Examining the Opportunities for Establishment of a New Kiln Drying Facility in the Scottish Borders
12 June 2014
Background

EnviroCentre with Project Partners Buccleuch Woodland and Nevin Associates were commissioned by Scottish Borders Council to undertake a feasibility study in relation to potential development of a wood kiln facility (with particular focus on utilisation of waste heat from an Advanced Thermal Treatment plant to be located at Easter Langlee, Galashiels).


The study incorporated the following key areas:
- Technical Review
- Market Research
- Financial Modelling and Business Case
Speakers and Agenda

Alan Massey: Forestry Consultant on Behalf of Buccleuch Woodlands
*Background on Timber Demand, Constraints and Identification of Kilning Requirements*

Graeme Duff: EnviroCentre Ltd
*Overview of the Findings of Scottish Borders Kiln Drying Feasibility Study*

Mike Nevin: Nevin Associates Ltd
*Findings of the Financial Analysis*
Alan Massey, NDF
Forestry Consultant on Behalf of Buccleuch Woodland
The Buccleuch Woodlands’ report from March 2011 concluded that:

- The main added value manufacturers in the region use either imported or home-grown kiln dried spruce, with no locally produced material sourced.
- Within the Borders region - only two timber drying kilns. **Annual capacity around 750m³ a year.**
- The existing large sawmills out with the region have no spare capacity.
- Dried timber is a prerequisite for most added value timber products.
- There is a ready market for dry wood for use as biomass fuel.
### Kilning Demand - Sawn Timber

<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>REQUIREMENT M3 p.a.</th>
<th>COMMENT</th>
<th>Species</th>
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<tbody>
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<td>Air dries</td>
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<td>No Demand air dries</td>
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<td>Poss demand for hardwood</td>
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<td>5000</td>
<td>Sawn fencing for treatment</td>
<td>Pine</td>
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<td>13</td>
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<td>Own Kiln</td>
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<td><strong>TOTALS</strong></td>
<td></td>
<td><strong>5550</strong></td>
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</table>
Results

- **Demand Small < 6000m³ p.a.**
- Main demand - **dry sawn fencing timber. (posts & stobs) prior to pressure preservative treatment**
- Secondary demand - **kiln dried joinery products, softwood and hardwood flooring and larch cladding.**
- Small demand - **hardwood internal joinery products, tongue and groove flooring.**
- **No demand for construction timbers or for pallets.** Markets serviced by the major sawmill groups and by sawn timber imports.
- **“Chicken & egg” situation**

**Downstream Demand.**

A large manufacturer of timber products indicated an interest in sourcing some local timber if dried and machined to their standards.
Results

- *Due to small demand for the drying of sawn timber* - group looked for alternative products.

  **Biomass fuel - logs and chip.**

  **Increasing Demand** driven by:

  - *Government policy to reduce carbon emissions through carbon taxation* such as the Carbon Reduction Commitment (CRC) and Climate Change Levy (CCL).
  - *Government policy to encourage the use of renewable energy* by both industrial and domestic markets via the Renewable Heat Incentive (RHI).
  - *Rising fossil fuel prices* which, in particular, affect rural areas off mains gas-grid and heavily reliant on heating oil.
Results

Market Demand in Scottish Borders

As part of the research - potential commercial customers for biomass wood chip and logs were contacted.

Observations

The market for wood chip is **embryonic and requires a period of business development**. Since this survey Domestic RHI launched, may provide stimulus to demand for dry wood chip. *(It should also be noted that kilns are not considered the most economic technology for drying wood chips.)*

**Firewood logs, a traditional but growing market.** Market research found thriving business in logs around Edinburgh with (imported) kiln dried logs taking an increasing market share due to superior quality in terms of cleanliness, ease of lighting and calorific value.

**In order to “pump prime” the business - a business case using a mix of dry wood chip and kiln dry logs investigated.** *(The kilns chosen in this study can be adapted to dry sawn timber with the addition of the appropriate kilning schedules.)*
Background

The study had a number of key objectives:

• Technical review of capability to harness waste heat from the Easter Langlee Advanced Thermal Treatment facility to drive a wood kiln

• Assessment of potential market areas in and around the Borders for kilned wood to inform appropriate kiln selection

• Consideration of potential placement locations for the kiln facility

• Development of a financial model for the proposed facility
Advanced Thermal Treatment Plant
District Heating Scheme
Available Heat and Kiln Selection

• The feasibility assessment focussed on a continuous exportable heat source of 1.2MWth

• Technical discussion was carried out with kiln manufacturer Kiln Services Limited to identify potential viable kiln options.

• On the basis of the market findings a 12 bin kilning unit, processing a total of 2,000 tonnes of wood chip/1,470Tonnes of wood logs per bin per annum was identified as the preferred facility
Available Heat and Kiln Selection

- This kiln facility required heat allowance would be 1MWth.
- This would result in a total processing weight of 12,000 tonnes of wood chip/4,000 Tonnes of wood log per annum.
- Utilisation of heat from the ATT facility will not provide a RHI, however adoption of a biomass boiler as part of the facility will incorporate RHI.
Kiln Facility
Kiln Facility
Kiln Facility
Kiln Facility

• Kiln incorporates 30m³ hook bins (weight three tonnes when empty) which are loaded in to the kiln via a roller door utilising a hook bin trailer or similar.

• The main fans and heat exchangers are situated adjacent to the hook bin releasing the hot air directly into the bin. The kiln has forced air extraction units to remove moisture laden air, whilst vents introduce fresh air.

• The drying period for wood chip is approximately 1.5 days, with logs taking up to 4-5 day
Kiln Facility

- Staff requirements would incorporate two operators, one appropriately trained to operate a hook bin trailer or similar to move each bin into position.
- In addition the facility would require wood processing (chipper for wood chips or a log processor for fire wood) to allow the incoming wood to be appropriately processed to size prior to drying. It is considered that these works be sub-contracted but the operation themselves would take place on site.
Kiln Facility

• The facility will require a storage unit (barn like structure closed on three sides), this will principally be utilised for storage of dried wood and equipment. As such the facility should be sized to store at least one months production of dried wood (circa 500m³ of wood chip). A barn approximately 25m by 25m has been allowed for as part of the development.

• A bagging unit would be required to be installed in the storage shed to allow for bagging of dried logs.

• The facility will also require a hardstanding yard area to allow access for vehicles, storage of wood and processing of wood. A hardstanding concrete area of 1,800m² has been allowed for as part of the development.
Site Location Considerations

- Proximity to district heat network.
- Cost for acquisition.
- Access road suitability.
- Service connection.
- Planning zoning.
- Available storage units and hardstanding areas.
- Historic land usage with respect to contamination, geotechnical and flooding constraints.
- Surrounding land use with respect to traffic implications.
- Room for growth.
Carbon Footprint

• Utilisation of carbon during the growth of the tree more than offsets the total carbon emissions resulting from harvesting, processing and transporting timber/woodchip to Easter Langlee.

• Given the proximity of the timber sources to the potential kiln facility, there will be a carbon saving related to transport in the Borders area. Indicative calculations indicate that would be a carbon reduction of up to 7 times the current emissions value for kiln dried wood imported to the Scottish Borders.

• Annual wood production from 12 kiln unit would produce 1,402 tonnes of CO2 per annum. In comparison natural gas and LPG would produce 6,668 and 7,720 tonnes of carbon dioxide respectively in production of the equivalent kilowatt/hour.
Long Term Vision

• Growth of facility in relation to expanding markets

Fencing – kiln would reduce sawmill stock carrying requirements allowing them to respond rapidly to orders and ensure consistency of the moisture content of the stock prior to treatment.

Joinery - Joinery products, wood flooring and larch cladding a number of sawmills interviewed indicated a long-term demand. Potential product range included mouldings, stair risers, architraves and tongue and grooved flooring. In addition, one sawmill noted a particular demand for the drying of larch cladding.

These sawmills have been turning down orders due to the lack of local kilning capacity. Whilst the sawmills identified that demand and enquiries were low at present, again following establishment of a kiln and initial production there may be potential to actively market to increase demand levels.
Long Term Vision

Potential for policy decisions for future development increasing demand for wood chip, allowing growth of facility with biomass boiler (potentially supplying waste heat to district heating system).
Mike Nevin,
Nevin Associates Limited
Presentation Structure

• Aims and approach
• Key inputs
• Results
• Commentary
Aims

• To assess the feasibility and viability of providing a kiln drying facility for the Borders timber processing sector
Approach

1. Assess the technical feasibility, outline design and costs of a commercial kiln drying facility under different scenarios (logs / wood chip).
2. Develop an outline business plan and financial forecasts based on the findings of Task 1, for an operating period of 15 years.
3. Task 3 – prepare a longer term strategy for development of the timber resources in Scottish Borders.
Financial Modelling Scenarios

1. Base case - kiln drier developed exclusively for drying logs;
2. Alternate model - kiln drier developed solely for drying woodchip;
3. Intermediate model - 50% of the drier’s capacity used for logs, and 50% for woodchip.

Two sub-options for heat generation:
[a] Heat entirely derived from external sources.
[b] Heat partly generated by a biomass boiler on site using just over 500 t of logs per annum in order to generate half of the plant's heat requirements & benefiting from RHIs.
Key Inputs – Capacity and Capital Costs

• Drying cycle: 4.5 days for logs & 1.5 days for wood chip;
• 12 operational drying bins, each of 30 cubic metres’ capacity;
• The annual capacity per bin is
  – 2,400 tpa of wood chip,
  – 400 tpa of logs;
• Total capacity assumed in the financial model is:
  – 12 × 333 tpa = 4,000 tpa of logs, or
  – 12 × 2000 tpa = 24,000 tpa of wood chip.
Key Inputs – Capacity and Capital Costs

1. Site acquisition and preparation: £50,000
2. Drying bins: £81,000 = 18 bins @ £4,500 each.
3. Kiln: £380,000
4. Civil works: £75,000 = 1,800 m² @ c £30 / m² + services
5. Storage shed for finished product: £100,000 = 25m x 25m @ £100 per m² + services
6. Wood drying kiln = £30,000
7. Installation of a biomass boiler = £250,000 (optional)

Net capex = just under £1 million (£966,000) + 15% for professional fees
Operating Costs (Opex)

1. Heat requirement of 1MWth @ £10 per MWH (1p per kWh).
2. Electricity requirement of 150 MWH pa @ £130 per MWH (or 13p per kWh).
3. Chipping: £10 per tonne (mobile chipper to cut softwood into wood chip - not required for logs).
5. Mobile plant annual cost of £20,000
6. Provision for plant life cycle maintenance of 4% of capex
7. Provision of £70,000 for staffing & admin costs
8. Provision of £9,000 pa for Rates
Operating Revenues

1. Logs:
   - average cost per tonne pre-drying: £45,
   - average net price per tonne of input post-drying: £177 (= average gross price of £300, with each tonne of wet logs going into the kiln converting into 590 kg of dry logs)

2. Wood chip
   - average cost per tonne pre-drying for softwood: £32,
   - average net price per tonne of input post-drying: £59.20 (= average gross price of £80, with each tonne of wet wood chip going into the kiln dryer converting into 740 kg of dry chip).
Financing Parameters

1. Corporation tax rate: 20%,
2. Writing down allowances: 18% (plant & equipment only)
3. Three financing scenarios, respectively assuming capex is funded 100%, 50% and 25% by equity, remainder by loans
4. Loans assumed to be repayable after 7 years @ 7% interest;
5. Dividend payout ratio of 70%;
6. Discount rate of 3.5% (real) applied to calculate the Net Present Value of the project.
Key Results

- Project IRR in Real Terms

![Graph showing project IRR in real terms with different fuel types and biomass burners.](image-url)
Project NPV in Real Terms

- Logs: £473,931
- Wood chip: £1,115,351
- 50% logs, 50% wood chip: £794,738
- Without biomass burner: £465,004
- £1,106,704
- £785,617
- £0
- £200,000
- £400,000
- £600,000
- £800,000
- £1,000,000
- £1,200,000

Options:
- 50% logs, 50% wood chip
- With biomass burner
- Without biomass burner
Equity IRR in real terms with 75% debt funding

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Equity IRR with 75% debt funding</th>
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</thead>
<tbody>
<tr>
<td>Logs</td>
<td>16.8%</td>
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<tr>
<td>Wood chip</td>
<td>25.2%</td>
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<tr>
<td>50% logs, 50% wood chip</td>
<td>21.3%</td>
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<tr>
<td>With biomass burner</td>
<td>28.5%</td>
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<tr>
<td>Without biomass burner</td>
<td>24.0%</td>
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Comments on the results –

(1) Is the project viable?

- The project appears viable on all the scenarios modelled, with a positive real Project IRR and Net Present Value;
- IRR is slightly higher in the cases without biomass burning on-site;
- But from a long-term energy security viewpoint, there is merit in considering installation of a biomass boiler so that the kiln dryer is at least partly self-sustaining in energy terms - i.e. “with biomass boiler” is a lower risk option
Comments on the results –

(2) Woodchip or logs?

• Highest IRR and NPV is generated by woodchip;
• However, the market for woodchip is currently undeveloped;
• Safest initial option might therefore be log drying – lower IRR, but still viable;
• IRRs of the options where 50% of the capacity is applied to woodchip and 50% to logs are intermediate between the woodchip only and logs only (as one would expect)
Comments on the results –

(3) To leverage or not to leverage?

- Modelled scenarios indicate that the returns to equity could be enhanced if part of the capital cost was funded by debt;
- Higher leverage tends to raise the returns to equity if the rate of interest on debt is lower than the project's internal rate of return;
- But higher leverage also brings higher risks, as debt amortisation is a fixed cost, whereas the dividend returns to equity are variable – i.e. dividends can be reduced if for any reason project returns are lower than forecast.
Final Observations on Funding Structure

• Banks are still relatively risk-averse in the aftermath of the financial crisis, & may only lend for 7 years rather than the project lifetime (& at high margins)
• Conclusion: Funding by grants and equity to the extent possible – using debt finance as the funding source of last resort.
Overall Conclusions
Conclusion

• There is a current market for biomass logs, particularly in the Edinburgh region (embryonic in Scottish Borders)
• A twelve bin batch kiln presents the most viable available technology for this drying process. This facility would utilise approximately 1MW of available heat.
• Financial models confirms project appears viable on all the scenarios modelled, with a positive real Project IRR and Net Present Value.
• The most attractive option is woodchip without biomass burning, followed by woodchip alone with biomass burning. The market for woodchip is not currently well-developed in the Scottish Borders area. The safest initial option might therefore be log drying, which offers a lower IRR, but is still viable.
Additional Considerations

• Potential for development of Island facility utilising biomass boiler only. Information provided by Log Kiln Services indicates this is a financially viable alternative.

• Alternative methodologies for wood drying including drying floors and tumble drying systems. These have not been considered as part of this assessment.
Discussion