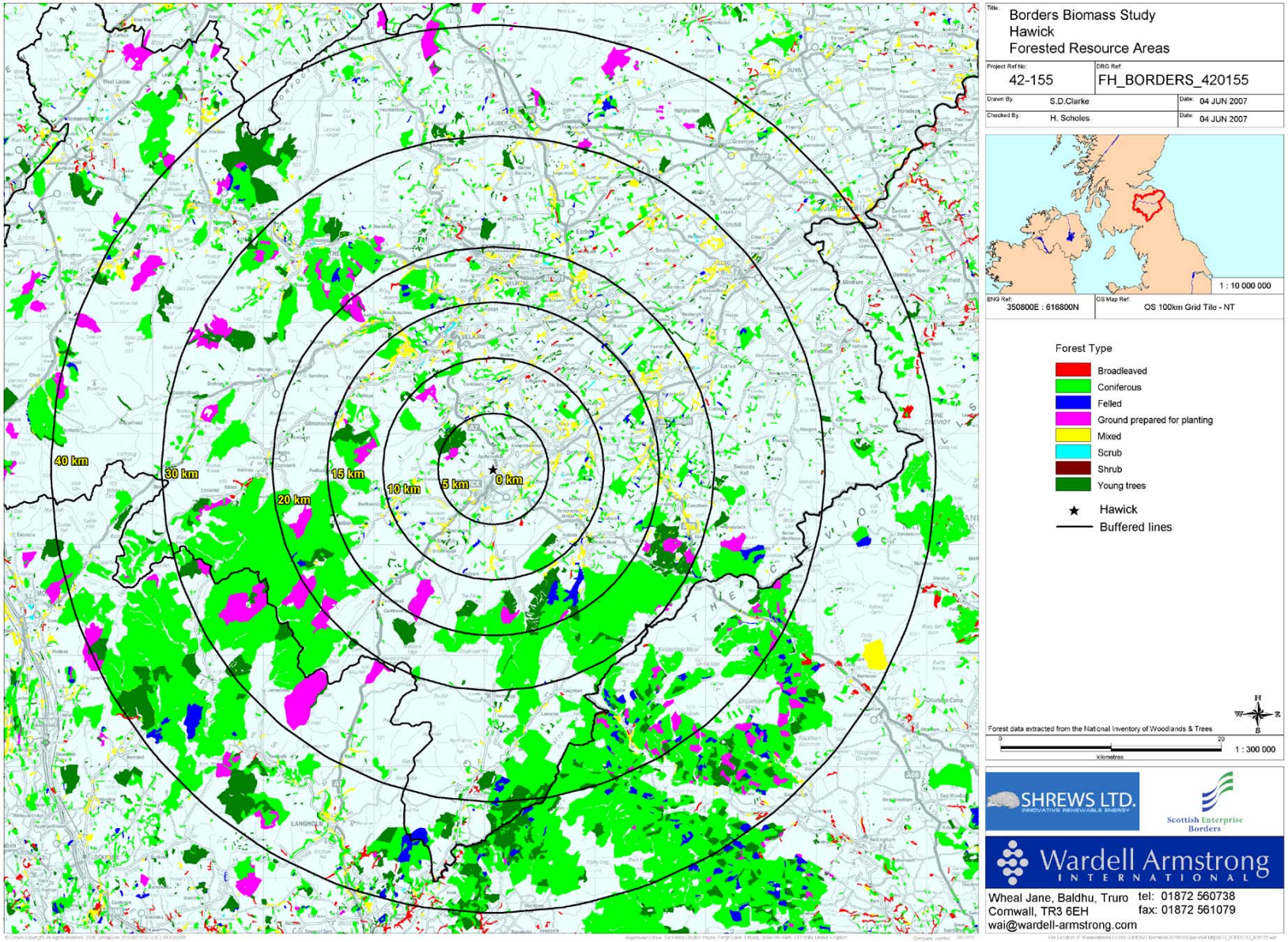


Figure 15-1: Forest Resource Areas Relative to Hawick

g) Availability of a suitable technology which will operate economically at the required scale and is acceptable to the funders

Following an evaluation of the available technologies, the technology considered most suitable for this site is the equipment supplied by Biomass Engineering Ltd of Newton le Willows, Lancashire. This plant is now proven technically and several plants have been installed and are operating which means that performance guarantees can be provided.

For a 500kWe installation, the equipment will comprise two downdraft gasifiers which produce a relatively low calorific value gas (primarily containing N_2, H_2 and CO), a single gas clean up and cooling system and a 500kWe conventional spark ignition gas engine. The overall electrical efficiency of the plant is around 30%. A heat exchanger in the gas engine's exhaust system would be used to generate around 500kW of steam for process heat. A similar amount of heat from the gas engine's water jacket would be used to dry incoming wood fuel to below 20% moisture. Additional waste heat from the gas cooling system could be used for space heating when appropriate.

An initial financial assessment for this plant suggests an internal rate of return (IRR) of around 7% over ten years even with a grant. Although this is probably not high enough for a speculative commercial developer (projects based on waste in populated areas are probably achieving in the order of 25-30% IRR) it would make financial sense for Hawick Knitwear in terms of reduced operating costs, a more environmentally sensitive image and greater security of supply.

h) Adequate return on the investment

A full economic model has been produced and this has been provided separately in electronic form. The main outputs are summarised in Tables 15.2 - a, b and c.

The assumptions for the development of the project are as follows:

Table 15-1: Assumptions Relating to the Model

Inflation	0%			
Real increase in electricity prices	4%	per year		
Equity	150.0	£'000's		
Equity as percent of total project cost	8%			
Capital investment	1580.0	£'000's		
Debt plus equity	1,400	£'000's		
Bank overdraft interest	7%			
Bank deposit interest	3%			
Term loan interest rate	7%			
Term loan period	96	Months		
Total loan	1250.0	£'000's		
Depreciation -equipment	120	Months	- straight line - calculated monthly on cost b/f	
Depreciation -buildings	240	Months	- straight line - calculated monthly on cost b/f	
Grant	400.0	£'000's		
Release of grant	60	Months		
Number of plants	1			
Hours worked per year	8000			
Heat sales capacity	1.5	MW/h		
Monthly industrial heat demand	0.85	MWh		
Monthly district heat demand		MWh		
Electricity sales	0.5	MWe		
Labour costs per month				
Supervisors	1800	£/month		
Operatives	1200	£/month		
Wood cost	20	£/ tonne		
Average delivered moisture content	40%	wet basis		
Average moisture content of wood chips sold	15%	wet basis		
Sales price				
Heat industry	25.0	£/MWh		
Heat district heating	22.0	£/MWh		
Electricity base price	24.0	£/MWe		
Electricity ROC price	92.0	£/MWe		
Electricity Climate Change Levy Benefit	5.5	£/MWe		
Wood chips ex works	65.0	£/tonne at	18%	moisture content dry basis
Ash	5.0	£/tonne		
Debtors	0%	collected in current month		
	100%	collected in next month		
	0%	collected in subsequent month		
Creditors	20%	paid in current month		
	80%	paid in next month		
	0%	paid in subsequent month		

The capital investment for the project is projected to be in the order of £1.6 million for plant, buildings and connections into heating system and power system.

Sales are projected to be in the order of £617,000 per year, increasing as power prices increase.

Profits before tax are projected to be £160,000 per year increasing to £226,000 after ten years. The profit is achievable with a grant of £400,000. This would be the maximum grant available under a Scottish Executive Biomass Support Scheme if the scheme were to be repeated and the previous rules applied.

Table 15-2: Small Scale Financial Model

Table 15-2 a

Financial Projections (£'000s)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Sales	106	617	621	625	630	634	639	644	649	654
Operating Costs	(105)	(186)	(186)	(186)	(186)	(186)	(186)	(186)	(186)	(186)
Gross Profit	1	431	435	439	444	448	453	458	463	468
Overheads	(309)	(269)	(269)	(269)	(269)	(269)	(269)	(269)	(269)	(269)
Operating Profit	(308)	162	166	170	174	179	183	188	193	199
Interest and grant	(14)	(1)	11	23	36	(4)	(17)	(3)	12	27
Profit before tax	(323)	160	177	193	210	174	166	185	205	226
Operating profit % to sales		26.2%	26.7%	27.1%	27.7%	28.2%	28.7%	29.2%	29.8%	30.4%
Profit after tax	(645)	160	143	156	170	141	135	150	166	183

Projected Balance Sheet (£'000s)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fixed assets										
Machinery	1,377.1	1,228.1	1,079.1	930.1	781.1	632.1	483.1	334.1	185.1	36.1
Buildings	86.6	82.1	77.6	73.1	68.6	64.1	59.6	55.1	50.6	46.1
Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	1,463.7	1,310.2	1,156.7	1,003.2	849.7	696.2	542.7	389.2	235.7	82.2
Cash	25.3	102.7	162.7	236.1	323.1	434.5	565.9	713.0	876.1	1,107.9
Long term loans	(1,320.8)	(1,197.8)	(1,041.5)	(885.3)	(729.0)	(572.8)	(416.5)	(260.3)	(104.0)	0.2
Trade creditors	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)	(12.4)
Grants	(346.7)	(266.7)	(186.7)	(106.7)	0.0	0.0	0.0	0.0	0.0	0.0
	(172.7)	(12.5)	130.6	287.1	457.2	598.4	733.0	883.2	1,049.5	1,232.4
Initial equity	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Share premium account	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit and Loss account	(322.7)	(162.5)	(19.4)	137.1	307.2	448.4	583.0	733.2	899.5	1,082.4
	(172.7)	(12.5)	130.6	287.1	457.2	598.4	733.0	883.2	1,049.5	1,232.4

Table 15.2 b

Asset value and return per share

	Start	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Number of shares (000's)	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Asset value per share (£)	1.00	-1.15	-0.08	0.87	1.91	3.05	3.99	4.89	5.89	7.00	8.22
Profit per share (£)		-2.15	1.07	1.18	1.29	1.40	1.16	1.11	1.24	1.37	1.51
Profit per share net of income tax	40.00%	-3.59	1.78	1.96	2.15	2.33	1.94	1.85	2.06	2.28	2.51

Table 15.2 c

Capital Investment Cumulative(£'000s)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Equipment	1490	1490	1490	1490	1490	1490	1490	1490	1490	1490
Buildings	90	90	90	90	90	90	90	90	90	90

i) Assumptions and Role of Scottish Enterprise Borders

The above financial forecast has been based on budget costings supplied by the proposed equipment supplier, Biomass Engineering Ltd, and a budget quote for connection from Scottish Power plc.

Fuel supply costs are an estimate based on discussions with potential suppliers but firm quotes are required. A limitation on the use of the Biomass Engineering gasifier is the need to use chunks or large chips which are best produced from small round wood and not recovered from brash.

It is also assumed that there is a grant of £400,000 towards the project which is above the 15% Regional Selective Assistance grant of £217,500. However it is the amount which was available under the previous Scottish Biomass Support Scheme (SBSS) and it is assumed that this amount will be available in any future scheme. If there is no second round of the SBSS then other sources will have to be sought, such as Lottery funding.

The project is not core business to Hawick Knitwear Ltd and though the management has expressed interest in the project, it is not a top priority. It is believed that encouragement from Scottish Enterprise Borders will be required to bring this project to fruition in the near term. This will probably involve inputs from SEB staff and support with consultants while the project engineering and more detailed investment model is developed.

j) Identifiable project developer

Hawick Knitwear Ltd is looking to reduce costs and could act as the project developers. This option is being investigated by the Company. Another option is for the Company to enter into a contract with a special purpose vehicle company (SPV) funded by an established energy supply company or venture capitalists.

The economic model is based on the assumption the project operates as a separate Special Purpose Vehicle (SPV) based on conventional assumptions regarding depreciation.

In view of the low level of return, ownership of the project by Hawick Knitwear would appear to be the best option with costs used as a direct offset against imported energy with overheads absorbed into existing factory operations.

External investors would probably be venture capitalists who would be investing through a venture capital arrangement and seeking to obtain enhanced capital allowances.

Investors could be sought if the Company decides not to pursue the project in their own right.

Next Steps

Before a final investment decision can be made the following actions are required:

I. Obtain a commitment from the management to progress the project;

II. Obtain commitments from the public sector to assist with the detailed study leading to funding and implementation of the project;

III. Appoint consultants to work with the management and the public sector to implement the project;

IV. Undertake a detailed engineering appraisal to confirm that the proposed plant can be integrated into the existing heating systems at the factory and provide a detailed cost of installation;

V. Liaise with the local planning department to confirm their requirements for a planning application and then prepare and submit a planning application;

VI. Liaise with Scottish Environmental Protection Agency (SEPA)

VII. Prepare a detailed financial forecast (including obtaining a firm quotation for the supply of the proposed equipment as well as possible alternative suppliers, quotations and proposals for the supply of biomass), and

VIII. Agree with the management their preferred strategy for funding and then assist with implementing that strategy.

15.4 Medium Scale

Within this context a medium sized plant is one producing in the range of 1-5MWe. The location of this size of plant is determined by proximity to the grid network and also by having a theoretical biomass supply catchment within about 40 km. This assumption is arbitrary but believed to be in keeping with the proximity principle. These sizes of plant are readily available from suppliers of gasification technologies.

No large scale heat user in the Borders was identified which would be capable of using the surplus heat load from a plant of this scale. Therefore the option of developing a business to both generate power and produce a product or commodity using the surplus heat has been developed. This would not preclude such a plant being sited next to a heat user who would use part of the heat for part of the year, such as a grain dryer, though the heat demand from a grain dryer is, in the context of the biomass power plant, very small.

Because of the capabilities of the chosen technology, the use of recovered biomass such as waste wood would be possible and the use of some waste wood in the biomass fuel for the power plant is assumed. This is compatible with Government policy which allows double ROCs (see Section 11 for a full explanation) on recovered biomass and is also encouraged as a diversion of this material from landfill.

The products considered from such a plant, in addition to electricity, are dried wood chips and wood pellets.

One of the advantages of wood chips is the lower capital cost but the market for dry chips is limited and considered unlikely to develop to the scale where all of the product from the plant could be sold. Original expectations were that the Scottish Borders Council, with their policy of biomass as the preferred source of heating in new public sector buildings (initially the new High Schools and the Primary Schools), would provide a launch market and set an example for other businesses. However, it is understood that the Council has now decided that the fuel for these will be wood pellets, largely due to their easier delivery and storage coupled with the lower maintenance costs and ease of operation. This decision is in line with that taken by several other Councils, mainly in England, such as Nottinghamshire and Leicestershire, which have installed pellet burners in their schools. Also, the option of sending excess chips to E.ON at Lockerbie was investigated and, while this is still an option, it is not considered to be a likely ongoing commercial one nor of a sufficiently large scale.

The development of a pellet industry offers in the longer term better prospects for developing the wood fuel market in the Borders as this opens up industrial, commercial and residential markets. In Upper Austria (Renewable Energy World, March 2007) the industry is worth €1.6

billion and employs 3500 people. Demand is also growing rapidly in North America where demand is expected to increase from 1.5 million tonnes in 2006 to some 3 million tonnes in 2010. Exports from North America (mainly Canada) are expected to increase from about 0.7 million tonnes in 2006 to some 8.5 million tonnes in 2010. The rapid increase in production world wide is being matched by rapid increases in pellet demand, mainly from power stations but also from increases in domestic and commercial heating plants based on pellets. Although there is currently considerable price uncertainly, supplies are readily available as this is now an internationally traded commodity. Due to the high bulk volume, transport is a major cost and so there are advantages in the pellets being produced locally.

In terms of production, there are economies of scale in the manufacture of pellets. A minimum scale for a commercial plant is considered to be 4 tonnes per hour, equating to about 30,000 tonnes per year. Traditionally pellet manufacture has been from wood sawdust but this is not a pre-requisite and pellets can be manufactured from any biomass. In this study, it has been assumed that the source of biomass will be forest residues and thinnings but the inclusion of agricultural by-products would be possible and if a full project feasibility study is undertaken then this source should be investigated further.

The model developed is for the generation of about 3MWe with the production of about 30,000 tonnes per year of pellets and, as the equipment and capacity will be available as part of the overall development, some dried wood chips to existing and potential wood chip users and to E.ON.

Two sites have been investigated. **Site A** is at Galalaw Business Park (OS NT 508 168) and **Site B** is near Newton St Boswells Grain Mill, Newton St Boswells (OS NT 585 295).

a) Suitable site with access and title, by way of freehold or lease

Site A

A site at Galalaw Business Park, with excellent access directly off the A7, has been identified. This site is already designated for industrial use and has the added advantage for the first project as it is in the control of Scottish Enterprise Borders and so the issues of negotiating control over the site are avoided and progress on planning permission can be made without delay. In addition there is adjacent land immediately to the south east owned by the Council that could be incorporated into the site to make it more developable. Furthermore, there could be opportunities in the future to deliver heat into the 32.9 hectares to the north east which has been identified in the Local Plan for mixed use development. A plan indicating the land in SEB's ownership as Site 2 (with the Council land adjacent) is included as Appendix J.

Site B

The site near Newton St Boswells, comprising about 5.7 ha, and the ownership is known. The advantages of this site are excellent access only ¼ mile from the A68 trunk road, space and a user for the excess heat during the grain drying season. The space issue is important as this will permit the project to expand later beyond the initial concept, both by adding additional power generation facilities and additional pellet manufacturing capability.

b) Acceptable environmental impact of the project

Again a gasification technology is proposed for this project but it is somewhat larger than the Hawick Knitwear plant, i.e. 2-6MWe. The same planning and environmental impact legislation applies as for the Hawick Knitwear plant, however, the sites at both Galalaw and near Nweton St Boswells will probably fall within Schedule 2 of the Regulations and a screening opinion should be obtained from the local planning authority under Section 5 of the Regulations to determine which environmental issues would need to be addressed in an EIA. These are likely to include:

- Project Description
- Renewable energy legislation and relevant planning policy
- Best available technology (BAT) assessment
- Emissions control
- Management systems
- Wastes (to air, ground, water and disposal of solid wastes)
- Air quality issues
- Noise level predictions
- Transport issues
- Ecological impact
- Visual impact
- Mitigation measures
- A site condition report
- Hydrology
- Geology
- Amenity and nuisance
- Material assets
- Human health risk
- Cumulative impacts
- In process control
- Raw materials
- Groundwater regulations
- Habitat regulations

The issue of PPC permitting is somewhat more complex than the Hawick Knitwear plant. For both the Galalaw site and the site near Newton St Boswells the fuel, in addition to virgin timber in the form of small roundwood, may well comprise forest residues and whether this falls into the definition of waste depends on the "intention to discard". For example, forest brash is not a waste if, at the time of harvest, there is a contract in place for the removal of that brash to a biomass plant. If, on the other hand, an *ad hoc* decision is taken at some later date to collect and remove the brash for delivery to a biomass plant then it is waste. However even if the fuel is waste, the requirements of the Waste Incineration Directive (WID) may not apply, for example virgin timber is excluded from WID. If the fuel is waste, but WID does not apply, there are different thresholds:

> If the rated throughput of the plant is more than 1 tonne per hour, it is likely to be permitted as a Part A process. If the rated throughput of the plant is less than 1 tonne per hour it is likely to be permitted as a Part B process.
>
> If the fuel is waste, and WID does apply, all plants are permitted as Part A processes irrespective of size.

As each site and each plant is likely to have its own specific characteristics, it is wise to consult SEPA in advance of any application to determine into which set of regulations the process falls. The costs associated with a Part A application are greater than for a Part B process and will need to be taken into account in any detailed further feasibility study.

Notwithstanding these additional requirements, the plant is not expected to produce any significant environmental impacts that will prevent it gaining planning permission and permitting.

c) Planning permission

The development at Galalaw Business Park **(Site A)** would be supported by the Local Plan as the site is already designated for employment, access is good and, because one of the Principal Aims of the Scottish Borders Structure Plan is that individual sustainable communities should have access to a range of permanent, quality jobs, the development would create some 27 jobs.

At the site near Newton St Boswells **(Site B)** any development would be supported by the Local Plan as the site is safeguarded for employment under Policy ED1 provided the proposed use falls under Classes 4, 5 or 6. The proposal is likely to fall within Class 5 Industrial Use and therefore accords with the aims of the Local Plan. A further requirement of ED1 is that the proposal is compatible with neighbouring employment

uses and that it respects the character and amenity of the surrounding area. The site is currently adjacent to a number of existing employment uses which are dominated by high visibility grain silos. Access to the site is good along a side road directly off the A68 and used by existing users of the industrial estate. In addition the development would create some 27 jobs.

In both cases the proposed development falls within Schedule 2 of the Environmental Impact Assessment (Scotland) Regulations 1999 being one intended for the generation of electricity on more that 0.5 hectares. However, the need for any planning application to be supported by an Environmental Statement will depend on the sensitivity of neighbouring receptors.

The greatest impact will be from the 30 or so additional lorry movements per day that the developments will generate. However the Galalaw site is directly off the A7 trunk road and is served by a service road designed to take traffic loads of this magnitude and the site near Newton St Boswells site is only ¼ mile along a side road directly off the A68 with the capacity for this quantity of additional traffic. The landscape impact of the proposed developments is likely to be minimal as the Galalaw site is already well screened from the town and from neighbouring residential development and benefits from a topography that would act as a beneficial backdrop, and the site near Newton St Boswells is dominated by neighbouring grain silos. However the gasification process will require emissions to be discharged to atmosphere via a stack. The greater impact of this will be at Galalaw where this may fall on the residents of the nearby Stirches estate whereas near Newton St Boswells it is unlikely that it will be taller than the grain silos. The height of the stack can only be determined by detailed emissions analysis using dedicated computer software that takes into account wind direction and local topography. The only other direct impact that would need to be mitigated is noise from the chipping process and from the electrical generating equipment.

d) <u>Proximity to a sub-station to allow for the export of power</u>

Scottish Power PLC have provided a non-binding opinion that there are no technical stumbling blocks to developing a power generation facility at Galalaw but a 3MW connection would probably require the installation of around 2km of underground cable to a connection point nearer to their Primary Substation in Commercial Road, Hawick. A very approximate budget guesstimate of connection cost is £500K.

Similarly there should be no over-riding difficulties for a power connection near Newton St Boswells. The estimate provided by Scottish Power for the connection charge for a larger project of 14MWe is £500,000 including the upgrade to accommodate a power

output at 33KV. This should be confirmed by a full study by Scottish Power, the cost of which will be included in the development appraisal.

e) Opportunity to use the heat and so obtain a "Quality Combined Heat and Power Certificate" (QCHPC)

There are no opportunities currently for the development of QCHP in the Borders to use the heat from a medium scale biomass plant. The development of a power plant at Galalaw or near Newton St Boswells will therefore entail the establishment of a heat using business, though some heat can be used in the grain drying business of Philip Wilson (Grain) Ltd at harvest time. The options for a heat using business so far identified are:

1) Supply of dried wood chips

The development of a wood chip drying business is the logical first step. The facilities for handling chips will already be installed as part of the fuel supply process to the biomass power plant and similarly the drier to dry the chips for the gasifier. Both the chip handling facilities and drier will have to be increased in capacity in order to produce dry chips for sale. Storage facilities will have to be provided for both the wet chips on arrival and the dry chips prior to shipping to the customer.

The main issue will be one of sales. The target market is to users of wood chip boilers. However, as explained in the Phase 1 Report the market is small due to the lack of a supply of quality dry chip. The biomass power plant will meet that demand but it will take some time for the market elsewhere to respond. It is now apparent that any biomass boilers installed by the Scottish Borders Council will specify pellets. As the market demand will lag behind supply an outlet of last resort is therefore required. The only available market for the quality of chip that will be produced (containing bark and some needles) is the biomass power station facility at Lockerbie operated by E.ON. E.ON has subcontracted the supply of biomass to A. W. Jenkinson of Penrith who in turn have contracts with sub-contractors, including Scottish Woodlands Ltd and Euroforest Ltd, for the collection of the biomass from forest residues. Initial responses regarding the supply of dry chips to Lockerbie are favourable and encouraging but further discussions are needed. Scottish Woodlands Ltd and Euroforest Ltd, through their joint venture Forest Energy UK Ltd, have also indicated an interest in supplying biomass directly to the Galalaw plant. The site near Newton St Boswells is less favourable as a location to supply the plant at Lockerbie due to

the higher transport distances for both the wet wood and the dry chips. This option is not however excluded and should be pursued either as the main outlet for a wood chip drying only plant or as additional production of wood chips from a pellet mill.

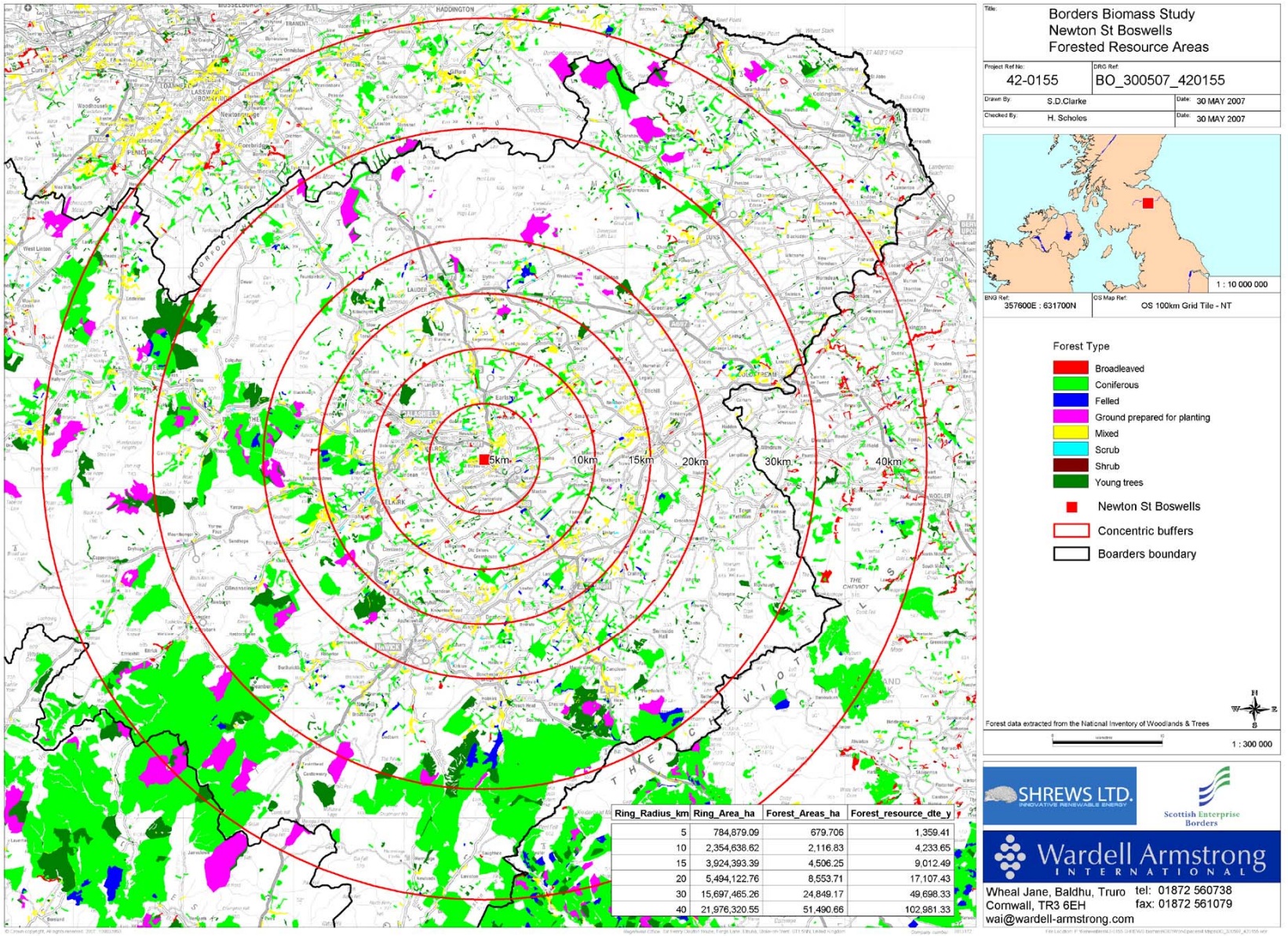
2) Production of wood pellets

The processing of dry woodchip on the site and the availability of heat and power creates the immediate opportunity to process the chips further into wood pellets. Traditionally wood pellets are made from sawdust but there are no significant sawmills in the Borders to provide this resource. However, there is nothing to preclude the conversion of low grade woody biomass from brash into pellets which have a much higher value. Also the pellets could contain other sources of biomass although these may result in a less robust pellet than using clean wood. This can be compensated for by the inclusion of starch in the pellets. Information about pellets from other sources is available on www.itcbc.org. The development of a financial model for a pellet mill is outside the terms of reference of this Study but for the purposes of completeness a financial model has been developed based on the production of 30,000 tonnes of pellets per year. This size of plant has been chosen because it fits with the biomass power plant, could fit on either site, achieves reasonable economies of scale and can be supported by local biomass supplies. The financial forecasts for the option for a pellet mill with some production of dried wood chips are set out below. The costing for the pellet mill is based on a quotation from GAME Engineering Ltd for a turnkey project to supply and install a CPM pellet mill. There is no recommendation attached to this quotation.

f) Proximity to a sustainable fuel source at an economic cost

Each project is expected to require some 26,000 dte of wood fuel per annum and a further 34,000 dte for the production of pellets. In wet tonnes this is about 100,000 tonnes per year. They will also each require a similar amount of material for production of dried wood chips and/or pellets. This is theoretically available within a 40km radius for either plant location based on forest residues alone (see Figure 15.2). However, it is to be expected that the existence of a plant will encourage other sources of biomass to become available, such as from small woodlands, forest thinnings from commercial forests and wood from tree surgery operations. The option of upgrading either plant to comply with the EU Waste Incineration Directive to make it capable of processing waste

wood and biomass from domestic refuse should also be considered in order to improve the financial returns by reducing fuel costs.



Ring_Radius_km	Ring_Area_ha	Forest_Areas_ha	Forest_resource_dte_y
5	784,879.09	679.706	1,359.41
10	2,354,638.62	2,116.83	4,233.65
15	3,924,393.39	4,506.25	9,012.49
20	5,494,122.76	8,553.71	17,107.43
30	15,697,465.26	24,849.17	49,698.33
40	21,976,320.55	51,490.66	102,981.33

Figure 15-2: Forest Resource Areas Relative to Newton St Boswells

g) Availability of a suitable technology which will operate economically at the required scale and is acceptable to the funders

Investigations have indicated the availability of a number of suitable technologies. These include Compact Power Ltd, ENER-G Group, First London Renewables Ltd and ITI Energy Ltd. Details of these companies and their technologies can be found in Appendix K.

The authors of this Report make no recommendation as to the most appropriate technology. However, in order to develop a project based on actual information, the technology supplied by First London Renewables Ltd (FLR) has been selected and the projections based on their indicative costs and their higher efficiency of power generation. No firm quotations have been provided and any costs must be confirmed with the equipment suppliers.

The economies of scale of the project are such that, at 5MWe, the power production will be slightly above the range set for a Medium Scale project. This scaling up of the project is in response to the higher grid connection cost for Site A (Galalaw) (although the extra cost of the larger cable is minimal), the opportunities for potentially larger project still near Newton St Boswells and the requirement for higher power usage at the pellet mill. The ability to export all the power generated when the pellet mill is not operational will of course still be required.

The main reason for choosing FLR as the example technology is that it satisfies the requirements for generating efficiency, price, simplicity of operations and reliability as well as being a qualifying technology under the regulations for awarding Renewable Obligation Certificates whether clean biomass, or biomass embedded in waste, is used as the fuel. Also the company is interested in selling the equipment to a developer whereas other companies are interested in developing the project themselves. Those options are not precluded at this stage but for simplicity, conventional project finance is the basis for evaluation.

h) Adequate return on the investment

The full economic model has been supplied separately. Note that the project as set out below assumes the production of pellets as well as the sale of electricity. The additional sales of any dry wood chips will be a bonus but as the local market is small, and no firm response has been received in respect of the E.ON plant despite several approaches, it is thought best to ignore this potential source of revenue at this stage. The main outputs are summarised below in Tables 15.4 - a, b and c below.

The capital costs are projected to be some £9.9 million for the power generation and pellet mill and £2.4 million for buildings and infrastructure.

Output from the plant is projected to be 5.9MW, based on projections provided by First London Renewables Ltd.

The assumptions pertaining to the model are as follows:

Table 15-3: Assumptions Relating to the Model

Inflation	0%			
Real increase in electricity prices	2.5%	per year		
Equity	2,500.0	£'000's		
Equity as percent of total project cost	19%			
Capital expenditure	12,280	£'000's		
Total project cost net of grant	11,500	£'000's		
Bank overdraft interest	7.0%			
Bank deposit interest	3.0%			
Term loan interest rate	6.5%			
Term loan period	96	Months		
Total loan	9000.0	£'000's		
Discount rate	7%			
Depreciation -equipment	120	Months	- straight line - calculated monthly on cost b/f	
Depreciation -buildings	240	Months	- straight line - calculated monthly on cost b/f	
Grant	1,842	£'000's		
Release of grant	60	Months		
Number of plants	1			
Hours worked per year	8000			
Heat sales capacity	10.9	MW/h		
Heat demand from district heating	0.0	MWh		
Heat demand from industry third party	0.0	MWh		
Electricity sales	5.9	MWe		
Labour costs per month				
Supervisors	1800	£/month		
Operatives	1200	£/month		
Recycled/recovered wood	10	£/ tonne		
Wood cost	25	£/ tonne		
Average delivered moisture content	40%	wet basis		
Average moisture content of wood chips sold	10%	wet basis		
Sales price				
Heat	22.0	£/MWh		
Electricity Base price	26.0	£/MWe		
Electricity ROCs	46.0	£/MWe		
Climate change levy	5.0	£/MWe		
Pellets	120.0	£/tonne at	10%	moisture content dry basis
Wood chips ex works small	80.0	£/tonne at	10%	moisture content dry basis
Wood chips ex works small	55.0	£/tonne at	10%	moisture content dry basis
Ash	5.0	£/tonne		
Debtors	0%	collected in current month		
	100%	collected in next month		
	0%	collected in subsequent month		
Creditors	20%	paid in current month		
	80%	paid in next month		
	0%	paid in subsequent month		

Sales in the order of £8.4 million in year two are predicted, increasing to about £9.5 million per year by year 10 based on current costs and prices.

Operating profit is expected to be £2.4 million in year 2, increasing to £3.6 million by year 10.

Employment for the project is projected to be 6 full time management and administration and 21 operatives.

i) Assumptions and Role of Scottish Enterprise Borders

In the above financial forecasts, it is assumed that either project would be funded through the usual equity investment route by the developer. The projects will qualify for QCHP under a venture capital scheme through a Limited Liability Partnership and will be able to claim enhanced capital allowances that will improve the returns to investors.

To get to the position where a project can be funded, it is estimated that a development budget, covering planning permission and detailed project design and appraisal leading to financial closure, will be £100,000.

It is also assumed that there is a 15% grant available under Regional Selective Assistance or other funding sources such as a second phase of the Scottish Biomass Support Scheme or Lottery Funding.

The grants will be justified as a way of kick starting a business in the Scottish Borders which will have important implications for new employment, both directly and in the wood/biomass supply industry, as well as significant environmental benefits from improving forest and woodland management and encouraging the development of power generation from biomass on a dispersed basis.

j) Identifiable project developer

It is believed that a defined project can be circulated to venture capitalists and others inviting bids to develop the project.

Of the two sites considered the preferred site is near Newton St Boswells. It is recommended that Scottish Enterprise Borders secure an option to either lease or purchase the land on stated terms subject to the project being developed, the power connection arrangements with Scottish Power PLC being confirmed and planning permission over the site for the project as proposed secured. The project could then be sold to a project developer.

Table 15-4: Medium Scale Financial Model

Table 15-4 a

Financial Projections (£'000s)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Sales		0	8382	9372	9402	9433	9464	9496	9529	9563	9598
	Operating Costs	(73)	(4443)	(4443)	(4443)	(4443)	(4443)	(4443)	(4443)	(4443)	(4443)
	Gross Profit	(73)	3939	4929	4959	4989	5021	5053	5086	5120	5155
	Overheads	(1049)	(1592)	(1592)	(1592)	(1592)	(1592)	(1592)	(1592)	(1592)	(1592)
Operating Profit		(1122)	2347	3336	3366	3397	3429	3461	3494	3528	3563
	Interest and grant	(160)	(187)	(50)	93	241	363	183	346	515	681
Profit before tax		(1282)	2160	3286	3460	3639	3792	3644	3841	4043	4244
Operating profit % to sales			28.0%	35.6%	35.8%	36.0%	36.2%	36.4%	36.7%	36.9%	37.1%
Profit after tax		(2564)	1750	2662	2803	2947	3072	2951	3111	3275	3438

Projected Balance Sheet

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fixed assets											
	Machinery	9,437.1	8,449.1	7,461.1	6,473.1	5,485.1	4,497.1	3,509.1	2,521.1	1,533.1	545.1
	Buildings	2,380.0	2,260.0	2,140.0	2,020.0	1,900.0	1,780.0	1,660.0	1,540.0	1,420.0	1,300.0
	Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		11,817.1	10,709.1	9,601.1	8,493.1	7,385.1	6,277.1	5,169.1	4,061.1	2,953.1	1,845.1
Cash		454.6	1,451.3	3,725.4	6,140.1	8,699.5	11,413.7	14,345.4	17,436.6	20,691.8	24,859.5
Long term loans		(9,213.8)	(8,232.5)	(7,107.5)	(5,982.5)	(4,857.5)	(3,732.5)	(2,607.5)	(1,482.5)	(357.5)	17.5
Trade creditors		(28.9)	(296.2)	(296.2)	(296.2)	(296.2)	(296.2)	(296.2)	(296.2)	(296.2)	(296.2)
Grants		(1,811.3)	(1,442.9)	(1,074.5)	(706.1)	0.0	0.0	0.0	0.0	0.0	0.0
		1,217.8	2,967.4	5,629.3	8,431.9	11,379.3	14,450.8	17,402.2	20,513.2	23,788.2	27,225.8
Initial equity		2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0
Share premium account		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit and Loss account		(1,282.2)	467.4	3,129.3	5,931.9	8,879.3	11,950.8	14,902.2	18,013.2	21,288.2	24,725.8
		1,217.8	2,967.4	5,629.3	8,431.9	11,379.3	14,450.8	17,402.2	20,513.2	23,788.2	27,225.8

Table 15-4 b

Asset value and return per share

	Start	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Number of shares (000's)	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0
Asset value per share (£)	1.00	0.49	1.19	2.25	3.37	4.55	5.78	6.96	8.21	9.52	10.89
Profit per share (£)		-0.51	0.86	1.31	1.38	1.46	1.52	1.46	1.54	1.62	1.70
Profit per share net of income tax	40.00 %	-0.85	1.44	2.19	2.31	2.43	2.53	2.43	2.56	2.70	2.83

Table 15-4 c

Capital investment (£'000s)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Equipment	9880	9880	9880	9880	9880	9880	9880	9880	9880	9880
Buildings	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400

This approach is being proposed as there are investment funds for projects but these funds would be most attracted to a project which has in place all of the development criteria, thereby removing much of the development risk. The speculative cost of the project development could either be recovered in the sale price of the project or a loss taken to encourage a developer to come forward.

Next Steps

This project should be progressed by contact being made with the landowners of the site near Newton St Boswells and a deal struck on the development of the land. If a deal cannot be struck then the site at Galalaw should be developed. Without security over the land, all investments in the development are at risk and should not be undertaken. Once the site has been secured, be it near Newton St Boswells or Galalaw, the project should then be progressed by Scottish Enterprise Borders with a view to bringing on board an investor or developer. Only when the investor/developer is identified can the financial structure for the project be finalised. While searching for an investor/developer additional investigations are required. The more certain the project is, in respect of planning permission and confidence in the economic model, the higher are the chances of financial commitments being made. The following actions are therefore required:

I. Negotiate an agreement in respect of the land near Newton St Boswells;
II. Obtain commitments from the public sector to assist with the detailed study leading to funding and implementation of the project;
III. Appoint consultants to work with the public sector to prepare the planning application and develop the project design financial model;
IV. Liaise with the local planning department to confirm their requirements for a planning application and then prepare and submit a planning application;
V. For the development near Newton St Boswells liaise with Scottish Borders Council on the possibility of securing biomass from the waste stream;
VI. Liaise with Scottish Environmental Protection Agency (SEPA);
VII. Prepare a detailed financial forecast including obtaining a firm quotation for the supply of the proposed equipment as well as possible alternative suppliers, quotations and proposals for the supply of biomass, and
VIII. Actively promote the project to investors/developers

The final selection of the equipment and scale of the project will only be determined when the investor/developer is committed and takes over the project. The planning permission will be for the buildings and the use of the buildings along with any restrictions on access or requirements for landscaping, for example. Other regulatory approvals, such as a Pollution Prevention and Control Permit are specific to the equipment and method of operation and so any applications will have to be submitted when the equipment is specified.

16.0 COMPLIMENTARY POLICIES

Considerable efforts are currently being directed at UK level to increasing the push towards the greater use of biomass as a source of renewable fuel. The White Paper on *Energy: Meeting the Energy Challenge* May 2007 refers extensively to encouraging the development of distributed power with specific encouragement in the proposal to introduce from April 2009 "double ROCs".

In Scotland the production of a Biomass Action Plan, supported financially by the Scottish Biomass Support Scheme, is a clear indication of the way the Scottish Executive wants to see renewable energy from biomass develop. Scottish Planning Policy (SPP) 6: *Renewable Energy* requires local planning authorities to make positive provision for renewable energy developments.

To compliment Local Plan policies Scottish Borders Council have issued Supplementary Guidance on Renewable Energy aimed at developers and planners and intend soon to develop a Wood Energy Strategy. Work is already underway to install renewable heat systems in schools and Council buildings using biomass fuel.

The projects being proposed are therefore fully complimentary with current UK, Scottish and local polices which:

a. Encourage the use of renewable energy, especially biomass;
b. Encourage the development of forestry in the Borders, especially small woodlands; and
c. Promote the expansion of timber harvesting companies and associated employment.

16.1 Land issues

These have all been covered in the preceding sections.

16.2 Planning Issues

These have all been covered in the preceding sections.

16.3 Forest Policy

These have all been covered in preceding sections.

16.4 Biomass Supply

Using the data acquired in the Phase 1 resource assessment, the amount of forest residues within 40km of the proposed project sites has been estimated. For Galalaw the results are shown in Table 16.1 below and geographically in Figure FH_BORDERS_420155 contained within the Phase I Report. There is potentially five times the amount of material from forest residues alone required for both plants within 40km of Hawick.

Table 16-1: Forest Residue Resource within 40km of Hawick

Distance (km)	Total resource area (ha)	Forest residues (dte/y)
5	770	1540
10	3637	7274
15	13238	26476
20	24850	49699
30	73529	147058
40	121760	243520

For the site near Newton St Boswells the results are shown in Table 16.2 below and geographically in Drawing BO_300507_420155. There is potentially three times the required resource to sustain the plant available from forest residues within 40km alone.

Table 16-2: Forest Residue Resource within 40km of Newton St Boswells

Distance (km)	Total resource area (ha)	Forest residues (dte/y)
5	680	1360
10	2117	4234
15	4506	9012
20	8554	17107
30	24849	49698
40	51491	102981

In addition there is the timber from woodlands of less than five hectares not included in the above figures as well as biomass from farms and embedded biomass in waste.

16.5 Supply Chains

There are a number of options for the supply of biomass to either or both of the plants:

- Direct contracts with local estates e.g. Buccleuch Estates
- Contract with Forest Enterprise
- Contracts with Forest Energy UK Ltd – a joint venture between Euroforest Ltd and Scottish Woodlands Ltd
- Contracts developed through the South Scotland Forest Industries Cluster.

16.6 Power Connection Issues

For Hawick Knitwear Ltd there is already an 11KV substation on site and feedback from Scottish Power PLC is that there should be no over riding issues precluding the connection of 500KW to this substation. The budgeted cost is £50,000.

For Galalaw the issue is not quite so straightforward. As reported above there are no technical stumbling blocks but a 3MW connection would probably require the installation of around 2km of underground cable to a connection point nearer to the Primary Substation in Commercial Road, Hawick. A very approximate budget guesstimate is a connection cost of £500,000. Connection to the grid from a plant near Newton St Boswells would be less complex and consequently less expensive.

16.7 Markets for dry Wood Chips

Markets for dry wood chips must be developed. They do not exist at the moment as there is no supply of dry chips. However, once chips are available then there is a possibility of switching existing boilers that use wet chips to those using dry chips. The advantages of dry chips over wet chips are smaller boilers, greater controllability of the boiler, faster response times, cleaner emissions and smaller storage areas. It is also believed that the resistance to wood chip boilers using dry chips will be reduced for the reasons given above as well as for the lower capital cost.

These markets will take time to develop so in the short term there needs to be a market of last resort. The only practical option for this is the biomass power station at Lockerbie. Discussions indicate that there would be an interest from a major wood supply company, who have the supply contract for the E.ON plant, entering into such an arrangement. This

would benefit the E.ON plant as, although the boiler can burn wet chips, the efficiency is higher with drier chips. The supply contract could be integrated with their existing supply contracts for forest residues.

It is not believed that the market will become sufficiently large to provide sufficient income for the proposed plant but the drying of wood chips, even for a small market, would be profitable and diverting dry chips from the plant before the pellet mill becomes operational is not a problem. The selling of some dry chips has been considered as part of the revenue stream for the proposed plant but the main revenues will come from pellet and power sales.

16.8 Infrastructure Issues

No major infrastructure issues are foreseen for any of the sites. At Hawick Knitwear, a new entrance to the factory will be required. In designing the access, account has to be taken of the narrowness of the road and that all deliveries and departures of full and empty wagons will be mainly via the B6399 from the South.

The problem of access to Hawick Knitwear from the North could restrict the supply arrangements to some extent but most of the forested areas lie to the South from where there are no access problems.

17.0 STRATEGIC APPROACH TO THE DEVELOPMENT OF PROJECTS

The two projects proposed are unlikely to develop without support and encouragement from the public sector.

Small Scale

The management of Hawick Knitwear Ltd have expressed interest in the concept and have been most cooperative and helpful in providing information and assistance. The project proposed has been developed to meet the needs of the factory, while taking into account the limitations of the site. The limitations are largely the small area available for development of a biomass plant and access.

The small scale of the project and the partial heat loading results in the project being marginal at current energy prices. However, the use of heat will be enough to secure a "Quality CHP" certificate, which will attract enhanced capital allowances. Were gas prices and power prices to increase in real terms relative to biomass costs then the project would become more attractive.

The project is still considered worth pursuing as it will help stabilise energy costs at the mill and provide a case study for other potential projects in Scotland, possibly on a larger scale such as at paper mills and other industries not necessarily located in the Scottish Borders.

The most probable developer of the project is considered to be the Hawick Knitwear Company itself and this option should be pursued first. The option of venture capitalists funding the project under the venture capital arrangements though Limited Liability Partnerships should not be dismissed and could be followed up if the Company finds it is unable to pursue the project.

Medium Scale

For medium scale projects, approaches should be made to potential suppliers of equipment who are likely to act as developers. These include (contact details in Appendix K):

- First London Renewables Ltd
- Compact Power PLC
- ITI Ltd

Approaches should also be made to venture capital funds details of some of which are in Section 23.

Key to bringing any investor on board will be the removal of any development obstructions that will reduce the risk of delays caused by finding development finance. It is recommended

that Scottish Enterprise Borders consider forming a development or project company. In the name of the company, it will be necessary to put in place:

a) A lease/purchase option over the site

b) Confirmation of the connection of power to the grid, covering both arrangements for connection and a servitude right for the cable;

c) Basic site layout design and buildings specified suitable for a range of technologies;

d) Application made for planning permission for a biomass project and associated chip drying business; and

e) Provisional contracts/letters of intent for the supply of biomass, the sale of electricity and the sale of wood chips to the Council and other major users.

The project company would then be offered to interested parties and sold to a developer. It is understood that this approach is probably not the normal one but from previous experience, this is ultimately the easiest route. An alternative is to agree a lease option over the land and then transfer the option and any associated benefits to a development company.

In either case public sector support during the planning phase is believed to be essential to attract investors to the region. The risk of not providing support is that developers will pursue potentially more profitable projects in areas where there is the possibility of using recycled wood or biomass in waste streams for which they will receive a gate fee.

18.0 CONFLICTS AFFECTING THE DEVELOPMENT OF PROJECTS

The two projects described in this Report have been carefully selected and defined so as to avoid or minimise any conflicts which may arise in respect of their development.

It is evident from scrutiny of relevant strategies, programmes, plans and policies identified in Phase I that the proposed developments present no conflict with either national or local renewable energy policy, economic policy, biomass and forestry policies or land use policy. There could, however, be a number of potential conflicts where there is competition for resources.

There could be competition for the biomass resource, principally from the power plant at Lockerbie, but one of the reasons for choosing Hawick or Newton St Boswells as the area for the first developments is because there is access to ample wood resource. This resource is unlikely to diminish as small woodland management intensifies and farmers look to diversify into energy crops. Another reason for selecting these sites is the proximity to the existing market for electricity and potential market for pellets. The market for heat is created internally and all these give the proposed plants a competitive advantage.

A possible limiting resource is the capacity of the electrical network to absorb the available power from localised generation. The competitors for this resource are developers of wind power whose cost of connection to the grid will be much higher than for a biomass based facility. Moreover the push for renewable energy from biomass in the Scottish Borders is in recognition of public disapproval of windfarms in the sensitive Borders landscape and this will tend to further reduce the competitive pressure. Windfarms are also perceived as bringing low local economic benefit. Nevertheless the allocation of capacity is on a first come first served basis and so there is merit in developing the project early before all capacity is absorbed. However, discussions with Scottish Power would indicate that at the present time the networks could absorb the proposed power and the possible expansion of generation near Newton St Boswells.

On the other hand competition for investment resources will tend to favour the lower risks and higher returns available from alternative technologies such as wind unless biomass projects are supported with public money in order to reduce the risks (principally planning). With competition for finite levels of grant aid, it will be important for the emerging biomass industry to demonstrate that the downstream economic benefits derived from kick-starting an immature market represent value for taxpayer's money. It is anticipated that the projects proposed will meet this important criterion.

19.0 PRIMARY AND SECONDARY ECONOMIC BENEFITS

19.1 Reduced Energy Costs for Hawick Knitwear

The move away from the use of fossil fuels and exposure to increasing fuel costs will reduce the costs to the Company, help secure their economic future and maintain employment. A 500kWe biomass fired CHP plant will satisfy all of their annual electrical demand (with as much again available for export to the grid) and approximately half of their annual heat demand. Assuming an electricity price of 10p/kWh and a gas price of 2p/kWh, Hawick Knitwear's energy bill should be around £236,000 per annum. The cost of wood chips for a 500kWe CHP plant would be £113,000 per annum (470 wet tonnes/month @ £20/tonne). If they install such a plant, Hawick Knitwear could expect to save some £70,000 per annum with around £125,000 of additional income from sales of green electricity to the grid.

19.2 Benefits to Forest Owners

The increased demand for forest residues will create an income for forest owners and also reduce the costs of replanting. It will also benefit the forest through greater and improved levels of management. The increased demands for forest products could also potentially increase the levels of new planting as income is improved. This will further increase direct and indirect employment.

A significant benefit is expected to accrue to small woodland owners in the vicinity of Hawick and St Boswells. Previous studies on small woodlands have pointed to the low level of management due to the absence of, or limited markets for, forest products from these woodlands. It is expected that the CHP plants will provide a market for wood from these woodlands, so encouraging improved management. For example an increase in price of £1 per tonne for the product of a cleaning operation could turn a loss of £0.50 per tonne (in which case the operation would not proceed) into a profit of £0.50 per tonne (in which case the operation would proceed). Although the potential benefit is largely unquantifiable it has nevertheless been highlighted in discussions between the Study Team and members of the Borders Machinery Ring.

Overall employment multipliers and direct employment are covered in section 8.7 below.

19.3 First examples of small scale disaggregated power generation in Scotland

The projects described, which are for combined heat and power, will be the first examples in Scotland of biomass power generation on a small or medium scale. These projects could be exemplars of their kind and encourage others to follow suit.

It should be noted that there are several examples of biomass heating from wood chips but these are based on wet chips. Wet chip boilers are more expensive than dry chip boilers to purchase and operate. The development of a supply of dry chips in the Borders is expected to encourage the development of biomass heating boilers in larger buildings as the economics become more favourable.

19.4 Meeting Government Targets

The addition of about 5 MWe of renewable electricity will only be a small part of the total target but it will be significant in that the projects will be based on biomass and will be CHP plants. The larger projects will also act as a stimulus for greater use of biomass for direct heating of public and larger buildings during the initial period when dry chips are produced.

19.5 Acting as Catalyst for Development of Heat Only Projects

The benefits of encouraging direct heating from biomass are referred to above but are worth stressing. The supply of dry chips has the benefit of delivering a fuel which has a much higher effective calorific value, can be used in smaller and hence lower cost boilers in which combustion is more controllable and emissions levels are lower. Storage is less problematical in that smaller volumes need to be stored for the same calorific or heating value and issues of rot and fungal spores from wet chips are avoided. The cost per MJ or heating value may be higher but the capital cost and operating costs are lower.

These benefits similarly apply to the use of pellets. The additional benefits of pellets over dry wood chips are the greater controllability of combustion (because it can be easily automated) and a higher fuel density requiring less storage and easier handling.

19.6 Opportunity for Value Added Production

The production of chips will satisfy a portion of the market, namely the demand for larger heating units of about 100kWth and above. The bigger market is however for smaller units of about 20kWth, a market best served by pellets but there are no producers of pellets in the Borders. It is envisaged that as the market for dry chips is limited, the proposed biomass

power plant will very quickly enter into a second phase of producing wood pellets. The heat available would allow for production to be increased further and the onsite power along with installed capacity for handling and producing chips would make a pellet mill from forest residues viable. Without a low cost source of heat for drying the wood to the required moisture content it is not believed that a pellet mill in the Scottish Borders would be viable at this time as the operating costs would mean the product is not competitive on price. A pellet mill would increase employment and value added from the locally available biomass. A local supply of pellets would also encourage further the development of the installation of pellet stoves so reducing the consumption of gas and oil for heating in the region.
The site near Newton St Boswells has the advantages of being a large site so production could be expanded at a later date if this was thought appropriate.

19.7 Employment

Direct employment in the projects is expected to be:

- Small scale project (Hawick Knitwear) 4 additional jobs
- Within the medium scale project there are expected to be employed 10 operatives (ranging from supervisors, semi technical and plant operators) connected with power generation and 11 operatives (supervisors, machine operators and plant operators) in the pellet mill. The numbers in the pellet mill may increase further if a packing plant is added.
- Forest and transport employment 75

The above information is summarised in Table 19.1 below.

Details of expected employment costs by grade are included in the spread sheets attached to this report.

Based on the 1999 study *Scottish Forestry: An Input-Output Analysis on Multipliers* (http://www.forestry.gov.uk/pdf/scotmult.pdf/$FILE/scotmult.pdf) the increase in demand for biomass resulting in an annual purchase of about £4 million will generate some £8.4 million of additional economic benefit in the Borders. The employment multiplier given is for 180 jobs to be created in the forestry sector, but this is probably very much on the high side as allowance should be made for inflation since 1999 and also improvements in productivity though increased mechanisation especially in harvesting forest residues. The report highlighted that employment in the forestry sector would be largely local whereas the downstream employment would be less local. This is to be expected as the fuel or biomass supply is expensive to transport and so will be obtained from close to the plant but

equipment and spares for the plants will be obtained from outside the area. The multipliers of the study are summarised in Table 19.2

Table 19-1: Direct & Indirect Employment arising from the Two Identified Projects.

Employment generation

		Direct	Indirect	Total
Small scale project				
Skilled		2		2
Unskilled		2		2
Administration				0
Not specified			3	3
	Sub total	4	3	7
Medium Scale Project				
Energy plant				
Skilled		6		6
Unskilled		2		2
Administration		3		3
Not specified			36	36
	Sub total	11	36	47
Wood processing/fuel preparation plant				
Skilled		7		
Unskilled		4		4
Administration		3		3
Not specified			36	36
	Sub total	14	36	43
	Totals	29	75	97

Allowing for inflation (21.5% since 1999 UK Treasury), improvements in productivity and the expectation that much of the biomass will be obtained from forest residues and farm woodlands the multiplier effect of a demand is expected to be less than the figures given above. The figures most appropriate are considered to be farm woodland and thus with about £4 million expended on biomass purchases, the additional employment is expected to be about 60 jobs in forestry, transport and related services within the Scottish Borders region. Direct downstream benefits, other than from the wages impact from the direct employment, are not expected to be significant as the power will be exported and the fuel produced will be used as a substitute for other types of fuel.

Table 19-2: Summary of demand-driven (backward linkage) forestry multipliers

	Type II Output multiplier	Employ. effect per £1m increase in demand (FTE)	Income effect per £1m increase in demand (£m)	Type II employ. multiplier	Type II income multiplier
Woodland types					
Existing native woodland planting/maintenance	1.585	15.078	0.282	2.088	1.941
New native woodland planting & maintenance.	2.037	23.445	0.450	2.559	2.442
Commercial conifer plant/ maintenance	2.183	44.918	0.878	1.584	1.539
Farm woodland planting and maintenance	1.708	15.454	0.297	2.789	2.669
All Scottish forestry Planting/maintenance	*1.928*	*29.061*	*0.564*	*1.805*	*1.744*
Existing native woodland harvesting	1.683	40.639	0.424	1.319	1.809
Commercial conifer harvesting	2.056	33.521	0.440	1.860	3.211
All Scottish forestry Harvesting	*2.015*	*34.304*	*0.438*	*1.766*	*2.966*

Note: Type II employment multiplier =Total employment effect (direct plus indirect plus induced)/Direct employment effect

For comparison, it is understood that the 44MW plant at Lockerbie is expected to support 340 jobs in the area. On the basis that it will require 450,000 wet tonnes of biomass, the multiplier is 1,323 wet tonnes per job. Although the methodology used to forecast the number of jobs at Lockerbie is unknown, the 100,000 wet tonnes required by the projects would suggest a total employment multiplier of 75 jobs. A study (*Economic Contribution of the Forest Industry to the UK Economy* - June 2006) undertaken for ConFor and the Forestry Commission forecast that 59,000 new jobs would be created by the biomass sector in the UK of which 16,723 would be created in the forestry industry and another 42,000 in downstream industries as the demand for bio-energy increases. These figures were based on estimates produced for the Bio-Energy Group (BEG) established by the Forum for Renewable Energy Development in Scotland (FREDS) and applied to the UK. These figures are considered by the Study Team as very optimistic.

20.0 SOCIAL IMPACTS

20.1 Small Scale Project

The project at Hawick Knitwear is expected to have an indirect positive impact as it will act as an exemplar for the Borders in particular and Scotland in general as to what can be achieved from small scale embedded biomass CHP plants.

There will be a direct positive impact from additional employment in the factory itself, projected at 2 people and 2 existing jobs safeguarded, plus some additional employment in the forest and in transport.

The project will result in reduced costs for the Company and protect them from future rises in energy costs, so helping to protect the economic viability of the company which currently employs about 200 people.

20.2 Medium Scale Project

The medium scale project will have a positive impact on direct employment in the project as well as employment in forestry and in transport. The provision of markets for low grade wood will improve the economic viability of forests and woodlands thereby further improving employment prospects.

20.3 Training and Education

Forestry skills are prevalent in the Scottish Borders and although an increase in employment is anticipated, it is believed that the existing skill base would be sufficient to accommodate the increase anticipated.

As regards the operation of the plant at Hawick Knitwear, the company already employs plant engineers and this should form a sound skill base for the project. Additional skilled staff for plant operations will be required and this may involve specialised training. As part of the plant installation the supply company, Biomass Engineering Ltd, will provide operator training and comprehensive operation and maintenance training. Annual maintenance will be undertaken by sub-contract and this will probably be supplied by specialists from outside the region.

As regards the proposed Medium Scale Project there will be a requirement to recruit specialist skills for both the operation of the energy plant and the wood pellet production. The range of staff will include:

- Administration and management
- Qualified maintenance engineers
- Health and safety staff
- Plant operatives
- Semiskilled labour (fork lift truck drivers etc.)
- If the plant is operating on waste then staff with the appropriate WAMITAB (Waste Management Industry Training and Advisory Board) certificates will be required.

As part of the full project appraisal which is required an investigation of the available local skill base should be undertaken to identify any staffing problems.

20.4 Environmental

The increased use of biomass from small woodlands will enable the land owner to intensify management of the woodlands so improving their productively and diversity. It is expected there will be some reversal in the decline of the condition of the small woodlands in the Borders, so benefiting the visual environment and improving habitats for plants and animals.

21.0 ENVIRONMENTAL IMPACTS OF PROPOSED PROJECTS

It is anticipated that the impact on small woodland owners will be both significant and positive as markets for low grade wood from woodland emerge. This will provide an incentive for improved management of small scale woodlands in the Southern Scottish Borders. The improved management will bring about an improvement in habitat through higher ground cover, improved effectiveness as windbreaks and new plantings.

Some concern has been expressed about increased levels of harvesting affecting rain run off. The forests that will be harvested will be forests under management and so any forests that are cleared will be replanted. Indeed the benefits of removing the brash, which will be the main fuel for the biomass plants, will mean quicker and lower cost establishment of the next crop and faster growth of the forest as the competition from weeds will be less.

The amount of carbon saved is beyond the scope of this Study but as a guideline for every kWh of electricity produced by a biomass power plant, 860g of CO_2 produced by coal fired power stations is displaced (source BWEA).

Gasification technologies achieve very high standards for gaseous emissions and so the impact on the environment is small.

The environmental impact will mainly come from increased lorry movements. These impacts are however minimised by:

- locating the plant as close as practicable to the forest;
- developing combined heat and power (CHP) projects so energy recovery is as efficient as possible;
- locating the plant alongside or close to major roads;
- drying the chips so the weight of water transported about needlessly is minimised; and
- replacing the burning of fossil fuels with sustainable biomass energy.

Visual and landscape impacts are discussed in Section 3.

The production of 30,000 tonnes of pellets per year using the waste heat from the power generation plant will replace the use of some 15,000 tonnes per year of oil and reduce the release of primary carbon dioxide to the atmosphere.

22.0 LONG TERM SUSTAINABILITY

The projects have been defined so the risks associated with their implementation are small

The forests of the Scottish Borders, though mostly planted within the last century, are managed on a sustainable basis. There is therefore no reason to suggest that the proposed projects, which are only using a proportion of the existing available forest biomass, are not sustainable. It is also likely that other sources of biomass not now considered will become available, such as some form of farm biomass or hedge trimmings. For the medium scale plants the proposed technology is very tolerant of many forms of biomass and it is expected that the developer will seek these new forms in order to reduce costs.

The financial projections, based on the costs considered to be the most likely, indicate that the projects are viable in the longer term as stand alone businesses provided the initial perception of better options elsewhere is overcome. The risks associated with the projects are:

a) Material costs – rising cost of harvesting and cost of biomass is a risk but this could be offset by increased use of recovered biomass from the waste stream

b) Supply contracts – there are sufficient resources in the catchment area of the proposed plant to adequately meet the demands of the plant as proposed and there are believed to be sufficient numbers of woodland owners and harvesting companies to meet the demands of the project

c) Energy prices – it is considered unlikely that energy prices will fall as they are largely tied to fossil fuel prices. The main risk is the premium which will be achieved (the Double ROCs) but this is considered unlikely to fall. The 2007 White Paper sets the ROC horizon at 2027 so the target for renewables will be increased in line with government policy and.

d) Electricity sales – electricity will be sold under long term contract. Markets are available for renewable electricity and so the risk of no sales contract being obtained is small

e) Heat sales – these will be internal

f) Product sales – the main market will be for pellets or dry chips to local distributors as well as end users such as the Borders Council, if they have a demand for biomass. If there are insufficient markets for these products in the short term then the dry fuel will be exported from the region to either other biomass power stations or for co-firing.

The benefits of securing the QCHP certificate and the decision made on internal heat pricing will allow the price to be reduced to be competitive

g) Technical risk – the choice of technology will be made by the investor/developer of the project who presumably will satisfy themselves as to its efficacy and the availability of manufacturers' warranties. However, the proposals have been made based on the use of pyrolysis/gasification which offer higher efficiencies than conventional steam cycle technologies and are being more widely adopted as being suitable for small scale disaggregated plants operating on local sources of biomass fuel.

The greatest risk to the project is ensuring control over the site (if Site B near Newton St Boswells is chosen) and then securing planning permission. It is in this area that Scottish Enterprise Borders should focus their efforts. Longer term risks will be assessed by the developer.

23.0 REALISATION OF THE PROJECTS

Project 1 – Small Scale

The management of Hawick Knitwear have expressed an interest in the project and should be encouraged to follow up on the concept. The project driver has to be the Company but support should be forthcoming from the public sector through the funding in whole or in part of (i) the full feasibility study and (ii) the granting of consents. The level of costs through to consents is estimated to be in the order of £100,000 depending on the level of detail required in the planning application.

At this stage the Company has the option of either undertaking the project themselves or approaching investors to form an Energy Supply Company (ESCo)

Provided the financial forecasts show an appropriate return (preliminary figures in this Study indicate this to be the case) and the political risks associated with consents have been removed then it is believed backers for the projects can be found.

It is our assessment that with assistance with development funding and then a grant of £400,000 the project will become sufficiently attractive to the Company and/or developers to proceed with the project. Below these levels of assistance there is not the incentive to move away from the *status quo*, which works and does not require any capital investment.

The greatest chance of success is if the management of Hawick Knitwear Ltd adopt the project and an internal project champion emerges. Meetings with the Company by the Study Team indicate an interest in the project if support is forthcoming from Scottish Enterprise Borders as the project is outside their normal experience and would be an additional burden on the management.

Possible backers would include venture capital companies and individuals wishing to invest under an Enterprise scheme. A list of possible investors is given below.

Project 2 – Medium Scale

The Medium Scale Project is a “green field” investment. To attract the necessary investment into such a project, the barriers to development should be removed so making this an early opportunity and low speculation project, namely:

- A site should be secured by way of purchase or lease and designated as a site for a biomass plant. One of the sites suggested is in the ownership of Scottish Enterprise Borders and should be retained by them for the purpose of a biomass plant. Selling or allocating the site for other purposes would scupper the project;

- Application should be made for detailed planning permission for a biomass plant and ancillary facilities to produce wood chips and pellets following the preparation of an Environmental Impact Assessment;
- Confirmation should be sought on the connectivity to the grid and the costs involved;
- The full project costs should be assessed including accurate construction costs; and
- Draft contracts should be put in place for the supply of electricity, the supply of biomass and sale of wood chips to existing major users, such as E.ON, and letters of intent from potential buyers of dry chips such as Scottish Borders Council.

The development process is expected to take at least 15 months. Table 23.1 below shows a simplified project timescale.

Table 23-1: Probable Project Timescale

Activity	Months															20 year plant life
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Secure purchase or lease of site																
Identify developer/technology provider																
Planning/permitting scoping request																
Detailed plant design and costing																
Environmental impact assessment																
Electrical connection design and costing																
Secure biomass supply contracts																
Secure power purchase agreement(s)																
Secure grant funding																
Financial review																
Planning and permitting applications																
Consultation period																
Planning/permitting granted																
Financial close/sale to developer																
Procure plant and IPC contract																
Build																
Operate																

The achievement of the above is considered realistic but there are elements outside the developers control, mainly the inputs from the public sector.

The public sector can either take a very proactive role through the formation of a project company, which then has the lease over the site and the other contracts in their name. The company would subsequently be sold to a developer.

Alternatively a less proactive route would be to offer to provide support to a developer.

Developers for either scenario could include project development companies such as:

Intrinergy Inc
10408 Lakeridge Parkway
Suite 900
Ashland, VA 23005
United States of America
+1804381400
http://www.intrinergy.com

Renergy Ltd
2 Costly Meadows
South Molton
Devon
EX36 3JN

or technology supply companies which are seeking to develop their own outlets for their plant such as:

ITI Energy Ltd
Innovation Technology Centre
Advanced Manufacturing Park
Brunel Way
Rotherham
S60 5WG
0114 254 1233
http://www.iti-energy.com

or

Compact Power Ltd
Hydro House
St. Andrew's Road
Avonmouth
Bristol BS11 9HZ
U.K.
+44 (0) 117 980 2900
www.compactpower.co.uk

or

First London Environmental (UK) Limited
Unit 5
Allbright Industrial Estate
Ferry Lane North
Rainham
Essex
RM13 9BU
01708559691

Venture capital companies which could be interested include:

Climate Change Capital
49 Grosvenor Street
London
W1K 3HP
United Kingdom
Tel: +44 (0)20 7290 7040
www.climatechangecapital.com

Econergy International Corporation UK
22 Billiter Street,
London
EC3M 2RY
Tel +44 203 102 3403
www.econergy.com

ENER·G Natural Power Ltd,
ENER-G House
Daniel Adamson Road
Manchester
M50 1DT
(+44) 161 - 745 74 50

ESD Ventures Ltd
Overmoor
Neston, Corsham
Wiltshire
SN13 9TZ
+44 (0) 1225 812102
www.esd.co.uk

Novera Energy Limited
30 Bedford Street
London
WC2E 9ED
T: 020 7845 9720
www.noveraenergy.com

Power Capital
14 Kensington Court
London
W8 5DN
Tel: +44 20 7795 6585
Fax: +44 20 7460 5345

Renewable Energy Holdings
Adam House
7 - 10 Adam Street
The Strand
London
WC2N 6AA

+44(0) 1624 641199
www.reh-plc.com

Rockland Capital Energy Investments Limited Liability Partnership
11 Grosvenor Crescent
London
SW1X 7EE
+44 (0) 2072459400

Tersus Energy Plc
8th Floor
7 Farm Street
London
W1J 5RX
T: +44 (0)20 7408 5420
www.tersusenergy.com

Triodos Bank Scotland
32 Annandale Street Lane
Edinburgh
EH4 4LS
Tel: 0131 557 5528
www.triodos.co.uk

Banks offering debt funding for renewable energy projects include:

Helen Wade
Clydesdale Bank PLC
Level 3
88 Wood Street
London,
EC2V 7QQ
+44 (0) 20 7710 2127
helen.wade@nab.co.uk

Royal Bank of Scotland
Borders Commercial Banking Centre
1st Floor
35 Bank Street
Galashiels
Selkirkshire
TD1 1EP
01896 755 173
www.rbs.co.uk

Bank of Scotland PLC
0845 603 2408

Fortis Bank
Commercial Banking
Suite 5, 1st Floor, Aztec Centre
Aztec West
Almondsbury
BRISTOL,
BS32 4TD
01454 203380
chapman.harrison@fortisbank.com
www.fortisbusiness.com

The Co-operative Bank PLC
PO Box 101
1 Balloon Street
Manchester
M60 4EP
www.co-perativebank.co.uk

Rabobank
Erik van de Brake
through:
28 Walker Street
Edinburgh
EH3 7HR
0131 226 4034
www.rabobank.com

Each organisation above listed is known to support projects such as the ones defined. However, each has its own criteria for investing, based on such factors as risk, return on investment, perception on technology risk and scale. The projects as defined are believed to fall within the gambit of warranting consideration for investment by the venture capitalists and with support by the banks. Each project will be assessed according to the final detail which will emerge from the preparation of the business plan and the final balance between equity (and the terms of the equity investment – classes of shares), debt (type of loan, security, debt service ratio requirement, interest rate, purchase versus lease, term of loan) and the resulting funding gap requiring grants will only be determined on the submission of the detailed business plan. The projects as described are considered to be a suitable starting point for negotiations. The ratio between debt and equity will be the bank's perception of commercial and technical risk.

If the public sector is not prepared to accept the risk of securing the planning consent and then recovering some or all of the investment cost by selling the project company then a budget should be agreed to support the development of the business plan and the planning application. There are more attractive locations for developing biomass projects, based largely on recycled wood or embedded biomass in waste streams, in or

close to large conurbations rather than the Borders. What will make this project attractive is the removal of the planning risk and creating the opportunity for early development.

A synopsis of the project should be prepared for circulation to the above venture capital organisations along with the level of support which will be forthcoming from the public sector. In this instance it is assumed that the support will be forthcoming from the public sector will contribute to the cost of the planning application. The cost of the application, covering design fees, environmental impact assessment, planning fee and public relations is £100,000. It is believed that the public sector should offer to meet at least 50% of this cost.

24.0 SECOND STAKEHOLDER WORKSHOP

The project concepts developed in Phases 2 and 3 were raised and discussed at the second Stakeholder Workshop held in Galashiels on 10th May 2007. The feedback from the Workshop was generally favourable but the view was expressed that the medium scale plant should be located closer to the forest, but despite repeated efforts no willing landowner either in the public or private sector was identified.

The minutes of the Workshop are included as Appendix L.

The presentation is available on www.bodersbiomassstudy.com .

25.0 CONCLUSIONS AND RECOMMENDATIONS

The development of biomass CHP projects both at small scale (less than $1MW_e$) and medium scale ($2\text{-}5MW_e$) in the Borders is technically and practicably feasible.

Larger scale projects are not considered to be practicable or feasible due to the road network being inadequate to support the amount of material that will have to be moved, the footprint of such a plant would be large and inappropriate for the forest resource of the Borders and the electrical grid network would not support such a plant.

A small scale biomass plant of $500kW_e$ power with heat recovery embedded into a knitwear factory in Hawick (Hawick Knitwear Ltd) is considered feasible and practicable. The project is small scale and only produces a marginal return.

However, there may be:

- Cost savings to be made by integrating the plant fully into the factory to reduce labour costs and overheads;
- Additional savings to be made on energy costs and a better financial arrangement may be negotiable with a gas and power supply company connected with the trading of ROCs;
- Potentially increased revenues from ROCs if the “double ROC” banding for biomass gasification suggested in the recent Energy White Paper is adopted;
- Reduced capital costs through negotiated contracts with suppliers of plant than estimated for the model at this stage. Locating the plant differently within the boundaries of the factory than assumed for this Study may also bring reduced costs; and
- An improved price negotiable with the preferred supplier for the supply of the gasification and power generation.

The above factors will be clarified during the more detailed study which should now follow on from this study. The possibility of using clean recycled biomass in lieu of fresh biomass should be investigated as this will reduce the energy used for drying and also the costs will be reduced, so making the project more attractive.

It is recommended that Scottish Enterprise Borders continues to engage with and support the management of Hawick Knitwear Ltd to investigate the project more closely and encourage the management to take ownership of the project and see it through to fulfilment. With the management of the company driving the project the chances of the project coming

to fruition are higher and if the management seek an outside investor the chances of securing this investment will also be higher.

A medium scale project producing some 3MWe power with heat recovery being used for the drying of chips for sale to third parties is considered practicable and economically viable, subject to a market for the excess dry chips being found while the demand for dry chips for direct heating develops within the Borders.

Making this project more attractive to an investor over other opportunities can best be achieved by the impediments and uncertainties being removed so it becomes a project that can be implemented without delay to the investor. It is therefore recommended that Scottish Enterprise Borders form a project company and then proceed to put in place the fundamentals for project development. The project company would then be sold to a developer.

The fundamentals are essentially:

- Site with a lease/purchase option;
- Site with planning permission for the processing of biomass and recycled wood;
- Confirmation as to connection to the grid; and
- Letters of intent for the supply of biomass and the purchase of dry chips.

The company would be attractive to venture capitalists as well as technology companies that have their own technology.

Appendix A - Biomass Resource Assessment Methodology

Forest Resource

The National Inventory of Woodland & Trees (NIWT) 2002 was sourced from the Forestry Commission.

The data consisted of many objects representing differing types of forestry.

A 40km buffer was created around the Borders Region representing the accepted maximum extent to which any biomass plant could economically source biomass material.

This area was then used to clip the NIWT.

A minimum woodland size of five hectares was to be applied as the cut off for harvesting woodland material for use in a Biomass Power Station. Before performing a cull based on a minimum woodland size of 5 hectares, all of the woodlands were joined and then disaggregated so that contiguous areas of woodland less than five hectares would not be lost as part of the cull.

The data set was then culled leaving only those joined up pieces of woodland of five hectares or more.

The remaining woodland was then analysed to establish the total woodland land cover. The total number of hectares was multiplied by the amount of wood resource sustainably extracted per hectare, giving a figure for the total available woodland resource.

A five-kilometre grid was created to encompass the study area

The grid was then updated with the proportion of the area occupied by the woodland dataset. This figure was then multiplied by the amount of wood resource which could sustainably be extracted per hectare giving a total resource figure for each five kilometre grid square.

Potential Growth Areas for Biomass (Short Rotational Coppice)

The assessment of potential biomass resource was based on establishing suitable growth areas within a 40km radius of the Borders Unitary.

The National Land Cover data set for Scotland was sourced from The Macaulay Institute and the Agricultural Land Classification for England was sourced from DEFRA.

Both datasets were clipped to the Borders 40km buffer.

The classifications selected in each data set were different but comparable classifications of suitable arable land type were drawn from both. For Scotland's National Land Cover Dataset the classifications were; Arable and Recently Ploughed. For England's Agricultural Land Classification, arable land graded between one and three were selected as the suitable types.

The selected land types from both data sets were combined to form one layer and then disaggregated. In doing this smaller contiguous land areas were not lost as part of the subsequent cull. The cull as before involved removing all potential biomass growing areas that was less the 5 ha as it was not considered economically viable to harvest from smaller areas smaller than that. The remaining land area represents the total land area suitable for new biomass. Yields in the Borders from SRC biomass crops are assumed to be in the region of 8 dte/ha/yr. However take up of this as a crop is believed likely to be in the region of between 5 and 10%.

A five-kilometre grid was created to encompass the study area

Each grid square was then updated with the proportion of the area occupied by the suitable arable land. This figure was then multiplied by eight representative of the collectable resource per hectare. To allow for varying take up of the biomass crop this figure was then divided by 10 (10%) or 20 (5%)

Appendix B - Heat Load Questionnaire

The following was sent to some 200 organisations.

Organisation
Address 1
Address 2
Address 3
Post Code
Date

Dear Sir/Madam

Scottish Enterprise Borders have commissioned SHREWS Ltd and Wardell Armstrong International Ltd to undertake a feasibility study on an integrated biomass power plant in the Scottish Borders region. Part of this study is to identify organisations with large energy loads, which could be supplied with lower cost sustainable heat, or electricity from such a plant located close by.

Your organisation has been identified as potentially having a large energy requirement and your input to the study would be much appreciated. Please could you fill in the following questionnaire and return it, if possible, by Friday 2nd February.

What is your current annual electrical usage?	kWh	
What do you expect it to be by 2010?	kWh	
What is your current annual heat usage?	kWh	
What do you expect it to be by 2010?	kWh	
How much of this is for process heat?	kWh at	°C
What is your current heating fuel (oil/gas/coal/LPG/wood)?		
What is your current annual heating bill (optional)?	£	
Have you considered biomass fuelled heating or a CHP system?		
Have you any suggestions for potential locations for an integrated biomass power plant?		

Please fax this form back to 01872 561079 or email to: pevans@wardell-armstrong,com. Thank you for assisting Scottish Enterprise Borders in this study. If you would like to know more about the study please call John Birchmore on 01968 660022 or email john.birchmore@shrews.co.uk.

Yours faithfully

Paul Evans
Renewable Energy Specialist

Appendix C – Current and Planned Industrial Estates

Hawick: At Burnfoot Industrial Estate (OS NT 520 160) there looks to be developable land available behind McLeod Glass – unobtrusively set against the hillside but where access would have to be investigated both into the estate and into the site itself. Geo & Jas Oliver are currently marketing a 523.1m^2 factory/warehouse unit with land on the Estate.

Gala Law Business Park (OS NT 508 168) has excellent access directly off the A7. The Park's potential lies in the 32.9 hectares to the north, which has been identified for mixed, use development.

At Weenslaw Mill, (OS NT 529 167) on the A698 east of Hawick, Scottish Enterprise are marketing the site of a demolished former building.

Jedburgh: Next door to Hartrigge Park is Wildcat Wood (OS NT 664 206) an area allocated for industrial use accessed through Wildcat Gate from a B road uphill from the main A68. The site would be suited to industrial development with a wooded backdrop but access is not ideal for HGVs.

Edwin Thomson is currently marketing a site of 2.5 acres at Bankend South Industrial Estate (post code TD8 6ED) where a redundant factory complex takes up a large proportion of the site.

Kelso: Pinnacle Hill Industrial Estate (OS NT 733 330) is prominently located on the hill above Kelso with excellent access (indirectly) off the A698 – indeed Kelso, lying on the edge of the arable Tweed valley plain, is readily accessible from all directions.

There is a plot of developable land on the Estate but the real potential lies in the 4.3 hectares of arable land to the west, which is identified for supermarket use, and employment land. However, this land is very prominent and open and may be difficult to consent for a biomass plant though this could be overcome if sited properly (e.g. at the back of the site). The other major advantage is the large arable hinterland.

Duns: Duns is a small town on the edge of the Tweed valley readily accessible, like Kelso, from all directions. Berwickshire High School (OS NT 777 535), to the west of the town, has a swimming pool and sports facility and land across the road is currently under development for one of the new schools. To the south of the town, off the A6112, is Duns Industrial Area (OS NT 790 530).

The real attractions of Duns are the 3.9 hectares at Peelrig Farm to the east of the Industrial Area allocated for employment use, and its wide arable hinterland.

Eyemouth: A small fishing town on the North Sea coast, Eyemouth is currently benefiting from ERDF investment in new infrastructure viz; a new harbour link road which is opening up development opportunities at Guns Green (OS NT 947 633). Indeed work on site access and preparation is already under way. Although the site is prominently situated on a hillside overlooking the town development of a biomass plant should fit relatively unobtrusively. Access from the arable hinterland to the north and south (via the A1) is good but poor from the west. Although the developable area extends to 34.1 hectares potential users of heat on the site are currently unknown. Various plots are being sold by Scottish Borders Council

Scottish Borders Council are also marketing a 0.36ha plot on Acredale Industrial Estate (OS NT 935 640) to the west of the town.

Peebles: Although there is a developable site to the west of Southpark Industrial Estate (OS NT 242 402) its only access is through a quiet residential area and therefore not really suitable for a biomass plant.

Cavalry Park (OS NT 264 398) is predominantly comprised of high quality Class 4 offices and may not therefore be a suitable location for a biomass plant.

Galashiels: Opportunities here are also limited. Neither Netherdale (OS NT 506 353) nor Easter Langlee (OS NT 517 357) Industrial Estates have developable sites, potential users of heat or easy access.

Melrose: A greenfield site adjacent, and to the west of, Melrose Hospital (OS NT 530 340) is identified for mixed use development. It has good road access from all directions. Despite the site's exposed nature, it should be possible to locate a biomass plant relatively unobtrusively using the hills as a backdrop. Being so close to a hospital the quality of emissions will inevitably be an issue.

St Boswells: There is a good developable site to the east of Charlesfield Industrial Estate (OS NT 585 295) identified for commercial use. It is very close to the A68 trunk road that runs north/south and there are good road connections east/west as well. The site is already well screened and a biomass plant should fit relatively unobtrusively. There are a small number of businesses that could take the heat but the real potential lies to the north where an extensive area of land has been allocated for housing and mixed use development. Already a recycling business located on this site.

Selkirk: There are a couple of small developable sites in Riverside Business Park (OS NT 472 296) and although access is good from the north, access from elsewhere is poor.

Appendix D – Suppliers of Biomass in Borders

Torwoodlee & Buckholm Estates Co Ltd
Torwoodlee,
Galashiels
Borders(Scottish)
TD1 1TZ
01896 752153
Logs,

Stobo Sawmill *
Floors Cottage, Dawyck, Stobo
Peebles
Peeblesshire
EH45 9JU
01721 760246
Logs, Kindling, Kenny Patterson - just supplies neighbours now as no money in the business and has used for his offcuts. Specialises in green oak Close ties with Dawyk (Robert Balfour 01721760226) and Stoo (Hugh Seymour 01721 760245) estates who are looking as to what to do with their wood lands

Clyde Valley Hardwoods (CVH) *
Kypeburn Farm, Lesmahagow
Lanark
South Lanarkshire
ML11 0JL
Logs, Chips,

Logs on Line is the Internet Trading name of Druidswood Forest Products *
Mount Stewart,
Sandilands
South Lanarkshire
ML11 9TT
01555-880931
Logs,

Falkirk Wood
Mavisbank Farm, Shieldhill Rd,
Falkirk
Stirling
FK1 2AZ
01324 623759
Logs,

Edinburgh Woodlands *

Woodmuir House, Breich,
West Calder
West Lothian
EH55 8JW
01501 772 126 / 07836387473
Logs, Alastair Heggie also operates two mulchers which cut to waste. produces split logs from arboricultural work problem of handling big logs. Looking to get crane loaded log splitter. Thinks way to go is to produce 2 metre lengths of wood for staking by roadside to dry down for sale to firewood merchants. Now produces about 5 tonnes per week which delivers by pick up truck and sells for £60 per load (about .8 tonne of wet wood) Wants crane fed wood chippers. Has site 5 acres. In Borders Dick Brothers have crane fed wood chipper. Lot of wood burned off as no markets for wood. Woodwaste at Boness used to take up to 0.5m lengths for hammer mill

CVH - CLYDE VALLEY HARDWOODS *

16 GREENRIG ROAD, HAWKSLAND,
LANARK
SOUTH LANARKSHIRE
ML11 9QA
07974 388 218
Logs,

David Neill Forestry & Arboriculture

Smallholding no 2, Stonebyres,
Lanark
South Lanarkshire
ML11 9UW
01555 660329
Logs, Chips, Kindling,

Gray Tree Services

East Fenton Farm,
North Berwick
East Lothian
EH39 5AH
07811907414
Logs,

THE SKYE MAN TREE SERVICES

WOOLSTOUN HOUSE, CHAMPANY,
LINLITHGOW
WEST LOTHAIN
EH49 7LT
01506 834296
Logs, Chips,

Champfleuire Estate Ltd

Champfleurie House, Champfleurie Estate,
Linlithgow
West Lothian
EH49 6NB
01506 847999
Logs, Chips, Kindling,

Pentland Plants *

Loanhead, Midlothian,
Edinburgh
Edinburgh
EH20 9QG
07812025578 Richard Sprey
Logs, Chips, Pellets, has wood chip boiler

Mercs energytec

21 Meadowbank Road , ,
Kirknewton
West Lothian
EH27 8BH
01506 882720 Kenny Patterson
Chips, Pellets, Briquettes, - mainly pellets and just got contract for chips

WoodExport *

68 Belford Road, ,
Edinburgh
Scotland
EH4 3DG
02082296416 wrong number
Chips, Briquettes,

CONTRACTOR

LOG YARD, STATION ROAD, CHIRNSIDE
DUNS
BERWICKSHIRE
TD11 3LJ
01890 818 745
Logs, Kindling,

Abbey Timber

The Sawmill, Abbey St Bathans
Duns
Berwickshire
TD11 3TX
01361 840 251
Logs, Chips, Kindling,

DG Trees and Timber
Platform 1, Station Rd Industrial Estate,
Duns
Berwickshire
TD11 3HS
01368 830 776
Logs,

Border Fuels *
Unit 6d, Charterhall Aerodrome,
Duns
Berwickshire
TD11 3RE
01890 840734
Kindling,

Stanley Brash
Charlesfield
Newton
St.Boswells

Treeline *
Gavin Marshall
Baddingsgill
West Linton
Peeblesshire
EH46 7HL
01968660698
Firewood sold by 1m3 (approx 500kg) at £60 for hardwood and £50 for softwood.
Means of getting rid of wood, not really a profitable business.

A W Jenkinson
CLIFTON MOOR,
CLIFTON PENRITH,
CUMBRIA, CA10 2EY
Tel:(01931) 712644
info@awjenkinson.co.uk

Major supplier of biofuels and has the main contract to supply E.ON at Lockerbie. Sub contracts such as to Euroforest.

Buccleuch Bioenergy Ltd *

27 SILVERMILLS COURT .
HENDERSON PLACE LANE .
EDINBURGH .
EH3 5DG
T +44 (0) 131 524 0910
F: +44 (0) 131 524 0911
E: BIOENERGY@BUCCLEUCH.COM

Wood product manufacturers

Acorn Fencing and Timber Supplies South Slipperfield West Linton 01968660005
A & R Timber Products Ltd Woodside Sawmill Coldstream TD12 4LX 01890840525

Forestry

3G Energi *

Allesudden,
Charlesfield,
St Boswells
Melrose
TD6 0HH
Tel: 01573 229198 Fax: 0870 8314098
Email: gavin@3genergi.co.uk
Website: http://www.3genergi.co.uk

Description: Domestic Stoves and Boilers, kunzel, Enviro, Extraflame. Commercial boilers KOB. Supply and install bespoke feed systems and silos. Consultant and developer of drying and handling systems for pellets and raw materials.

BALCAS Ltd *

Laragh,
Enniskillen,
County Fermanagh
Northern Ireland
BT94 2FQ
Tel: 028 6632 3003 Fax: 028 66324082
Email: peter.kernohan@balcas.com
Website: http://www.balcas.com

Description: A privately owned sawmill with operation in UK, Ireland and Estonia. 700 employees and turnover £58 million. Manufacture and supply wood pellets

Appendix E – Stakeholder Seminar Delegate List

Borders Chamber of Commerce
Business Gateway
Borders Machinery Ring
Forestry Commission
Scottish Forestry Industries Cluster
NHS Borders
Scottish Borders Council
National Farmers Union Scotland

Appendix F – References

Scottish Forest Industries Cluster, "Woodfuel Opportunities – renewable energy for Scotland", 2002

Forest Machine Journal, Vol10 No 1. January 2004

Woodfuel from Forestry and Arboriculture, Good Practice Guidelines, ETSU, 1998

Scotland's Forest Industries , Scottish Forest Industries Cluster, 2004

Cedric Wilkins, "Wood pellets- Biofuel of the future", Newsletter of the Scottish Forest Industries Cluster, Issue 05, Winter 2002

Renewable Energy from Wood. An opportunity for Scotland, Bidwells Property Consultants Undated (estimate 2004)

Woodfuel –Sustainable Heating for Large Buildings, Bioheat II project, NIFES Consulting Group (undated)

Balachandran, V and Henderson A, "Sawmill Survey 2000", Forestry Commission, 2001

John Clegg and Co, "South Scotland Small Woodland Project – a study to identify the potential opportunities for the development of small woods in South Scotland", Report to Scottish Enterprise Borders, Scottish enterprise Dumfries and Galloway and Forestry commission February 2001.

"Scottish Borders Woodland Strategy". Scottish Borders Council 2005

Justin Cunningham "Green Burn", Professional Engineering Vol 20, No 2 pp 22-23, 2007

EU Cogeneration Directive (2004/8/EC)

World Alliance for Decentralised Electricity Edinburgh www.localpower.org

Appendix G - Contact Details Hawick Knitwear Ltd

HAWICK KNITWEAR

PO BOX 13331
LIDDESDALE ROAD
HAWICK
ROXBURGHSHIRE
SCOTLAND
TD9 0WX

TELEPHONE: +44 (0)1450 363100
FAX: +44 (0)1450 363111
WEB: www.hawickknitwear.com

E-MAIL:sales@hawickknitwear.com

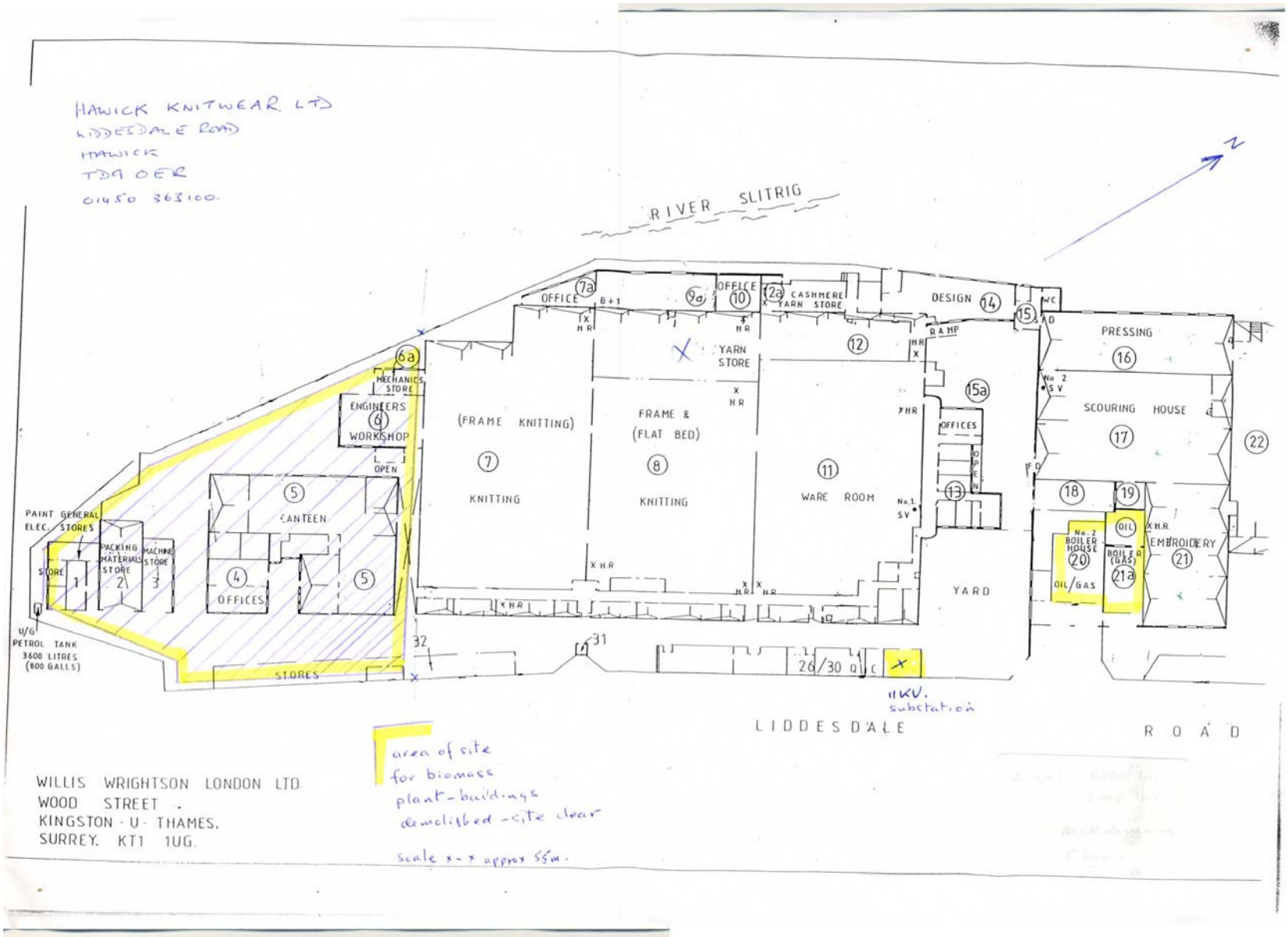
Appendix H - Hawick Knitwear Energy Consumption Data for 2006-2007

Hawick Knitwear Electricity and Gas Consumption 2006-2207											
		Electricity Consumption				Gas Consumption					
Month	Working* hrs/month	Day (kWh)	Night (kWh)	Total (kWh)	Demand** (kW)	Steam (kWh)	Demand** (kW)	Heating (kWh)	Demand** (kWh)	Total (kWh)	Demand** (kW)
January	518	80254	23464	103718	200	233985	452	303671	586	537656	1,038
February	468	82983	25248	108231	231	363229	776	311584	666	674814	1,442
March	518	90860	27825	118685	229	384911	743	351123	678	736033	1,421
April	418	72103	19935	92038	220	231427	554	171921	411	403348	965
May	518	100128	28486	128614	248	285419	551	121120	234	406539	785
June	468	87499	25798	113297	242	343790	735	24767	53	368557	788
July	435	80313	22471	102784	237	248387	572	9337	21	257724	593
August	351	79798	21223	101021	288	198904	567	29515	84	228420	651
September	501	75341	20185	95526	191	276029	550	38193	76	314222	627
October	485	72134	19931	92065	190	223355	461	134836	278	358191	739
November	501	92131	27236	119367	238	278245	555	273840	546	552084	1,101
December	351	69717	21666	91383	260	315725	900	326012	929	641738	1,828
Annual totals	**5532**	**983261**	**283468**	**1266729**		**3383406**		**2095921**		**5479327**	
Monthly average	**461**	**81938**	**23622**	**105561**	**231**	**281951**	**618**	**174660**	**380**	**456611**	**998**
Monthly minimum		**69717**	**19931**	**91383**	**190**	**198904**	**452**	**9337**	**21**	**228420**	**593**
Monthly maximum		**100128**	**28486**	**128614**	**288**	**384911**	**900**	**351123**	**929**	**736033**	**1828**

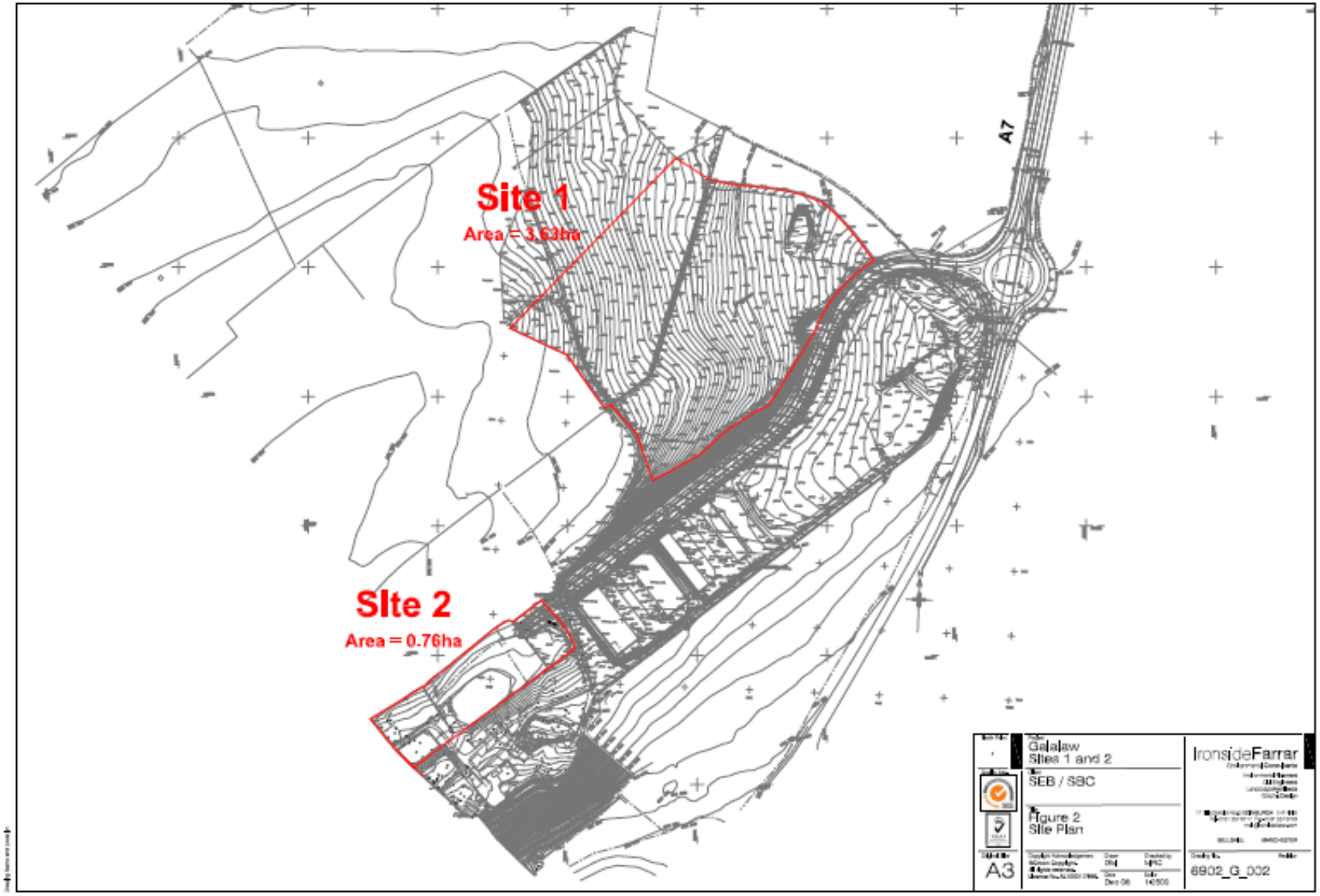
* Based on a six day working week, Sunday 21:00-24:00, Monday – Thursday 00:00-24:00, Friday 00:00–18:00 + holidays

** Averaged demand over the month.

Appendix I – Hawick Knitwear Site Plan



Appendix J – Galalaw Site Plan



Appendix K – Technology Companies

- Biomass Engineering Ltd
  Junction Lane,
  Sankey Valley Industrial Estate,
  Newton-le-Willows,
  WA12 8DN, United Kingdom
  Tel/Fax: +44 (0)1925 295959
  Email: andrewc@shawton.co.uk

- Compact Power Ltd
  Yara House
  St. Andrews Road
  Avonmouth, Bristol, UK
  BS11 9HZ
  Tel: +44 (0) 117 980 2900
  Fax +44 (0) 117 980 2901
  E: info@compactpower.co.uk
  W: www.compactpower.co.uk

- ENER·G Group
  ENER·G House
  Daniel Adamson Road
  Manchester, UK
  M50 1DT
  T: 44 (0) 161 745 7450
  F: 44 (0) 161 745 7457
  E: info@energ.co.uk
  (Using their Energos technology)

- First London Renewables Ltd
  Rainham, Essex
  T: 01708559691

- ITI Energy Ltd
  Innovation Technology Centre
  Brunel Way
  Rotherham
  South Yorkshire S60 5WG
  Tel: 0114 254 1233
  Fax: 0114 254 1235
  Email: info@iti-energy.com

- Advanced Plasma Power Ltd
  Advanced Plasma Power
  Mercury House
  Triton Court
  14 Finsbury Square
  London
  EC2A 1BR
  United Kingdom
  T: +44 (0)20 7374 6335
  E: info@advancedplasmapower.com

- Brightstar Environmental Ltd
  17, St. Ann's Road,
  Harrow,
  Middlesex.
  HA1 1JU
  Telephone: 0208 515 2211
  Mobile: 07788 750488
  Fax: 0208 861 2888
  E: peter.cumberlidge@brightenv.com
  W: www.brightstarenvironmental.com

- Novera Energy Europe Ltd
  2nd Floor Malt Building
  Wilderspool Park
  Greenalls Avenue
  Warrington, Cheshire
  WA4 6RH
  Telephone: 01925 438319 (300 Switchboard)
  Mobile: 07710 905436
  Fax: 01925 438333
  E: john.howson@noveraenergy.co.uk
  W: www.noveraenergy.com

Appendix L - Minutes of Stakeholder Workshop.

PHASE 2/3 STAKEHOLDER WORKSHOP
10TH MAY 2007, GALASHIELS

Present:	Consultants	
	John Birchmore	SHREWS Ltd
	Haydn Scholes	Wardell Armstrong International
	Jamie Carruthers	SHREWS Ltd
	Stakeholders	
	Christina Tracey	FCS, Weavers Court, Forest Mills, Selkirk TD7 5NY christina.tracey@forestry.gsi.gov.uk
	Amber Bush	SEPA, Galashiels Tel: 01869 754797
	Ian Robson	M G Robson, Farm/Forestry Contractors
	Mark Walton	SBSEF/BCIF
	Charlie Fulton	SSFIC
	Chris Trotman	Business Gateway
	David Rodgers	FCS
	Hilary Deighton	3G Energi
	Alastair Cranston	BMR Ltd, Roanoke, Netherraw, Lilliesleaf, Melrose TD6 9EP alastair@al-max.demon.co.uk
	Richard Howard	SEB

The Study consultants gave a presentation that ran through the Study drivers and local supporting policies and programmes. These created opportunities to capitalise on the biomass resource in the Scottish Borders but which nevertheless needed the creation of demand to kick-start investment and also some joined-up thinking. The conclusion from Phase 1 was that there was plenty of biomass resource but that there were only a small number of sites on which development could realistically take place in the short term.

Phase 2/3 identified two possible project opportunities that could be developed relatively quickly and were worked up as exemplars of what could be achieved. Whilst the technologies chosen are capable of processing waste wood this was not factored into the feasibility as it was not within the terms of reference of the Study.

Hawick Knitwear

The first is on the premises of Hawick Knitwear in Hawick where it is considered that a 500KWe plant could be established that would supply about half of the factory's electrical needs, with the balance being exported for sale to the grid, as well as most of their heat demand. This would require the supply of some 3-4,000 tonnes of fresh biomass per annum

delivered by road. Using a series of assumptions the financial appraisal indicated this project to break even if undertaken by an outside investor. If developed by the company, it would bring savings in the short term which would increase with time as electricity prices rose.

The technology, chosen as an example of what would be a good fit on this site, is from Biomass Engineering Ltd of Newton-le-Willows. Fresh biomass would be taken initially but, as dry biomass became available later, this would be considered. The technology is robust and can easily be switched on and off. The company has been working on plant development for some 10 years and now has 4 plants running in the UK with a number of orders soon to be despatched to Germany. The plant is also modular and comes with process warranties which no other gasifier technology is currently able to offer.

Galalaw

The site identified at Galalaw Business Park, on the northern edge of Hawick, is owned by SEB with adjacent land owned by Scottish Borders Council. This would allow the development of a 3MWe plant. 30,000 tonnes per annum of biomass would be delivered and put through a pyrolysis plant to generate electricity for export to the grid. The 6MW of heat that this plant would generate would dry a further 40,000 tonnes of chipped biomass from which 30,000 tonnes per annum of dried chips would be produced for sale into the dry chip market. Until this market developed these dry chips could be used to fuel the biomass power station at Lockerbie.

The technology chosen as an example of what would suit this site is from First London Renewables Ltd. This technology is very efficient at this scale and flexible in the type of biomass feedstock it can take. It is also modular. The drawbacks of this technology are that there is, as yet, no reference plant from which emissions data can be obtained and that there is still a small technology risk. Using a series of assumptions the financial appraisal indicated this project would generate a return of some 10-12% on capex if undertaken by an outside investor.

The consultants then answered a series of questions:

The First London Renewables (FLR) technology is very flexible in its biomass feedstock. The Biomass Engineering (BE) technology is less sensitive to biomass size and quality so that biomass could be screened with large chunks going to BE and the rest to FLR. In terms of end user applications 3G Energi's experience is that bigger boilers are less sensitive to chip quality, that hardwoods are best, softwoods OK but miscanthus should not be used. There was a view that, whatever site or technology was chosen, it should be capable of taking 30% conditioned chips at £50 per tonne delivered because that is all that will be available.

Drying chips to 15% is ideal especially for the 3G Energi boilers. This does make the chips more expensive but the drier the chip the more concentrated the energy so the end user

saves in the long run. For example dry chips at 15% would be twice the price of conditioned chips at 30%. Only if dry chips are exposed to water will they tend to absorb it, and then only on the surface.

The market for dry chips is big enough to enable both projects to run side-by-side with the Lockerbie power station, and the 3HS and 4PS projects, capable of taking all the output from the Galalaw plant in the short term. If the chip market was too slow to take off there was a possibility of a pellet plant being sited at Galalaw to produce higher value wood pellets for which there was probably a bigger market. The cost of a pellet plant with an output of 30,000 tonnes per year would be in the region of £3m. Another possible alternative is to take conditioned chips (at 30%) and trickle air-dry in-bag to 18-20%.

A drum chipper, as opposed to a screw chipper, would probably be incorporated into the Galalaw plant.

There was some discussion about the choice of sites with some stakeholders preferring to see the 3MWe plant sited closer to the source of biomass i.e. within the forest, for example in the Teviothead area. Stakeholders were asked to put forward sites that met a set of criteria to be posted on the Study website. Apart from meeting town planning criteria, the site would need to be one that could be brought forward very quickly.

The consultants were questioned about the amount of biomass available with the amount likely to be captured only a fraction of what was available particularly because of the long term contracts that FC has already in place for small roundwood. In addition it was believed that the residues originating from forests grown on peat would not only require to be "harvested" by specialist machinery but likely to be too contaminated to be a useful fuel. Small woodlands (<5ha) (not taken into account in the calculation of biomass availability) might be the answer but this might not be sustainable. Nor would that be compatible with a forest-centre site away from major road infrastructure.

As far as district heating is concerned it was commented that the 10% requirement for new housing developments to have renewable energy was being resisted by house builders. If they were forced down that route they would probably opt for ground source heat pumps rather than biomass anyway.

It was, however, universally agreed that demand for biomass needed to be driven by the development of a plant somewhere.

Note At the meeting the view was expressed that other sites should be considered besides Galalaw. Further enquiries have brought forward the possibility of developments at the grain mill but no forest sites have been identified. The grain mill site is at this stage only a consideration and no commitments have been made by the management of the grain mill.

Appendix M - Good Quality Combined Heat and Power.

CHPQA Certificates may be used to support a claim for the benefits offered to Good Quality CHP.

To claim Enhanced Capital Allowances (ECAs), you must have a Secretary of State (Energy Efficiency) Certificate before claiming the allowance on your Tax Return.

To claim Climate Change Levy (CCL) exemption on fuel inputs to and power outputs from, the CHP Scheme must have a Secretary of State (combined heat and power) exemption Certificate for your CHP Scheme.

A Supplier Certificates (PP11) must then be completed and submitted to each of the energy suppliers (copied, together with Supporting Analysis Form PP10, to HM Revenue and Customs).

SoS Certificates are required to show the legal entitlement to claim the benefit concerned.

Please note existing Secretary of State (combined heat and power) exemption Certificates remain valid from the date of issue unless varied or revoked, provided the operator maintains that validity by sending a copy of the current CHPQA Certificate to the SoS annually by 30th June.

Most CHPQA Certificates record actual performance of CHP Schemes for the previous year.

It is also possible to assess the design of new or upgraded Schemes and Certify their expected performance in operation.

The issue of Secretary of State (combined heat and power) exemption certificates (required for claiming CCL exemption) and Energy Efficiency Certificates (required for claiming ECAs) is dependent on the information contained in your CHPQA certificate.

Please note, for schemes with a facility to export electricity, the main intended business must be to provide heat and power for identified users on site or to known third parties and not to generate power for sale to or via unspecified third parties. If eligible and requested when completing CHPQA Form F3, this will be issued once the self-assessment has been satisfactorily validated by CHPQA.

In order to receive a Secretary of State (combined heat and power) exemption Certificate a copy of the CHPQA Certificate must be sent with a letter of request to:

CHP Certification Team

Defra Environment DG
Climate and Energy: Household and Markets
Energy Markets: Distributed Generation and CHP Branch
Ashdown House
123 Victoria Street
London SW1E 6DE

Tel: 020 7082 8724
Fax: 020 7082 8708

Email: judit.nagy@defra.gsi.gov.uk