

UK trade in woodfuel – an overview

FR Report to FC Plant Health

Author: Geoff Hogan
Biomass Energy Centre
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1. Background

Wood is imported into the UK from a number of countries for a range of purposes. In most cases this is in the form of sawn or prepared timber for a wide range of applications and has been kiln dried and the bark removed.

In addition to this, wood is imported into the UK for use as fuel in a number of energy applications. As a general rule this has undergone far less processing before shipping and may include bark. In addition, as it is simply the energy content that is required, there is often very little attention paid to the tree species included.

Reliable figures for the current and likely future level of imports of different forms of woodfuel are hard to come by. The data that does exist is often based on estimates and indirect information, and expected changes over the next few years are generally not available. What this study has tried to do is gather data from a number of different sources in order to build up a consistent picture of what forms of woodfuel are being imported into the UK, by whom, in what quantities, and how the picture is likely to change over the coming few years. In addition, any available information on tree species involved, in particular any ash, and any pre-processing employed, was also gathered where available.

In addition to material explicitly categorized as “Fuel wood” of one kind or another, it is likely that a proportion of timber imported as “Wood in the rough” (i.e. roundwood) also becomes fuel. This has not been explicitly addressed in this project but there is mention of the potential for crossover between categories, use of some or all of a load for purposes other than the primary, or intended one, and for mis-categorization. A separate project ([Roundwood Imports and Exports – An Investigation](#), N. Moore 2012) has recently addressed the scale of imports (and exports) of material within this category. It does, of course, also present a potential biosecurity threat owing to the presence of bark.

2. Summary

There are several different materials loosely categorized as woodfuel of one form or another. These include firewood, wood pellets, wood chips, and various forms of low grade wood such as sawdust, shavings and wood waste that can be used for fuel, as well as other purposes. There are also several distinct sectors that import one or another of these types of material, at vastly different scale and with different end applications. However, such materials, imported under a woodfuel coding, may also be used for a range of other purposes, such as animal bedding, and this must be remembered when analysing trade data.

The majority of trade volumes quoted herein are based on HMRC International trade data. This source is discussed in detail elsewhere in this report, but there is always the potential for miscoding and, owing to the way relatively small trade volumes are handled, figures for all but the very largest importers should be treated as informed estimates.

At the largest scale by far is biomass electricity generation. Although the smaller (dedicated) biomass power stations are only using fuel produced within the UK, without exception those which are importing are importing pellets, and plan to continue doing so. With a current scale of about 1.5 million tonnes a year (tpa) (2012), almost all (1.4m tonnes) from USA or Canada, this trade is expected to increase significantly over the next few years; pellet imports for electricity generation are predicted to rise to about 10 million tpa by 2015 and perhaps 15-20 million tpa by 2020. At present this includes both the fully converted power stations, such as Tilbury, some co-firing with coal, and also some with plans to convert to biomass on a unit by unit basis, such as Drax. Drax's publicly stated aim is to convert three of its six generating units (around 1.8 GW) to biomass. In order to achieve cost effective procurement of biomass fuel from overseas, these imports require maximum energy load per shipment, typically about 20,000 to 35,000 tonnes per ship for pellets. There is also a much smaller trade in wood pellets for animal bedding and litter.

There appears to be a significant quantity (68,000 tonnes) of coniferous woodchips being imported into the UK from the Republic of Ireland, and it is thought this is coming across the border into Northern Ireland. There is also a significant, though smaller (23,000 tonnes), quantity of coniferous wood chips arriving, ostensibly from the Netherlands, however these may be partial consignments that have originated elsewhere and have simply been offloaded at a Dutch dock into a smaller ship. Unfortunately it is not possible to identify either the origin or the importer for such deliveries with the EU. With the exception of these two specific sources, wood chips do not appear to be currently imported for fuel in any great quantity, and Ofgem RO (Renewables Obligation) figures show no imported woodchips used for electricity generation. The total from the rest of the world is 69 tonnes. Only one power generator spoke of possibly importing woodchips from Scandinavia or the Baltic, however there were no concrete plans for this yet and pellets was the more probable option. Finally, there appears to be a significant number of imports of kiln dried hardwood chips being brought in by companies selling barbeques and food smokers, to provide various smoke flavours.

The firewood trade consists of individual containers of stacked logs that are described as kiln dried, typically containing about 20-24 tonnes per container. The dominant source of this is Latvia, with the Netherlands also appearing as a principal source. This does not necessarily mean that the wood actually originates in Latvia or the Netherlands, though, as this is simply the country from which it was shipped. Estonia and Poland also supply significant quantities each. The total in 2012 was only about 8,400 tonnes. This is predominantly hardwood, and it is likely that there is a proportion of ash amongst this. It will probably include bark, however all importers spoken to said they kiln dried before shipping, partly for biosecurity reasons, but also because of the problems with mould formation during shipping in an enclosed container, and of shipping the additional weight of water. Companies importing 'kiln dried' firewood may source it from a number of overseas suppliers and achieving the correct moisture content (<20%) appears to be the main priority rather than the drying schedule. They may well not know the details of the drying protocol used by each supplier, whether it is slow and low temperature or fast and higher temperature, and consequently it is not clear whether sufficient temperature is always achieved to ensure full phytosanitary protection.

The final category of woodfuel is wood waste, scrap wood and sawdust. The total here, for 2012, is about 9,000 tonnes, coming from all over the world, though the majority was from within the EU. This appears to be used for a wide range of purposes including animal bedding and litter, kindling, briquettes and food smoking. As this is waste wood, including offcuts from secondary wood processing and recycled wood products, the majority of it is likely to be wood that has been kiln dried for its primary purpose.

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4. Methodology and key sources

There is no single, comprehensive source that gives information on all the imports, quantities, originating countries, tree species mix, pre-processing, end use etc. that we would like. It has therefore been necessary to make use of a number of different sources, as well as directly contacting many of the key players.

The primary source of data is the trade data collected by HM Revenue & Customs (HMRC). This can be accessed through the UKTradeInfo website (www.uktradeinfo.com), which allows interrogation by for example commodity code, year, and countries of origin, and results to be downloaded as spreadsheets. This does not give any information about the company making the import, though, and can also be misleading for a number of reasons. Although country codes are used to denote where the shipment has come from, that may not be the originating country. In particular, large bulk shipments to main ports may be distributed within the country with a proportion of the load (partial consignment) transferred onto smaller ships for onward transport to a third country. HMRC statistics only record the country from which the consignment was shipped, not the original country. Also, although consignments over the Intrastat threshold of £600,000 for arrivals to the UK from within the EU include full details for Intrastat, below that figures are based on VAT returns and involve a certain amount of estimation and are termed Below Threshold Trade Allocations (BTTA). With the exception of the large pellet imports by the power generators, the vast majority of which come from the USA or Canada, almost none of these consignments are sufficiently valuable to reach this threshold and so there are no data from Intrastat. BTTA methodology is based on the assumption that distribution of trade by commodity and country just below threshold is the same as that just above threshold. There is a little more discussion of this, and links to relevant documents, in the Introduction to the data, Appendix 1, below.

An earlier report ([Roundwood Imports and Exports – An Investigation](#), N. Moore 2012), looking at imports and exports of roundwood, found that figures obtained from HMRC were significantly at odds with those suggested by UK industry experts, including the Forestry Commission Statistics Team. Detailed re-evaluation of the HMRC figures revealed that they significantly overestimated the level of trade in almost every case, in some case by a factor of ten.

It is also possible to obtain more detailed information about individual consignments from HMRC, but only on imports from outside the EU, and such a dataset has been obtained for this project. This can help to identify key players amongst those importing from outside the EU, but does not pick up any that are only importing from within the EU. In particular this includes some of the key sources around the Baltic, such as Latvia and Estonia, as well as Poland and Germany. For trade within the EU, below the Intrastat threshold, as the basis for the figures is assumptions based on VAT returns, information on individual companies is not available.

A third key data source is the Sustainability reports available from Ofgem (www.ofgem.gov.uk/Sustainability/Environment/RenewableObl/FuelledStations/ro-sustainability/Documents1/Annual%20Sustainability%20Report%20Dataset%20-%202011-12.xlsx). This gives details of all the biomass fuels used to generate

electricity for which ROCs (Renewable Obligation Certificates) have been awarded. Although this only covers biomass fuels used for electricity generation, it gives information on fuel type, country of origin, and quantity. For some categories of woodfuel this can then be cross referenced with the HMRC trade data to identify whether this represents the bulk of the imported material, or whether a significant proportion is unaccounted for and is thus being imported for another market.

Finally there is the direct approach; telephoning and/or emailing those identified as potentially significant importers. This will include dedicated biomass power stations, both currently operating and under construction, coal-fired power stations co-firing biomass, large scale wood pellet manufacturers, larger firewood merchants, panelboard manufacturers, and companies identified from HMRC data as importing one or other category of woodfuel.

4.1 Principal potential importers

There are a number of market sectors that either do, or might, import one or another form of woodfuel into the UK. Whether they currently do, or whether they expect to over the coming few years, was part of the remit of this study to find out.

Electricity power generators are the most obvious potential importers of biomass fuel, and at potentially by far the largest scale. Both **dedicated biomass power stations** and **coal fired power stations co-firing biomass** potentially have fuel demands of the scale of tens or hundreds of thousands of tonnes a year, easily into millions of tonnes a year, depending on scale. This dwarfs almost any alternative market for these low value forms of wood. One possible exception is the production of second generation (ligno-cellulosic) liquid biofuels, using techniques such as biomass gasification and Fischer-Tropsch synthesis. Although the potential feedstock demands of any such plants are likely to be of the scale of millions of tonnes p.a., these technologies are still very far from commercial reality and with the insolvency in 2011 of the leader in this field, it is unlikely that there will be plants of any scale in the UK on a timescale within the remit of this study.

Many different forms of biomass have been used over the years for electricity power generation in the UK. The mix includes agricultural residues and energy crops as well as wood, and fuels have been sourced from both the UK and overseas. The balance will depend on the current incentives under the Renewable Obligation (and any successor), price of the fuel per MWh, total transport costs, and the cost of any fuel processing and handling implications. In many cases, and particularly that of imported fuel, the transport costs can be a very considerable if not a dominant factor in the total cost, and consequently energy density becomes an important parameter as it affects the total energy content of a ship, container or lorry load. With power stations often able to import full shiploads, of 20,000-35,000 tonnes, maximizing the energy carried can make a significant impact on the total fuel cost per MWh.

For this reason, although in the past agricultural residues such as olive cake or palm kernel expeller have been imported for co-firing, we have been unable to identify any generator who intends importing this in the future, and the much higher energy density

of pellets makes this the only form of woodfuel that generators are currently importing, or expect to import over the coming few years. Wood pellets are thought to entail very low biosecurity risk owing to their manufacturing process, which usually involves debarked wood, always requires a starting moisture content (MC) below about 15% (wet basis), and a final MC typically below 10%, and also involves high temperatures and pressures.

Another category of large user, and potential importer of woodfuel, is the larger **wood pellet manufacturers**. Although smaller manufacturers are typically making use of residues from their own, and perhaps neighbouring wood processing businesses, the two largest manufacturers in the UK both have production capabilities of 100,000 tonnes p.a. (tpa). However Balcas' plants at Invergordon and Enniskillen, and Verdo's two manufacturing plants all use only UK sourced feedstock, and have no plans to import. Balcas' manufacturing plant at Enniskillen, Co. Fermanagh is only about 12 miles from the border with the Republic of Ireland, however they are not currently importing any feedstock, although they have imported some sawdust in the past.

Although the quantities are likely to be much lower than for imports of wood pellets, such manufacturers can use feedstock in a form that has undergone very little pre-processing, and consequently the potential for plant health risk of importing such material could be far greater if the biosecurity precautions have not been adequately observed. Both the Republic and Northern Ireland, as well as the rest of the UK, have Protected Zones for coniferous wood imports. Consequently a plant passport would be required to accompany imports of coniferous wood from Ireland into Northern Ireland unless it is debarked or kiln dried and marked KD (or accompanied by an official statement that it is kiln dried). More detail on Protected Zones and timber import regulations is given in Section 6.

Although wood **panel board manufacturers** require significant quantities of feedstock (4.0 million tonnes in 2012), using roughly equal quantities of roundwood, sawmill residues and recycled wood, none in the UK are currently importing feedstock according to the Wood Panel Industries Federation. Over the last few years, however, there has been a small amount of imported material used in some years.

The **firewood industry** is another potential importer of woodfuel, however the quantities here are considerably smaller than those of the power generators. Imports generally consist of individual 40' containers which typically contain about 20-24 tonnes of stacked, kiln dried hardwood. It is however likely that a proportion of this is ash wood, and in most cases it is not debarked. The only phytosanitation mechanism is therefore "kiln drying" to <20% moisture content. However, in relation to maximising pest reduction for both insects and pathogens in wood, the drying process must be achieved through an appropriate time and temperature schedule, with the main impact coming from high temperature kiln drying. Air drying or low temperature kiln drying to <20% MC may not achieve full pest mortality, particularly for pathogens. At 20% MC a 40' container typically contains about 20-24 tonnes of stacked logs. However the maximum gross weight for these containers is 30.4 tonnes, with an empty weight of 3.8 tonnes, thus leaving a maximum net load of 26.6 tonnes. Given the variability in wood density with species, and variations in stacking density, any MC higher than about 20%

could easily give rise to gross weight that exceeded the maximum, potentially impacting the quantity that can be shipped. It also runs a much higher risk of developing mould during transit in a sealed container which is highly undesirable to both importer and end customer. Achieving the correct moisture content therefore is the primary concern for these importers. Importers sourcing firewood from a number of overseas suppliers may well not know the details of the drying protocol employed by each supplier, in particular whether it is achieved using a slower, relatively low temperature processes, or a genuine high temperature kiln. This could have profound implications on the biosecurity efficacy of the process.

Some companies also import some kindling, usually from recycled wood waste, into the UK, however it is likely that this will have been fully kiln dried for its initial purpose. In addition to this, however, it is likely that there are a number of small firewood merchants who may bring just one or two lorry loads of firewood into the UK, and are unlikely to appear in any formal statistics. From experiences in the USA where movement of firewood has been a highly significant factor in the spread of the invasive emerald ash borer (*Agrilus planipennis*), even relatively small quantities of untreated or poorly treated firewood can represent a major pathway for pest movement.

As well as firewood, there is a significant trade in high value woodchips for **food smokers and barbeques**. Typically sold in small quantities of a few kg, these are very dry chips of a small number of specific species whose smoke is used to flavour food. Popular woods include hickory, mesquite, apple, cherry, oak, beech, alder, cedar and occasionally ash. Although ash is not often offered, it has been listed, but has been withdrawn from sale by at least one company in order to forestall potential public concerns associated with *Chalara*. These wood chips are bark free, thoroughly dried and generally of high cosmetic standard as high value-added products. Although charcoal has a separate commodity code from the various forms of woodfuel, and has therefore not been included in this study, there are a number of companies selling barbeques, food smokers and chimineas who import a range of woodfuel products. Among the broadleaved tree species, Directive 2000/29/EC specifies criteria for chips of *Acer saccharum*, *Castanea*, *Platanus*, *Populus* and *Quercus* originating in non-European countries; wood must be bark free and either kiln dried to <20% MC using an appropriate time/temperature schedule or fumigated and shipped to prevent re-invasion. Ash (*Fraxinus* spp) is covered in a recent amendment and requires that ash wood in the form of chips is either from an area known to be free of *Agrilus planipennis* (emerald ash borer) or has been processed into pieces of not more than 2.5 cm thickness and width.

Briquettes are also imported by a number of companies, however until January 2013 they did not have an individual commodity code of their own, simply appearing within the wood waste category, although strictly speaking, the new category simply includes agglomerated sawdust, wood waste and scrap other than pellets. This, combined with the fact that the vast majority are imported from within the EU, where detailed information cannot be obtained because data are obtained from VAT returns, makes giving a precise number to this trade very difficult. Since, in common with wood pellets, they must be made from wood that has been dried to typically below about 15% moisture content, and are usually made from dry waste wood that is debarked, the plant health risk is probably negligible.

The final significant category of importer is companies importing for **animal bedding and litter**. Ultra low moisture content (3%) pellets that have had dust removed very thoroughly, are used, as are low dust wood shavings and also wood chips.

4.2 Biomass power stations

As stated above, the principal importers of woodfuel products of any kind are the biomass power stations, including those converting from co-firing biomass with coal to dedicated biomass capacity.

At present **Tilbury** (RWE npower) is the largest operating on imported pellets, with a capacity of 750 MW_e (megawatts electrical output) and current requirements of 2.3 million tpa of pellets. However this is due to close mid 2013 under the requirements of the Large Combustion Plant Directive (LCPD). There are plans to build a dedicated biomass power station (870 MW_e) that meets the requirements for operation under LCPD, delivering over 37% thermal efficiency, that is expected to require 2.7 million tpa of pellets.

Drax power station is undergoing a process of conversion from coal, to (eventually) converting half of its six 660 MW_e generators to run on sustainable biomass, the vast majority of which will be wood pellets. The first of these came on stream at the beginning of April 2013 with the second planned for 2014 and the third in or before 2016. When fully converted the three units are estimated to require about 7 million tpa of biomass.

E.ON's 1,000 MW coal fired **Ironbridge** plant is converting one of its two 500 MW_e generators to 100% biomass using pellets. It too is due to begin operation in early 2013, however is currently expected to close under LCPD in 2015. It is likely to require about 1.5-2 million tpa of pellets.

Forth Energy, a collaboration between SSE and Forth Ports Ltd., has plans for three 100 MW_e dedicated biomass power stations. **Grangemouth** is planned to open in 2017 and is expected to run on about 750,000 tpa of wood pellets. **Dundee** and **Rosyth** will probably run on wood pellets, but are still maintaining the option of wood chips, including possibly imported wood chips from Scandinavia and/or the Baltic and will each require about 1 million tpa.

Helius Energy have plans for a 100 MW_e plant at **Avonmouth** and a second 100 MW_e plant at Southampton. The **Southampton** plant is expected to require 800,000 tpa of solid biomass, which will be a mix of virgin wood fibre, energy crops and recycled wood, and possibly some agricultural residues. Biomass fuel will be sourced both from within the UK and imported.

4.3 Other users of UK biomass

There are a number of other users of biomass who do not currently import woodfuel, and have no plans to do so, but by drawing on the UK domestic supply will influence total demand for this resource. Although there is some overlap between users of UK woodfuel and importers, in general these are two, separate markets with significantly

different characteristics. In general, if a company is importing woodfuel it will either be because they cannot get what they need within the UK, such as those importing specialist, high value-added chips for food smokers, or because they can achieve sufficient economies on the purchase price to cover the shipping costs. Some firewood importers said that they would like to be able to source more from the UK, but use imports to supplement supply as they cannot otherwise get enough.

For many years there have been suggestions that UK firewood consumption might be considerably greater than current estimates suggest. Although it is possible that it may exceed 1m tpa, much of this is thought to consist of a range of informal arrangements including self supply, informal collection, barter, etc., rather than through any formal sale process. Although most estimates suggest the market for firewood in the UK has been growing strongly for a number of years, the cost of imported, kiln dried logs is likely to keep this as a relatively small component of the market. It seems likely that the informal market may remain largely separate from the commercial market, however there is likely to be an element of displacement.

Of potentially greater influence on the availability of UK sourced woodfuel is demand from the existing and planned small power stations. Although none of these have plans to import fuel, they can have annual fuel requirements of several hundred thousand tonnes or more, which can make significant inroads into the domestic supply, with commensurate knock-on effects for those who will be importing some or all of their requirements. Many of the existing dedicated biomass power stations are currently using fuels other than wood, including poultry litter, straw and paper mill residues. Of those currently using wood, Stevens Croft at Lockerbie (44 MW_e), Wilton 10 (30 MW_e) and Western Wood Energy in Port Talbot (14 MW_e) are the largest currently operating predominantly on wood. Between them they have an annual fuel demand of perhaps 900,000 tonnes, though there is certainly a proportion of recycled wood included. There are also a number of smaller generators of a few MW_e capacity using a few tens of thousands of tonnes p.a. of various biomass fuels; the Ofgem Sustainability data for RO accredited generating stations show that some of those are using some wood. At present some coal fired power stations are co-firing a proportion of biomass with coal, however the low level of RO Certificates awarded for this means that this practice appears to be generally coming to an end.

Finally, there are a number of dedicated biomass power stations that are at various stages of the planning process. Those that are reasonably advanced have been approached as part of this project, but there is a constant flux of new proposals and projects withdrawn, so it is difficult to obtain a realistic estimate of the likely capacity for timescales beyond that considered by this project. It seems likely, though, that at least some more biomass generators will make it through planning unless changes in government policy towards biomass power generation make this unfeasible. In the longer term these will add to total demand for biomass fuel, some of which may be from wood, and with finite domestic resources, it will have a direct or indirect effect on import levels.

5. Results

5.1 2012 figures

Product	Commodity code	Arrivals from EU tonnes	Imports from outside the EU tonnes	Total Imports tonnes
Fuel wood logs	4401 1000	6,831	1,570	8,401
Coniferous woodchips	4401 2100	90,941	69	91,010
Non-coniferous woodchips	4401 2200	1,264	80	1,344
Wood pellets	4401 3100	122,724	1,364,156	1,486,880
Wood waste (sawdust)	4401 3910	878	549	1,427
Wood waste (not sawdust)	4401 3990	6,742	788	7,531
Total		229,381	1,367,212	1,596,593

Figure 1. Woodfuel imports into the UK 2012 Source: UKTradeInfo (HMRC)

By far the largest quantities of woodfuel imported into the UK are in the form of **wood pellets**. These are manufactured from wood, dried to below 15% moisture content (or less), ground to small particles and mechanically extruded under high pressure through a metal die. In doing so very high pressures and temperatures in excess of 110°C are generated; this softens the natural lignin in the wood, which then binds the pellet together on cooling. They typically range in diameter from 6 mm to 14 mm, with smaller diameter pellets used for domestic applications and larger ones for industrial use, and typically range in length from about 1 cm to a few cm. The vast majority are used for **electricity generation**, either in dedicated power stations or for co-firing. Of the 1.6 million tonnes of woodfuel imported into the UK in 2012, 1.5 million were in the form of pellets. The vast majority (1.4 million tonnes) of these came from Canada (855,000 tonnes) or the USA (475,000 tonnes), with comparatively small (though nevertheless significant) quantities from Latvia (102,000 tonnes), and some from South Africa (34,000 tonnes), Portugal (16,000 tonnes) and Germany (5,000 tonnes). The most recent (2011-2012) Ofgem Annual Sustainability Report covers the period up to 31st March 2012; it gives a total for pellet usage over that period of 1.3 million tonnes, agreeing well with the HMRC import data, and suggesting that very nearly all of the pellets, and in fact very nearly all of the woodfuel imported into the UK, is used for electricity generation.

The tree species used in the manufacture of wood pellets will depend on where they are manufactured and also what is available at the time. The large scale importers of pellets for electricity generation strictly monitor the sustainability criteria of their fuels, including monitoring the tree species used. The vast majority are manufactured from coniferous species, with lodgepole pine dominant in Canada and the US sites currently supplying pellets to the UK. Spruce also forms a significant part of the harvest in British Columbia, with other species including hemlock, cedar and Douglas fir also commonly included.

The other market for imported wood pellets is for animal bedding. For the high value animal bedding/litter market there is a requirement for pellets with very low dust content and very low moisture content (3%), which specialist suppliers say cannot be adequately met by UK products from manufacturers who are concentrating on the fuel market. These are apparently predominantly made from pine. The largest such importer brings in about 60-80 containers a year from Canada, containing about 22 tonnes each, corresponding to about 1,500 tonnes a year. In addition, a small quantity is also being imported from the USA for pellet barbeques.

Wood pellets from the USA and Canada are being landed in the UK at a number of locations. According to UKTradeInfo, of the 855,000 tonnes of pellets imported from the US, 380,000 tonnes (44%) came in at Tynemouth, 380,000 tonnes (44%) came in at London (including Tilbury) and 93,000 tonnes (11%) came in at Immingham. We can assume that the London docking was more or less all at Tilbury and was destined for the Tilbury power station. The consignments docked at Tyne and Immingham can be assumed to be destined for Drax, in the case of Tyne, via the East Coast Main Line. Of the 475,000 tonnes of pellets from Canada, 237,000 tonnes (50%) arrived at Tilbury, 180,000 tonnes (38%) at Tyne, and 53,000 tonnes (11%) at Hull. Again, those landed at Tyne and Hull may be assumed to be destined for Drax. In addition, 34,000 tonnes of pellets were imported from South Africa, all landed at Avonmouth (presumably part of the HMRC Bristol allocation assigned to Drax).

The consignments imported for the non-power generation markets, such as animal bedding, were imported through a range of entry points including EPU 191, Southampton, Medway, and even several airports.

In terms of quantity, the next largest category of imported woodfuel is **coniferous woodchips**, at 91,000 tonnes in 2012. However the vast majority of this trade (68,000 tonnes) is from the Republic of Ireland. As this trade is within the EU, and consequently data is inferred from VAT returns, it is not possible to obtain more detailed information about the individual companies making these imports, or the end market for which they are destined. It is likely however that they are simply chips transferred across the border by lorry into Northern Ireland. This is possibly supported by the fact that there is no port data accompanying these arrivals and the port of entry is simply given as "Unknown". So far it has been extremely difficult to identify where these chips are going. Various possibilities have been considered including use for co-firing at the Kilroot coal power station. However AES Kilroot has been contacted directly and has stated that it has not imported wood chips from the South, and has no plans to do so. There is one more dedicated biomass power station in Northern Ireland, Tyrone Biomass Power Station, however this uses 100% recycled wood as fuel, which would be categorized separately in the trade data, and when contacted said that it only imports about 10% (around 2,500 tonnes) from the Irish Republic. Other possibilities are that these woodchips are being used for heating, for animal bedding and litter, or garden mulch, and form part of the normal sources for woodchip suppliers within the North, but close to the border. Finally, it is possible that some of this can be accounted for by miscoding or by inaccurate assumptions within the HMRC BTTA estimates. It is likely that the answer is that it is a combination of these, but speaking to woodfuel suppliers

close to the border has not so far managed to identify any that are importing significant quantities.

There is also a smaller, but not insignificant quantity (23,000 tonnes) of coniferous woodchips that appears to be coming from the Netherlands. Once more, as shipping within the EU it is not possible to obtain details on individual consignments, however they can be investigated on a monthly basis and it can be seen that deliveries in some single months are of the order of just a few hundred tonnes, or even less in one month. It is therefore suggested that these may be partial consignments, imported into a large port in the Netherlands by bulk freighter, then broken up to several destinations, including by smaller ship to the UK, possibly in lorries. It is therefore not possible to identify the original country of origin of the load. It has again so far not been possible to identify the importer or end market for these consignments. Again, no dedicated or co-firing power station has said they are using this, or have any plans to import wood chips, and the Ofgem sustainability data also shows that no imported woodchips were used for power generation under the Renewable Obligation. The main UK pellet manufacturers and major chip suppliers in the South East too confirm that they do not import wood chips. Owing to the shipping costs it is likely that this is going to some high value added market, further supporting the conclusion that this is not going for energy although the quantities are relatively large. Possible destinations might be the horticultural, garden or recreational market (including decorative mulch and play chips) as well as food smoking chips and possibly kindling, although kindling would more usually be expected to be found under a different commodity code.

A small quantity (69 tonnes) of material categorized as coniferous woodchips were imported from outside the EU. Closer inspection identified that almost all of these came from Sub-Saharan Africa and the US. In terms of quantities, the largest quantity (40 tonnes) was from Sub-Saharan Africa, and this has been identified as imports of pine cones from South Africa which are finely milled for use in a chemical absorber product. The material imported from the USA, consisted of a number of consignments for various purposes. Two consignments were imported by a barbeque company for use in food smoking. Two consignments were imported to demonstrate a microwave based torrefaction product (along with some hardwood chips). One other consignment was imported by a company who sells a range of high value wood based products, however the only wood they import from the US is aspen fibre (debarked and kiln dried) which appears to have been miscoded as coniferous chips. For three consignments the name of the consignee is not available. Finally there are two consignments that do not appear on the UKTradeInfo data. One of these at least is almost certainly miscoded as the company is a gun maker and he has confirmed that the consignment he has received from Armenia was walnut gun stock billets, not coniferous woodchips. The final is listed as having come from Hong Kong to an Estate Office in Yorkshire, however there is no record of any consignments from Asia in the UKTradeInfo data.

Non-coniferous woodchips, however, are a much smaller trade, with just 1,300 tonnes imported into the UK in 2012, predominantly from the EU. Those companies that have been identified as importing hardwood chips are for the most part importing kiln dried chips for sale in small quantities of up to a few kg for food smoking and barbeque purposes. Woodchips sold for this purpose include hickory, apple, mesquite, cherry,

alder, oak, beech, and ash. Ash is less widely stocked than most of the other common woods, and some companies are withdrawing it from sale in the light of perceived public concerns over *Chalara*, though maintaining that there is no risk associated with their chips. Almost all the consignments imported from outside the EU were for this purpose, with just a few small consignments for specialist applications including a chemical absorber product, and some chips to demonstrate a microwave torrefaction process.

The Ofgem sustainability data support the conclusion that no woodchips are imported from overseas for electricity generation under the RO.

Fuel wood logs (firewood) is predominantly imported in individual container loads, typically containing about 20-24 tonnes of stacked, kiln dried firewood. The majority (6,800 tonnes out of a total of 8,400 tonnes in 2012) comes from the EU, with the vast majority ostensibly coming from either Latvia (2,400 tonnes) or the Netherlands (2,600 tonnes), in roughly equal proportions. Smaller quantities are sourced from Estonia (630 tonnes), Poland (590 tonnes), Sweden (300 tonnes) and Germany (280 tonnes).

A large proportion of the firewood imported appears to be hardwood of one kind or another, and it is likely that most includes bark. Every importer spoken to, however, only imports what they describe as kiln dried firewood. Apart from the biosecurity implications (of which they were generally aware), the biggest driver is that wood with a high moisture content left in a closed container is liable to develop mould which is highly undesirable to the end customer. Handling kiln-dried firewood also reduces the shipping weight, allowing a 40' shipping container to be filled to maximum capacity without exceeding maximum gross weight of 30.4 tonnes (26.6 tonnes net). A typical load of stacked, kiln dried, hardwood firewood in a 40' container is about 20-24 tonnes if it is below 20% moisture content. Although it is therefore likely that the moisture content is low, there is no guarantee that this has been achieved using sufficiently high temperature regime to ensure full phytosanitary effectiveness unless this has been ensured by the parties involved, as discussed above.

It was commented by one importer that there is probably much more firewood imported than the statistics show as there are lots of small companies who simply bring in just one or two lorry loads a year from Eastern Europe. This is particularly worrying in that small loads of firewood from Eastern Europe could include the European part of Russia where emerald ash borer is established on European ash.

Although only one of the firewood importers spoken to said he had imported ash, and he still had half a container which he was not currently selling, it would be surprising if there were not a proportion of ash finding its way into consignments of mixed hardwood. Many of the importers specified loads of individual tree species, such as hornbeam, birch, beech and alder.

Also potentially included in the same commodity code category as fuel wood logs, is pulpwood sold for chipping for fuel, however in general this should be within the "rough wood" coding (CN code 4403), which also includes pulpwood for matches and non-fuel purposes. It is known that significant quantities of pulpwood are sold into Northern Ireland from the Irish Republic for chipping or other processing for fuel, for animal

bedding or horticultural purposes. According to the UKTradeInfo data, the total fuelwood in logs arriving in the UK from the Irish Republic in 2012 was 3.6 tonnes, so this particular trade is clearly being recorded elsewhere, presumably within CN code 4403, but potentially within the woodchip category, as this is the end use.

The final categories of material within the woodfuel coding are described as **sawdust** and **wood waste and scraps**. In the 2012 data this would also include material agglomerated into briquettes. A separate sub-category (4401 3920) has been introduced from January 2013 to cover such material in agglomerated form other than pellets (essentially briquettes), however this does not apply to the trade data for 2012. For comparison however, in January 2013 (the only month for which data are currently available) 34 tonnes of briquettes were imported from within the EU (almost all from the Republic of Ireland) and 23 tonnes from Russia. Although briquette manufacture, like pellet manufacture, requires feedstock that has been dried to below about 15% moisture content, and subjected to high pressures and usually high temperatures, there is a greater variation in briquetting technologies and parameters. In view of the potential risk from emerald ash borer, and other pests in Russia it would therefore be helpful to have information on the briquetting processes and equipment employed in Russia. In the case of wood waste imports from outside the EU in 2012, the average monthly figure would be 111 tonnes, so it is possible briquettes form a significant proportion, along with kindling, which is also known to be imported. In the case of arrivals from within the EU it is less clear that a significant proportion is represented by briquettes.

There do however appear to be about 9,000 tonnes of wood waste and sawdust imported into the UK, predominantly (7,600 tonnes) from the EU. This will include kindling, briquettes, but also wood shavings, and it appears that a significant proportion of this goes for animal bedding and litter.

Some wood, generally in the wood waste category, is imported for use as kindling, both from within the EU and from other regions such as Africa. One company was contacted which ships firewood from the UK to Jersey, and kindling from end of life pallets, from Jersey to the UK.

5.2 The next few years

None of the companies spoken to were expecting a significant increase in the level of imports of woodfuel products with the exception of the large, dedicated biomass power generators. These large users are almost all planning to import just wood pellets, with just one exception who is still keeping chips under consideration. The coal power stations who have been co-firing biomass with coal no longer consider it economically viable at the current level of ROCs. For the dedicated biomass power stations the shipping costs form such a significant proportion of the fuel cost, the overriding criterion is maximizing energy per load and so are now only considering pellets. It is estimated that the quantity of pellets imported will rise to about 10 million tonnes in 2015. Beyond this is far more speculative with estimates varying from 15 to 20 million tonnes by 2020. The vast majority of these are likely to come from Canada and the USA, though some generators are also considering the Baltic states and Portugal.

Although the firewood merchants hoped to increase sales in the coming years, some said that imports were simply used to take up the slack where they could not source enough from within the UK. It was stated that they would prefer to be able to source more from within the UK, although other companies had been set up specifically to import from the Ukraine and/or Latvia.

6. Biosecurity implications and plant health regulations

Dr Eric Allen, Research Scientist, Natural Resources, Canada has undertaken a literature review on the level of biosecurity risk that wood pellet material presents as a pathway for forestry pests and diseases.

He identified no studies that specifically address the phytosanitary risk associated with wood pellets. There is information regarding temperatures that are typically achieved in the production process. Nielson *et al.* 2009 cites unpublished data that the pelletizing process generates heat that maintains the temperature of the operating die at 110 –130 °C, temperatures that are in the range of the glass transition point for lignin, which forms the principal mechanism binding the pellet together (Brackley & Parrent 2011). There is likely to be variability in different pellet production processes (and the temperature involved) depending on equipment, setup parameters (die profile, clearance, etc) and differences in the chemical characteristics of different wood raw materials. When pellets are further processed by torrefaction, they are exposed to temperatures between 200-300 °C (Bergman and Kiel 2005).

Others have assumed that these temperatures are sufficiently high to provide phytosanitary protection: Kopinga *et al* 2010 stated that “Wood that already is transformed into wood pellets does not form any risk at all for spreading pests and diseases as during the production process the heat that is required to press the sawdust together destroys all living organisms.”

Notwithstanding the paucity of research data Allen suspects that there is very little pest risk associated with wood pellets especially considering that the end use of the vast majority of the product is combustion.

Zaini *et al.* (2008) studied characteristics of wood pellets made from Mountain Pine Beetle-infested wood, wood that was colonized with blue stain fungi (likely species of *Ophiostoma* and *Ceratocystis*). They reported that “Mold (*Penicillium*) was the only fungi was observed in each culture. No sap-stain or other type of fungi was observed.” As reported in the paper the microbiological part of this work was preliminary and there was not much detail on methods.

A study by Madsen *et al.* (2004) looked at microbial dustiness of various biofuels. While this work doesn't specifically address the question of whether microbial organisms survive the pellet production process, the research does suggest that pellets have very low levels of fungi associated with them: “One of the wood chips studied and the straws had comparatively high dustiness in terms of fungi, while both wood pellets and wood

briquettes had comparatively low dustiness in terms of all microbial components” and that “Total numbers of fungi in dust from wood briquettes and pellets were below the detection level”.

The biosecurity implications of other forms of woodfuel are considerably less clear cut.

In the case of firewood it almost all appears to be described as ‘kiln dried’, and appears to have been reduced to below 20% moisture content as required by both phytosanitary requirements and the practicalities of container shipping. There is however less evidence that it has undergone a drying regime that incorporates sufficient temperature and time schedule to ensure rigorous phytosanitary protection. Air drying, or low temperature kiln drying may not achieve full pest mortality, particularly for pathogens, and even relatively small quantities of untreated, or poorly treated firewood has been seen to represent a major pathway for pest movement.

EU Plant Health Directive (Council Directive 2000/29/EC) sets in place a number of requirements to attempt to limit the spread of insect pests and plant pathogens within the EU.

A number of EU Protected Zones (PZs) exist and specifically relate to organisms named in the EU Plant Health Directive and which are already present in parts of the EU and could establish in other parts. Thus, for example, the UK and Ireland each have PZs for the European spruce bark beetle *Ips typographus* and require that coniferous wood is debarked or originates in an area known to be free of the pest or that the wood is kiln dried to below 20% moisture content, expressed as a percentage of dry matter, at the time of manufacture, achieved through an appropriate time/temperature schedule. A plant passport is used to prove that it has come from an area free from the pest. Some organisms, such as the great spruce bark beetle *Dendroctonus micans* are covered by a PZ for the Republic of Ireland and Northern Ireland and relate to exports from the rest of the UK and Europe. Imports from third countries (i.e. outside the EU) are covered by the various Annexes in the Directives and have specific requirements depending on the commodity. Plant material moving from one Protected Zone to another requires a plant passport unless it is either debarked or has been kiln dried and marked KD (or accompanied by an official statement that it has been kiln dried).

Among the broadleaved tree species, Directive 2000/29/EC specifies criteria for chips of *Acer saccharum*, *Castanea*, *Platanus*, *Populus* and *Quercus* originating in non-European countries; wood must be bark free and either kiln dried to <20% MC using an appropriate time/temperature schedule or fumigated and shipped to prevent re-invasion. Ash (*Fraxinus* spp) is covered in a recent amendment and requires that ash wood in the form of chips is either from an area known to be free of *Agrilus planipennis* (emerald ash borer) or has been processed into pieces of not more than 2.5 cm thickness and width.

7. Conclusions

The quantity of woodfuels being imported is expected to rise from about 1.6 million tpa in 2012 to about 10 million tpa in 2015. Beyond this it is less easy to speculate, with significant uncertainty, and many coal power stations pulling out of co-firing. Estimates for 2020 vary from about 15 to about 20 million tpa in 2020. However it is likely that the plant health implications of this rise will be negligible as it will almost entirely consist of wood pellets.

At present trade of woodfuel is dominated by imports of wood pellets from Canada and the US for electricity generation. Typically pellets have a moisture content below 10%, are made from debarked wood, and, most significantly, have been subjected to high temperature and pressure during the manufacturing process. It is thought therefore that the predominant woodfuel import stream poses a negligible plant health risk.

Firewood was originally thought to be one of the high risk categories of imports. Although this material is not generally debarked, and is likely to include ash, it appears to be almost universally kiln dried before shipping. Even if there were the possibility that quality assurance might have the potential for laxity in some cases, the requirements for kiln drying in addition to biosecurity would be likely to ensure that importers maintain fairly rigorous quality control. However, as observed above, there is usually no information on the temperature/time protocol employed in what is loosely described as 'kiln drying' and which may therefore not employ sufficiently high temperatures for full phytosanitation purposes. The total recorded import volume of firewood and small roundwood/pulpwood, was 8,400 tonnes. It has been suggested that a possible concern might be small firewood companies who perhaps only import one or two lorry loads a year, who fall below the radar of trade statistics and for whom kiln drying may perhaps be of secondary importance. With significant quantities of felled ash likely to be available around Europe it would be surprising if none of this found its way onto the UK market. Owing to the nature of this trade it is very difficult to verify whether this does happen to any extent.

Woodchips were also thought to present a potential biosecurity threat, especially as it is also likely not to be debarked in many instances, and also very difficult to identify individual species present. EU Plant Health Directive 2000/29/EC sets out certain measures to help counter the spread of plant pests and pathogens for both coniferous and broadleaf tree species including, for ash chips, requiring that if they are not from an area known to be free of emerald ash borer, processing into pieces of not more than 2.5 cm thickness. This particular measure is principally for insect pests. Were these chips intended for the woodchip bulk fuel market, it is unlikely that the price achievable would justify shipping and kiln drying, so with the exception of chips imported from the Republic of Ireland (which require neither shipping or drying) it seems unlikely that this is the final market. At least a proportion of the hardwood, and presumably some of the coniferous chips, appear to be intended for food smoking and barbeques, and are sold in small quantities, thoroughly kiln dried, owing to the high value added nature of the products. Similarly, animal bedding and garden mulch are also high value added products, warranting the biosecurity pre-treatment processes required. It is therefore unlikely that imported woodchips are entering the biomass fuel market. One power

generator still claims to be considering wood chips as a possible imported fuel, however it remains to be seen whether such imports materialize.

The wood waste imported appears to be debarked and dried for another purpose. A proportion will be in the form of briquettes, and from January 2013 it has been possible to identify these products with a separate commodity code. Once again, therefore, it is unlikely to present a significant biosecurity threat.

Overall, therefore, it would appear that international trade in the various forms of woodfuel is unlikely to include a significant quantity of material that presents a significant biosecurity risk. It is likely that there is a small quantity of ash brought in within the firewood category, however the majority is likely to be kiln dried to below 20% moisture content. It is not yet possible to quantify imports of ash fuel wood logs but it appears to represent a small proportion of the estimated trade of 8,400 tonnes in 2012. It is, however, possible that there is a significant quantity of firewood imported on an *ad hoc* basis in individual lorry loads - these may or may not be recorded in the official statistics, and these may or may not be dried to below 20% moisture content. Since this could be intrinsically extremely high risk, further investigation of such a potential trade would be required before determining whether it is an acceptable biosecurity risk.

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Appendix 1. Raw data from UKTradeInfo

Introduction

The data in the following six table contain the raw values obtained from UKTradeInfo, based on information from HMRC on international trade in commodities. It gives the values of commodities imported and exported from countries outside the EU, collected from customs declarations. It also gives the values of arrivals from other EU countries and dispatches to them. Detailed data on trade within the EU is collected via Intrastat, however only businesses whose annual value of arrivals and/or dispatches exceeds the exemption threshold (£400,000 for arrivals, £250,000 for dispatches) are required to make Intrastat declarations. In the case of most forms of woodfuel this is likely to exclude all trade, with the possible exception of wood pellet imports. Below the Intrastat threshold data is gathered from VAT returns from VAT registered businesses. Data is calculated based on BTTA (Below Threshold Trade Allocations) methodology which assumes that the distribution of trade by country and commodity is the same as that just above the threshold. Owing to this estimation methodology data on trade within the EU cannot be regarded as definitive. Information about [Overseas Trade Statistics Methodology](#) is available from HMRC, via the UKTradeInfo website (www.uktradeinfo.com), incorporating a section on the BTTA methodology. There is also a more detailed discussion of the BTTA methodology, and some of the anomalous results it can give when applied to trade in roundwood, in the 2012 report on the subject by Nicholas Moore ([Roundwood Imports and Exports – An Investigation](#), N. Moore 2012).

The average unit cost I have calculated in £ per tonne as a reality check to give an idea of whether the commodity in question can realistically be regarded as a bulk energy fuel, or whether it is perhaps entering a higher value-added market (such as food smoking chips).

Tables

			Total Exports			Total Imports		
EU Indicator	Continent	Country	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)
EU	European Community	Belgium	5,023	112,375	22	0	0	
		Cyprus	2	442	182	0	0	
		Denmark	0	0		38	14,536	378
		Estonia	0	0		630	112,771	179
		Finland	4,939	214,927	44	0	0	
		Germany	11,210	295,866	26	283	142,409	503
		Irish Republic	73,279	7,278,046	99	4	7,807	2,146
		Latvia	0	0		2,374	574,621	242
		Lithuania	0	0		20	2,178	107
		Malta	3	2,115	783	0	0	
		Netherlands	38,253	1,837,086	48	2,593	896,524	346
		Poland	0	0		591	200,416	339
		Sweden	226,440	4,494,294	20	298	63,190	212
NON EU	Asia and Oceania		2	29,020	12,450	717	276,610	386
	Eastern Europe		0	0		577	117,802	204
	Middle East and N Africa		697	142,913	205	47	8,807	189
	North America	United States	56	146,125	2,604	27	41,614	1,552
	Sub-Saharan Africa		0	0		203	65,527	323
	Western Europe exc EC		0	1,786	4,961	0	0	
Total			359,905	14,554,995	40	8,401	2,524,812	301

Table A 1 UK trade in firewood logs, etc. 2012 (4401 1000)

			Total Exports			Total Imports		
EU Indicator	Continent	Country	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)
EU	European Community	Belgium	981	29,605	30	205	20,007	98
		Cyprus	9	601	65	0	0	
		Denmark	0	22	1,375	0	0	
		Finland	3	236	69	0	0	
		France	7,394	551,713	75	1	2,844	4,040
		Germany	45,078	616,097	14	445	116,014	261
		Irish Republic	3,768	646,286	172	67,665	1,469,679	22
		Italy	20	1,450	71	0	0	
		Malta	0	506	5,953	0	0	
		Netherlands	3	388	125	22,626	1,836,514	81
		Poland	2	144	69	0	0	
		Portugal	2	602	312	0	0	
		Slovakia	4	273	72	0	0	
		Slovenia	0	2	2,000	0	0	
		Spain	14	1,009	71	0	0	
		Sweden	1,683	17,615	10	0	0	
NON EU	Asia and Oceania		515	117,175	227	0	0	
	Latin America and Caribbean		0	3,168	226,286	0	0	
	Middle East and N Africa		361	61,466	170	0	0	
	North America	United States				29	27,576	946
	Sub-Saharan Africa					40	12,918	323
	Western Europe exc EC		25,120	1,881,825	75	0	0	
Total			84,959	3,930,183	46	91,010	3,485,552	38

Table A 2 UK trade in coniferous woodchips 2012 (4401 2100)

			Total Exports			Total Imports		
EU Indicator	Continent	Country	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)
EU	European Community	Belgium	68,767	1,098,565	16	42	27,254	647
		Czech Republic	0	98	6,125	0	0	
		Denmark	0	0		0	495	1,695
		Estonia	0	0		20	3,104	157
		France	0	350	7,143	11	7,765	678
		Germany	7,437	105,811	14	1,157	366,100	316
		Greece	0	17	944	0	0	
		Irish Republic	46	29,265	639	1	22,269	29,534
		Italy	69	491,527	7,138	0	0	
		Malta	0	62	2,480	0	0	
		Netherlands	0	1,275	12,260	31	13,438	438
		Poland	0	0		2	2,186	1,239
		Spain	0	104	981	0	0	
		Sweden	16,097	194,638	12	0	67	353
NON EU	Middle East and N Africa		1,318	285,952	217	0	0	
	North America	Canada				2	2,655	1,230
		United States	7	5,729	830	77	122,295	1,580
	Western Europe exc EC		54	11,372	210	0	0	
Total			93,795	2,224,765	24	1,344	567,628	422

Table A 3 UK trade in non-coniferous woodchips 2012 (4401 2200)

			Total Exports			Total Imports		
EU Indicator	Continent	Country	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)
EU	European Community	Belgium	31,413	1,190,936	38	55	12,443	224
		Cyprus	1	104	134	0	0	
		Denmark	2,323	256,650	110	0	0	
		Finland	10	1,125	111	0	0	
		France	1	97	154	0	0	
		Germany	23	3,370	148	4,839	1,110,417	229
		Irish Republic	231	54,109	235	0	0	
		Italy	0	0		13	66,822	5,195
		Latvia	0	0		101,877	10,733,895	105
		Malta	27	9,381	351	0	0	
		Netherlands	19,567	2,031,022	104	267	86,658	325
		Portugal	0	0		15,673	1,445,684	92
		Spain	0	15	136	0	0	
NON EU	Asia and Oceania					110	14,614	133
	Eastern Europe		1	1,715	1,906	423	63,613	150
	Middle East and N Africa		4	1,225	337	0	0	
	North America	Canada	0	0		854,603	108,073,728	126
		United States	2	7,730	4,156	475,337	59,993,226	126
	Sub-Saharan Africa		12	2,779	232	33,684	3,519,203	104
	Western Europe exc EC		8	31,419	3,976	0	0	
Total			53,621	3,591,677	67	1,486,880	185,120,303	125

Table A 4 UK trade in wood pellets 2012 (4401 3100)

			Total Exports			Total Imports		
EU Indicator	Continent	Country	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)
EU	European Community	Austria	0	1,310	2,873	0	0	
		Belgium	45	14,551	324	0	0	
		Cyprus	1	1,485	1,247	0	0	
		Czech Republic	4	10,305	2,580	0	0	
		Denmark	0	1,095	7,349	0	0	
		Finland	3	10,767	4,186	0	0	
		France	1	1,720	2,560	0	0	
		Germany	5	4,509	869	2	545	334
		Greece	0	70	1,296	0	0	
		Hungary	1	1,631	1,953	0	0	
		Irish Republic	26	5,209	201	738	440,109	597
		Latvia	0	0		58	8,946	153
		Luxembourg	0	757	4,822	0	0	
		Malta	1	986	1,043	0	0	
		Netherlands	1	5,031	3,558	80	19,991	250
		Poland	4	7,718	1,925	0	0	
		Portugal	1	2,522	2,156	0	0	
		Spain	4	4,798	1,244	0	0	
		Sweden	5	34,708	7,598	0	0	
		NON EU	Asia and Oceania		5	1,624	325	53
Eastern Europe			0	0		74	12,440	168
Middle East and N Africa			19	22,884	1,228	0	0	
North America	Canada		0	0		13	68,520	5,411
	United States		0	0		409	290,092	709
Total			126	133,680	1,064	1,427	854,091	599

Table A 5 UK trade in sawdust 2012 (4401 3910)

			Total Exports			Total Imports		
EU Indicator	Continent	Country	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)	Net mass (tonne)	Value (£)	Average unit cost (£/tonne)
EU	European Community	Belgium	77,752	1,813,477	23	3,445	673,744	196
		Bulgaria	2	1,735	700	20	14,367	721
		Cyprus	46	2,382	52	0	0	
		Denmark	174,101	868,201	5	8	4,039	539
		Estonia	11	8,336	783	0	0	
		Finland	27	1,385	51	0	0	
		France	777	39,941	51	8	31,661	3,881
		Germany	441	168,075	381	1,522	491,620	323
		Greece	2	234	131	0	0	
		Hungary	4	179	51	0	0	
		Irish Republic	5,034	647,252	129	246	208,733	849
		Italy	153	7,557	50	2	1,356	789
		Latvia	0	33	1,833	0	0	
		Lithuania	0	30	1,667	0	0	
		Luxembourg	33	413	13	0	0	
		Malta	0	163	2,629	0	0	
		Netherlands	1,573	129,124	82	1,493	554,355	371
		Poland	103	5,059	49	0	0	
		Portugal	22	10,072	450	0	0	
		Slovakia	4	226	51	0	0	
		Slovenia	2	1,058	703	0	0	
		Spain	1,300	64,680	50	0	0	
		Sweden	98,142	2,370,327	24	1	45	79
NON EU	Asia and Oceania		0	0		509	253,793	498
	Eastern Europe		0	944	8,354	46	9,646	210
	Latin America and Caribbean		0	0		1	1,036	2,072
	Middle East and N Africa		7	7,698	1,048	5	950	176
	North America	Canada	0	0		94	79,494	843
		United States	0	0		57	35,824	628
	Sub-Saharan Africa		9	5,258	580	76	30,133	398
	Western Europe exc EC		0	1,026	4,685	0	1,649	18,121
Total			359,545	6,154,865	17	7,532	2,392,445	318

Table A 6 UK trade in wood waste (not sawdust) 2012 (4401 3990)

Appendix 2. Planned and current biomass power stations planning to import woodfuel

Currently (or nearly) in operation

Drax (Drax Power)	www.draxpower.com	YO8 8PH
Tilbury (RWE npower) (Grid reference TQ 661 746)	www.rwe.com/web/cms/en/1763234/rwe-npower/about-us/our-businesses/power-generation/tilbury/tilbury-biomass-power-station/	RM18 8UJ
Ironbridge (E.ON)	www.eon-uk.com/generation/ironbridge.aspx	TF8 7BL

To open 2015-2017

Avonmouth (Helius Energy)		BS11
Grangemouth (Forth Energy)	www.forthenergy.co.uk/biomass-grangemouth.asp	FK3

To open 2017 onwards

Rosyth (Forth Energy)	www.forthenergy.co.uk/biomass-rosyth.asp	KY11
Dundee (Forth Energy)	www.forthenergy.co.uk/biomass-dundee.asp	EH6
Southampton (Helius Energy)	www.southamptonbiomasspower.com	SO15

Appendix 3. Principal UK wood pellet manufacturing plants with post codes

Name	Location	Approximate capacity (tpa)
Abacuswood www.abacuswood.co.uk	Bridgend CF32 9RQ	35,000
Arbuthnott Wood Pellets www.hotstovies.com	Lurencekirk, Scotland AB30 1PA	3,000
Balcas (Brites) www.brites.eu	Enniskillen, Northern Ireland BT94 2RQ	55,000
Balcas (Brites) www.brites.eu	Invergordon IV18 0LE	100,000
Clifford Jones (Blazers) www.blazersfuels.co.uk	Ruthin, N Wales LL15 2TN	30,000
Duffield www.duffieldwoodpellets.com	Ripon HG4 5JB	12,500
Ecowood Fuels Ltd. www.ecowoodfuels.co.uk	Cullompton, Devon EX15 3PF	8,000
LandEnergy www.land-energy.com	Girvan, Scotland KA26 9PF	60,000
Puffin Pellets www.puffinpellets.com	Boyndie, Scotland AB45 2LR	25,000
Verdo www.verdorennewables.co.uk	Andover, Hampshire SP10 3XW	55,000
Verdo www.verdorennewables.co.uk	Grangemouth, Scotland FK3 9UY	55,000
Wood Pellet Energy UK Ltd. www.woodpelletenergy.co.uk	Chilton, Co. Durham DL17 0PF	30,000
WTL International Ltd. www.wtl-int.com	Macclesfield SK11 0PE	50,000

Appendix 4. Map of locations of biomass power stations importing woodfuel and principal wood pelleting plants

