

AYRSHIRE JOINT STRUCTURE PLAN AND TRANSPORTATION COMMITTEE
3rd JUNE 2005

Biomass in Ayrshire: Study of Resources

PURPOSE OF REPORT

1. To advise the Committee on the scale of the Woodfuel Biomass resource available to Ayrshire as measured by its potential for electricity generation.

BACKGROUND

2. Biomass, particularly woodfuel, is attracting new prominence as a carbon-neutral renewable energy resource. It is a fuel which is already well established in other EU countries (providing 64% of total EU renewable energy utilisation) as a fuel for heating, combined heat and power and as bio-ethanol for transport fuel. It offers potential to be part of a portfolio of energy sources, helping to achieve Scotland's renewable energy targets as well as providing opportunities for business diversification in the woodfuel supply chain. It is a predictable and secure source of energy supply that is almost immediately available and can be accessed and utilised with mainly known technology.
3. Ayrshire has a substantial woodland and timber resource that appears to offer considerable potential as a fuel feedstock for renewable energy production. However as a first step in considering its future contribution it is important to be aware and realistic about the size of the resource and to assess what might be available for energy use without disrupting existing wood user supply chains and displacing existing activities.
4. In order to do this the note attached tries to quantify firstly the amount of biomass fuel that might be available for use in Ayrshire from a variety of sources, and secondly to assess its contribution to total energy needs. This assessment (see Appendix) limits itself to measuring biomass supply in terms of electrical energy generation capacity. In reality there are other uses for biomass that may be more efficient but these have not been considered here.

FINDINGS

5. Biomass fuel arises from the following sources:
 - Sustainable managed woodlands
 - Primary Processing Products
 - Arboricultural Arisings
 - Waste wood
 - Purpose Grown Energy Crops – Short Rotation Coppice
 - Black Liquor

6. The total average annual supply of available biomass woodfuel in Ayrshire during the period 2003-2021, from all sources, is of the order of 110,0000 odt pa. Woodlands are the most significant resource contributing over 90% of the total.
7. The maximum electricity generating capacity supported by the available biomass supply would be 25MW, which could support up to 25,000 households and 125 jobs.

CONCLUSION

8. Forecast biomass supplies available to Ayrshire from currently unused sources would, if utilised for electricity generation, make a small but significant contribution to renewable energy targets representing between 2.1% and 3% of Ayrshire's total electrical energy consumption needs. Supplying biomass from these unused sources would not divert activity or impinge on existing uses and markets. Biomass could potentially contribute more but would require one or more of the following:
 - To divert wood supplies away from existing users;
 - To increase energy crops/ self-rotation coppicing;
 - To import supplies; or
 - To increase utilisation of Black Liquor from pulp processing.

The extent to which biomass feedstock supplies actually increase and are utilised will be dependent on biomass energy supply being sufficiently profitable to compete in existing markets.

RECOMMENDATION

9. It is recommended that the Committee note the contents of the attached report .

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Appendix

Biomass in Ayrshire: Study of Resources

Ayrshire has a substantial woodland and forest resource which appears to offer great potential as a fuel feedstock for renewable energy production. However it is important to be realistic about this potential if it is to make a larger contribution in line with the recent FREDS Biomass report. What actually is the scale of this resource and what might be available for use as biomass without disrupting existing wood user supply chains and displacing existing activities?

This note tries to assess firstly the scale of Ayrshire's biomass resource as a fuel for energy use and secondly to assess its contribution to total energy needs? The note considers the capacity for electricity generation rather than for heating or CHP (although there is better fuel conversion efficiency via bio-mass utilisation in CHP or heat plants). The scale of generating plant has an effect on resource efficiency through economies of scale for both generation and supply. However a range of plant from 250kW to 30 MW has been considered for illustrative purposes. Scale will have very different spatial implications for the siting of generating capacity.

What are the possible sources of Biomass fuel?

- Sustainable managed woodlands
- Primary Processing Products
- Arboricultural Arisings
- Waste wood
- Purpose grown energy crops – short rotation coppice etc
- Black Liquor

1. Scale of potential contribution of Biomass Fuel sources:

A. Sustainable Managed Woodlands

What contribution can forests and woodlands in and accessible to Ayrshire make to the supply of biomass? Is there sufficient woodfuel to make a significant contribution to renewable energy generation? Does the existing wood fuel supply availability mean that bio-fuel crops and short rotation coppice are not needed or not a priority in Scotland because of the existing wood resource as the FREDS Report on Biomass indicates?

An assessment of the 3 Forest Districts of Scottish Lowlands; Galloway and Ae which lie within 30 miles of the most likely areas for the development of biomass electricity generating plant in Ayrshire indicates a total potential of over 1,000,000 oven dried tonnes. However over 70% of this supply has existing or potential alternative markets as sawn timber. There are therefore 283,000 oven dried tonnes of woodfuel available to Ayrshire in the absence of competing markets. Of this total a much smaller **100,000 tonnes** is available without impinging on existing markets. This is significant in national terms accounting for 12% of the estimated British supply (ie 823k odt pa).

Forecast Biomass available to Ayrshire						
Annual Production 2003-2021 odt (for woodlands >2ha)						
Forest District	Stemwood 7-14cm*	Poor Quality	Tips	Branches	Foliage	Total
Scottish Lowlands	5859	11957	1397	15602	6338	41153
Galloway	8939	7082	505	5148	2089	23763
Ae	5652	6991	1202	13969	5999	33813
Total	20450	26030	3104	34719	14426	98729
Source: Forest Research - Woodfuel Resource						

*Only stemwood below 14cm is included as it is unlikely that energy end markets will be sufficiently profitable to allow larger dimension stemwood to be diverted from their existing markets. Below 14cm only 10% of 7-14cm Stemwood is included.

B. Primary Processing Co-Products

Approximately 50% of the volume of wood sold to sawmills for conversion into planks, batons etc. generates co-products in the form of sawdust, chips and bark. The annual production of co-products from sawmills of home grown wood in Scotland is 404k odt pa. (Co-products from imported timber would be additional and as the UK imports 85% of the softwood timber it consumes this will be significant) This is almost half (47%) of the British total of 859k.

Overall, 68% is in the form of chips and 18% in the form of sawdust. Approximately 83% of total co-products already have markets in the wood processing industries. On this basis it would appear to be unrealistic to assume more than 10% would be available to the energy market.

Figures by Forest District are not available and therefore to show Ayrshire's share of the Scottish total on a strictly comparable basis is not possible. However if we assume that co-products are produced in proportion to forecast local production levels then Ayrshire with 7.4% of forecast production might be expected to produce sawmill co-products from home grown timber of 30k odt pa. of which 3,000 would be available as biomass fuel. (Imported timber may add a further 169k odt pa bringing the total to approximately 200k pa). However because Ayrshire has a relatively high concentration of sawmilling and other wood processing activities the actual amount of co-product may be considerably higher than this. For example one very large sawmill at Troon (Wilson's) alone appears to produce around 45,000 odt pa of sawdust. (90,000 tonnes* @ 50% moisture content). This will include both home and imported timber. If we assume that the Troon mill comprises 50% of the total sawmilling capacity in Ayrshire then this would indicate an upper limit of say 90,000 odt pa. of which 10% or 9,000 odt pa would be available to the energy market.

In summary, the available biomass fuel supply from co-product could lie between a lower limit of **3,000 odt pa** from home grown timber to an upper limit of **9,000 odt pa** from both home grown and imported timber.

* Woodfuel Feasibility Study for South Ayrshire, 2005

C. Arboricultural Arisings

The fellings, thinnings, and pruning of trees in urban areas, transport and utility corridors are generally left on site or removed to landfill. Britain produces a total of 492 odt pa. Although 68% from this source is unmarketed and therefore is in theory available as a contribution to biomass fuel supply it may be uneconomic to collect. It is small scale in Scotland. Only 34,717 odt pa are produced in Scotland which is around 5% of the British total. A total for Ayrshire is unknown but on a pro rated share may be of the order of **2,500 odt pa**.

D. Waste Wood.

The waste woody material segregated from collected household waste and civic amenity sites across Britain is 179,000 odt pa. The Scottish and Ayrshire figure is unknown. However on the basis that South Ayrshire Council produce 500 tonnes pa and assuming similar amounts from the other two councils would give a total of **1500 tonnes pa**.

E. Energy Crops / Short Rotation Coppice

95% of British total of 17,000 odt pa is in England, with just under half in Yorkshire and Humber. Scotland produces 600 odt pa in total. If Ayrshire produces any it is insignificant at present.

F. Black Liquor

In Finland 8.2% of energy is 'generated' in the form of 'black liquor' which is part of the chemical recovery process from pulping. Pulp mills are very large energy users and utilisation of this fuel enables pulp plants to reduce energy consumption from the grid and to increase their energy self-sufficiency. Technological advances in gasification of the black liquor offers the potential to increase the efficiency of this process significantly. The scale of current usage and extent to which this may impact in Ayrshire is unknown but given the scale of pulping locally, could offer the potential for significant energy generation from this source.

Summary of forecast Biomass potential in the presence of competing markets

The total average annual potential supply of available biomass woodfuel in Ayrshire during the period 2003-2021, without impinging on existing markets, is of the order of 110,000 odt pa. Woodlands are much the most significant resource contributing over 90% of the total.

Available Biomass as Energy Fuel for Ayrshire odt pa		
Woodlands over 2ha	100000	91%
Primary Processing Co-products	6000	5%
Arboricultural Arisings	2500	2%
Waste Wood	1500	1%
Energy Crops/ SRC	0	
Black Liquor	Unknown	
Total	110,000	100%
Source: Various		

2. How much electricity could this biomass supply generate?

Using a range of different sized generating plants with differing fuel supply needs indicates the scale of provision. The maximum generating capacity supported by the available biomass supply would be 25 MW. There are clear fuel energy efficiencies to be gained from larger scale plant. Electrical generation is converted into a standard measure of number of households supplied to indicate the impact and scale in relation to the scale of the market in Ayrshire. If the biomass supply available to Ayrshire were to be used to feed electrical generating capacity it could support between 18,250 and 25,500 households. This would generate around 125 FTE jobs.

Power Plant Capacity	Biomass fuel (odt pa) required per plant*	No. of power plants supported by available biomass supply	No of Houses Supplied by available biomass supply
250kW	1500	73	18,250
1 MW	5600	19.6	19,600
5 MW	25,000	4.4	22,000
30 MW	130,000	0.85	25,500
Source: *Forestry Commission Wales			

This is equivalent to supplying between 11% and 16% of domestic electricity consumption in Ayrshire. As domestic energy consumption is 32% of total energy and 19% of electricity consumption in Ayrshire, available Biomass could contribute between 2.1% and 3.0% of total electricity used, equivalent to 0.13% and 0.19% of total energy use. As this is a fairly small proportion of the total there is clearly scope to develop biomass supply much further if it is to contribute more to renewable targets. The development of energy crops will be required in order to allow this to happen unless the profitability of woodland biomass improves sufficiently to allow biomass energy demand to compete in existing wood supply markets.

Conclusion

Forecast Biomass supplies available to Ayrshire from currently unused sources are estimated to be 110k odt pa. Supplying biomass for energy use from these sources will not divert activity or impinge on existing markets. This biomass supply is sufficient to meet the electricity needs of up to 25,500 households and would generate around 125 FTE jobs. This is a small but significant contribution to renewable energy targets representing between 2.1% and 3% of Ayrshire's total electrical energy consumption needs.

Biomass could potentially contribute more but would require one or more of the following:

1. to divert wood supplies away from existing users
2. to increase energy crops / SRC
3. to import supplies
4. to increase utilisation of black liquor

Sources:

Woodfuel Resources in Britain McKay, H 2003

Promoting & Accelerating the Market Penetration of Biomass Technology in Scotland SE 2005

Woodfuel Opportunities, Scottish Forest Industries Cluster

Forest Research, Woodfuel Resource, www.woodfuelresource.org.uk

Energy Planning Study for South Ayrshire, Energy Agency South Ayrshire.

Woodfuel Supply Chains in Scotland, OPET and NIFES Consulting

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