BIOMASS, CARBON FOOTPRINTS AND ROAD HAULAGE
An appeal for some joined-up thinking.

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1. SUMMARY

1.1. Commercial forests produce a number of products and benefits. Larger diameter logs generally go to local sawmills. Lower value small-roundwood (SRW) is generally sent for processing at large mills. This paper focuses on issues relating to the transport of small-roundwood.

1.2. The processing mills are large and of necessity are widely separated from one another. They are often remote from the forests that produce the SRW. The value, per tonne, of SRW is low.

1.3. Low-value forest products could be used as biomass to heat rural communities close to the woods that produce them. In the main, in Scotland, SRW is trucked far away from the forests close to such communities and fossil fuels (oil, gas and coal) to heat homes in these areas, are trucked in.

1.4. The cost to Scotland, in terms of maintenance of road surfaces, congestion, noise, air pollution and accidents (the social cost) of moving SRW is often much greater than the net return (after deduction of haulage, extraction and harvesting costs) to the timber grower.

1.5. This paper argues that this timber traffic and therefore the social cost could be reduced if low value forest products were used to fuel district heating systems in those timber-producing areas of Scotland that are far removed from timber processing mills. The savings in the social cost that would result from the reduction in road haulage should be used as an incentive to bring about this radical change in heating provision. Numerous other benefits ensue including reduced carbon emissions, noise and air pollution, and road congestion as well as enhancing support for rural industries and economies while delivering cheaper heat to the public thus helping alleviate fuel poverty.

2. Background:

2.1. Kincardine Estate in Aberdeenshire is a timber-growing estate. It is just one of a great many timber growers in rural Scotland. From our 1,500 acres of timber we produce timber for a variety of destinations. The higher quality saw-logs go to nearby mills. However we also produce low-value small roundwood (SRW) and this has to be transported to our nearest markets, processing mills at Cowie near Stirling and Morayhill, near Dalcross, or sent overseas. The removal of the local railway in the 1960s means that road haulage is realistically the only means of transport available.

2.2. Timber growing is, obviously, a slow process. Trees that are planted take about 25 years before they reach the stage for first thinning. Subsequent thinnings are made roughly every 5 years. This is necessary if the quality of the final crop is to be assured. The early thinnings produce mostly SRW and this proportion reduces as the tree crop grows and log diameters increase.

2.3. The costs of growing the trees are high and the situation is exacerbated by the time taken between the establishment costs (cash out-flow) and positive cash-flows which may only begin to show at the second or even third thinning (depending on location) or some 30 to 35 years after the initial investment in planting the woodland.

2.4. Ignoring, for the time being, the historic costs of establishment the timber grower faces marginal costs when it comes to thinning his trees. Felling and de-branching; extraction to road-side; and transport by lorry to market are all expensive processes and it is common to find that SRW brings the grower a net return of less than £1 per tonne once these immediate costs are taken into account.

2.5. As a timber grower we are well aware of the cost of upkeep of our internal forest roads and tracks. All too often the wear and tear of HGVs on gravel tracks requires further expenditure once timber has been extracted.

2.6. This paper draws attention to the public cost of the transport of such low-value commodities and suggests how the cost could be reduced while bringing about environmental, social and economic benefits.

3. The public cost of road haulage.

3.1. From his experience in repairing his own private roads the writer sought, some years ago, to identify the public cost of sending a single lorry load of SRW to a Scottish processing mill. The public or social cost is made up of a number of separate elements including road maintenance, air pollution, and congestion. It seemed to him likely that the public cost was greater than the very slender net return to the grower. While it is easy to identify the costs payable to the haulier (depreciation, fuel, maintenance, taxation, insurance, wages and profit) it proved initially far more difficult to find an answer to the issue of the social cost.

3.2. The first surprise was the difficulty in getting an answer to what was an inherently simple question. Enquiries were made of the Scottish Executive (responsible for trunk road system) and Local Authority (Aberdeenshire Council which is responsible for our local roads network) in 2004. Neither were willing or appeared capable of providing an answer. The best response was that 'it was all very complicated and depended on the type of lorry and road' i.e. nothing that a simple computer model could answer. Of greater concern to me as a taxpayer was the fact that neither seemed in the least bit interested in providing an answer or even asking the question in the first place.

3.3. In the private sector, if a process costs more than it is worth then the provider of that process has to face serious scrutiny as to why it should be carried out. The fact is that the public sector did not seem to concern itself about the cost and benefit of road haulage.

3.4. A further line of enquiry was made to the Macaulay Institute with no greater success.

3.5. Finally, in 2006, a lead pointed to a 2003 document published by the Strategic Rail Authority (SRA) entitled Sensitive Lorry Miles (SLM). This analysis identifies the cost to society of HGV haulage and therefore provides an opportunity for costing and assisting modal shift (i.e. from HGV to train).

3.6. SLMs have been used, since 1991, to assess the external benefits from the transfer of freight from road transport. (Freight Facilities Grant & Track Access Grants). Payments are made on a 'per lorry mile removed basis'. It isn't a straight-line calculation since different values are attributed for each road category (Motorway, A roads, C roads etc.) They take into account cost elements as follows (in alphabetical order).

- Accidents
- Climate Change
- Noise
- Pollution
- Rail External Costs
- Road Congestion
- Road Infrastructure Costs
- Road Tax

3.7. The estimate of SLM costs quoted in Table 3 of the SRA paper is repeated here as it helps understanding of the concept and how it is calculated.

Table 1: SRA derived values of net externalities of rail freight (pence per lorry mile).

	Motorway			London & Conurbation		Rural & Urban		Weighted Average
	High Congestion	Medium Congestion	Low Congestion	Trunk & Principle	Other	Trunk & Principle	Other	
Accidents	4	4	4	10	8	10	8	7.5
Noise	4	4	4	11	9	2	4	3.8
Pollution	22	22	22	52	61	18	20	23.4
Climate Change	5	5	5	5	4	4	3	4.3
Infrastructure Costs	5	5	5	8	26	10	32	11.2
Road Congestion	94	44	7	124	124	43	6	44.0
Unquantified	10	10	10	10	10	10	10	10.0
Taxation	-29	-29	-29	-29	-28	-29	-28	-28.9
Rail Costs	-10	-10	-10	-10	-10	-10	-10	-10.0
TOTAL	105	55	18	181	204	58	45	65.3

3.8. From this weighted average it can be seen that the net gain from a shift from HGV to rail freight was assessed in 2003 as being 65.3pence per lorry mile.

3.9. This paper is asking the reader to consider the situation where, instead of transferring freight from HGV to train (often an impossible option in rural areas as the rural railways were removed decades ago), steps are taken to ensure that the payload (SRW) is removed from the transport requirement through use close to production as biomass to fuel district heating.

3.10. In this scenario to the savings to the pubic purse can be added the rail costs quoted in Table 1 above. Thus savings of 75.3pence (2003 figures) per lorry mile can be expected where the HGV load is simply removed from the transport system.

3.11. Two further points must be taken into consideration however.

3.12. The use of SRW as biomass for heating will reduce the demand for oil and gas for heating. In that efficiencies of combustion of oil, gas and biomass are very similar the calculation can be made by comparing the calorific values when the fuels are burned in a boiler at 88% efficiency:

- Wood chips at 35% moisture will yield 2400 kWh / tonne.
- Kerosene at 60F yields 11,831kWh / tonne.

3.12.1. Thus it can be seen that 1 tonne of oil transport requirement is removed for every 4.74 tonnes of wood chips burned. (For the sake of simplicity it is assumed that the extra weight of pressurised tanker transport for liquid gas means that the savings in replacing gas would be greater than oil. Oil is far more commonly used for heating than gas.

3.13. Against the savings made in not burning oil or gas will have to be set the costs of distributing wood chips locally. For district heating systems transport will probably be by HGV. In some instances distribution will be by smaller lighter vehicle than HGV and a separate calculation for transport cost will have to be made. It is known that smaller vehicles cause less wear and tear on road infrastructure per tonne mile than do HGVs. However against this will have to be calculated any effect on noise and congestion etc. as listed in Table 3 above. The writer is not able to make this calculation (see recommendations).

3.14. More recently still the UK Government has published a website that enables the SLM and the social cost of HGV journeys to be calculated. This is a development of the work from the above mentioned SRA paper. http://www.dft-eb-calculator.co.uk/ Rather misleadingly the 'social

cost' is identified as '*environmental benefit'* as this is the figure by which the country would gain if the freight was moved from road to rail.

3.15. It is good that the Government has accepted the concept. However it is a pity that it hasn't taken the next logical step which is to use the information the system provides to seek to remove uneconomic loads from the roads system. An obvious example would be the long distance haulage of SRW.

Example: I x HGV Load of SRW transported from Aboyne, Aberdeenshire to Norboard Factory at Cowie, Stirlingshire.

Payload 25 tonnes Value to Grower £1 / tonne
Total Net Return to grower. £25.00[1]
Social cost of round trip as calculated by DFT website: £137.20

4. **Discussion**:

4.1. The above example shows that there would be an environmental benefit of £137.20 if this round trip could be transferred to rail. Needless to say that this isn't possible.

4.2. The 'social cost' of this trip is in fact higher than this. The SRA paper (see Table 1) discounts £0.10p being the 2003 cost of making the trip by rail. Raising this cost in line with inflation results in the present day cost of the rail trip would be around £0.11p per mile. The round trip from Aboyne to Stirling is 286 miles. Therefore 286x11p (£31.46) can be added to the environmental benefit (£137.20) to give the **true estimate of 'social cost' of this one HGV trip as being £168.66.** This is equivalent to a cost of £6.75 a tonne against a value, to the grower, of £1.00 a tonne.

4.3. There is an opportunity to use the savings that might result from taking these loads out of the roads system. This is to use the SRW to provide the fuel for district heating systems in the areas of timber production in Scotland that are more remote from the SRW processing mills.

4.4. If this were done then numerous benefits would ensue:

4.4.1. Carbon emissions (from burning oil or gas to heat communities) would be reduced in accordance with government objectives.
4.4.2. Pollution, from the HGV journeys eliminated, would be reduced.
4.4.3. Traffic congestion would be reduced bringing savings for other road users and for government.
4.4.4. Accidents would be reduced.
4.4.5. Rural industry (forestry) would be supported.
4.4.6. Local rural economies would be supported (the development and operation of district heating schemes creates sustainable jobs).
4.4.7. Fuel poverty would be reduced in the areas supplied by wood-fired district heating (the unit cost of heat produced is considerably cheaper than from e.g. oil which is usually the most cost-effective source in areas outwith mains gas network.
4.4.8. Fuel security would be enhanced.
4.4.9. Government would save a great deal of money in the long term from the reduction in social cost of road traffic.
4.4.10. Government would more easily meet international carbon reduction targets.

4.5. The development and installation of wood-fired district heating systems will require incentives to bring this beneficial change about. The Scottish Biomass Support Scheme is aimed at kick-starting the trend towards such heating systems. In reality the SBSS will need to continue and be funded many more years in order to bring about a large-scale change towards biomass heating.

[1] Net return to grower is not the same as value of load. The value is in the region of £20 / tonne.

The Danish experience indicates the requirement for a long-term and continuous input of support funding to achieve this.

4.6. This paper suggests that the funding for longer term targeted incentives could partly be found from the savings in social cost that would come from the reduction in lorry traffic that resulted in the use of SRW as fuel close to point of production.

4.7. The SBSS though well intentioned, has been badly managed to date. Its introduction was a muddle and its focus is short-term. The paper suggests that lessons are learned from this experience and that a revised and modified SBSS is implemented with a long-term target of achieving high levels of biomass powered district heating in Scottish forestry producing areas.

5. Conclusions:

5.1. The Government has identified the social cost of road haulage. It has failed in the next logical step; to use this information to identify elements of road haulage that could be diverted by active, thoughtful and responsible government using joined-up thinking and long-term support strategies.

5.2. The haulage of SRW over longer distances is one example where the social cost is considerably greater than the return that the haulage activity brings to the producer. It makes a great deal of sense therefore for the Scottish Executive to pursue a policy that seeks to reduce this traffic by promoting policies that divert such traffic to local use.

5.3. The Scottish Executive should:

5.3.1. Revise and renew the Scottish Biomass Support Scheme in order to meet the long-term aim of greatly increasing the proportion of houses that are heated by biomass.

5.3.2. Implement a grant scheme, either as part of or in addition to the SBSS, for the timber-growing areas that are more remote from SRW processors to assist the installation and development (including connection of housing and other customers) of wood-chip fired district heating schemes for settlements close to those areas.

5.3.3. Calculate the economic benefit that would come to Public Expenditure from the reduction in road haulage as a result of this policy and transfer the savings in social cost of road haulage to part-fund the above scheme.

Example: District Heating Scheme in rural Aberdeenshire.

Consuming 2,000 tonnes of 35% MC timber / annum: = 4,8MWh / annum.
Equivalent of 2,860 tonnes of raw timber:

Savings:	**Long-distance road haulage:**	**Social Value:**	**£19,305 per annum**[2]
Savings:	**Oil & Gas displaced: 421 tonnes oil**	**Social Value:**	**£ 424 per annum** [3]
Costs:	**Local haulage by smaller vehicles:**	**Social Value:**	**£1,315 per annum** [4]
Net Savings that would ensue		**Social Value:**	**£18,414 per annum.**

Over a 10-year period the replacement by a biomass-fuelled district heating scheme of individual oil-fired heating boilers illustrated in the above scheme would save £184,140 of Government and Local Government Expenditure.

The first 10 or more years of savings could be used to support grant schemes, over and above existing grants. Over the longer term the savings would continue to accrue to government.

5.4. The conversion to district heating in these areas would achieve a number of results:

- Reduce carbon emissions in accordance with government objectives and international obligations.
- Reduce cost to the public purse in social costs of road transport
- Reduce traffic congestion
- Reduce pollution from HGV emissions
- Support rural industry (forestry)
- Support local economy (development and operation of district heating schemes creates sustainable jobs)
- Reduce fuel poverty
- Enhance fuel security

5.5. In addition questions should be asked as to:

5.5.1. Why Government itself fails to think in such joined-up terms.

5.5.2. Why does the Executive show so little initative in the identification of activities that are costing society more than the benefits they bring and failing to take steps to make better use of this activity so that their contribution to society can be more productive or better utilised?

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[2] 2,860 x £6.75
[3] Nearest oil depots in Aberdeen. £1.01p / tonne (assuming 25 tonnes / lorry load) x 421 tonnes
[4] £0.80p / tonne x 2,000. Figure produced by DFT calculator, including adding £0.11p / mile for rail adjustment.

Example Scenario: A wood-fired district heating system is developed for settlements that are close to (within 5 miles) the forests and without mains gas supplies.

Identifiable Benefits:	Who gains?	Who loses?
Benefit to SE Transport Department and Local Authority Roads Departments. Reduction in haulage of timber from 170 mile round-trip to below 10 mile round-trip. Reduction in haulage of heating oil, LPG and bottled gas into communities following development of district heating systems. Helping to meet Government Carbon Emission Targets.	Scottish Executive: (Taxpayer) - Reduced road maintenance. - Fewer accidents - Less pollution - Less congestion Various Local Authorities (Taxpayer) - Reduced road maintenance. - Fewer accidents - Less pollution - Less congestion –	Road haulage businesses – through reduced level of business.
Benefits to the environment. The transfer from fossil fuels to renewable energy resource. Reduced atmospheric pollution from road haulage. Reduction in noise from road haulage.	All. A greener environment. Helping meet international obligations and national targets. Better health of citizens.	Heating Fuel Suppliers
Benefits to local economy. District Heating plants, even small ones will require managing and to have some provision for on-site supervision.	Local economy – local jobs to operate district heating plants. Heating Engineers – in maintenance of district heating plants.	Heating Engineers – reduced maintenance of boilers in individual homes
Benefits to other road users. A reduction in congestion.	All road users	
Benefits to householders: A reduction in the cost of their heating in an era where fossil fuel prices are set to escalate. This is an important element of fuel-poverty strategies.	Householders who get connected to district heating systems fuelled by wood will pay less for their heat than currently with oil-fired heating.	