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Executive Summary

There is a rising level of interest in wood fuel as a source of renewable heat and power in London due in large part to a planning requirement that 20% carbon emission reductions in larger developments are achieved through on-site renewable sources. The rate of wood fuelled boiler and combined heat and power (CHP) installations is expected to increase further as fossil fuel prices rise and new housing developments move towards the Government's 2016 zero carbon target. However uncertainty remains about the availability of fuel for planned and projected installations. To date wood fuel supply infrastructure in London is rudimentary, particularly for wood chip.

This report assesses the number and capacity of planned wood fuel plant in London and their potential fuel demand. It then examines the potential sources of fuel and makes recommendations for enabling the growth in fuel production from London's own resources. For some sources of wood fuel such as recycled timber processing capacity within 25 miles of London is considered. It does not cover the import of fuel into London from further afield.

The results of the assessment are summarised in the table below.

Source	Proposed thermal capacity (kW)	Proposed electrical capacity (kW)	Estimated wood fuel requirement at 30%mc (t/yr)*
GLA Stage II (August 2005 – May 2008)	~23,500	1300	24,400
Installers – minimum estimate	~13,500		7,700
Local authorities (excluding those likely to be covered by the installers)	6,000	820	10,280
Total	**43,000**	**2120**	**42,380**

* Load factor varies with application type (residential, office hospital etc.). An average of 1750 full load equivalent hours used with 88% boiler efficiency. CHP fuel requirements based on 24 hour running, 25% electrical efficiency and 85% availability.

Table 1 Planned wood fuel boiler and CHP installations in London

The potential for wood fuel supply from a number of sources was considered. The potential supply is summarised in the table below.

Source	Potential resource (tonnes/yr)	Likely moisture content	Current availability as fuel for use in on-site renewable energy installations
Small and medium wood using enterprises	140,000	15%	Very low, some used for on-site heat
Construction & demolition	200,000	<20%	Nil, requires WID compliant boilers

Civic amenity sites	32,000	<20%	Nil, requires WID compliant boilers. Gasification based CHP systems show promise
Wood recyclers	114,000 – 142,500	20%	Trials indicate that a fuel chip approaching G50 specification can be made using current equipment
Woodlands	150,000	30-45%	Uncertain, can respond quickly to increased demand
Tree surgery	130,000	45%	10,000

Table 2 Potential wood fuel production from in and near London

The key finding of the report is that London has a potential wood fuel resource exceeding the requirements of currently planned wood fuel plant by a factor of 20 if not more. However, a lot of this is waste wood which would require Waste Incineration Directive (WID) compliant boilers and for some of this wood, recycling and reuse might be better environmental options. In general, most of this resource is not available now and policies and support frameworks need to be put in place to ensure London can better develop its wood fuel supply chain.

A substantial increase in wood fuel boilers/CHP would have air quality implications in London. It is beyond the scope of this report to address this issue in any detail but it is recognised that more work is needed to ensure that climate change mitigation objectives are balanced with concerns about other emissions.

Principal recommendations:

- A publicly available biomass installations database needs to be established and regularly updated, covering installed and proposed units.
- More research to be carried out into the air quality implications of increased biomass use building on the results of the London Councils' assessment published in December 2007[1]. This should lead to regulations on permitted emissions levels in boilers in urban areas.
- For SMEs: opportunities for wood fuel production are publicised through the biomass installations database, trade journals and networks and the development of production is supported through demonstration units and capital grants.
- For construction and demolition timber: a programme to trial separation of clean from contaminated wood and support for small scale WID[2] compliant CHP systems. However, there is a need to ensure that this does not compete with recycling or re-use, where they are the better environmental options.

[1] December 2007, *Review of the Potential Impact on Air Quality from Increased Wood Fuelled Biomass Use in* London, produced by AEA Energy & Environment for the London Councils and available at: http://www.londoncouncils.gov.uk/Transport/briefings/ReviewofthePotentialImpactonAirQualityfromIncreasedWoodFuelledBiomassUseinLondon.htm

[2] Waste Incineration Directive

- Training should be provided for wood recyclers so they can meet the tighter wood chip specifications for smaller boilers. This training should be delivered by existing wood fuel supply providers in advance of supply contracts being concluded.
- For tree surgery arisings:
    - Information about the business opportunity for wood chip and pellet production should be made available to tree surgeons through the biomass installations database, trade journals and networks
    - Proactive support from local authorities for new facilities
    - Capital grants for new production capacity that complements other support mechanisms such as Defra's Bio-Energy Infrastructure Scheme.

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Abbreviations

BedZED	Beddington Zero (Fossil) Energy Development
BEIS	BioEnergy Infrastructure Scheme administered by Defra
BID	Biomass Installations Database
C&D	construction and demolition
CA site	civic amenity site - disposal point for householders
CCHP	combined cooling, heat and power
CHP	combined heat and power plant
Defra	Department for Environment, Food and Rural Affairs
DTI	Department of Trade and Industry (now Department of Business, Enterprise and Regulatory Reform)
EA	Environment Agency
EEDA	East of England Development Authority
ELWA	East London Waste Authority
GLA	Greater London Authority
kW	kilowatt
kWe	kilowatts of electricity
kWh	kilowatt hour
kWth	kilowatts of thermal output
LEP	London Energy Partnership
LDA	London Development Authority
LDD	London Development Database
LTOA	London Tree Officers Association
LPA	local planning authority
MDF	Medium density fibreboard
mc	moisture content
MW	megawatt
MWh	megawatt hour
NO_x	oxides of nitrogen
OSB	oriented strand board
PDD	Planning Decisions Database
PM10	particulate matter less than 10µm
PM2.5	particulate matter less than 2.5µm, both this and PM10s may give rise to respiratory problems when inhaled
PPS	Planning Policy Statement
SEEDA	South East England Development Authority
SME	small and medium enterprise
t/yr	tonnes per year
tpa	tonnes per annum
WID	Waste Incineration Directive
WRAP	The Waste and Resources Action Programme

1 Introduction

Wood fuel use in London is set to increase as modern wood chip and wood pellet boilers and CHP plants are installed and commissioned in response to planning requirements for on-site renewable energy generation, the desire of business to reduce carbon dioxide (CO_2) emissions and the increased cost of fossil fuels. Policy drivers come both from some local councils and from the Mayor of London's requirement for larger developments to achieve a 20% reduction in CO_2 emissions through the use of on-site renewables. The on-site renewables requirement was raised from 10 to 20 percent in spring 2008 when the revised London Plan was published. This increase is expected to increase the demand for wood derived heat and power.

This report is one of a two part series entitled *Biomass for London*. The other report, *Wood Fuel – A Guide for Developers,* provides advice on the practicalities of designing and managing wood fuel boilers and Combined Heat and Power (CHP) systems. This report, *Wood fuel demand and production,* covers the wood fuel supply chain and the steps necessary to develop this in line with the increasing demand for wood fuel.

Both reports follow on from the initial *London Wind and Biomass Study* produced by the London Energy Partnership in 2006, which details the potential for large-scale wind energy in the capital, identified the potential resource of biomass fuel in London and highlighted a series of sites for large wind and biomass installations.

Objectives

The objectives of this follow up study were:

- to estimate the likely wood fuel demand and timing from new heating and combined heat and power (CHP) plant currently in the planning or pre-planning stages and
- to identify measures which would encourage and support the development of the wood fuel supply chain so that as much as possible of the required fuel can be sourced from local, London resources.

The report aims to identify practical steps that can be taken to advance the development of wood fuel supply chains in London, based on the realisation that there are opportunities for developing viable new wood fuel supply enterprises, bringing economic and social benefits.

While an expansion of wood fuel energy would have clear benefits in terms of CO_2 reduction, planning authorities, developers and other stakeholders need to be mindful of other environmental issues. There is some concern that a substantial increase in biomass use would have implications for London's air quality. It is beyond the scope of this report to address this issue in detail but it is recognised that any expansion in wood fuel use needs to minimise environmental impacts. This is reflected in the preference given by the London plan to energy efficient design and to CHP over heating only facilities.

The first part of the study looks at the planned capacity of wood boilers and CHP using several sources of information in order to cross check and verify the estimates made. Information about wood fuelled heating and CHP systems is not routinely compiled. If available this would give potential wood fuel producers the confidence to invest in production facilities. Recommendations on how better information on biomass energy installations might be collected are made.

The second part of the study assesses the barriers to and opportunities for development of the wood fuel supply chain from different sources of wood arising within London. These include:

- tree surgery
- small and medium sized enterprises using wood
- construction and demolition (C&D) activities
- wood recyclers processing large amounts of pallets and packaging.

There are few large woodlands and very little land available for short rotation coppice in London. Also, techniques for wood fuel production from these sources are well developed, so they are not considered in detail in this report.

The third part of this study looks at potential sites for new wood fuel production units concentrating on tree surgery waste since a model for this exists in Croydon. Five potential sites around London are highlighted.

Finally, the report makes a number of recommendations about what is needed to ensure wood fuel can play an appropriate role in delivering the Mayor's climate change targets.

2 Methodology

The three partners who carried out this study (BioRegional, CEN and South East Wood Fuels) are all actively engaged in supporting the fledgling wood energy industry in London and the South East. The network of contacts among wood fuel producers and users, local authorities and boiler installers assisted the partners in researching for the report.

The period available to prepare the report was limited, restricting the amount of original research and field investigation that could be undertaken. A range of methods were used to prepare the report including:

- literature research
- consultation with regulatory bodies such as the Environment Agency (EA)
- a mail survey of over 1000 wood using small businesses
- completion of data analysis from a previous survey of tree surgeons
- telephone interviews with a wide range of key individuals and organisations including the GLA and local authority planning departments
- meetings and site visits as appropriate.

The research work was completed between mid-January and the end of February 2007. Revisions to the text were made and data on GLA planning referrals was updated in May 2008.

3 Bridging the gap

Since the adoption of the London Plan and its associated Energy Strategy in February 2004 the Mayor has required applications referred to him to incorporate renewable energy technologies. The recently revised London Plan now requires a 20% carbon dioxide emissions reduction through on-site renewable energy generation. This is expected to result in an increased uptake of renewable energy, and of wood fuel in particular. Wood fuel is a key technology, and often the most economic one, for on-site renewable energy production and therefore is being increasingly proposed in major developments.

Although there is considerable potential wood fuel supply in London, and in the surrounding area, unless there is a sophisticated supply chain to process and supply the wood, operators of wood fuel systems may find it easier to use dedicated suppliers from outside of London and even abroad. In the worst case, if the supply chain is not in place wood fuel boilers may be under-utilised or even mothballed. Setting up a supply chain will involve an investment of time and money and therefore the first part of the study was aimed at estimating the future demand for wood fuel in London.

It also needs to be recognised that a proportion of the wood fuel supply will go for re-use and recycling, particularly waste wood. The waste hierarchy set out in the London Mayor's Municipal Waste Management Strategy puts re-use and recycling of waste materials ahead of energy recovery techniques as the better environmental option. This view is also supported by BRE in line with the Best Practical Option technique. Additional work may be required to determine the most appropriate use of different wood materials to strike a balance in meeting waste and renewable energy policy objectives, as well as meeting local air quality policy objectives.

The aim of this study was to gather as much information as possible on planning applications that included wood fuel boilers & CHP plants, or installations of boilers that do not require planning, which would give an estimate of the confirmed demand for wood fuel in approximately 2-3 years time. Similarly information was gathered on future developments that were being proposed – either the planning application was being prepared or the design teams were using wood fuel in their designs. This estimate would help to predict the wood fuel demand further down the line.

3.1 Biomass proposals within strategic and non-strategic planning applications.

Planning context

The Mayor is responsible for setting strategic planning policies through the Spatial Development Strategy (The London Plan). These policies form part of the Development Plan for each Local Planning Authority (LPA) in Greater London and therefore constitute a primary consideration for all planning applications in London alongside the LPA's own Unitary Development Plan. The Mayor also has the power to direct a LPA to refuse planning permission for strategic planning applications[3] where the Mayor considers the proposal to be contrary to the spatial development strategy or prejudicial to its implementation, or otherwise contrary to good strategic planning in Greater London. Approximately 300 planning applications a year are currently referred to the Mayor under these powers, in the context of approximately 30,000 planning applications submitted annually in Greater London.

A planning application can either be an outline application, considering matters of principle such as land use, access and siting of buildings, with other matters reserved for a further application (a reserved matters applications), or they can be a full application where the majority of the scheme's details are established subject to conditions regarding final details.

[3] "Strategic Development" is defined by the Town and Country Planning (Mayor of London) Order 2000 - Statutory Instrument 2000 No.1493. The Mayor's powers and the Mayor of London Order are currently under review with proposals to create planning powers to approve applications of strategic importance and altering thresholds for referable schemes.

The LPA is currently solely responsible for determining reserved matters application and for discharging planning applications, with the Mayor of London's input coming solely at the outline or full application stage.

The direct application of the London Plan energy policies (4A.7-9) has resulted in the incorporation of biomass boilers in principle within new strategic developments. The draft national Planning Policy Statement (PPS) on Climate Change[4] has established the principle of on-site renewable energy technology and decentralised energy for all LPAs. All adopted Unitary Development Plans in London are currently being reviewed under recent changes to the planning system, and under the PPS are required to assess their area's potential for accommodating renewable and low carbon technologies, including for micro renewables to be secured in new development. They are required to ensure that a significant proportion of the energy supply of a substantial new development is gained on site and renewably and/or from decentralised, renewable or low carbon energy supply.

The London Plan waste policies (4A.21 – 4A.29) support developments where energy is generated from waste that cannot be recycled, particularly on-site energy generation where the heat and power is used. Preference is given to new and emerging technologies such as gasification and anaerobic digestion over conventional incineration, especially where the products can be used as fuels (e.g. biofuels and hydrogen). All though each case will be treated on its individual merits, the Mayor's waste policies need to be recognised when selecting wood fuel energy generation technologies.

Process of assessing specific schemes

Biomass (including wood fuel) heating and CHP are established as valid options to meet planning policy objectives for on-site renewable energy.

In order to establish approximate wood fuel demand from strategic planning applications, a review of schemes considered by the Mayor was undertaken based on the public information available. Figure 1 shows the number of wood fuel proposals in new developments. The research also shows that there is a distribution of demand across London (see figure 2 below), with some concentration in Central-East London.

The energy strategies for the planning applications are available from the local authorities. For the 20 largest developments these were sourced and the exact strategy recorded – though this was not always possible as some local authorities have yet to put all the information on their websites, and it is necessary to visit the council offices to retrieve the information.

A key finding of the research was that the level of detail available in planning submissions, for example the likely energy demand for a scheme in terms of heating, or the proposed size of biomass boiler, increased over time. Wider research conducted by London South Bank University[5] for the the GLA has established that as developers, planners and consultants have become more familiar with the implications of the energy policies in the design and development process, the policies have been more effectively implemented.

In the case of wood fuel, the need to ensure detailed consideration of issues at early stages of the development and design process has led to the requirement for detailed information at the stage a planning application is submitted.

[4] Planning Policy Statement: Planning and Climate Change – Supplement to PPS1.
[5] Review of the impact of energy policies in the London Plan on applications referred to the Mayor (phase 2), http://www.london.gov.uk/mayor/planning/docs/lsbu-research.rtf

This requirement has been clarified in Supplementary Planning Guidance to the London Plan on Sustainable Design and Construction[6], and strengthened in the revisions to the London Plan.

Figure 3.1 shows the estimated cumulative capacity of wood fuel plant included in planning applications referred to the Mayor over the 3 years to May 2008. Stage 2 applications are likely to go ahead in the form approved so can be taken as a firm indication of future demand. However, it was not possible to separate wood chip and wood pellet demand from the information available. The more rapid increase in total stage 1 & stage 2 applications demonstrates the increasing popularity of wood fuel. As stage 1 planning applications are reviewed for consideration at stage 2 and the Mayor's energy hierarchy is considered some proposals for wood fuel use may be dropped in favour of gas fired CHP and CCHP plants. The data does not reflect the recent increase in requirements for on-site renewable energy generation from 10% to 20%. This will tend to increase biomass use further.

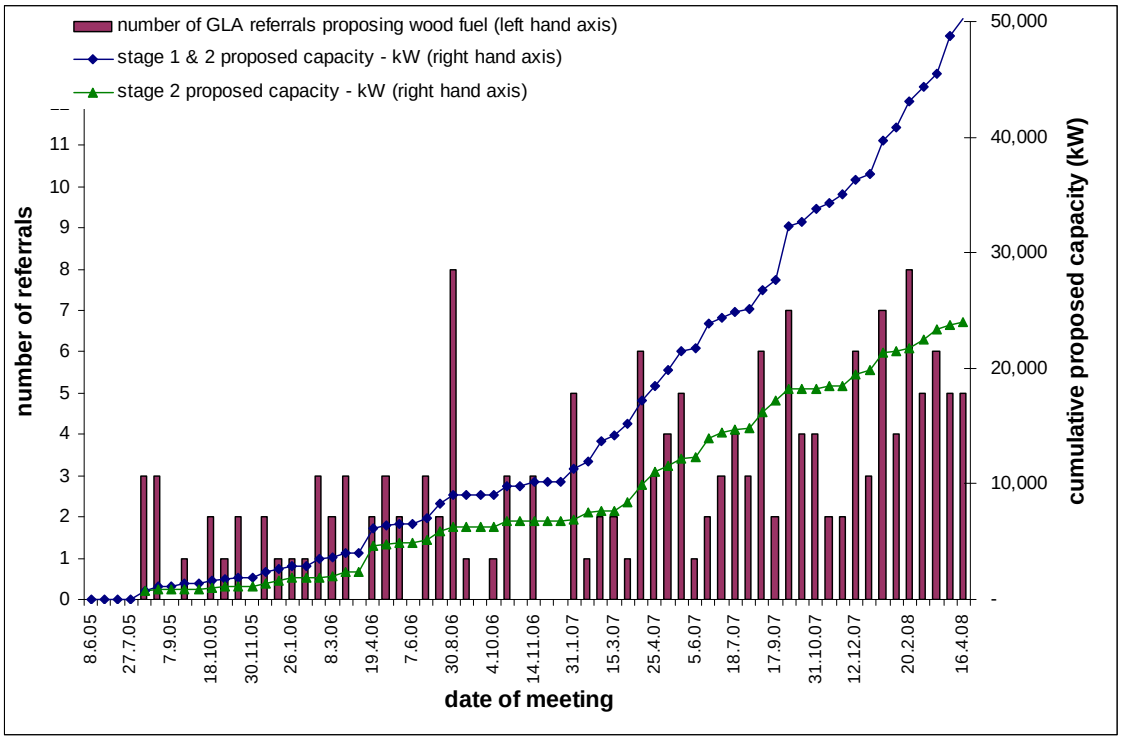


Figure 3.1 Number of wood fuel proposals and cumulative proposed capacity from GLA referrals

It is evident that the implementation of planning policies established in 2004 has played a key role in creating a demand for biomass, and that national, regional and local planning policies are being revised to ensure climate change is a key planning consideration. These policies are driving earlier consideration of biomass in the development process, and demonstration of this at the initial planning stages.

[6] For detailed information see Supplementary Planning Guidance – Sustainable Design and Construction, Appendix D – Energy Statements, available at http://www.london.gov.uk/mayor/strategies/sds/docs/spg-sustainable-design.pdf

Figure 3.2 Location of proposed wood fuel installations referred to the GLA (June 2005 – November 2006)

3.2 Local authorities

All of London's local authorities were contacted to try and gather information on the proposed developments in their boroughs that will be using wood fuel, particularly those in an early stage of planning or ones that are too small to be referred to the Mayor. The information provided is summarised in Table 3.1.

Additionally, their attitude to wood fuel was assessed, whether they were broadly favourable or whether they have reservations. Generally, views on the use of wood fuel were polarised. Many local authorities were enthusiastic and were actively promoting it, while others were more sceptical, and cited three reasons for this:

1. Increases in emissions other than CO_2, in particular NO_x and particulates (PM10 and PM 2.5).
2. Increased lorry movements, particularly in quiet residential areas
3. The lack of a secure local supply

It was predominantly the central London boroughs such as Hammersmith and Fulham and Westminster, who were most concerned about increased air pollution problems due to the burning of wood fuel[7]. A number of installers also cited this as a problem in certain boroughs. The main issue appears to be that although the boilers comply with the Clean

[7] This is likely to be linked to those areas which currently suffer the highest levels of air pollution. The Mayor's Air Quality Strategy indicates that this is generally central and inner London, major roads and the areas around Heathrow. Further details are available at: http://www.london.gov.uk/mayor/strategies/air_quality/air_quality_strategy.jsp

Air Act they may still have an adverse impact on air quality. The Clean Air Act was only intended to minimise smoke and did not consider what is now the latest health evidence or cover other EU and government objectives. Generally, it is also true to say that Air Quality officers are the most concerned (especially in central London boroughs) while energy and planning officers are often more positive about biomass.

A report commissioned by London Councils[8] showed that under certain scenarios widespread adoption of wood fuel would adversely impact on air quality in areas where air quality is failing to meet health based targets. The report also highlighted the regulatory regimes in place to control solid fuel use, and how these might be more effectively used. Work is being considered by central government and central London boroughs to clarify the potential impact of biomass use and draw up guidance for its use.

This is obviously an important issue and it must be borne in mind that emissions from wood-fired boilers will be compared to those of other heating fuels, especially natural gas. Historically natural gas produced lower concentrations of local air pollutants per mass burned than solid fuels and was used in major cities to reduce air pollutions since the Clean Air Act was introduced. Recent advances in biomass boiler technology have significantly reduced their emissions levels, in some cases to levels not very different to natural gas boilers[9]. However, a local authority may still expect an installation to include additional mitigation measures to reduce emissions, especially those of particulates (PM10 and PM2.5).

In response to concerns about pollutants, boiler manufacturers are now starting to provide clean up equipment such as bag filters for particulates for smaller boilers, even below 1MW[10]. Other wood fuel to energy technologies with lower emissions, for example those based on gasification and pyrolysis, are becoming commercially available for CHP and CCHP applications. Where air quality impacts are problematic, for example in inner city areas, fewer but larger wood fuelled plants could be the way forward, perhaps linked to district heating schemes. It is easier and more cost effective to provide the additional management and monitoring that may be required for emissions reduction at these larger installations. In general, mitigation technologies have significant economies of scale and some such as urea based clean up of NO_x emissions, are not viable for small boilers and CHP units. Outer London locations with fewer air quality constraints may prove more appropriate for wood fuelled plants.

Barking and Dagenham were especially concerned about transport noise in one particular large new development that is situated in a quiet residential area to the extent that it is investigating other strategies that can be used to meet its carbon target.

A number of boroughs, in particular Lewisham, have voiced concerns about the source of the wood fuel. In March 2007 the only wood fuel proposals they were aware of were the 10 schools in the Building Schools for the Future programme. By May 2008 private developers had proposed 2,100 kW of biomass boiler capacity in 4 schemes. They have raised concerns about the source of the wood fuel, whether it is UK in origin, whether it is coming from sustainably managed forests and what the transport impact is of delivering the fuel into London.

[8] December 2007, *Review of the Potential Impact on Air Quality from Increased Wood Fuelled Biomass Use in* London, produced by AEA Energy and Environment for the London Councils and available at http://www.londoncouncils.gov.uk/Transport/briefings/ReviewofthePotentialImpactonAirQualityfromIncreasedWoodFuelledBiomassUseinLondon.htm

[9] Chris Miles, managing Director, Econergy Ltd., personal communication

[10] Stewart Boyle, Wood Energy Ltd., personal communication

This concern, real or perceived, demonstrates the need not only to establish an efficient supply chain, but also the need to make sure its existence is well known to planners, developers and regulators. Only then will confidence in the sustainability of wood fuel use increase.

Borough	Development name	State of planning	Size	Comment
Kensington and Chelsea	Holland park glasshouses	Being proposed	300kW approx	Would aim to use their own wood waste
Haringey	GLC Supplies Depot,	Submitted	1500kW	Confirmed by an installer
Havering		Planned	12 schools	Probably pellet
Barking	7 sites,	Range, proposals though to planning granted	Totalling approx 250 units	
Barking			1000 unit	Borough is opposed to use of biomass here
Croydon	Fire station	Proposed (no planning required)	200kW	
Croydon	187-195 London Road			
Croydon	Capital Business Centre, 22 Carlton Road			
Croydon	Two New for Old properties			
Croydon	Newgate Roundabout, Wellesley Road	Proposed – not yet submitted for planning	500kW	730 houses
Croydon	51-53 Whytecliffe Rd, Purley			
Croydon	'Altitude 25' Fairfield Road,	Planned Feb 06		196 apartments plus commercial space
Croydon	Former Safari Cinema, London Road			
Croydon	Wandle Park Village, former British Gas site, Purley Way		2 x boilers	~800 units and 10,000m^2 industrial
Greenwich	Heart of East Greenwich	Proposed	720kWe CHP	Strategy put forward at the tender stage
Lewisham	Building Schools for the Future	Proposed (but likely)		20 schools
Hammersmith and Fulham	White city	Proposed		A long way out at this stage

Borough	Development name	State of planning	Size	Comment
Hammersmith and Fulham	Powerday proposal	Proposed	100kWe CHP and 600kW thermal	Initially refused due to air quality issues – plans being revisited

Table 3.1 Proposed wood fuel installations referred by the relevant local authority (March 2007)

3.3 Wood fuel boiler installers

There are only a limited number of installers of wood fuel boilers in the UK, not all working in London. Their current projects in London give another estimate of future wood fuel demand. This is likely to give a less accurate assessment of the demand, because the installers are unable to know exactly how seriously the wood fuel option is being taken. Similarly, due to commercial sensitivity issues the level of detail that they are able to give is much lower, and as a developer may talk to more than one installer there is the likelihood of double counting. Also the different installers were prepared to give information on projects at different stages – some only wanted to comment on firm projects – that is those where the application was being prepared, and others where happy to give some information on more 'prospective' projects. Nonetheless this gives another helpful gauge of future wood fuel demand.

The installers who were contacted were:

- Vital Energi
- Wood Energy Limited
- Econergy
- Rural Energy Limited
- Buccleuch Bioenergy
- Talbott's Ltd
- Bioenergy Technology Ltd
- Mercia Energy
- Farm 2000, Teisen Products Ltd
- 3G Energi

Three of the installers are particularly active in London – the remainder are less so. In Table 3.2 the projects that each installer is working on have been summarised for six areas of London, for the three main London installers the specific figures are given while those for the remaining installers are aggregated. Generally the installers divide their leads into 'hot' and 'warm' leads, and Table 3.2 lists the 'hot' leads for the installers. Where possible it does not include those installations included in Table 3.1, but while it was straight forward to remove the proposal in Haringey, it is likely that the Croydon proposals are included.

Location in London	Installer A (kW)	Installer B (kW)	Installer C (kW)	Other installers (kW)	Total: max (kW)	Total: min (kW)
South West	220	2,500		600	**3,320**	**2,500**
South East	2,720	1,500		650	**4,870**	**2,720**
East	1,500	2,000	2,600	350	**6,150**	**2,600**
North	520	1,500	350	200	**2,570**	**1,500**
West	2,700	1,250		20	**3,970**	**2,700**
Central	600 installed	1,250	1,000		**2850**	**1,850**
Total	**8,260**	**10,000**	**3,950**	**1,820**	**24,030**	**13,870**

Table 3.2 Summary of most installers best leads

Trying to account for the likely double counting it appears that approximately 10-15MW of wood fuel proposals are currently being developed. No doubt a significant number of these will decide against using wood fuel, but it supports the evidence from the GLA and the local authorities that there is an ever growing number of organisations are looking at wood fuel as an option and that this is only likely to grow in the future.

3.4 Consultants

A number of engineering consultants who are known to frequently recommend wood fuel were approached to see if they would divulge information on any projects that they were working on in London. Generally the response was not positive, they felt that it may contravene client confidentiality and would be considerable work for them to compile the information for little commercial reward.

3.5 Environment Agency (EA)

Where planning permission is not required, for example when an existing boiler is being replaced, the boiler will still need to meet local air quality standards. The Environmental Permitting Regulations [11]are the regulatory regime that controls the emissions from industrial activities, including biomass combustion. Larger installations are covered by the EA, while local authorities are responsible for smaller ones. The only application that the EA was aware of for London was at the Tate and Lyle factory in Silvertown. This project will replace four 19MW gas turbines with 65MW of biomass CHP capacity. The plant will run 24 hours a day and is expected to require 135,000t/yr of biomass at 8-10% moisture content when in full operation in 2009. The planned fuel is not wood but wheat feed, a by-product of flour milling which will be imported from outside London.

Tate and Lyle's Silvertown site is next to the Royal Docks and the River Thames would appear to be the most efficient route for bringing biomass into the site. Tate and Lyle stated that this would be their preferred option but that they may not be able to do this immediately.

Although this very large installation is not to use wood fuel and is not going to be supplied locally, it again demonstrates the growing interest in the use of biomass. Depending on where their supply will be coming from it could also offer future opportunities for creating an external supply chain for biomass into the London market. Wood fuel could use a similar supply arrangement to wheat feed.

An existing large user that has significant influence on London wood fuel supply and use is Slough Heat and Power. After initially drawing supplies from a wide area they now source

[11] The Environmental Permitting Regulations replaced the both the Pollution Prevention and Control and Waste Management Licensing regulations on 6th April 2008.

most of their fuel within 50 miles. There has been a marked increase in the number of tree surgeons within London who are supplying Slough.

3.6 Summary of wood fuel demand

The report has aimed to estimate the future demand over two distinct time frames by looking at developments that have already applied for planning permission, and those that are being prepared. Searching back through the GLA planning referrals from August 2005 until May 2008 identified 170 developments that were proposing wood fuel, of which 83 were Stage 2 and therefore relatively certain. The GLA referrals supplied the most information on proposed developments that would use wood fuel but the data is not always detailed and the proposed unit size was estimated.

The wood fuel boiler installers proved to be the best source of information for future developments that may use wood fuel. Of course many developers will be looking at more than one renewable energy option and possibly be discussing wood fuel with more than one installer. Nonetheless it still gives the best estimate of the number of planning applications that will come in over the next few years, which will contain a proportion of wood fuel.

Source	Proposed thermal capacity (kW)	Proposed electrical capacity (kW)	Estimated wood fuel requirement at 30%mc (t/yr)*
GLA Stage II (August 2005 – May 2008)	~23,500	1300	24,400
Installers – minimum estimate	~13,500		7,700
Local authorities (excluding those likely to be covered by the installers)	6,000	820	10,280
Total	**43,000**	**2120**	**42,380**

Tate & Lyle's large biomass CHP plant (15,000kWe, 45,000kWth) is excluded from this table since it uses wheat residues rather than wood as fuel.

* Load factor varies with application type (residential, office hospital etc.). An average of 1750 full load equivalent hours used with 88% boiler efficiency. CHP fuel requirements based on 24 hour operation, 25% electrical efficiency and 85% availability.

** All Croydon installations have been assumed to have been covered elsewhere, as has the Kensington and Chelsea installation. All schools have been assumed to be 100kW

Table 3.3 Summary of possible future wood fuel installations

Table 3.3 summarises all the proposed wood fuel installations and shows that 43MW of wood fuel boiler capacity is being considered. Even though a significant number of these proposals are unlikely to come to fruition this demonstrates the level of interest that wood fuel is currently generating.

3.7 Storage of the biomass installation information

Currently retrieving information about prospective biomass installations is a longwinded, laborious and inaccurate process. This applies to all forms of biomass - not just wood fuel. Information about proposed installations is not collated, either within the GLA or within the local authorities. Unlike the other key renewable energies such as wind, solar and ground source heat, biomass relies on a delivered fuel, and therefore there is a greater need for a centralised database of all proposed biomass installations. This research has demonstrated that there is likely to be a substantial increase in demand for biomass in London – but the exact scale of this increased demand is difficult to gauge because even for the major installations the information is not readily available.

3.7.1 The need for a centralised storage system

There are a number of wood pellet manufacturers who, seeing the likely increased demand, are setting up factories and/or distribution systems in or around London. They include Neway Energy, the Renewable Fuel Company (UK) Ltd., Energy Crops Company, the Surrey Hills Wood Fuel Group and Biojoule Ltd. Yet without accurate information on the number of pellet boilers being installed it is impossible to know if local production capacity will be sufficient to meet supply. Anecdotal evidence suggests that the majority of boilers in Central London will use pellets since they take less storage room and are more easily delivered by bulk tanker but this cannot be verified with existing information sources. Two pellet suppliers in particular expect to be able to deliver over 50,000 tonnes per annum between them, sufficient for approximately 10MW of pellet boilers. This would appear to meet current and currently proposed pellet demand. These larger pellet producers are able to use forestry thinnings and other green timber as they include wood chip drying capacity, expanding the potential for pellet production beyond the traditionally used ready dried offcuts and sawdust from furniture makers, joinery workshops and other wood using businesses.

The situation with wood chip is more complicated. There is a greater supply of wood chip available locally and already some local supply options exist, such as the Croydon Tree Station and large-scale tree surgeons who send their chip to Slough Heat and Power. Yet it appears that, possibly because wood chip is a less processed fuel with more variable quality, it has attracted less commercial interest, and there is less of a formal supply chain developed. The need to have a readily available source of high quality chip remains unmet.

If the commercial market is going to be relied upon for the supply of wood fuel, in either chip or pellet form, then they will need to be convinced that there is going to be sufficient demand to make investing in supply infrastructure commercially attractive. A publicly available, London-wide database of all existing and proposed biomass installations would let these companies plan their growth to match demand. This in term would breed confidence in biomass and leading to an increase in use.

3.7.2 Information capture system

A centralised database of biomass installations would need to cover a few pieces of key information including:

- all proposed and all installed biomass systems – with a differentiation between the two
- the size of the unit
- the date of the installation or the proposed installation date
- the technology used – preferable the make of the unit, but as a minimum whether it is a CHP/CCHP unit or a boiler
- fuel type – chip or pellet
- location – ideally a postcode.

3.7.3 Managing the system

Ideally this information would be stored nationally, in which case a national organisation, such as the Renewable Energy Association, would be the most appropriate body to coordinate the information. But as London is aiming to take the lead on the use of renewable energies and due to its large concentrated population it is likely to have biomass supply issues significantly before the majority of the country.

The GLA Planning Decisions Unit are currently developing the Planning Decisions Database (PDD), which will contain information on energy systems being installed and could include specific information on biomass installations. This would be one potential storage location for all future referrals to the Mayor, but it would have a number of drawbacks:

- it would not be certain that these systems had actually been installed as the proposals can be revised at a later stage
- it would not cover the smaller scale installations that fall outside the GLA's remit or retrofitted installations
- it will not contain any information on existing proposals.

Another storage option would be the London Development Database (LDD), as this includes all developments that are considered significant at the local level, normally any development over 10 housing units. Again there are some concerns about this as a storage vehicle:

- it only contains information on installed systems and therefore would not allow suppliers to react to future demand
- it would not cover retrofitted installations.

Therefore there appear to be two options, adapting either the PDD or the LDD to cover the information required, or setting up a separate system. The separate system should be funded and established by the GLA, the London Energy Partnership or LDA (for example through the London Climate Change Agency). It could be managed internally or outsourced to an external organisation. As long as all the required information was made available to the third party either option would work, though it maybe easier to coordinate all the information internally.

The system manager would need to undertake a number of tasks to set up such a Biomass Installations Database (BID), though once it was running a few days a month of research should be sufficient to keep it up to date. The initial tasks are:

- research all existing proposals, certainly all GLA referrals and ideally all proposals in London that have come to the attention of planning officers in the Boroughs
- set up a network of local planning officers who would be able to advise on possible installations in their area.

There already exists the Association of London Borough Planning Officers, the London Boroughs Energy Group, the London HECA Forum and the London Environment Coordinators Forum, all of which are networks that could be used to gather information. As long as it was made clear to the network members why the information was important and all meetings were attended this may be an effective method of gathering the data.

Once the system was established the BID could be maintained by:

- searching the PDD and LDD, and following up any proposals or installations as required
- monthly communication with the planning officer network to be updated on any other installations that they are aware of
- periodic checking with the EA in case any large scale installations that are above the Local Authorities remit are being proposed.

It is proposed that the London Energy Partnership enters into discussions with relevant London stakeholders to explore options for the establishment of such a database.

4 Wood fuel supply chains

4.1 Small and medium scale enterprises

There are a large number of businesses using wood in London. These were considered to have potential as sources of raw material or for diversification into local small scale wood fuel manufacture since anecdotal evidence suggested that:

- they commonly produce wood waste at a predictable, regular rate;
- the waste wood is very often kiln dried so has high value as fuel;
- some waste is often used on site for heating in the winter but much is disposed of through the commercial waste system, ends up in the general waste stream and is eventually landfilled;
- the cost of waste wood disposal is often significant for small businesses;
- with a knowledgeable workforce, segregation of untreated timber at source is easy to implement.

The potential to take waste, which is expensive to dispose of, and produce fuel for own use or sale is a powerful incentive for many of these businesses. Firms are prepared to invest in reducing the cost of waste disposal. For example, several companies have invested in sawdust and shavings briquetting equipment to reduce the volume and increase the density of waste being put into skips. Any sales of the resultant briquettes are looked on as a bonus.

4.1.1 Wood using business survey

The aim of this survey was to:

- provide information on the distribution of wood using companies in London
- estimate the type and quantity of waste wood produced
- if possible, to identify potential partners to take the lead in production of wood fuel for local use

A questionnaire and covering letter explaining the objectives of the survey were prepared. The questionnaire was kept as short and simple as possible and sent out with a return paid envelope to encourage a greater response rate. A copy of the questionnaire and letter is included as Appendix D.

A total of 2171 companies engaged in a range of wood based enterprises in London were identified (see Table 4.1). For this survey the M25 was taken as the London boundary. Their distribution is shown in Figure 4.1 below. The types of firms included in the survey are summarised in Table 4.1. Of these firms 1080 were chosen at random and sent questionnaires. A total of 46 responses were received. A response rate of 4.2% is low but still sufficient to give an insight into the structure and operation of waste wood disposal routes.

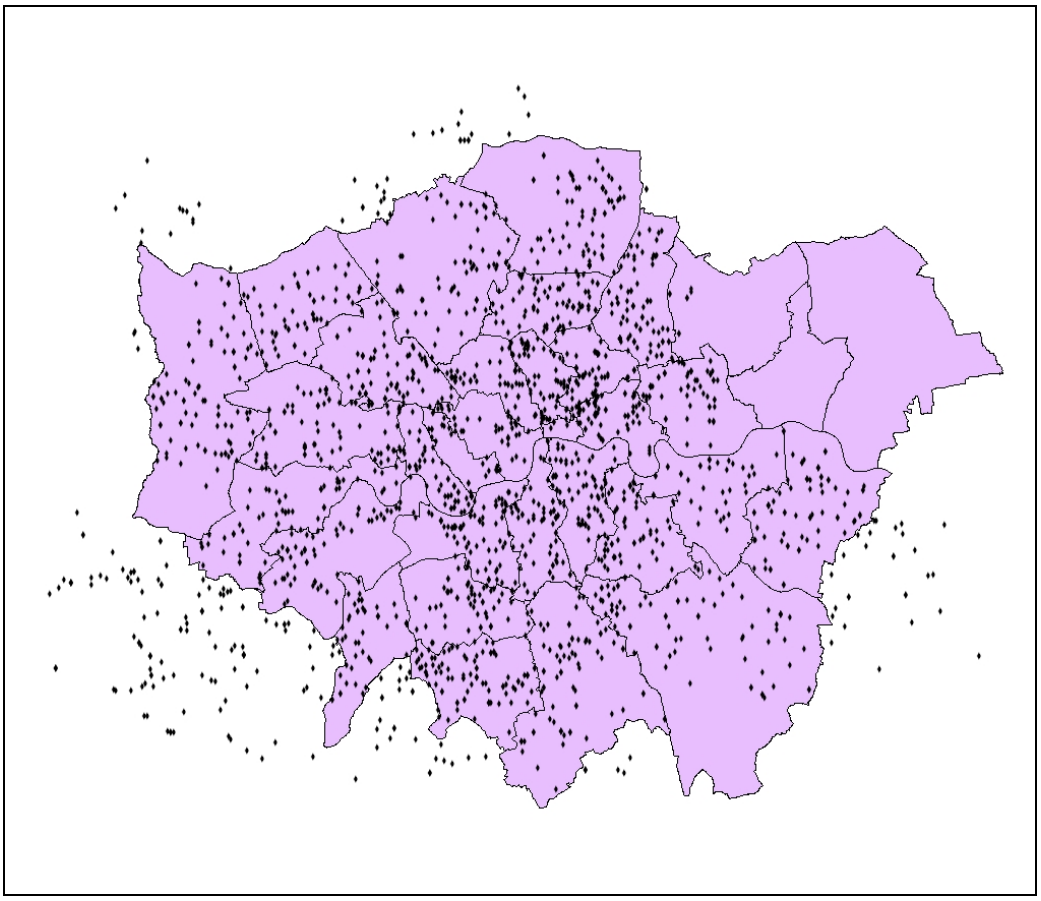


Figure 4.1 Distribution of small wood using businesses in London

Type of business	Number within M25	Type of business	Number within M25
Balustrade & Handrail Mfrs	18	Joinery Mfrs	188
Bar Fixtures & Fittings	3	Kitchen Furniture Mfrs	24
Builders' Merchants	263	Pallet & Case Makers	30
Buildings-Sectional	5	Partitioning Mfrs	2
Cabinet Makers	110	Sawmills	2
Carpenters & Joiners	812	Shop Fitting Mfrs	15
Chair Frame Mfrs	1	Staircase Mfrs-Wood	7
Coffin & Casket Makers	1	Timber Importers & Agents	16
Door Mfrs-Domestic	23	Timber Merchants	165
Door Mfrs-Industrial	44	Veneer Mfrs & Merchants	11
Furniture Fittings	10	Window Frame & Accessory Mfrs	21
Furniture Mfrs & Designers	256	Wood Carvers & Turners	23
Furniture-built-In & Fitted	99	Woodworkers	22
		Total	**2171**

Table 4.1 Range of wood using businesses in London

4.1.2 Survey results

Figure 4.2 below illustrates that although there are many small firms producing less than 1 tonne of wood waste each week, the majority of the wood waste is generated by a few larger companies. One company that responded to the survey is much larger than the others and has been excluded from the estimate of the total amount of wood available in London, as it would have skewed the result. This company produces 4,800 tonnes a year of wood waste from board products, much of which is used to heat the company's premises. If the small sample excluding this large company is assumed to be representative of all wood using firms in London, scaling up suggests that 140,000 tonnes of waste wood are produced annually.

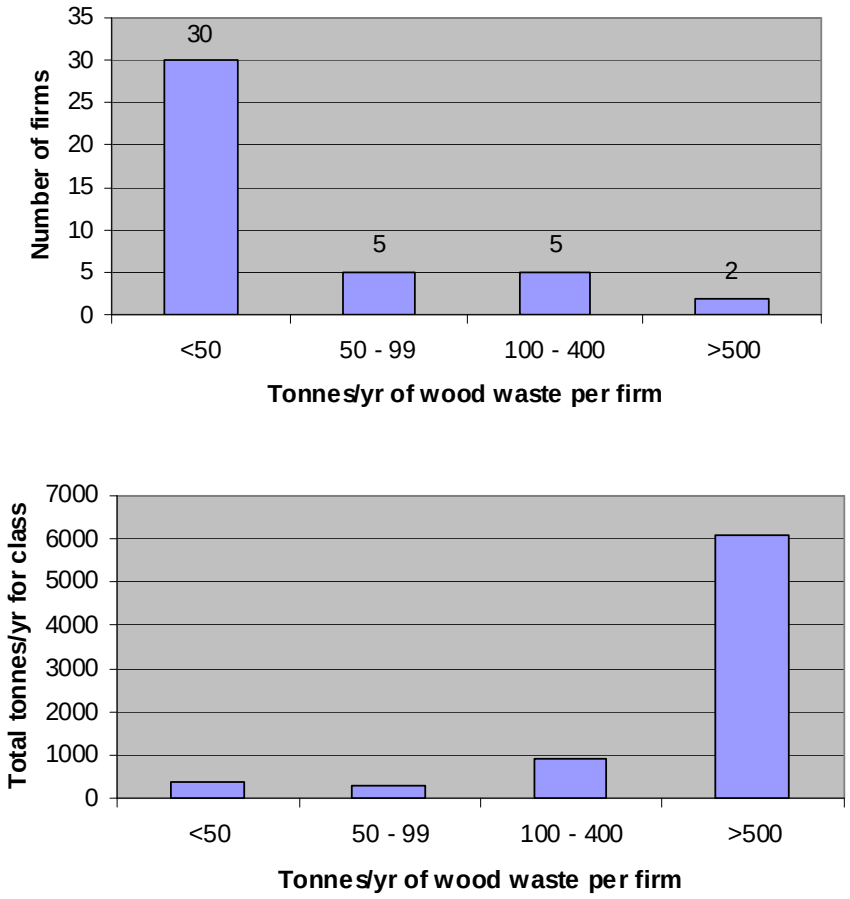


Figure 4.2 Number of survey respondents in London and their wood waste production (respondents where no waste timber is produced have been excluded)

Most respondents produced both solid timber offcuts and sawdust and shavings. In the sample 73% of the material was offcuts and 27% sawdust and shavings. The offcuts were further divided into clean timber and wood that has been combined with other substances. The categories were:

- untreated softwood and hardwood
- painted timber
- timber treated with preservatives (CCA and creosote), which is classed as hazardous waste
- MDF - widely used in furniture making
- chipboard, oriented strand board, plywood and other wood panels.

The results are summarised in Figure 4.3. 77% of the offcuts were untreated hardwood or softwood. These are easily segregated at source and provide a potentially high quality, pre-dried fuel with low ash content. Wood panels may be made from recycled wood fibre which might include a small percentage of preservative treated timber. Despite the very low potential levels of contamination wood panel offcuts such as e.g. MDF and chipboard which might contain recycled fibre may only be burnt in Waste Incineration Directive compliant equipment (see Section 4.2 for more information). A significant risk of pollution arises if these materials are burned in other equipment.

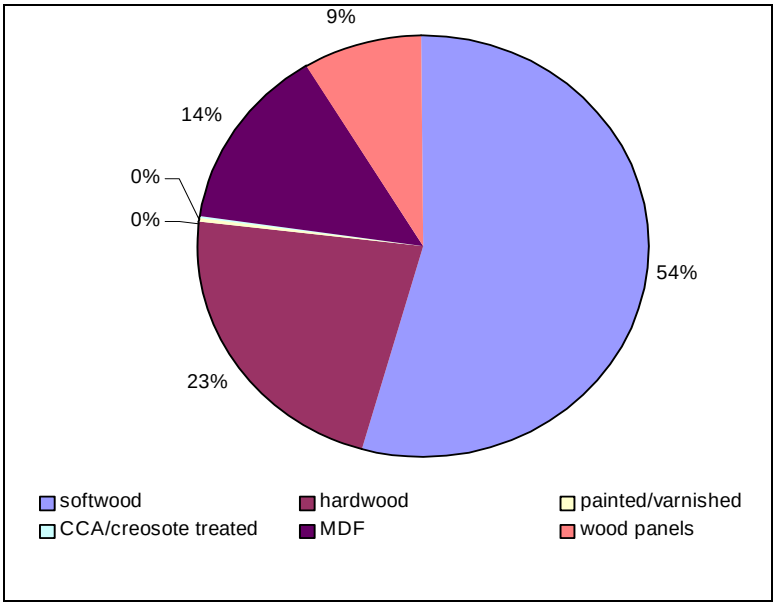


Figure 4.3 Composition of solid wood part of waste wood production in London, excluding anomalous large firm

A similar argument applies to sawdust and shavings from premises where both preservative treated and untreated timber are used. In addition where pellets are made from the sawdust, if this contains glues or other substances it may lead to emissions problems when they are burnt.

90% of waste wood producers in London (32 of 35) pay for waste disposal of at least part of the waste they make, the cost ranging from 3 bottles of wine to £29,000 annually. Rising waste disposal costs provide an incentive for entry into fuel production. The most frequent use for waste wood offcuts is for space heating. Other disposal routes are giving away to customers and other local people, use as animal bedding or in chicken houses, or for incorporation in mushroom compost. A particular problem was reported with hardwood sawdust which is said to be unsuitable for animal bedding.

4.1.3 Potential for use of wood waste as fuel

Unprocessed offcuts

Use of offcuts as fuel without further processing is well established for joinery workshops and similar smaller enterprises. Where used by others they are normally given away. Although a useful disposal route for small quantities of offcuts this does not provide a use for sawdust, shavings or larger quantities of wood waste.

Briquettes

Briquetting sawdust and shavings using moderate pressure is a relatively low cost way of reducing their volume and hence reducing waste collection and disposal costs. It is a practice that has been adopted by several firms in London since the process is a simple addition to current sawdust and shaving collection practices.

Briquettes can be made in a range of shapes and sizes. The most common are 'logs' averaging 5 cm long and around 4 - 5 cm diameter. They can be burnt in wood burning stoves, chimeneas, on open fires (where they are best mixed with normal logs) and in wood boilers designed to burn offcuts. Once alight they tend to disintegrate if disturbed and can collapse and interfere with the air flow through the grate. As the briquettes are very dry (often <10% moisture content) the sawdust 'logs' burn with an intense hot flame which can damage the grate or firebox in some appliances.

The producers contacted as part of this survey reported that it can be difficult to dispose of briquettes as there are no well developed routes to market for them. The number of people locally with suitable combustion equipment is limited. Some briquettes end up in the skip, so opportunities to use them on site are increasingly attractive.

Wood chip

Solid timber offcuts can be chipped using suitable equipment and provide a high quality fuel. However, most firms do not produce enough fuel for their own use and with limited raw material it is hard to justify investment in chippers. Securing markets for limited amounts of chip is difficult for individual firms. Formation of a collective marketing group might overcome this problem. As with direct use of offcuts for fuel this does not provide an outlet for sawdust and shavings. Collection of offcuts for central processing into wood chip fuel is possible but provides only a partial solution for many firms. A collection service which removes all clean wood offcuts, sawdust and shavings, would be more attractive.

Pellets

Pellet production from clean waste wood can use offcuts, sawdust and shavings potentially maximising reduction of waste to landfill. Waste from small companies is normally suitable for pellet production without further drying. Robust systems to avoid contamination of processed material with treated timber offcuts and sawdust are vital. Pellets lend themselves to use on site since pellet stoves are cheaper and easier to install than wood chip boilers.

Pellets are a widely traded, standardised product with well-defined grades. Pellet stoves and boilers are becoming more popular in London so it is likely that there will be a growing market for locally made pellets. A number of schools in London have installed pellet boilers. They are normally sold and delivered directly from producer to user but other intermediaries and distributors are likely to be come more important as the number of smaller installations increases. Sale in pre-packed bags through solid fuel merchants DIY stores and alongside logs and other winter fuels on garage forecourts are particularly appropriate for domestic users.

Equipment is available for small scale pelleting at relatively low cost though this requires more labour input than larger automated systems. Some firms may generate enough waste to supply a small pellet mill by themselves but many will be too small. Three possible strategies for local pellet production are:

1. Using only waste generated on site. This has the advantage that there is the strictest control over the wood that is used to make the pellets with the opportunity to segregate waste at source and eliminate any surface or pressure treated timber. The composition of the wood waste (proportions of hardwood and softwood, moisture content etc.) will also be well known making it easier to produce a consistently high quality pellet. However the minimum quantity of wood

required for economic pellet production is around 135t/yr[12] so this will not help the large number of firms who produce less clean wood waste.

Because of the small scale of the mill the production costs are relatively high. Over 10 years, including cost of machinery it is equivalent to around 3.0p/kWh of pellet energy. Assuming a waste disposal cost of £45 per tonne the avoided cost of disposal reduces the production cost of pellets to 2.0p/kWh, similar to purchased wood chip. However there may be additional costs in segregating clean from contaminated waste wood, though these would vary widely from company to company and have not been considered here.

2. Using wood waste brought in as well as produced on site enables higher production, up to 500t/yr with a larger Farm Feed Systems unit. This requires 1 person to operate and manage production, sales etc and reduces production costs (excluding waste disposal benefits) over 10 years to around 2.4p/kWh.

   Bringing in wood waste increases risk of contamination, so there may be a need to emphasise the need for clean wood waste to those bringing it in and to institute quality control procedures. Feedstock brought in will inevitably be more variable than that produced on site with, for example, varying proportions of softwood and hardwood sawdust. This may lead to inconsistent pellet quality. However feedstock costs will remain low as a free drop for other producers of wood waste could be offered. There may even be scope to charge for disposal of their waste. Taking in waste from third parties will mean that the producer is subject to the waste management and licensing regulations.

   An initial analysis indicates an internal rate of return (IRR) of 10% over 10 years if pellet production at this scale is set up on an existing site and bulk sales of pellets made at £150/tonne. IRR could be increased to almost 25% by bagging and selling pellets to small users locally where a price of £175/t could be expected.

3. A third option is stand-alone production on a separate site. Costs will be greater than for a production unit integrated with a waste producer as site rental and other overheads will have to be paid entirely from pellet production. It is probable that the minimum annual production for viability will be greater than with an integrated site.

   If there are sufficient wood waste producers in an area it may be possible to offer a waste wood collection service at a lower charge than existing general waste companies, giving an additional income stream for the pellet producer.

To illustrate the potential for pellet production in London at different scales an assessment of two production systems is given below.

[12] Using costs and production rates from the Farm Feed Systems 10hp unit.

Case Study: Wood briquette production from joinery waste

A joinery workshop in Croydon producing 2 tonnes of waste shavings and sawdust a week could not dispose of the shavings for animal bedding since they contained a mix of unsuitable hardwood species. Disposal was through use of a 35m^3 hook lift skip collected by a waste management company once a month. The cost was £450 per collection.

The company purchased a briquetting press for the shavings and sawdust primarily to reduce the volume of waste material and reduce disposal costs. It was commissioned in December 2006. The total cost was £12,000 comprising:

Briquetting press	£9,500
Rotary sweep arm in base of shaving collection bin to fill auger for press	£1,000
Electrical work	£500
Installation and commissioning	£1,000

The benefits to the company are:

- savings in waste disposal costs of several hundred pounds a month
- less time require to deal with waste shavings, estimated at an extra 2 hours production each day
- a developing market for the briquettes which are sold bagged to small users for the equivalent of £500/tonne. 1 tonne has been sold so far
- free disposal for briquettes that cannot be sold to a local boiler owner
- sale of larger quantities (40 tonnes) at £100/tonne.

Having made the initial investment in a briquetting press there are new opportunities for the joinery workshop:

- they are considering installing a wood heating system that can use the briquettes
- waste from other companies may be processed as the market expands since there is spare capacity in the briquetting press
- purchase of a slow speed shredder is being evaluated so all offcuts can be processed and briquetted, eliminating disposal of waste wood to landfill.

Briquetting has proved a cost effective solution to rising waste disposal costs for this joinery. Capital costs were modest, much cheaper than establishing a pellet mill. Markets for the briquettes are not well developed but there is potential for use in-house. There is the opportunity to replace fossil fuel use for heating leading to further cost savings.

4.1.4 Small-scale pellet production

Small-scale pellet production could bring significant benefits. Average disposal cost for joinery shop waste reported in the survey was £80/tonne. Pellet production from clean waste timber gives a product worth £120-£150/t in bulk or up to £180/t if packed in small 'carry home' plastic bags.

Farm Feed Systems Ltd. make a range of pelleting machines with capacities of 100 – 250kg of pellets per hour which can be manually fed or used in automated systems. Farm Feed Systems was established in 1999 and developed their wood pelleting machines based on experience in pelleting animal feed and other materials. Their first wood pellet mill was supplied for evaluation to Coed Cymru in Wales in 2004 and the first commercial system was commissioned in Scotland in early 2007. This is a demonstration project which will give insight into the possible use of the equipment in London

For successful pelleting with this equipment it is essential that:

- moisture content is below 16%
- particles for pelleting should pass through a 4 mm sieve, achieved by passing sawdust and shavings through a hammer mill
- a consistent mix of sawdust is provided for pelleting since softwood and hardwoods require different amounts of additives to control the degree of compression. Additives include water, vegetable oils and/or pellet binders. Some softwoods do not need any additives. Variable feedstock for the pellet mill will result in variable pellet quality with soft or very hard pellets produced.

Figure. 4.4 Farm Feed Systems 10HP pellet mill

Figure. 4.5 Farm Feed Systems 25HP pellet mill

The pellet mill is the key stage in the production process but there is additional equipment needed for preparation of the raw material and handling, packing and distribution of the finished product. The estimated investment costs for a 500kg/hr

pelleting plant are summarised. Costs were based on information provided by Farm Feed Systems[13] and Fast Forward Energy[14]. Based in Powys, Fast Forward Energy have installed a Finnish Korte pellet mill of similar capacity to the Farm Feed system and are supplying customers in Wales and as far away as Exeter and Sussex, have provided information on ancillary equipment costs.

Operational experience with the Farm Feed Systems pelleting plant is limited. The first plant was commissioned in Scotland in February 2007 as a demonstration unit[15] under the North Sea BioEnergy Project, led in the UK by Forestry Commission, Scotland. The plant works well with spruce sawdust as a feedstock and trials with hardwood sawdust are scheduled. Vegetable oil is used as a lubricant for the pellets. The plant is simple to operate and works unattended although staff need to be in the vicinity to refill the feed hopper, respond to warning signals and carry out other simple tasks. At the time of writing the plant had not been operated at full stretch, 8 hours a day all week although full-scale continuous production was planned.

Item	Estimated cost (£)
Raw material preparation	
shredder for offcuts	30,000
conveyors x 2	16,000
Pelleting plant	
sawdust/shavings loading hopper	
hammer mill	
transfer auger	
sawdust transfer conveyor	
wood pellet mill and hopper x 2	
wood pellet conveyor	
cooling and storage hopper	106,000
delivery and installation	9,000
commissioning	1,000
staff training	1,500
Packing and distribution	
extractor	5,000
bagging machine	9,000
delivery lorry	10,000
skips x 2	5,000
other equipment	24,000
Total investment	**216,500**

Table 4.2 Estimated investment costs for a 500kg/hr Farm Feed Systems pellet mill

Assuming an average sale price of £162.50/t for finished pellets (bulk and bagged sales) an initial evaluation indicates that the project is financially viable with an internal rate of return of 7.6%. The avoided cost of alternative disposal has not been included and it is assumed that the waste wood is delivered free to the production site.

4.1.5 Medium-scale pellet production

The Biojoule unit

Biojoule has developed a new modular transportable pelleting plant which produces 10,000t/yr of pellets. The first unit was commissioned in spring 2007 with others following

[13] Farm Feed Systems, Foxes Bridge Rd, Forest Vale Industrial Estate, Cinderford GL14 2PH t: 01594 824567
[14] Fast Forward Energy, Unit 1 Mid Wales Yarns, Waterloo Road, Llandrindod Wells, Powys LD1 6BH t: 01597 823835
[15] Contact William Bodles, Highland Birchwoods, Littleburn, Munlochy, Ross-shire IV8 8NN t: 01463 811606

soon afterwards. The aim is to produce pellets competitively from a wide range of raw wood and energy crop materials. It is fully automated and uses advanced drying technology enabling it to economically process biomass with up to 50% moisture content.

The plant is based on a proven Scandinavian pellet mill and has been tested on a range of feedstocks including wood chip from a variety of sources, willow short rotation coppice, straw and miscanthus. Built in pre-wired standard containers, it can be set up on any firm, level site. It consists of a number of modules, each based on a full or half standard size container:

- Generator unit;
- Wood chip fired air heater unit;
- Two wood chip drying units with integral screens designed for a maximum chip size of 50mm;
- Pellet mill unit containing a hammer mill, pellet presses, pellet cooling and dedusting equipment; and
- Finished pellet store holding up to 100 tonnes of pellet.

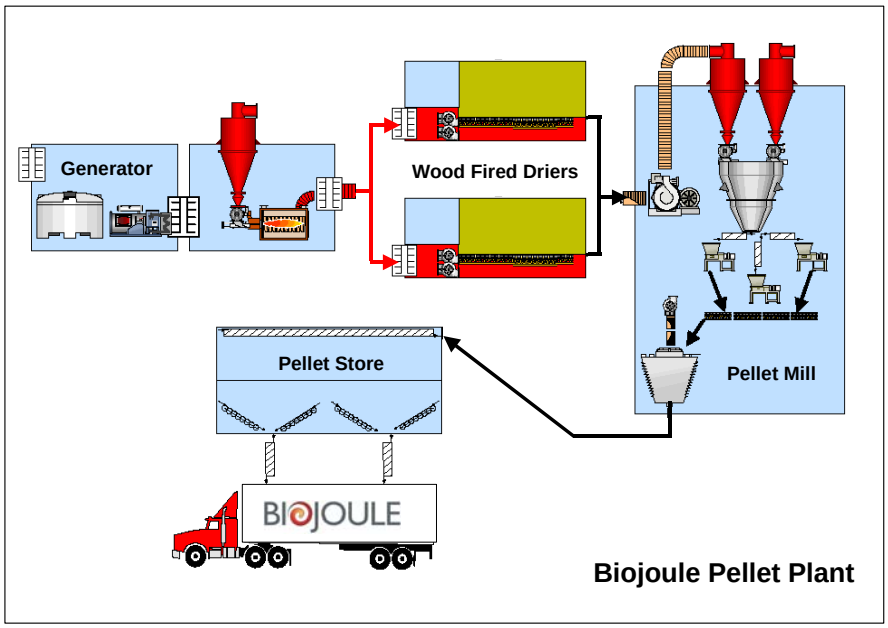


Figure 4.6 The Biojoule pellet production system

Originally conceived with energy crops (willow short rotation coppice and miscanthus) and forestry residues in mind, the Biojoule system is also suitable for other feedstocks. It can handle clean recovered wood and includes a magnetic separator to guard against stray nails. It also includes a heavy particle separator to reduce contamination with soil and grit. With these features it is suitable for making pellets from tree surgery arisings.

The plant can fit into the London wood fuel supply chain. A tree station could take in 20,000 green tonnes of wood chip and logs annually, sufficient to supply a Biojoule pellet plant. For example, at the Croydon TreeStation the current rate of input is equivalent to over 10,000 green tonnes per year with capacity to increase this.

Pellet quality

Pellet quality is now covered by a European Standard - CEN/TS 14961:2005 –"Solid biofuels – Fuel specifications and classes" This classifies pellets according to their size, moisture content, ash content and mechanical durability. Higher moisture pellets will contain less energy, although most will be less than 10% moisture. Higher ash pellets will require

boilers with ash handling systems – usually found on larger boilers. Mechanical durability is very important as this defines how a pellet behaves whilst being handled and fed to the boiler. If the pellet breaks down it can cause dust problems and also poor combustion.

Biojoule pellets are dried to 10% moisture and made to the highest mechanical durability standards. Pellets made using this system from forestry wood chips, or from energy crops that contain some bark, result in up to 1.5% ash. Pellets made from tree surgery arisings are likely to be of a similar classification. Most commercial scale and some domestic boilers can use pellets of this quality, although ash has to be removed more often than with higher grade pellets.

Boilers which can only tolerate up to 0.8% ash will need to use higher cost pellets made from debarked timber or clean sawdust.

Operation of the Biojoule plant
Biojoule is not looking to sell plants – rather it will operate them as joint ventures with on-the-ground business partners who can provide raw feedstock, a site, attendance for filling and occasional cleaning of the site, and security. Biojoule will provide the plant, remotely monitor it and arrange scheduled maintenance. It is looking for partners to expand from their first plant set up in Nottinghamshire.

Biojoule predict that margins from pellet production will exceed those from supplying large wood fuel users such as power stations with chip and this may be an attractive option for a tree station in London since it is a simple addition to wood chip production.

4.1.6 Summary and recommendations

Waste from SMEs is a potential source of up to 140,000t/yr of high quality wood fuel in London. It can be made available as offcuts, briquettes or pellets. Much is now disposed of through the commercial waste system. Where feasible, use for heating where it arises is attractive from a financial and environmental standpoint. Many firms have insufficient arisings to justify installation of specialist boilers. Sawdust and shavings are particularly expensive to dispose of because of their low density and several examples of firms investing in briquetting presses to increase density were found. The briquettes can be burnt in readily available wood fuel stoves.

Collection of arisings to a central processing point could give lower waste disposal costs for participating companies and enable the establishment of small-scale wood pellet production. Pellets have the advantage over briquettes of being a widely traded commodity with an increasing number of domestic pellet stoves and boilers being installed creating a high value local market.

Consideration should be given to:

- Support for a demonstration unit for small scale pellet production
- Publicity about the opportunities to dispose of clean waste wood to larger pellet producers who are now establishing production in or near London
- Assessing the viability of a dedicated waste wood collection service for SMEs linked to pellet production at a central site.
- Including pellet production within the scope of any capital grant scheme for investment in wood fuel production in London. The wood energy business scheme (webs) administered by the forestry commission in Wales provides this sort of support and could have lessons for any scheme developed for London.

4.2 Construction and demolition waste

4.2.1 The Waste Incineration Directive

The 'thermal treatment' which includes combustion, gasification and pyrolysis of solids or liquids that can be defined as waste is governed by the Waste Incineration Directive (WID). The guidance on WID from Defra states that for the purposes of the WID 'waste' has the same meaning as in the EC Waste Framework Directive (WFD), i.e.:

”any substance or object……which the holder discards or intends or is required to discard."

There are, however, a number of specific wastes excluded from the scope of WID:

- vegetable waste from agriculture and forestry
- vegetable waste from the food processing industry (providing the heat generated is recovered)
- fibrous vegetable waste from pulp making (provided this happens on the site of waste generation and the heat generated is recovered)
- wood waste (with the exception of wood waste which has been treated with wood preservatives or coatings)
- cork waste
- radioactive waste
- animal carcasses covered by the animal by-products regulations
- experimental plants that are used for research, demonstration and testing, and also treat less than 50 tonnes of waste per year

Even plants that are excluded from the WID by virtue of the fact that they only treat excluded wastes may still require an Environmental Permit [16]from the local authority or EA or have to register an exemption to the permitting requirements.

4.2.2 Wood waste

This study is interested in wood waste, and here specifically waste that derives from construction and demolition. Defra’s guidance on WID states that:

> “plants treating only wood waste, with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood-preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste, are excluded from the WID. Wood cannot be taken to include paper and card”.

For waste wood to be used as a biomass fuel in a non-WID compliant plant it must be demonstrated that the wood is clean, which is not straightforward. For example some fibreboard production does not use chemicals containing halogens or heavy metals in the manufacturing process. However, if the wood waste used for the manufacture of the fibreboard was already contaminated, then the final product may be also contaminated consequently the exclusion might not be applicable. The glues and resins used in board manufacture may also make it unsuitable for use in non-WID compliant equipment. The onus is on the operator of the wood fuel plant to demonstrate that the wood waste originally used did not arise from treated wood.

Similarly the thermal conversion of treated wood waste, as well as other industrial wastes and co-products, is covered by the WID. It also envisages that wood wastes arising from construction or demolition are likely to have been treated, or have come into contact with

[16] Environmental Permits were introduced on 6th April 2008 and replaced Waste Management Licenses and Pollution Prevention and Control permits with a single combined system.

treated material or mixed with it, and hence covered by the WID. It will be for the operator to demonstrate that this was not the case. This requires a negative to be proved, which is far from straightforward issue.

Conversely even though some untreated wood products, such as wood pallets, may become unintentionally or accidentally contaminated during their normal use with organic chemicals and/or heavy metals the exemption remains. This is because the contamination is not "as a result of treatment with wood preservatives or coating", thus it is assumed that the contamination will be minimal and the resultant effect on emissions levels minimal. Operators wishing to take advantage of this exclusion will have to demonstrate to the regulator that the contamination is accidental and not as a result of a treatment process.

One potential way of reducing the cost of proving that the wood being used was clean would be to have 'certified waste transfer stations' i.e. sorting stations that have wood sorting procedures in place that are shown to be sufficiently robust to supply only clean timber. This would also need to cover reagents that have been sprayed onto the wood. This would shift the onus to demonstrate compliance from the operator to the supplier, and as there are likely to be fewer suppliers this should be easier to regulate and therefore cheaper.

Figure 4.7 C&D waste delivered for processing. Source: Wood Energy Ltd.

4.2.3 Quantities of construction and demolition wood waste

Estimates of the quantity of construction and demolition (C&D) that is generated in London were not found. An assessment has been undertaken for South-East England[17], which estimates that C&D wood waste is approximately 300,000tpa. The most extensive analysis of the quality of the waste wood from C&D suggests that over 75% of the wood, by weight, is untreated[18] as shown in Figure 4.8 This suggests that there is over 200,000 tonnes of clean C&D wood available annually[19].

This study indicates that the majority of softwood, plywood and OSB are all untreated. For plywood the only contaminants are paint and laminate so these can easily be sorted by

[17] WRAP (2005) Wood Recovery Infrastructure in South East England
[18] WRAP (2004) Compositional Assessment of Treated Waste Wood
[19] This study does note that only the softwood and untreated category are likely to be representative of C&D waste generally, but as this is the largest wood category and the area of interest this is sufficient.

eye. For softwood it is more complicated as the main contaminants are CCA (chrome copper arsenate) or other copper treatments, or low pressure treatment with microemulsion which typically includes certain fungicides. Visual identification of these contaminants could be difficult.

Mechanical sorting of treated wood may be possible and techniques to identify wood treated with copper containing preservatives are in development. The techniques developed so far use reagents which change colour when metal containing compounds are encountered. These better suited to labour intensive sorting operations commonly employed in community wood recycling enterprises and may not be appropriate to large scale recycling plants dealing with mixed demolition waste.

The WID makes no distinction between solid timber and panel products – they are all treated as C&D waste. In discussions with the EA it was unclear whether the glue that is used in panel products would mean that they could only be burnt in WID compliant boilers. As the EA treats all C&D waste as homogenous and not exempt from WID they have yet to look into this – so it would need to be investigated further before panel products could be used in wood fuel boilers.

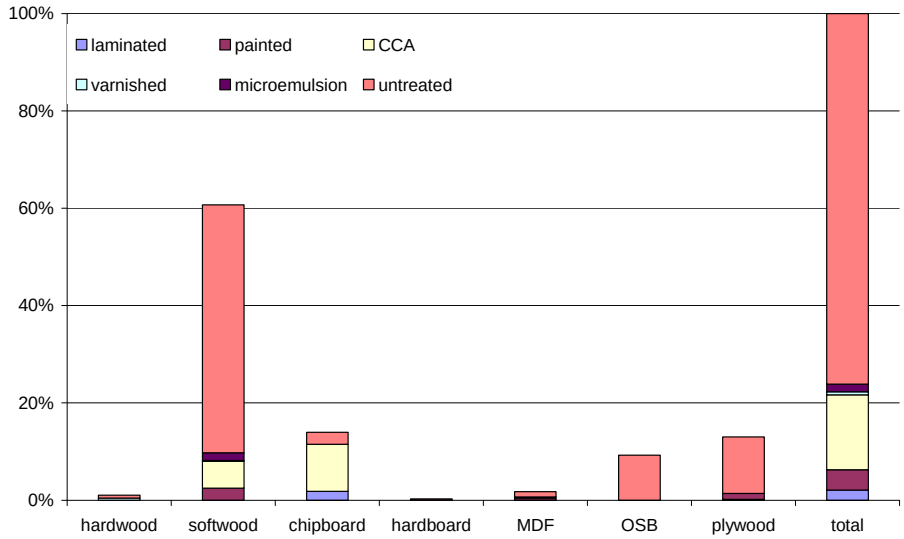


Figure 4.8 Breakdown of treatments to construction and demolition waste wood

Although WRAP's study demonstrates that the majority of C&D wood waste is untreated there are still a number of other issues. There appears to be a growing trend in timber merchants for all rough sawn timber to come treated, even though a large quantity of this will probably be used internally in stud walls. Equally in a demolition job there is little way of identifying what treatments the inhabitants of the houses may have put on any exposed timber.

For this range of reasons the EA would require convincing evidence that there is sufficiently robust source separation to ensure that no contaminated wood was entering the clean waste stream. As it is the plant operators who will need to demonstrate that they are only using clean wood, it appears difficult to see how a supply chain including C&D wood could be viewed as clean. Preliminary discussions with the EA have confirmed this view.

4.2.4 Source separation

Although construction and demolition are generally treated together there are quite significant differences in the barriers to segregation of timber and specifically clean timber.

Construction

On major construction jobs timber is now routinely separated as part of the waste management strategy. This separation at source increases the value of the waste as each component can be recycled separately. All case studies demonstrate that this approach reduces the cost of waste disposal. Generally though all timber is aggregated and the treated and clean timber are mixed together.

All best practice guidance and the DTI's guidance on Site Waste Management Plans[20] suggest that timber should be separated from other waste at source and common practice is to segregate metals, wood and inert material. Introducing extra categories of waste will require careful training of site operatives and on occasions extra labour time. It will however allow recycling for higher grade uses and will therefore increase the revenue generated from recycled materials.
During construction the timber is as yet not mixed with other materials. Hence, the clean and contaminated timber are separate, making source separation relatively straightforward. On the other hand many modern materials come pre-treated, such as tanalised (pressure-treated) softwood, and therefore the quantities of untreated timber maybe quite low. Although WRAP has undertaken an extensive study of the composition of waste wood this is quite a high level study and a more detailed analysis of C&D waste in particular would help understand how best to unlock this source of clean wood fuel. This would help answer questions such as whether construction or demolition is likely to produce the largest quantity of easily accessible clean wood waste.

Demolition

The Demolition Protocol is the accepted best practice procedure in demolition. While this also too advises the segregation of wood, it does not differentiate between clean and contaminated timber. The timber coming out of demolition will vary depending on the age and the state of the building. Generally very old timber (pre 1929) is stronger and of a higher quality than newer timber as it was slow grown. This timber should therefore preferentially be reused rather than recycled or used as fuel.

In older dwellings, the structural timber will be untreated, but with any exposed timber it is possible that it has been treated by the inhabitants making separation difficult.

BRE have used Best Practicable Environmental Option (BPEO) techniques to assess how waste timber should be treated[21]. Their conclusion seems to be that recycling the wood into panel board is more efficient than making fuel. Howeveronce made into panel board and contaminant with glue, it may become harder to use the timber for fuel and if not re-used or recycled the timber may have to be sent to landfill,where it will decompose releasing methane.

4.2.5 Use in WID compliant equipment

An alternative for C&D waste timber is to use it in WID compliant equipment. To date in the UK this is in larger plants, commonly over 20MW_e capacity, drawing timber from a wide catchment area and not well suited to use in local district heating networks or small CHP systems. Now several firms are offering smaller scale WID compliant wood fuelled energy plants, often CHP plants with capacities as low as 500kW_e. These are increasingly

[20]H http://www.constructingexcellence.org.uk/pdf/document/sitewastemanagement.pdf
[21] BRE 2003, Best Practice of timber waste management

being adopted on wood waste sorting facilities and transfer stations where the heat element is often wasted. There is potential for their use in London where full use can be made of the heat element. One example is the WID compliant small-scale (1900kW$_e$) gasification plant installed by ITI Energy Ltd[22] for Caithness Heat and Power. This is designed to use a wide range of feedstocks including all treated timber. This obviates the need for sorting of C&D waste and could also process wood from civic amenity sites that contain a higher proportion of contaminated timber. With an input of around 10,000t/yr of wood this type of plant could be an important element in an energy centre serving a site wide power and hot water system in larger new developments as they reduce emissions towards zero carbon.

In the medium term there are good prospects for WID compliant gasification based CHP plants at smaller scales, starting at 250kWe. This would be appropriate to many new housing or mixed used developments, fitting in with the strategy for decentralised generation and open up a new market sector for use of this waste which is currently difficult to dispose of.

4.2.6 Summary

The current WID makes it very difficult to use construction and demolition waste as fuel in conventional wood boilers, because it is assumed to be contaminated and the onus is on the plant operator to prove that it is clean. As the EA takes a very strict view on incineration and is currently prosecuting some operators for "inappropriate disposal of construction waste", their suggestion was that each piece of timber would need to be verified as being clean. As this would place a near impossible burden on the operator, options for use of C&D waste include:

1. Use C&D waste in WID compliant boilers – which would be prohibitively expensive for building integrated small boilers;
2. Operate a very small experimental plant, using less than 50 tonnes a year, to test the emissions from clean wood sorted from C&D waste;
3. Work with an operator on a working plant, with the EA's consent, to investigate the effectiveness of sorting clean wood from C&D waste and the impact of its use on local air quality.

Currently the WID states that C&D waste is not exempt. Therefore, even if it can be demonstrated that burning C&D waste has minimal impact on emissions this will only mean that the requirements to comply with WID will be less – not that it is exempt. Thus although it may be shown that there is no need for scrubbers, WID compliance will require stringent monitoring and the monitoring equipment is likely to be prohibitively expensive for small boilers.

This suggests that one key area of work will be to work with the EA to see how this large potential source of clean timber can be accessed. The WID has been changed before, pallets have been reclassified as clean timber and therefore exempt from WID, and so it may be possible to get C&D waste reclassified if the correct procedures are in place. To do this there would need to be a body of evidence to support the case for changing the legislation.

At this stage it seems that the most practical approach would be to work with a plant operator who has access to C&D waste, and the EA, to see if a pilot testing project could be established. If it is possible to demonstrate that a sufficiently robust source segregation system can be established so that only clean timber is burnt it may be possible to have

[22]H http://www.iti-energy.com/

this barrier to the use of C&D waste lifted. This would potentially unlock approximately 200,000 tonnes of clean wood fuel in South East England.

4.2.7 Potential partners

BioRegional have been in discussion with two organisations who may be suitable; Powerday and J Murphy and Sons Ltd. Both companies are considering installing wood fuel boilers or CHP units at waste transfer stations and using waste wood as a fuel if possible. As both companies have access to large amounts of C&D waste they would be keen to make use of this as a fuel source – but would use more conventional supplies if this proved impossible.

Both companies were open to acting as case studies for trailing the use of C&D waste – if the cost and monitoring schedule was not to onerous. J Murphy have held discussions with the EA and the steps required of them have been outlined – but as yet they have made no decision on whether they are too burdensome or not. Thus the progress of these two proposals should be monitored and reviewed by London Energy Partnership as these could make a suitable experimental case study if the EA allowed a pilot project using C&D waste to go ahead.

Another option would be to work with reclamation yards. Ashwells is a large timber reclamation yard and they are interested in using any wood that cannot be salvaged as fuel. They are also considering diversifying into this market with a C&D contractor who has 5000tpa wood arisings. Therefore, they too could make a case study if they are able to proceed.

4.3 Existing wood recyclers

4.3.1 Identifying existing wood recyclers

Fourteen existing wood recyclers were identified in and around London. The decision was taken to include recyclers that are situated outside of the M25 as many who operate in the London market are situated outside of the M25 due to land contraints. No wood recyclers were considered that were further than 25 miles away from central London. Of the 14 wood recyclers identified four requested not to be included in the survey. The other ten were based in the places listed in the Table 4.3 below.

Organisation	Location	Approx distrance from central London
1	Barking	6
2	Luton, Bedfordshire	20
3	Nazing, Essex	16
4	Buntingford, Herts.	24
5	Enfield	9
6	St Albans, Herts.	20
7	Ascot, Berks.	25
8	Crawley, West Sussex	30
9	Bedford*	57
10	Reigate, Surrey	22

*Head office in Bedford, production facilities closer to London

Table 4.3 Location and distance from London of wood recyclers

4.3.2 Wood Recyclers Survey

The 10 participating wood recyclers (see table 4.4) were surveyed to understand the following about their businesses:

- Current markets
- Willingness to supply wood chip to fuel market in London
- Quantity of wood fuel available
- Quality of wood fuel available
- Infrastructure (storage and delivery)

Willingness to supply small – medium heat market

There was an overwhelmingly positive response from the organisations contacted with the majority being keen or very keen to supply wood chip into the emerging heating market in London. Only one stated that they were not interested and this was due to struggling to keep up with existing demand.

Existing Markets

There were a wide range of existing markets for wood chip from wood recyclers. The predominant market was Slough Heat & Power with 5 of the 8 organisations that responded to our survey supplying to this market. Other markets included animal bedding, particle board manufacture, export, tracks and landfill.

Quantity

The amount of waste wood processed by the organisations who participated in the survey ranged from 500 – 75,000 tonnes per year. Of the 7 organisations that we received information from on quantities, the average is 28,000 tonnes per year and combined they process in excess of 200,000 tonnes of wood chip for various markets.
Of this processed total only a proportion is suitable for the wood fuel market. The organisations contacted were asked how much of their wood chip would be suitable for small – medium scale heating plant i.e. no treated material, MDF, hardboard, laminates etc. The responses were uncertain but suggested between 40% - 50% of the total could be separated out and used as fuel.

Quality

Only one organisation received purely uncontaminated wood from packaging and pallet wastes, the remaining organisations contacted receive their wood from multiple sources. These include construction and demolition, civic amenity sites, skips, packaging and pallet wastes. All said that they receive these in mixed loads but all stated that they could separate contaminated from uncontaminated feedstock on site before chipping, and all have bays that could be used to separate contaminated from non-contaminated feedstock and chip.

All but one organisation chip and store the wood on concrete. Of those that own and operate their own chipper all but one had two magnets, only one had three. Only one was fitted with an eddy current separator (for removing non-ferrous metals) and over half has separate screens. All stated that they are capable of producing a range of chip sizes.

Infrastructure

All of the organisations contacted can deliver wood chip. Half of these only have articulated walking floor lorries the other half have a full range of vehicles from 4 axel tippers to hook-lift bins and articulated walking floor lorries. All have capacity to store wood chip in their yards.

	Market	Willing-ness	Quantity		Quality of wood fuel									Infrastructure		
ORGANISATION	Current Markets	How interested are you in supply	Total wood turnover (t/yr)	Separated wood turnover	Source of wood	Is incoming timber mixed	Can you separate	Do you chip on hardstanding	Do you operate own chipper / shredder	How many magnets does it have	Does it have eddy current separator	Does it have separate screen	Chip Spec <80mm	Bays for separation of chip	Can you deliver	Type of delivery vehicles
1	Export		15K	>50%	All	Y	Y	Y	Y	2	N	Soon	Y	Y	Y	WF
2	LF	V Keen	5K	>50%	All	Y	Y	Y	N/A					Y	Y	All
3	Export, SL	Interested	50K	40%	All	Y	Y	N	Y	2	Y	Y	Y	Y	Y	All
4	SL, Other	V Keen	40K	40%	All	Y	Y	Y	Y	3	N	N	Y	Y	Y	WF
5	SL,PB, AB	V Keen	75K	>50%	All	Y	Y	Y	Y	2	N	Y	Y	Y	Y	WF
6	SL	V Keen	0.5K	100%	P+P	N	Y	Y	Y	2	N	N	Y	Y	Y	WF
7	SL	Not interested			All	Y	Y	Y	Y	2	N	Y		Y	Y	All
8		No response														
9		No response														
10	LF	Keen	15K	40%	All	Y	Y	Y	Y	2	N	Y	Y	Y	Y	All

Abbreviations: LF – landfill; SL – Slough Heat and Power; PB – particle board; AB – animal bedding; WF – walking floor trailer.

Table 4.4 Potential for and interest in fuel production from wood recyclers

Potential wood fuel production

An estimated 285,000 tonnes of wood is processed annually by the 10 wood recyclers identified within 25 miles of central London. A large proportion of this is already being produced as wood fuel for Slough Heat and Power. Redirecting this to the London heating and small CHP market would reduce transport distances, increase returns to the recyclers and provide a lower cost fuel to the London end user. The cleanliness and particle size of this material is a critical issue as the standards for supplying to small-medium scale heating and CHP plant are much higher than those required by existing users of this material. Slough Heat and Power already has access to alternative supplies of wood chip and is committed to developing local supplies of short rotation coppice so would not be disadvantaged by increased use of recycled chip in London.

Only one recycler currently takes in only untreated wood for processing the remainder take in both treated and untreated wood. Although all of the organisations contacted stated they can separate the wood prior to chipping and can store this wood chip in designated storage areas, levels of separation and cross contamination are uncertain and need to be investigated further. However, from the survey an estimated 114,000 – 142,500 tonnes of untreated wood chip could be available for the heating market per year providing separation is conducted in a satisfactory manner.

All the chippers have at least two magnets which are likely to remove satisfactory levels of ferrous metals from the wood chip. Only one chipper identified is fitted with an eddy current separator which suggest some level of non-ferrous metals are likely to remain in the vast majority of the wood chip produced. It is however important to note that non-ferrous metals are far less prevalent in wood suitable for fuel than ferrous metals which will be removed by normal magnets. All but one organisation contacted process wood on concrete so contamination with soil or other particulates will be limited to those already contained within the feedstock.

The particle size of the wood chip produced from chipping recycled wood is dependent on the quality of the machinery being used, screens and operator practices such as double passing and maintenance of cutting blades. A wide range of machinery is being used to produce wood chip by those organisations surveyed.

From the information we have it appears that they are all capable of producing a range of size specifications from G50 – G150. This particle size range will enable these organisations to service the majority of boilers. It is doubtful that G30 size specification (essential for the smaller boilers) could be produced without generating high levels of fines in the wood chip that would exceed industry standards and cause operational problems in the boilers.

4.3.3 Training needs

A clear understanding by the wood recycling sector of the industry standards for wood chip fuel, the Waste Incineration Directive and Environmental Permitting are essential to understanding and unlocking this fuel resource.

Currently this sector is supplying large quantities of fuel to large scale CHP (Slough Heat and Power) but has very little understanding of the small to medium scale heat/CHP technology and the comparatively tight fuel specifications needed to service this market. Without this knowledge estimates on feasible quantities of uncontaminated wood that could be made available for the heating market and ability to service this market successfully in the medium term are limited.

Wood fuel supply organisations near to London such as South East Wood Fuels Ltd are already running training programmes for wood chip producers from the forestry industry. These programmes could easily be adapted to focus on wood chip from the waste wood

industry. For this we view the following issues to be essential components of any training programme aimed at this sector:

- Wood chip Boiler Technology – Storage, feed systems, moisture and particle size parameters
- Industry Standards for wood chip fuel – contamination, particle size, moisture content
- Monitoring and practical assessment of wood chip samples
- Waste Incineration Directive
- Production methods – quality control, storage
- Air quality – impacts of fuel type, moisture content and contamination
- Logistics: route planning and vehicles types[23]
- Waste wood re-use and recycling opportunities

4.3.4 Other recommendations

The involvement of the waste wood sector in meeting the medium-term fuel demands in Greater London is essential due to its ability to supply wood chip at <30% moisture content at short notice. It is likely that this resource will need to be tapped quickly to avoid supply disruptions at the beginning of projects where moisture content of the fuel has been specified at <30% because wood chip from arboricultural arisings will not be able to meet this moisture without substantial investment in drying facilities. For forestry derived chip a drying period of 9 – 12 months is needed to reach <30% moisture content so this sector cannot respond very quickly to increased demand.

To promote the production of clean wood fuel from recycled wood it is suggested that the following recommendations be pursued:

- The LDA set aside funding for the development of a training programme and subsequent training days aimed at wood recyclers in line with the training needs highlighted above.
- Further research should be conducted into levels and nature of wood waste being processed by wood recyclers to ascertain levels and types of contamination. This should be conducted in conjunction with the following recommendation:
- A wood recycling site/organisation is chosen to act as a demonstration supplier of wood chip to Greater London with guidance and support from a relevant body to develop best practice in the sector for feedstock separation, contamination reduction and the production of wood chip to specified particle sizes.
- Research into determining which waste wood materials are more suitable for re-use and recycling depending on the level of contamination

4.4 Tree surgeons

Tree surgery is one of the largest potential sources of wood chip in London and has advantages over other types of waste timber:

- It is regarded as clean virgin timber and so is not subject to the same regulatory regime as some other wood fuel sources
- Tree surgery arisings are normally chipped rather than shredded giving a better quality product for use in small boilers
- Many tree surgeons pay for disposal and would welcome an alternative to disposal at waste transfer stations, even if this is not free but at reduced cost.

However, there are some drawbacks to use of arboricultural arisings:

[23] See the London Freight Plan for more detail. (http://www.tfl.gov.uk/businessandpartners/freight/1292.aspx)

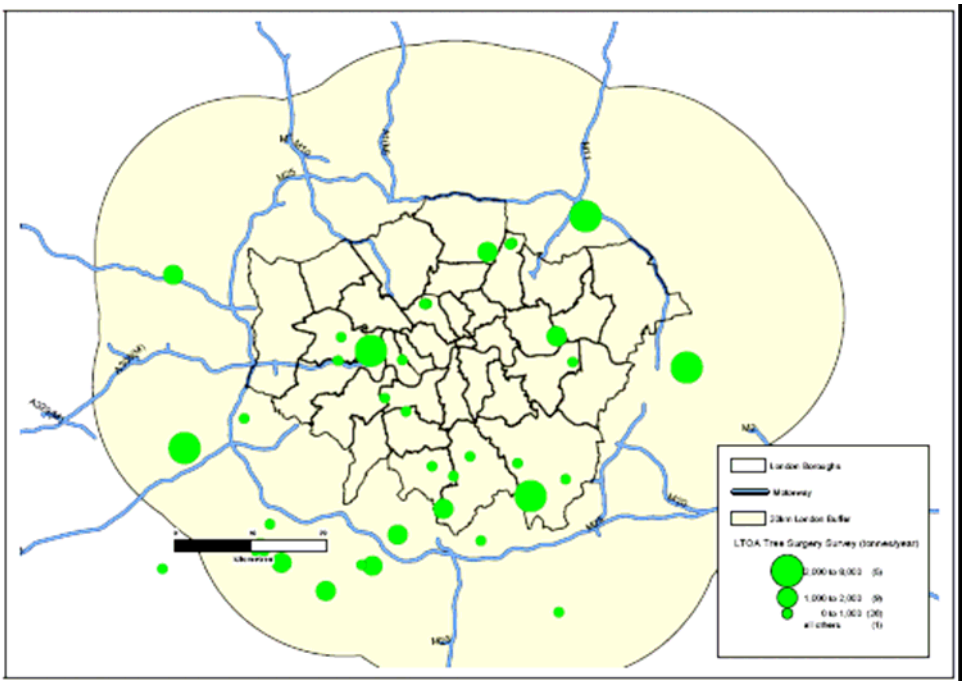
- Large logs are frequently encountered requiring large machinery to effectively chip them. In turn, for best value, large machinery requires higher throughput on a single site, or possibly sharing of machinery between several sites
- Logs from urban trees are more likely to be contaminated with metal and other debris than woodland derived material leading to higher maintenance and repair costs
- The moisture content of arboricultural arisings is high with logs and chip being delivered immediately after cutting at around 45-50% (wet basis). This is too high for smaller boilers with underfed hearths but suitable for larger boilers (over around 300kW capacity) fitted with step grate fuel feed systems. Many of these larger boilers are planned for London.
- The inclusion of leaves and twigs in the material chipped on site by tree surgeons increases the amount of ash resulting when burned. It also increases the proportion of fine material in the wood chip. This can make the chip unsuitable for use in some boilers unless it is screened prior to use.

Figure 4.9 Typical arboricultural arisings

4.4.1 Tree surgeon survey

BioRegional and the London Tree Officers' Association surveyed the capital's tree surgeons in July 2005[24]. This estimated annual production of arboricultural arisings at a minimum of 127,000 tonnes a year. As the survey covered only tree surgeons this is a minimum estimate. Landscape contractors and others also carry out tree work and produce woody arisings that can be used for fuel production.

[24] Tolfts A, 2006, *Biomass Assessment for the Z-squared combined heat and power plant,* BioRegional

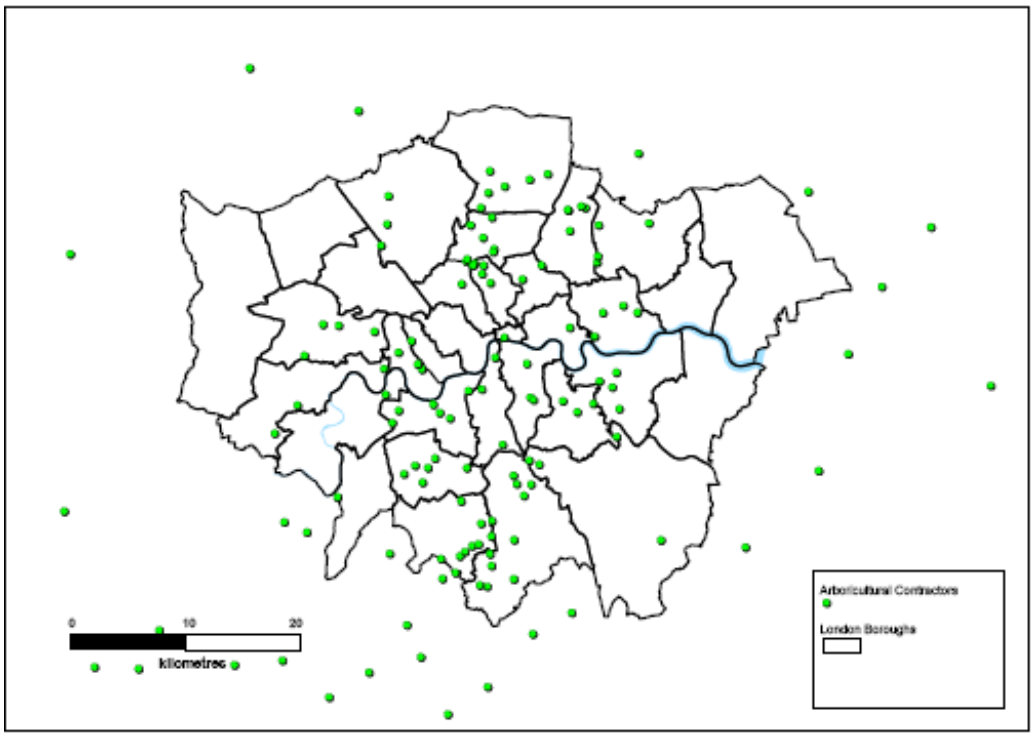


Source: SEA/RENUE *et al*, 2006 *Feasibility study into the Potential for Non-building Integrated Wind and Biomass Plants in London,* LEP

Figure 4.10 Location of arboricultural arisings by disposal site and tonnage

The survey questionnaire included questions about where tree surgeons worked and their disposal points. This information has been used to produce maps showing the location of yard and tipping points for the 36 tree surgeons who responded to the survey shown in Figure 4.10 and location of the 162 tree surgeons surveyed, see Figure 4.11. This does not show a strong concentration of tree surgeons in particular areas so gives freedom in the location of new wood chip production units. There is a slight clustering of tree surgeons in North London centred around Camden, Islington, Haringey and Enfield and a less clear concentration from Wandsworth through to Croydon in South London.

A significant number of firms reported taking arboricultural arisings out of London for lower cost disposal since larger, cheaper yards were available and informal disposal on farmland could be arranged. Several firms adopting this strategy are located to the south west of London.



Source: SEA/RENUE *et al*, 2006 *Feasibility study into the Potential for Non-building Integrated Wind and Biomass Plants in London,* LEP

Figure 4.11 Location of Tree Surgeons in London

Table 4.5 summarises disposal costs quoted by respondents (further details are in Appendix B). The average cost per tonne, £38.00, reflects the level of charges at waste transfer stations and is expected to rise further as landfill tax escalates. It highlights the opportunity to establish fuel production from tree waste facilities which reduce disposal costs to tree surgeons and are cost effective for boiler users.

Total tipping charges reported (£/year)		95,747
Average annual tipping charges (15 replies)		6,383
Total material disposed (tonnes/year)		22,997
Average material disposed (tonnes/yr, 30 replies)		767
Pay for disposal?	Yes	15
	No	15
	Sometimes	4
Average tipping cost (£/tonne) where charges paid (19 replies)		38.00

Table 4.5 Summary of Contractors Estimates of Disposal Costs and Volumes

As part of the follow up to the survey a number of tree surgeons were contacted in February 2007 to discuss their interest and ability to become involved in a wood fuel supply chain. The general comments were:

1. The tree surgeons were enthusiastic as there would be a real potential to reduce their disposal costs by taking their waste to a tree station.
2. All tree surgeons seemed confident that they would be able to produce fuel grade chip that could be used in small wood fuel boilers.
3. The main barrier to tree surgeons establishing their own tree station was land availability.

4. There was interest in diversification of business to establish a local tree station, especially in the north (Enfield, Waltham Forest) and south (Bromley), areas where there are a large number of tree surgeons.
5. Tree surgeons know each other and work together through established networks when necessary.

4.4.2 Potential for wood fuel production

The tree station at Croydon was set up by a partnership of BioRegional Development Group, Croydon Council and City Suburban Tree Surgeons Ltd. It was designed in the first place to supply just 1100 tonnes of chip annually to the CHP unit at the BedZED ecovillage. Unfortunately technical problems meant that this was never fully commissioned and only 1 load of chip was delivered.

However, the presence of a supply point gave confidence to local developers to specify wood chip boilers for new projects resulting in at least 9 projects being initiated in the borough by March 2007 with an planned capacity of over 3MW. Until these are installed the market for the Croydon chip is at large biomass CHP plants at Slough and Shotton in north Wales. This has allowed production capacity to increase to over 10,000t/yr. This level of throughput means that almost every piece of equipment on site has had to be upgraded to give a site that has been seen as a model for others in London.

Figure 4.12 Processing arboricultural arisings. Source: Andy Aitcheson

The principal lessons learnt from developing the Croydon TreeStation are:

- Tree surgery waste contains difficult to process, often large logs that need large scale, robust equipment to process them
- Large scale equipment must be matched with high throughput if the site is to be cost effective. The minimum viable size with this equipment is 15,000 t/yr
- The investment required is substantial. The costs at Croydon were over £200,000 even using second hand equipment. Updated cost estimates are given in Table 4.6 below. This covers only the investment at the tree station. Additional investment, for example in delivery vehicles, may be required. Alternative choices are always available, particularly for items like the chipper and costs can be cut if, for example, a storage shed and existing concrete hardstanding are available. Gravel

hardstanding should be avoided, as wood chip fuel must not be contaminated by stones and grit.

- At the scale of operation envisaged and with current chip prices second hand equipment is likely to be more cost effective in the initial stages. Items such as specialist chippers can often be found at significantly lower price on the continent where the wood fuel supply industry is better developed.
- To reduce the initial investment equipment and labour should be shared where possible, for example loading shovels and weighbridges.
- Setting up a tree station works particularly well if it is a diversification from an existing business such as tree surgery or composting.
- Careful site selection can reduce initial investment. If possible choose a site with covered storage and plenty of external storage area for drying logs and wood chip. Co-location with a waste transfer station or composting site will ensure that many features such as good access for road transport are in place.
- A supportive and engaged local authority is very useful since they often have suitable sites for a tree station available and can provide a secure market for chip by specifying wood chip boilers for their own buildings. Doing this the local authority reduces their fuel costs and has a 'green' disposal route for their own tree waste
- For long term viability it is essential to develop the higher value local market for wood chip as fuel. Supplying bulk users may pay for running costs but is unlikely to make a satisfactory return on investment.

Element	Cost (£)
wood chip store	40,000
concrete hardstanding	15,000
Utilities:	
3 phase power installation	6,000
mains water or rainwater collection	5,000
Total built infrastructure	*66,000*
log splitter	6,500
*tractor with crane for log splitter	19,000
*chipper	75,000
*tractor to use with chipper and trailer	20,000
*excavator for loading chipper	10,000
*trailer for chip around site	5,000
*loader with large bucket (telehandler)	10,000
bunded fuel storage	3,500
*chip screen and associated conveyors	17,500
Total equipment	*166,500*
Total capital cost	*232,500*

*bought second hand

Table 4.6 Capital costs to set up wood chip production from arboricultural arisings at Croydon in 2005.

To supply small boilers the chip will have to be made to G30 grade[25] at 30% moisture content or below. G30 grade can be achieved by using appropriate chippers for log wood

[25] See Appendix C – Wood fuel specifications for details of the grading system.

and screening of material received already chipped. Drying chip from fresh (45% mc) to under 30% mc is possible using low cost passive techniques – either storage in a well ventilated covered area or in windrows under a geotextile that prevents rain ingress while allowing water vapour to escape. The key resource for chip drying is space and time since it takes at least 10 weeks for a chip windrow to dry below 30%. The Croydon site is 0.85ha, too small for large scale passive chip drying.

A tree station could also be the basis of urban pellet production using medium scale equipment such as the Biojoule plant which is described in more detail in Section 4.1.5.

The most important lesson learned at Croydon is that it is essential to supply chip that consistently meets the specification of the user for both particle size distribution and moisture content.

Potential locations and partners for a further 5 tree stations have been identified in Section 5.3 together with recommendations for support measures for these. New tree stations would provide disposal sites for arboricultural arisings in all parts of London. For Croydon there is a developing system of smaller satellite sites in neighbouring boroughs where local tree surgeons bring their waste. This is then transhipped to the Croydon TreeStation in 35m^3 hook lift bins. This gives a local disposal point for more tree surgeons and minimises the distance travelled by smaller vehicles, reducing overall environmental impact.

5 Site selection for wood fuel production

The initial aim of this study was to collate the demand and supply data and identify any obvious clusters as these would make ideal locations for the setting up of wood fuel production sites. The quality of both the supply and demand data that is available is insufficiently accurate to enable identification of such clusters, but indicates that both supply and demand are spread relatively evenly across London. Table 5.1 summarises the estimates of potential and currently available wood from within London which could be used as fuel.

Source	Potential resource (tonnes/yr)	Likely moisture content	Current availability (tonnes/yr)	Comments
SMEs	140,000	15%	Very low, some used for on-site heat	75% sawdust and shavings suitable for pellet production
Construction & demolition	200,000	<20%	Nil, requires WID compliant boilers	75% clean timber but regarded as contaminated, needs WID compliant equipment
Civic amenity site	32,000	<20%	Nil, requires WID compliant boilers. Gasification based CHP systems show promise	May already go to wood recyclers. High levels of contamination
Wood recyclers	114,000 – 142,500	20%	Trials indicate that a fuel chip approaching G50 specification can be made using current equipment	Many recyclers supply Slough Heat and Power. Need to change production practices to meet specifications for small boilers
Woodlands	150,000	30-45%	Uncertain, can respond quickly to increased demand	Woods around London included.
Tree surgery	130,000	45%	10,000	Much more low quality chip now sold to Slough Heat and Power

Table 5.1 Summary of wood fuel availability from resources in London

5.1 Demand and supply

5.1.1 Demand distribution

In Section 3 the probable demand has been estimated for the immediate future, that is planning applications that have already been installed; and the near future, those that are being prepared and discussed. This data has been summarised in Figure 3.1. This shows a fairly uniform distribution of wood fuel users throughout London. There are areas of

concentration and absence due to the positive or negative policies that certain councils have to wood fuel, but broadly there is an even distribution reflecting the capital wide policy for renewable energy generation in larger developments.

In addition to wood fuel demand generated by individual developments at a small scale there are major centres of regeneration which would have a significant effect on the distribution of demand for wood fuel in London if it is enthusiastically adopted as an energy source. Likely major new centres of wood fuel use are discussed briefly below.

The Olympics

The regeneration of a large part of East London associated with the 2012 Olympics is on a scale not seen since the 1960s and 70s. The commitment to an enduring legacy and environmental best practice goes beyond that seen at previous Olympics. Wood energy is part of the strategy to deliver low carbon renewable energy.

The *Trees and Woodlands Partnership Vision for the 2012 Games* launched on 14 March 2007 states as one of its ten points that "We believe that London 2012 should consider creating within the Olympic Park an exemplar of renewable energy using biomass generated from the site itself and the surrounding London region". Similarly, the Olympic Development Authority's Sustainable Development Strategy[26] contains a commitment to use new renewable energy infrastructure to provide 20 per cent of Olympic Park and Village energy demand in the immediate post-Games period.

In addition to wind power, current plans include biomass boilers using wood fuel for heat at the northern energy centre. One 3MW boiler is planned before 2012 and a second 3MW boiler before 2020 as heat demand from the legacy developments increases[27]. Small-scale wood fuelled CHP and CCHP have been considered and rejected since the technology is not regarded as being sufficiently mature. It is proposed that the majority of the 120MW energy demand will be supplied through gas CCHP.

This approach is pragmatic, limiting risk but also limiting the potential reduction in CO_2 emissions which could be achieved. Wood fuelled CHP/CCHP systems would have allowed a further significant CO_2 saving but would also have required a larger area on site and would increase lorry movements. The lack of a well developed wood fuel supply chain also discouraged adoption of a larger wood fuelled system and Elyo Suez who will build and operate the energy centres plan to source wood from an associated waste management company. Alternative potential supplies and production sites for wood chip well positioned to supply the Olympic Park and Village were identified in the preparation of this report.

The Thames Gateway

The Thames Gateway, which includes the Olympics site, will see 160,000 new homes built[28]. The majority will be in or very near to London and all might potentially impact on wood fuel supplies for the capital. Figure 5.1 indicates that by late 2007 over 75,000 homes were planned for London before 2016. The total number may in the end approach 100,000. The potential demand for wood fuel from these new developments is considerable but as yet unquantified. It could reach 50,000 or 60,000 tonnes annually whilst remaining a minor component of the overall energy mix.

[26] Hhttp://www.strategicforum.org.uk/pdf/ODASDSfullpolicy.pdf
[27] Information provided by London 2012 and Buro Happold
[28] November 2007, *The Thames Gateway Delivery Plan*, Department of Communities and Local Government. http://www.communities.gov.uk/publications/thamesgateway/deliveryplan

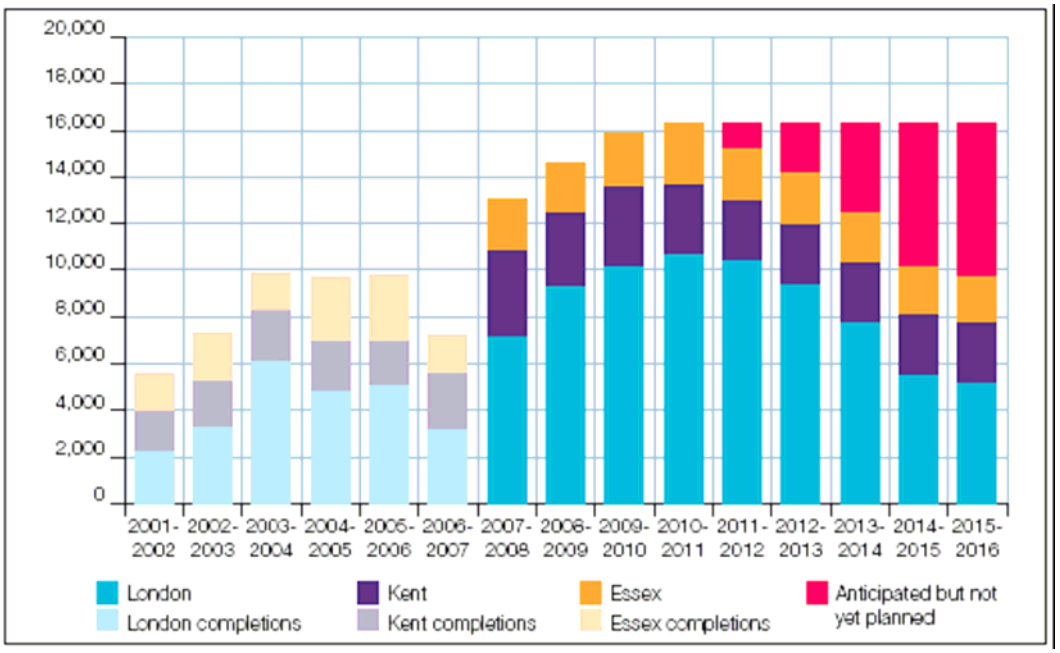


Figure 5.1 Completed and planned dwelling numbers for the Thames Gateway 2001-2016 source: Thames Gateway Delivery Plan (November 2007)

Demand from the associated commercial and industrial developments will add further to wood fuel requirements. 55,500 homes and associated infrastructure will also be built in the south Essex and north Kent Thames Gateway areas increasing local wood fuel demand and reducing the surplus available from these areas for London. Maximising use of local resources is essential and consideration may have to be given to using facilities on the river for import of wood fuels.

The Thames Gateway Delivery Plan sets out a vision for the area as an 'eco-region' and a 3 year programme to facilitate its development. In this a sum of £2 million is set aside for 'eco-assessments' of ten major housing developments aiming to ensure that environmental impacts of the projects are minimised right from the start of the design process. Energy efficiency is included in the eco-assessment. Elsewhere the Delivery Plan refers to the inclusion of district heating and cooling networks and use of low carbon and renewable energy. There is no specific reference to biomass or wood fuel although these could obviously make a contribution to achieving a low carbon energy supply. The Thames Gateway might have a disproportionate impact on wood fuel demand compared to other parts of the city as it is easier to include wood fuel boilers and CHP in new build than retrofit them in existing buildings.

Retrofit by large energy users

Large existing mostly industrial energy users with on-site generation based on fossil fuels can adopt wood for CHP or heating at medium to large scale. If existing equipment is replaced planning permission may not be necessary. At a scale of 10MW or more projects such as these will provide a market opportunity for wood chip producers across a large part of London and in nearby counties as well as imported biomass.

Any of the developments noted above will influence the local supply of wood chip. However, they are distributed across London so a wood chip production facility anywhere in Greater London will have one or two large users within delivery range as well as an increasing number of smaller (under 1 MW) wood chip or pellet boilers. Therefore, the governing factor in site selection for wood fuel production is not the location of users but rather the availability of suitable premises and raw material.

5.1.2 Supply side factors

Wood fuel supply can be viewed as occurring in two modes. Firstly the background quantity of wood that is available throughout London due to street trees, small parks, small joinery operations and pallets and packaging discarded by local businesses. Secondly more concentrated sources of wood from the large parks, existing wood recyclers, waste transfer stations and landfill sites and any concentrations of wood processing firms.

Wood fuel should obviously be sourced as locally as possible to minimise transport, but a lorry undertaking a 200km round trip with 25 tonnes of wood chip at 30% moisture content only expends approximately 0.9% of the energy contained in the wood in transportation[29]. Thus although there are concentrations of supply these can be made available throughout London without significant transport related CO_2 penalties. However, there are a range of other reasons including noise, other transport emissions and congestion favouring sourcing wood fuel as locally as possible.

5.2 New wood fuel production sites

New wood fuel production facilities will be needed for wood from all sources found in London if the supply is to keep pace with predicted growth in demand. Demand will be met in part by wood fuel imported into London from the surrounding counties or even further afield, particularly in the case of pellets.

Each source of wood fuel needs different processing methods, has different existing infrastructure and requires more or less support to increase the quantity and quality of wood fuel from it. Each source is considered below with most detail given for arboricultural arisings since:

- They are a significant unused resource, estimated to be a minimum of 50,000 tonnes per annum
- The potential for wood fuel production at commercial scale has been demonstrated at the Croydon TreeStation
- Little infrastructure is in place for processing arboricultural arisings in contrast to other sources of clean wood such as pallets and packaging or woodland waste.

5.2.1 Waste wood from small and medium enterprises

Much waste wood from SMEs is in the form of sawdust and shavings and at the moment a high proportion enters the commercial waste collection system. It is also almost all dry, below 15% moisture content. Provided it is uncontaminated it can be used for pellet or briquette production.

Reduction in waste disposal costs and in some cases creation of a new revenue stream should be sufficient to prompt investment in this sector either by the SMEs themselves or by others setting up larger scale standalone pellet production units. To facilitate this it is recommended that:

- Information about the options for wood fuel production from this waste should be made available to owners of SME waste wood producers to encourage them to enter production and use
- Support for marketing of the products be considered to make wood pellet or briquette users aware of new sources of supply.

[29] Energy content of wood chip 25t x 12.71GJ/t = 317.75 GJ; Lorry using 40l/100km diesel for 200km, 36.4MJ/l uses 80 x 36.4 = 2912MJ or 2.912GJ. That is 0.91% of energy in the wood chip.

5.2.2 Pallets and packaging waste

Many pallets and wooden packing cases are collected by wood recyclers but a significant proportion enter the general waste stream and are not recycled. Current markets for clean recycled pallet chip are at chipboard and fibreboard mills and large users of wood fuel such as Slough Heat and Power. As demand for wood chip at higher prices for smaller boilers increases there will be scope for increasing supply by lowering the gate fee charged to those disposing of clean waste wood.

Provided that wood fuel prices in London continue to reflect fossil fuel (natural gas) prices, the use of pallets and wooden packaging for fuel can be increased by expansion of capacity at existing wood recyclers; construction of new pellet production facilities; and direct chipping for use on site where large amounts of pallets are found. These actions are starting to happen. For example, 3 new small pellet producers have started production over the last 3 years. All 3 have plans for rapid expansion of production. Actions needed to support increased diversion of this waste stream to fuel production are:

- Publicity and information dissemination about the use of pallets for fuel and the market opportunity for new or expanded production
- Training for wood fuel producers to ensure that quality standards are met by those entering the fuel market.

With 14 specialist wood recyclers and several large general waste companies in or near London new processing sites are not required for the further development of this aspect of the wood fuel supply chain.

5.2.3 Construction and demolition waste

As noted in Section 4.2 around three quarters of C&D waste is clean and so theoretically suitable for use as fuel in non-WID compliant boilers. However guidance to the WID makes it clear that it will be very difficult to satisfactorily demonstrate that the wood sorted from the C&D waste is in fact clean.

Until robust systems of segregation are developed and changes in the guidance to the WID are agreed C&D wood chip can only be used in WID compliant equipment. Deployment of such equipment should be supported. Such installations will most likely be large, non-building integrated plants whose size will allow cost effective pollution control and monitoring.

Three such sites were identified by the LEP's 2006 *Wind and Biomass Study*[30] which identified mixed waste wood as a potential fuel. Development of these and similar sites should be supported to enable full use of local wood fuel resources even before robust segregation procedures for segregation of clean from contaminated wood are developed and approved.

5.2.4 Waste from civic amenity sites

Waste wood from civic amenity sites contains a lower proportion of clean wood (14%) than timber from C&D sites (76%)[31]. Even if it were possible to sort clean from contaminated timber it is unlikely to prove economic. Like C&D waste it will have to be burnt in WID compliant equipment. Not all of the 38 civic amenity sites [32]have separate bins for waste wood but they are available at an increasing number of them. Consequently an increasing

[30]SEA/RENUE *et al*, 2006, *Feasibility study into the Potential for Non-building Integrated Wind and Biomass Plants in London*, LEP
[31] Seabrook G and Bridgewater E, 2004, *Compositional assessment of treated waste wood*, WRAP
[32] seeH http://www.wrwa.gov.uk/files/various/London_CA_Site_Map.pdf

quantity of timber is available reinforcing the need to support development of WID compliant plants.

5.2.5 Existing wood recyclers

Existing wood recyclers have the infrastructure in place to produce wood chip fuel and are keen to enter the market with chip for both WID compliant and non-WID compliant boilers and CHP plant. This is an important market opportunity for them which may offer greater returns than from their current markets of board manufacturers and large wood fuel users.

The main need of wood recyclers is training to ensure that the fuel specification and quality needs of the small scale wood fuel user are understood. Support to organisations providing this training should be considered.

5.2.6 Wood fuel from woodlands

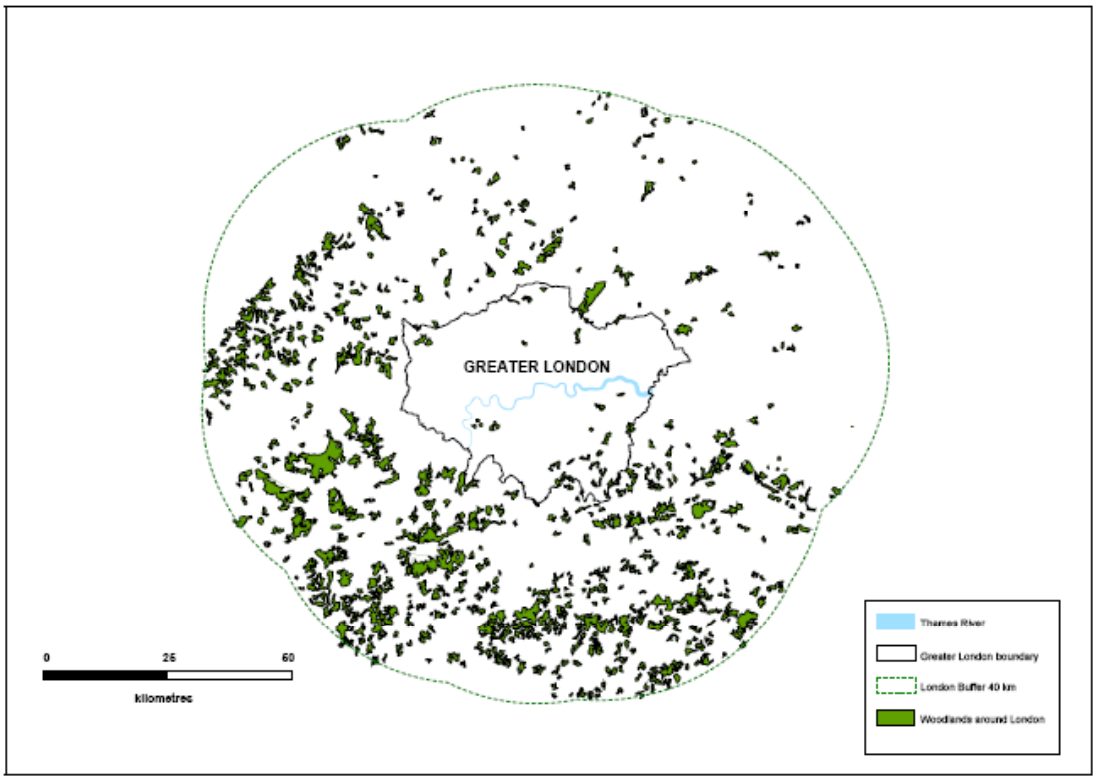
London is surrounded by woodlands, with most to the west and south – see Figure 5.2. 150,000 fresh tonnes of timber are potentially available annually from woodlands within economic transport distance of London. Many of these woods have fallen out of management due to lack of demand and falling timber prices. Wood fuel production creates a new opportunity for sale of low value produce previously sent to the St Regis pulp mill until it was closed in 2006. With wood chip fuel prices for small boilers in London around £75/t (April 2008) for chip delivered at 30% moisture content management of these areas is once again becoming viable. In addition to harvesting the main stem, whole tree chipping or collection of branches, tree tops and other 'waste' timber can increase returns for the forest owner.

Production of chip from woodlands fits in with existing patterns of woodland management work. Timber will be felled and stacked to dry in the woodland and processed with a mobile chipper in rural areas rather than the timber being brought into a central production site.

There is no need for specific support for wood fuel production from woodlands as:

- Owners and contractors are already anticipating increasing demand for wood chip and are able to access equipment and skilled labour. However, if production of wood fuel from woodlands increases rapidly, shortages of skilled labour may develop.
- Support for supply chain development from woodland outside London is available through Defra's BioEnergy Infrastructure Scheme, a second round of which is expected in the second half of 2008. In addition Regional Development Agencies are providing a range of support for wood fuel supply chain development. Wood fuel production is seen as making significant contribution to the revitalisation of rural economies in the counties surrounding London.

One area where additional support may be required is in the establishment of networks linking the rural woodland sector and urban wood fuel users.



Source: SEA/RENUE *et al*, 2006, *Feasibility study into the Potential for Non-building Integrated Wind and Biomass Plants in London,* LEP

Figure 5.2 Woodlands within a 40km radius of London

5.2.7 Tree surgery arisings

Arboricultural arisings could contribute a minimum of 50,000t/yr to the wood fuel supply in London after allowing for existing uses for wood chip and logs. Over 120,000t/yr are potentially available[33]. The infrastructure for wood fuel production from arboricultural arisings is less well developed than for other types of waste wood in London. Suitably processed, they can be used as fuel in the full range of wood boilers and CHP equipment. As virgin timber there are fewer regulatory hurdles to overcome than for other types of waste timber since it is regarded an uncontaminated virgin timber[34].

BioRegional helped establish the Croydon TreeStation, the first processing centre for tree surgery waste in London designed to produce fuel chip suitable for any wood chip boiler. The development of the Croydon TreeStation represents one model that could be used to turn tree surgery waste into fuel. The work at Croydon has highlighted issues that need to be considered when setting up wood chip production which will be useful for development of new fuel production units.

Site selection

Issues to consider when locating a site include:

- Proximity to areas of high demand for wood chip to minimise transport distance
- Location close to green waste processing sites. These can act as a source of logs and disposal point for reject material
- Co-location with a waste transfer station or other installation that will enable equipment (e.g. Weighbridge, loading equipment) and infrastructure, to be shared.

[33] Tolfts A, 2006, Biomass fuel assessment for the Z-squared combined heat and power plant, BioRegional
[34] http://www.environment-agency.gov.uk/business/topics/waste/39017.aspx

The BioRegional/LTOA survey found that approximately half of the tree surgeons pay for disposal of their arisings, with an average price of £38/tonne (see Section 4.4). A lower gate fee than this will increase the attractiveness of the site as a drop off point for tree surgeons. Several contacted in the Croydon area reported that they would like to use the tree station but have not changed to using it at the current £25.00 per tonne gate fee.

A suitable site must have:

- Sufficient area; the 0.8ha at Croydon is too small to allow passive drying of wood chip in windrows covered by geotextiles or to stockpile logs until they are dry.
- Concrete hard standing to prevent contamination with soil and stones. This is a requirement of many larger customers.
- Good vehicle access for lorries collecting finished product and numerous tree surgeons' vehicles arriving at the start and end of the day.

Suitable sites are scarce within urban areas and councils are able to justify site provision based on the benefits they gain from the presence of a tree station.

Partnership working

The varied resources needed to set up and run a tree station often mean that partnership working is the best practical option. They are:

- Land: an area of at least a hectare is needed if chip drying is to be done
- People with the necessary mix of skills and experience.
- A source of capital for investment. This could be partly through grants.
- A champion to drive the project forward and facilitate its progress.

At Croydon :

- The Council provided a site, made the raw material from its own tree management contract available and allowed the sharing of key equipment on the adjacent green waste composting site. They have also supported the project through advocacy of wood heating as part of its drive towards less carbon intensive development.
- City Suburban Tree Surgeons Ltd. brought suitable qualified and experienced labour, made capital investment in the site and kept the business focus of the project sharp.
- BioRegional initiated the project, raised funding for capital works, led the construction of the facilities and found markets for the chip.

Benefits accrue to all parties. The Council has a cost effective disposal route for tree waste in the borough and supports its renewable energy policy. City Suburban have diversified their business in a way which will give an economic return and improve their offer when bidding for new contracts. BioRegional achieve their objective of promoting the use of wood chip for energy and diverting arboricultural arisings from landfill.

Site design

Both logs and material chipped by tree surgeons for volume reduction by the roadside need to be processed. Manual labour input should be minimised to keep production costs low and reduce health and safety risks. Figure 5.3 gives a typical flow diagram for tree station operation.

This highlights a number of essential requirements if a tree station is to be successful:

- Space for reception, sorting and drying, if small boilers requiring chip under 30% moisture content are supplied. Logs may be dried before chipping or the chip can be dried passively using the heat generated when it is stored in a heap, either in an open sided barn or in a windrow covered by a geotextile sheet that lets water vapour out but prevents the ingress of rain. If space is at a premium active drying

of wood chip might be considered, possibly fuelled by fines screened out of the wood chip product to maintain the low carbon status of wood chip fuel.
- Extensive concrete hardstanding for chips. It is essential to prevent contamination with stones and grit at all stages of production as this can lead to boiler shutdown and excessive clinker build up.
- Good access for large vehicles.
- Covered storage for finished product.
- Mobile plant for materials handling along with a chipper (most likely a drum chipper) capable of tackling large diameter logs and rings.

There are also a range of desirable features that will help to produce high quality chip cost effectively:
- Three way screening facilities to remove oversize chip, fines and other contaminants. This is particularly useful when chip is delivered by third parties.
- A weighbridge for incoming and outgoing chip measurement.
- A disposal point for fines and dust screened out during wood chip production and other waste. At Croydon fines are added to the adjacent green waste composting site and the small amount of other waste is disposed of through commercial waste disposal companies.

5.2.8 Expanding on the Croydon model

Good financial performance depends upon:
- Increasing the throughput of the site to make best use of the equipment.
- Making use of existing facilities where possible.
- Improving the chip quality so as much as possible can be sold to higher value small to medium sized boiler market rather than in bulk to large users.

Increasing throughput

The chipper at Croydon can process over 20,000t/yr of logs. This is more than twice the current total input of logs and chip together so there is considerable scope to increase throughput. To do this requires some or all of:
- A marketing campaign targeting local tree surgeons.
- Transporting arboricultural arisings from further away via smaller satellite collection points.
- Reducing the gate fee to make it more attractive to drop off logs and chip. This would require the agreement of the council and could not be done until sales of chip at higher prices to smaller boilers increases.

City Suburban already operate an intermediate collection point for their own timber and chip at their Lambeth depot. Chip and logs are transferred to Croydon using 35m^3 hook lift containers saving vehicle miles compared to delivery by smaller vehicles and reducing CO_2 emissions from wood fuel production. The tree surgeons, by reducing the time spent travelling to drop off arisings, become more productive.

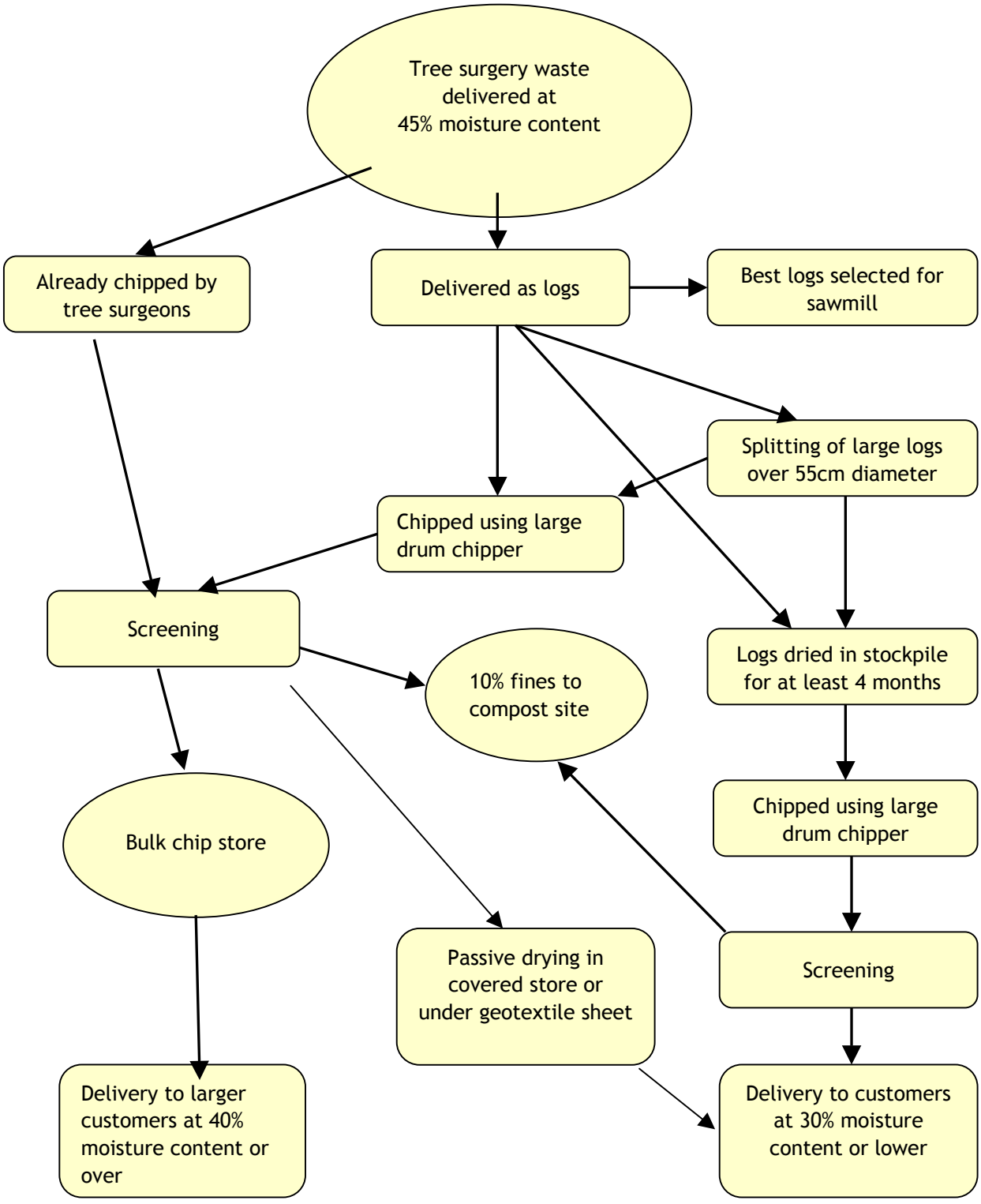


Figure 5.3 Flow diagram of a hypothetical tree station

Quality improvement

Improving chip quality requires attention to the detail of screening to ensure that the chip grade specified is supplied (see Appendix C – Wood fuel specifications) and drying the chip so it can be used in smaller boilers. 35m^3 hook lift containers can often be used for chip deliveries but chip blowing vehicles may be required for the smallest, most difficult to reach deliveries. The price charged for the chip will reflect the higher cost of delivery.

A system of monitoring and checking chip before delivery, particularly for smaller boilers will help to ensure that the correct grade of chip is delivered. This could be undertaken by an independent third party as part of a chip supply contract.

5.2.9 Supporting tree station development

Cost of a tree station

The development of the Croydon TreeStation was reviewed and the likely infrastructure and equipment needed for new wood fuel production hubs assessed. The costs for setting up a new site were assessed for two situations to give an idea of the minimum and maximum initial investment required. In the first case many facilities were already available and second hand equipment used. For the second case a bare site is assumed and all new equipment specified. A six month development period was assumed. The results are given in Table 5.2 and indicate that the cost will be between £225,000 and £675,000.

There are obvious drawbacks to using second hand equipment in terms of maintenance cost and downtime and it is unlikely that all the facilities will be available on a single site so the lower investment cost is unlikely to be attainable in practice.

Grants for supply chain development

Grants have been available for the development of wood fuel supply infrastructure in the past. The first round of Defra's BioEnergy Infrastructure Scheme (BEIS) ran in 2005. This supported the development of producer groups for wood fuel production from virgin wood sources, principally woodland management in rural areas.

A second round of BEIS opened in June 2008 with a third round planned for late 2008. This could potentially support the establishment of a London wood fuel producers group and provide capital support for specialist processing and delivery equipment.

A producers group for wood chip could set up to enable smaller producers to share equipment, and co-operate in marketing the services and products from tree stations and act as the first point of contact for buyers. To wood chip users it would offer reassurance that they were not reliant on one single supplier - if one producer is unable to meet the demand the producer group would be able to facilitate supply from elsewhere.

Outside London the Regional Development Agencies are supporting the development of wood fuel supply chains through the Rural Development Programme England. For example, SEEDA are proposing a £1,000,000/yr programme of support for wood fuel energy crops and liquid biofuels from 2008 to 2013. This could impact the London wood fuel market as production hubs are set up in adjacent counties.