Wood Miles UK

A Canadian Situational Analysis

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Summary

Like other countries, the UK is concerned about greenhouse gases and the role they play in climate change. The UK enacted its Climate Change Act in 2008, becoming the first country in the world to have a legally-binding long-term framework to cut carbon emissions. The Act sets out a target to reduce carbon emissions in the UK to 60 percent of 1990 levels by 2050. An important component in the UK strategy is a reduction in the greenhouse gas footprint of construction. Related but separate, global concerns about transportation distances of goods such as foods and building materials are increasing. For example, Japan has a “wood miles” policy intended to cast light on the carbon footprint of long transportation distances for imported wood. It is estimated that 10% of UK greenhouse gas emissions are associated with building material manufacturing and transportation.

In this work, we examine “wood miles” issues regarding Canadian exports of forest products to the UK; we evaluate how Canadian softwood lumber and pulp transported to the UK fares against other geographic supply sources serving the UK. We additionally look at the bigger carbon picture in the UK, characterizing current activity in carbon policy and regulations that may have an impact on the market for wood. This study had four objectives:

1. Develop a supply chain wood miles metric for softwood lumber and pulp delivered to the UK from western and eastern Canada, Scandinavia, continental Europe and Russia;
2. Provide a high level contextual analysis of existing green procurement policies applicable to lumber use in the UK;
3. Provide a high level contextual analysis of methodologies under development by the BSI (British Standards Institute) and others (Carbon Trust) for carbon footprinting of products; and
4. Provide a relative assessment of the significance of lumber transportation energy relative to a typical UK home’s operating energy use (i.e., years of equivalent operating energy use that lumber transportation may represent).

Key findings:

- Canada is outperformed in transportation footprint for sawnwood by its competition in the UK. Sweden is by far the dominant supplier of sawnwood to the UK, followed by Finland, Russia and Germany; Canada is a very minor supplier. All four of those countries have a far lower sawnwood transportation footprint than Canada in energy use and greenhouse gas emissions per tonne of product delivered to the UK.
- However, the difference in lumber transportation footprint (energy and greenhouse gas emissions) across these five suppliers to the UK becomes insignificant if we compare those figures to the energy and greenhouse gas emissions associated with operating a home. In other words, put in the context of the total energy and greenhouse gas emissions related to a home, the component due to transportation of the lumber is insignificant.
- Canada has historically been a major supplier of pulp to the UK but has recently lost share dramatically. The two current largest exporters of pulp to the UK, Brazil and the USA, both have a greater UK transportation footprint for pulp than Canada.
- Canada can somewhat reduce its transportation footprint to the UK by shifting as much volume as possible from road to rail.

- While “wood miles” is not a flattering metric for Canadian exports to the UK, there are several other sustainability developments in the UK that are highly beneficial to wood and may overshadow public interest in wood miles. For example:
  - The UK Code for Sustainable Housing provides incentives to use wood. An increased demand for wood in the UK will create increased need for imports from any source.
  - The Code provides a strong incentive for the use of biomass as a district and/or home heating fuel – this may spur a demand for wood pellets.
  - The Code puts a strong emphasis on energy efficiency of homes. Canadian Super-E houses may be well-positioned to benefit.
  - A new UK standard for carbon footprinting gives credit for sequestered carbon – this may help shift market share from non-wood to wood.
  - The Code does not follow this protocol for wood framing but perhaps should, given the precedent set by the Code’s carbon credit for biofuel. This may help shift market share from non-wood to wood.
  - The Code references the BRE Green Guide in pointing specifiers to green materials. Specific Canadian materials could be added to this guide. Note that Canadian western red cedar lumber is a recognized cladding option within the Green Guide. Its inclusion was spearheaded by Canada Wood UK and was added to the Green Guide based on LCA data developed by the Athena Institute in 2005. It may well be advantageous to have other Canadian wood building products recognized and scored in the tool as new Canadian wood product LCA data is available for a host of products – softwood lumber, OSB, plywood, particle board, MDF and shakes and shingles.
  - The UK greenhouse gas standard and the Code both indicate a strong regulatory and market interest in carbon-related measures. Carbon incentives may increase substitution for wood over non-wood.
  - Canadian wood suppliers may wish to supply data on the carbon footprint for product delivered to the UK, in order to distinguish themselves more easily from non-wood competition. This would also serve the purpose of pre-empting any outside attempt to develop this footprint for Canada. An even better option is to address carbon footprint data for an entire house rather than for individual components, as this puts the transportation component in the appropriate context – i.e., components are considered at an appropriate scale within the context of the lifetime footprint of the house, and transportation distance differences become less important.
  - Bottom line: Canada can overcome its transportation distance disadvantage by playing to the bigger carbon picture, in which case transportation is only one factor of many and may be overlooked. Canada – and other suppliers – will benefit by an increased demand for wood in the UK. Demand will likely increase in the UK due to a strong emphasis on reduction of carbon footprint, an acknowledgement already in place that wood has carbon benefits, and the development of a favourable standard for carbon footprinting. It is recommended that market growth based on carbon benefits of wood therefore be the target. This includes a push to include carbon credits for wood materials in the UK Code for Sustainable Homes.

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1 Objectives

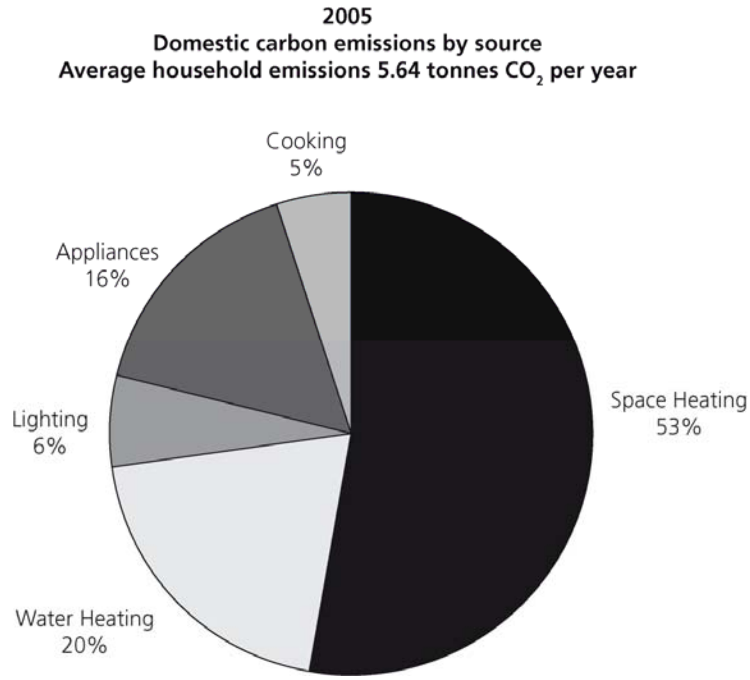
Building upon our previously completed "Wood miles–Japan Situation Analysis," we evaluate how Canadian softwood lumber and pulp transported to the UK fares against other geographic supply sources serving the UK. This study had four objectives:

1. Develop a supply chain wood miles metric for softwood lumber and pulp delivered to the UK from western and eastern Canada, Scandinavia, continental Europe and Russia;
2. Provide a high level contextual analysis of existing green procurement policies applicable to lumber use in the UK;
3. Provide a high level contextual analysis of methodologies under development by the BSI (British Standards Institute) and others (Carbon Trust) for carbon footprinting of products; and
4. Provide a relative assessment of the significance of lumber transportation energy relative to a typical UK home's operating energy use (i.e., years of equivalent operating energy use that lumber transportation may represent).

2 Introduction

The UK, like most Kyoto Protocol signatory countries, is targeting an ambitious shift towards a more sustainable, low carbon economy. Since 2005, the British Parliament has been developing policies and legislation in an effort to secure its future, within the mandates of the UK "sustainable development strategy."

Like other countries, the UK is concerned about greenhouse gases and the role they play in climate change. The UK emitted more than 556 million tonnes (metric tons) of carbon dioxide ($MtCO_2$) in 2005. Emissions from the domestic housing sector represent around 27% of this figure; these emissions come from energy use in the home for heating, hot water, lighting and appliances. Nearly three-quarters of the emissions come from heating and hot water, and around one-fifth is from lighting and appliances (see Figure 1). Recent trends in the domestic sector have shown an increase in use of energy for lighting and appliances, while energy use for cooking and hot water has been declining.



Source: Building a Greener Future: Policy Statement (2007) Department for Communities and Local Government (www.communities.gov.uk)

Figure 1 UK domestic carbon emissions by source

There is likely to be a continuation of these energy use trends through, for example, the growth in the market for home entertainment equipment such as large-screen plasma televisions and home computers. Moreover, climate change itself may lead to further developments, for example, a growth in demand for home air conditioning.

Although new home construction adds less than one percent to the existing stock every year, projections suggest that by 2050, as much as a third of the housing stock will have been built between now and then. The UK construction industry accounts for 10% of GDP, employs 1.4 million people and uses over 420 million tonnes of materials every year (15 million tonnes of which is timber[1]). But unlike N. America, only about 22% of new homes are timber framed. It is estimated that new housing starts in the UK will range between 200,000 and 240,000 over the next 40 years (2050). It is estimated that another 10% of the UK's greenhouse gas emissions are associated with building material manufacturing and transportation, which makes the construction industry a key policy target.

The UK enacted its Climate Change Act in 2008, becoming the first country in the world to have a legally-binding long-term framework to cut carbon emissions[2]. The Act sets out a target to reduce carbon emissions in the UK to 60 percent of 1990 levels by 2050. If the domestic housing sector took a proportionate share of this target, carbon emissions in the residential sector would need to fall from around

[1] In this report, we use the term "timber" as it is used in the UK, i.e., as an equivalent to the word "wood" and not in the North American meaning as a reference specifically to large-dimension structural wood components.
[2] http://www.defra.gov.uk/environment/climate/legislation/index.htm

154 $MtCO_2$ to around 62 $MtCO_2$. This requires a reduction of about 92 $MtCO_2$ from existing levels. However, as this is set against a background of rising pressures on energy demand due to growing household numbers and appliance use, the gap between 1990 levels and the 2050 target may be higher, at around 110 $MtCO_2$, as indicated by long-term government projections. Current policies aimed at the domestic residential housing sector are projected to bring carbon emissions down by around 43 $MtCO_2$ by 2020 but policies will need to go further to reach 60% and prevent emissions rising again in the longer term.

This strong focus in the UK on carbon holds promise for greater use of wood in construction. Most housing in the UK is built with non-wood materials that have a far higher greenhouse gas footprint than wood. A relatively easy way for the UK to get closer to its ambitious carbon targets will be to aggressively substitute wood for non-wood construction materials and fuels.

3 Methods

In completing this work, we drew on previous research and tools developed by the Athena Institute (e.g. Super E transportation calculator and Woodmiles-Japan analysis) as well as an extensive literature review of UK green procurement policies and international statistics regarding wood supply sources and quantities used in the UK.

4 Results

We report results here in five sub-sections. First, we look at the UK policy regarding wood procurement for government-funded construction projects. Next, we discuss a number of other initiatives in the UK with ramifications for wood. We then focus on one of those with particular significance, the Code for Sustainable Homes, as it affects all new home construction and has ambitious performance targets which may be assisted by wood. Next we examine an especially important recent development: the release of a protocol for greenhouse gas footprinting of goods and services. This footprinting method gives credit for the carbon stored in wood products. We complete the section with a discussion of “wood miles,” in other words, an examination of the transportation footprint of Canadian forest products delivered to the UK compared to the footprint of other exporters to the UK. We do this by estimating the energy use and global warming potential (GWP) effects of transporting wood products from various source countries, using various transportation modes, to the UK. We discuss the results of this analysis in the context of various supply scenarios and in the context of overall lifetime footprint of a house.

4.1 UK Timber Procurement Policy

The UK has a policy dictating requirements for wood used on government-funded projects. The arecently-updated version of this policy requires that[3]:

> *From 1st April 2009, only timber and timber products originating either from independently verifiable legal and sustainable sources or from a licensed Forest Law Enforcement, Governance and Trade (FLEGT) partner will be demanded for use on the Government estate – appropriate*

[3] Derived from Executive Summary of UK Government Timber Procurement Advice Note dated April 2009.

documentation will be required to prove it. From 1 April 2015 only legal and sustainable timber would be demanded.

Licensed 'FLEGT partner' is a timber-producing country that has signed up to a bilateral voluntary partnership agreement with the European Community concerning the EU's Forest Law Enforcement, Governance and Trade scheme and whose timber and wood-derived products have been licensed for export by that country's government.

Scope of application of the policy

The policy applies to all central government departments, executive agencies and non-departmental public bodies (NDPBs) in England. Any such body receiving government funds is mandated to follow the timber procurement policy. Until 1st April 2009, the UK Government timber procurement policy only required its central departments to actively seek to purchase legal and sustainable timber and wood-derived products. The policy applies to all timber and wood-derived products used on the government estate including temporary site works and material supplied by contractors.

The policy applies to virgin timber. As an alternative to demanding either legal and sustainable timber or FLEGT-licensed or equivalent timber, agencies can demand recycled timber. Documentary evidence and independent verification will also apply to recycled timber but will focus on the use to which the timber was previously put rather than the forest source.

Short-rotation coppice is exempt from the requirements of the timber procurement policy and falls under agricultural regulation and supervision rather than forestry. It should be noted that the European Commission is considering the development of sustainability criteria applicable to renewable sources of energy, including woody biomass.

This policy has also been adopted widely and integrated into other government regulatory codes including the *Code for Sustainable Homes* material category rating. This Code and its treatment of procurement are discussed later in this report.

Practical support for implementation

The Central Point of Expertise on Timber (CPET) is a technical advisory body to the Department for Environment, Food and Rural Affairs (DEFRA). It was set up with Ministerial support in 2005 in response to an Environment Audit Committee report. CPET provides free advice and guidance to all public sector buyers and their suppliers.

CPET also publishes the UK government procurement criteria for legality and sustainability, assesses timber certification schemes and makes recommendations to government. The CPET website[4] provides information and advice on procuring legal and sustainable timber and dealing with specification, selecting bidders, bid evaluation and contract compliance. References to either legal and sustainable or FLEGT-licensed *timber* include all *wood-derived products* originating from either legal and sustainable or FLEGT-licensed sources. Currently, The Forest Stewardship Council (FSC), CSA, SFI, and the Programme for the Endorsement of Forest Certification (PEFC[5]) are all recognized as approved timber

[4] www.proforest.net/cpet
[5] PEFC is an umbrella program endorsing national certification programs. PEFC has endorsed both the Canadian CSA and N. American SFI certification systems.

certification bodies; i.e., these schemes include a legal and sustainable forest management certification component and a chain custody certification. These same certification systems are also recognized in the Code for Sustainable Homes.

4.2 Other UK Policy and Regulatory Initiatives Affecting Wood Use

The UK government has set out five guiding principles and four priorities for immediate action to shape its sustainability strategy and in the process redefine its economic, environmental and social culture at national and regional levels.

The following section first provides a “high level” discussion of sustainability initiatives in the UK (especially with respect to energy and climate change) and how these policies and resulting legislation may influence the country’s future use of wood. Various building related initiatives are then outlined, and the section ends with a discussion of the UK’s new carbon footprint protocol and how it may also shape the way that wood products are viewed and used in the UK.

The five guiding principles of the UK’s sustainable development strategy are:

1. *Living within environmental limits – respecting the limits of the planet’s environment, resources and biodiversity;*
2. *Ensuring a strong, healthy and just society;*
3. *Achieving a sustainable economy;*
4. *Promoting good governance; and*
5. *Using sound science responsibly.*

The UK Sustainable Development strategy then sets out the following four priority areas for immediate action:

1. *One Planet Economy – Sustainable consumption and production;*
2. *Confronting the Greatest Threat: Climate Change and Energy;*
3. *A Future without Regrets: Natural Resource Protection and Environmental Enhancement;* and
4. *From Local to Global: Creating Sustainable Communities and a Fairer World*

The strategic intent is to join up social, economic and environmental policies and take an integrated approach to improving the quality of life in the UK and abroad. Policy initiatives have been expanded to include all stakeholders to help identify tensions between social, economic and environmental goals at the regional or the national level in order to help central government policy align these efforts. The attitude of the central government is that sustainable development is not about bolt-on initiatives or additional burdens. It is about better ways of working which make positive, long-lasting differences to peoples’ lives and the world they live in.

Several new policies and legislation that echo these principles and priorities have emerged in the last few years. Those with potential to influence the use of wood are discussed below.

4.2.1 Zero Carbon New Homes

The UK government has confirmed[6] that from 2016 onwards all new homes in England and Wales must be zero carbon, whereby net annual carbon emissions from all energy use in the home must be zero[7]. The policy will be delivered in a step-wise fashion through amendments to the Building Regulations and requires CO_2 emissions from new homes to be 25% lower than 2006 Building Regulations by 2010 and 44% lower by 2013. New homes will need to be highly energy efficient through a combination of passive solar design and high levels of insulation and thermal mass, with electricity and heating provided by renewable energy. The recent Callcutt Review of house building delivery[8] concluded that the policy is achievable together with other housing targets assuming that government provides strong leadership and actively manages progress towards the targets.

4.2.2 Zero Carbon New Non-Domestic Buildings

The UK government has announced its intention for all new commercial non-domestic buildings to be zero carbon beginning in 2019, with all new public sector buildings to be zero carbon from 2018[9], although its ambition is that all schools are zero carbon from 2016[10]. It is likely, as with the zero carbon new homes policy, that new non-domestic buildings will be required to meet interim reductions in CO_2 emissions up to 2018/19. The government said at the time it will consult on the proposed policy later this year.

4.2.3 The Code for Sustainable Homes

The Code for Sustainable Homes[11] has replaced EcoHomes as the single national standard for assessing the sustainability of new homes. Essentially a rating system, the Code has six levels, with Level 6 the best, and sets mandatory minimum performance standards. These standards are higher than Building Regulations in a number of areas. The Code covers energy and CO_2 emissions, water efficiency and run-off, materials, waste, pollution, health and well-being, management and ecology. The CO_2 emission targets required under the government's zero carbon new homes policy (see section 4.2.1 above) are equivalent to the energy/carbon standards of different levels of the Code for Sustainable Homes. Since May 2008, all new homes must be rated against the Code and must include that rating in documentation known as the Home Information Pack (HIP)[12]. Some publically-funded housing is required to meet Code level 3 at the moment, a target expected to be raised in the next few years. This important new program is discussed in more detail in Section 0.

4.2.4 Planning Policy Statement on Planning and Climate Change

The Planning Policy Statement (PPS) on Planning and Climate Change[13] seeks to ensure that new community developments reduce CO_2 emissions through location, form, layout and the use of renewable and low-carbon energy. In addition, new community development should be resilient against the impacts of future climate change, such as increased temperatures, reduced water availability, and increased risk of

6 www.communities.gov.uk/news/corporate/8-million-investment
7 www.communities.gov.uk/publications/planningandbuilding/building-a-greene
8 www.callcuttreview.co.uk
9 www.hm-treasury.gov.uk/2717.htm
10 www.dcsf.gov.uk/pns/DisplayPN.cgi?pn_id=2008_0113
11 www.communities.gov.uk/planningandbuilding/theenvironment/codesustainable
12 www.communities.gov.uk/news/corporate/705107
13 www.communities.gov.uk/publications/planningandbuilding/ppsclimatechange

flooding. A good-practice guidance to accompany the PPS is currently being developed[14].

4.2.5 Mandatory Site Waste Management Plans

Site waste management plans (SWMPs) have been compulsory for all construction projects in England costing over £300,000 since April 2008[15]. SWMPs aim to improve resource efficiency by requiring measurement of the waste produced on a site and recording whether it is reused, recycled or disposed and by encouraging the prevention and/or minimization of waste at source through resource-efficient design and construction methods.

4.2.6 Existing Buildings

The UK government is currently undertaking a review of existing buildings to identify a range of measures and policy options to improve sustainability (energy and water efficiency in particular) of the existing stock of both residential and non-residential buildings[16].

4.2.7 Sustainable Construction Strategy

This is a joint government and industry strategy "based on a shared recognition of the need to deliver a radical change in the sustainability of the construction industry", which sets a number of non-binding sustainability targets and signals the future direction of government policy[17].

4.2.8 Renewable Energy Policies

The UK government is developing a Renewable Energy Strategy[18] which sets a target for the UK to source 15% of its total energy from renewables by 2020, a ten-fold increase on current levels. Analysis indicates that renewables on new and existing buildings could contribute about one-fifth of this target[19]. The Government also plans to introduce a Feed in Tariff which will give a guaranteed price for electricity produced by renewable energy microgeneration technologies[20]. Since April 2008 some microgeneration devices have not required planning permission where they have little or no impact on neighbouring properties[21].

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14 www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/ppsclimatechange/practiceguidance
15 www.defra.gov.uk/environment/waste/topics/construction/index.htm#swmp
16 www.communities.gov.uk/planningandbuilding/theenvironment/improvingenvironmental
17 www.berr.gov.uk/sectors/construction/sustainability/page13691.html
18 http://renewableconsultation.berr.gov.uk
19 www.regensw.co.uk/downloads/RegenSW_210.pdf
20 http://nds.coi.gov.uk/Content/Detail.asp?ReleaseID=381477&NewsAreaID=2
21 www.communities.gov.uk/news/planningandbuilding/721557

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4.3 Code for Sustainable Homes

Against this policy backdrop, this next section describes the Code for Sustainable Homes and its material rating underpinnings that may influence the perception, procurement and use of wood products in the residential market.

The Code for Sustainable Homes (the Code) was introduced in England[22] in April 2007 following extensive consultation with environmental groups and with the homebuilding and wider construction industries. Until recently, the Code was a voluntary standard designed to improve the overall sustainability of new homes by setting a single framework within which the home building industry can design and construct homes to higher environmental standards and by offering a tool for developers to differentiate themselves within the market. As of May 2008, the Code is a mandatory performance standard for all residential construction. A document known as the Technical Guidance[23] contains the language of the code as well as more detailed information on techniques and requirements. The Technical Guidance also provides assessment methodologies and relevant references. The Code assesses environmental performance in a two-stage process (at the design stage and then at the post-construction stage) for various criteria and using various verification procedures.

The Code uses a sustainability rating system, indicated by stars, to communicate the overall sustainability performance of a home. A home can achieve a sustainability rating from one (★) to six (★★★★★★) stars depending on the extent to which it has achieved Code standards. One star (★) is the entry level; a home with one star is nonetheless still reaching a higher level of environmental performance that it would simply meeting the 2006 Building Regulations. Six stars (★★★★★★) is the highest level, reflecting exemplar development in sustainability terms.

The Code is organized into environmental impact categories and sub-categories ("issues"), as shown in

22 The Code does not apply in Scotland. The National Assembly for Wales recently announced that they would be adopting the Code in the near future, and Northern Ireland will be requiring Code Level 3 for all public sector housing from April 2008.

23 www.communities.gov.uk/publications/planningandbuilding/codeguide

Table 1. Each of these categories is identified by an intention, a performance benchmark, requirements for demonstrating conformance, and calculation algorithms used to assess performance and award points. The code also assigns a weight to each category. The total credits available, weighting factors and category points are shown in Table 2. Users are generally free to choose which of the categories and issues they wish to address (in other words, most of the specific credit opportunities are voluntary); however, in a few cases, compliance with a particular issue is mandatory.

Weighting factors are indicators of "importance" of each category, as defined by the developers of the Code. As an example, the 29 credits available for energy and CO_2 emissions are weighted at 36.4%, implying that the Code views this category as responsible for 36.4% of total building sustainability performance. Similarly, the 24 credits available for materials contribute to 7.2% per cent of the total available performance. In Table 2, we calculate a weighted value for each category by dividing the weighting factor by the number of credits. In this way, we demonstrate the relative importance of the categories to each other. For example, each credit earned in the water category (weighted value of 1.5 per credit) is worth five times the value of a credit earned in the materials category (0.3 per credit). Users of the Code might be expected to pay less attention to the categories with a lower weighted value, such as materials.

Table 1 Credit categories in the Code for Sustainable Homes

Categories	Issues
Energy and CO_2 emissions	Dwelling emission rate Building fabric Internal lighting Drying space Energy-labelled white goods External lighting Low or zero carbon technologies Bicycle storage Home office
Water	Internal water use External water use
Materials	Environmental impact of materials Responsible sourcing of materials – building elements Responsible sourcing of materials – finishing elements
Surface water run-off	Management of surface water run-off from developments Flood risk
Waste	Storage of non-recyclable waste and recyclable household waste Construction waste management Composting
Pollution	Global warming potential of insulants NO_x emissions
Health and wellbeing	Daylighting Sound insulation Private space Lifetime homes
Management	Home user guide Considerate constructors scheme Construction site impacts Security
Ecology	Ecological value of site Ecological enhancement Protection of ecological features Change in ecological value of site Building footprint

Table 2 Credits and weighting in the Code for Sustainable Homes

Categories of Environmental Impact	Total Credits	Weighting factor	Approximate weighted value per credit
Category 1 – Energy and CO_2 Emissions	29	36.4%	1.26
Category 2 – Water	6	9.0%	1.50
Category 3 – Materials	24	7.2%	0.30
Category 4 – Surface Water Run-off	4	2.2%	0.55
Category 5 – Waste	7	6.4%	0.91
Category 6 – Pollution	4	2.8%	0.70
Category 7 – Health and Wellbeing	12	14.0%	1.17
Category 8 – Management	9	10.0%	1.11
Category 9 – Ecology	9	12.0%	1.33
Total	**104**	**100.0%**	**–**

Relative to the LEED and Green Globes rating systems in N. America, the Code gives more weight to material selection (7.2% as opposed to about 4%); nonetheless, the weighted value of this category is the lowest of all the Code categories. Wood products are obviously relevant within the material category; however, they are also affected by the energy and CO_2 emissions sub-category “building fabric”, in the context of insulation values and air leakage. Another subcateogry of energy and CO_2 is low carbon technologies. In that category, carbon credits are given for the use of biomass as a heating fuel. No other “green energy” technologies are recognized in this manner. This favourable offset treatment of biomass CO_2 emissions may spur demand for renewable fuels from the domestic agriculture and forestry sectors in the UK and perhaps may even create a large import market for biomass energy products such as wood pellets.

The code makes no reference to sequestered carbon as an offset. In the next section we discuss the new carbon footprint protocol in the UK, which does address sequestered carbon. There would be value for wood products were the Code aligned on this issue with the carbon footprint protocol.

There are further opportunities within the energy category. The aim of the building fabric sub-category (2 credit points available) is to acknowledge passive energy reduction technologies such as high insulation and low air leakage over the life of a home. A heat loss parameter (HLP) value is calculated for the home design and assessed against prescribed hurdles. This may be an opportunity for Canadian Super-E home exporters; they could calculate the HLP for their homes as an additional service to UK importers of Super-E homes.

The 24 points allocated to the materials category are spread across three material sub-categories: "environmental impact of materials" (15 points), "responsible sourcing of materials -basic building elements" (6 points), and "responsible sourcing of materials -finishing elements" (3 points). The "environmental impact of materials" is a mandatory requirement and is assessed using the BRE Green Guide to Specification[24] 2008 for domestic buildings. BRE's Green Guide is an LCA-based assessment tool that provides a rating for different material assemblies across the five main elements of the building envelope: roof, external walls, internal walls (including unit separation walls), upper and ground floors (including separating floors), and windows. See Table 3 for a section of the Green Guide addressing timber assemblies. The Code uses its own "material calculator" tool ("Mat 1") to determine scores. Essentially, the Mat 1 calculator refers to the Green Guide ratings for assemblies, determines scores (A+ to E), and awards credits based on the proposed (design) or actual assemblies used (post-construction) in each of the five key assembly elements.

A review of the Green Guide assessment tool reveals that all timber-based assemblies have a rating of A+ or A and hence, will positively affect the final Code score[25]. Few assemblies actually score at the low end of the scale (D and E), and thus it is difficult to imagine that any material will find its usage affected by the Green Guide, except possibly some insulation materials. Note that Canadian western red cedar lumber is a recognized cladding option within the Green Guide. Its inclusion was spearheaded by Canada Wood UK and was added to the Green Guide based on LCA data developed by the Athena Institute in 2005. It may be advantageous to have other Canadian wood building products recognized and scored in the tool as new Canadian wood product LCA data is available for a host of products: softwood lumber, OSB, plywood, particle board, MDF and shakes and shingles.

Both the "responsible sourcing of materials-basic building elements" (6 points) and "responsible sourcing of materials-finishing elements" (3 points) consider the degree to which legal logging and sustainable sourced chain of custody (CoC) reporting have been documented. The "basic elements" refers to the building structure and envelope, while "finishing elements" includes millwork and cabinetry. There are certain tiers required to achieve the highest points in each category; wood products sourced from legal and certified sustainable forests with CoC documentation will attain the highest score. The sustainable forestry programs FSC and PEFC (CSA and SFI) are recognized as the gold standard and receive the highest tier points under the assessment criteria for "responsible sourcing of materials." Compared to some timber exporting nations, Canada is clearly well-positioned to be a supplier to the UK within the context of these Code incentives.

[24] http://www.thegreenguide.org.uk/index.jsp
[25] Canadian Red Cedar is a recognized cladding option in the Green Guide and typically scores well (A+) relative to similar structural assemblies with different claddings

Table 3 Green Guide 2008 ratings for timber-framed construction

Building type > Domestic Category > External Wall Construction Sub-category > Cladding on Framed Construction Element type > Timber Framed Construction	Summary rating
Angle seamed copper cladding on plywood (temperate EN 636-2) sheathing, breather membrane, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A
Canadian cedar weatherboarding, breather membrane, plywood (temperate EN 636-2) sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Canadian cedar weatherboarding, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Clay tiles on timber battens, breather membrane, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Clay tiles, battens, breather membrane, plywood (temperate EN 636-2) sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A
Concrete tiles, battens, breather membrane, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Concrete tiles, battens, breather membrane, plywood (temperate EN 636-2) sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Polymeric render system, breather membrane, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Polymeric render system, breather membrane, plywood (temperate EN 636-2) sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Pre-treated softwood weatherboarding, breather membrane, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
Pre-treated softwood weatherboarding, breather membrane, plywood (temperate EN 636-2) sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
PVC weatherboarding, breather membrane, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
PVC weatherboarding, breather membrane, plywood (temperate EN 636-2) sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
UK produced natural slate on timber battens, breather membrane, OSB/3 sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A+
UK produced natural slate on timber battens, breather membrane, plywood (temperate EN 636-2) sheathing, timber frame with insulation, vapour control layer, plasterboard on battens, paint	A

4.4 Carbon Footprinting in the UK and Wood Products

In response to climate change challenges, the UK has developed a standard[26] for greenhouse gas footprinting. The "Specification for the assessment of the life cycle greenhouse gas emissions of goods and services"[27] was released in October 2008 and was developed by the British Standards Institute in collaboration with the Department for Environment, Food and Rural Affairs and with the Carbon Trust. Also known as PAS 2050 ("publicly available specification" 2050), this is one of the world's first nationally oriented standards that assesses greenhouse gas emissions of individual products and services using life cycle assessment standards (ISO14040/44)[28] as a basis for the specification. Many other countries are reviewing this standard in the course of developing their own approaches to national greenhouse gas assessments for products and services.

To date, most countries (especially those that are signatories to the Kyoto Protocol) have focused their efforts on developing national inventories of greenhouse gases based on economic sectors as opposed to individual products or services. In other words, countries are calculating the greenhouse gas balances within individual national sectors such as land use and forestry, energy, manufacturing, and so forth. The Intergovernmental Panel for Climate Change (IPCC) has been charged with developing and monitoring the guidelines for building these national inventories[29]. There is considerable confusion about how forest biomass and products derived from forest biomass are to be treated in the IPCC methodology. Clarification is likely in the next round of climate change negotiations to be held in Copenhagen in December 2009.

Currently, the IPCC does not consider forest biomass to be "a priori" carbon-neutral; the burning of forest biomass is counted as a carbon emission. This emission is assigned to the forestry sector (where it is balanced by carbon removals by trees). In fact, the IPCC approach assumes that all wood removed from the forest is oxidized to carbon dioxide in the year it was removed (with the caveat that an adjustment can be made for carbon sequestered in harvested wood products if a country can show that the stock of the product is growing, for example, national housing stock is increasing and by corollary softwood lumber stocks are growing as well in order to meet the increased demand for wood).

The assumption that harvested wood is immediately oxidized is simply an accounting protocol: the wood will eventually be oxided (i.e., the stored greenhouse gases returned to the atmosphere), and this greenhouse gas emission needs to be assigned to one of the economic sectors in a national inventory. Because the IPCC allocates this emission to the sector "land-use change and forestry," the burning of biofuel in any sectors is not considered a GHG emission (if it were, biomass emissions would be double-counted). IPCC's national reporting guidelines do not always translate well when looking at discreet products or services from a life cycle perspective, hence the need for other standards such as PAS 2050.

The PAS 2050 method differs from the IPCC national accounting method in one important way: in PAS 2050, CO_2 emissions from forest biomass combustion are treated as carbon neutral (except for emissions of methane or nitrous oxide, which are to be included and reported). Like the IPCC guidelines, the

[26] Note that while we refer in this report to PAS 2050 as a standard, it is not (yet) actually a formal British standard. A PAS is often seen as one of the steps towards developing a full-consensus standard under the auspices of the British Standards Institute.
[27] PAS2050:2008) "Specification for the assessment of the life cycle greenhouse gas emissions of goods and services" British Standards Institute, Publicly Available Specification, October 2008.
[28] ISO 14040:2006, Environmental Management - Life Cycle Assessment - Principles and Framework and ISO 14044:2006, Environmental Management - Life Cycle Assessment – Requirements and Guidelines.
[29] Guidelines for National Greenhouse Gas Inventories (2006) Intergovernmental Panel on Climate Change. http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

carbon stored in wood products is included in the assessment, but PAS 2050 requires an adjustment made for expected life (i.e., how long the carbon is stored) relative to the 100-year assessment period used in the standard.

For example, if a product is expected to last at least 100 years, then full credit is given for the carbon stored in the product. For products expected to last less than 50 years, the carbon stored in the product is “discounted” as a function of expected product life. For products expected to last between 50 and 100 years, PAS 2050 does not specify how the carbon is to be accounted.

Of interest are inconsistencies between PAS 2050 and the Code for Sustainable Homes. In PAS 2050, biomass combustion is considered carbon neutral; in the Code, biomass is not just neutral, it’s worth a carbon credit. PAS 2050 gives credit for carbon stored in wood products; the Code does not. The strategic intent of the UK Sustainable Development strategy is to integrate social, economic and environmental policies and thereby *streamline* policy initiatives and make them more effective. PAS 2050 could apply to carbon footprinting of homes, and it would be consistent with UK streamlining intentions to align the carbon protocols of the Code and of PAS 2050. The global wood industry may wish to lobby for carbon storage credits to be included in the Code, as they are in PAS 2050.

Further, PAS 2050 differentiates between business-to-business and business-to-consumer product transactions. For business-to-business transactions, the system boundary for the assessment of greenhouse gas emissions for an intermediate product or input includes all emissions that have occurred up to and including the point where the input arrives at a new organization (including all upstream emissions). Softwood lumber is a commodity traded between businesses and as such the carbon footprint assessment boundary ends with the delivery of softwood lumber to the port of entry. So the PAS 2050 standard actually aligns quite well with the Woodmiles methodology.

Other international standards for carbon footprinting of products and service are also in development and include:

- The International Organization for Standardization (ISO) is developing an international standard (ISO 14067) for GHG footprinting and communication (due to be released Spring 2011); and
- The World Resources Institute (WRI) is developing a specification to establish an international standard for product-level accounting of GHG emissions (expected in December 2010).

The WRI (and the World Business Council for Sustainable Development) developed the Greenhouse Gas Protocol (GHG Protocol) which is the most widely used international accounting tool to measure and manage greenhouse gas emissions at the *firm* or *corporate* level. It is therefore likely that a WRI standard for product level GHG accounting would have widespread international uptake.

Currently, carbon footprinting standards are evolving, and the next two years will see a number of international protocols developed. How these various standards and protocols align internationally, if at all, remains to be seen. The role of possible carbon taxes and/or cap and trade systems will also affect these methodologies; current thinking is that these carbon footprinting efforts will rely on current life cycle assessment standards based on economic allocation approaches to align with the economic underpinnings of the evolving carbon market (the purchase of offsets, carbon taxes, or a cap and trade model).

4.5 Wood Miles

In this section, we evaluate how Canadian softwood lumber and pulp exported to the UK fares against other geographic supply sources for the UK when comparing the environmental impacts of transportation. To do this, we develop a "wood miles" metric for softwood lumber and pulp delivered to the UK from western and eastern Canada, Scandinavia, continental Europe, Russia, the US and Brazil. This metric estimates the energy use and global warming potential (GWP) effects of transporting wood products from various source countries, using various transportation modes, to the UK. The calculations are dependant on three factors: the mass of material transported, the distance transported, and the mode of transport.

Transportation LCA data for energy use and GWP are expressed on a per tonne-km basis for each mode of transport. There are many sources of data, based on different countries and/or continents. These vary depending on the methodology and local conditions, so it is difficult to decide which data is appropriate to use when making direct comparisons between different scenarios and countries. To illustrate, Table 4 shows a wide variety of results for energy use from different studies and different countries.

Table 4 Sample of variations in national transportation energy use data

	Energy Use (MJ/tonne-km)		
	Train-Diesel	Truck-Long Distance	Ship
Denmark[30]	1.15		
Finland[31]	0.38	0.68	
Norway[32]	0.62		
Sweden[33]		0.9	0.18
Mexico[34]	0.73	1.8	1.41
US[35]	0.22	2.2	
Canada[36]	0.27	1.35	0.16
BRE UK[37.]	0.1466		0.167
Imp. Col. UK[38.]		0.889	
Franklin ('90)[39.]	0.49	1.18	0.12
Franklin ('98)[39.]	0.24	0.94	0.19

[30] Environmental Data for Building Materials in the Nordic Countries, TemaNord 1995:577, Nordic Council of Ministers, Copenhagen, 1995. *Pages 82, 84, 85.*
[31] Environmental Data for Building Materials in the Nordic Countries, 1995.
[32] Environmental Data for Building Materials in the Nordic Countries, 1995.
[33] Environmental Data for Building Materials in the Nordic Countries, 1995.
[34] Transportation Energy Use in Mexico, Claudia Sheinbaum, Stephen Meyers, Jayant Sathaye, Energy Analysis Program, Energy and Environment Division, Lawrence Berkeley Laboratory, University of California, July 1994. *Table 5.2*.
[35] Transportation Energy Data Book: Edition 24-2004, Center for Transportation Analysis, Engineering Science and Technology Division, Oak Ridge National Laboratory, Stacy C. Davis and Susan W. Diegel, ORNL-6973. *Table 2.14*. http://cta.ornl.gov/data/download24.shtml
[36] Fuel Life Cycle Greenhouse Gas Emissions in Canada by Province and Territory for On Road Transportation: Gasoline, Diesel, Natural Gas, and Propane Vehicles 1990-1995, April Meyer, Frank Neitzert, July 29,1997. *Page 26*.
[37] BRE Methodology for Environmental Profiles of Construction Materials, Components and Buildings, Nigel Howard, Suzy Edwards, Jane Anderson. *Appendix 8*.
[38] Prof. W. Hillier, Imperial College London, personal correspondence, July 2005.
[39] Franklin Associates Ltd (1990 and 1998) data files incorporated in SimaPro software v6.0 by Pre Consultants, the Netherlands.

Because of the disparity in national values, and because data for some countries of interest to this study is either sparse or not available, we have chosen to use continental averages. For this study, we are using North American data for Canadian and US scenarios based on the Athena Super E Transportation Calculator databases and the US LCI databases. European average data for European scenarios comes from EcoInvent Centre v2.0, 2008 - Swiss Centre for Life Cycle Inventories – as modeled in Sima Pro. Note that it is not appropriate to use North American data for European scenarios, and vice versa. Table 5 shows the transportation factors used in this study.

Table 5 Average transportation energy and GWP factors

	North American values (also applied to Brazil)	**European values**
Energy use (MJ/tonne-km)		
Diesel trucking	1.02	0.861
Diesel train	0.261	
Avg. electric/diesel train		0.583
Ocean shipping	0.224	0.13
GWP (kg CO_2 eq./tonne-km)		
Diesel trucking	0.075	0.0598
Diesel train	0.019	
Avg. electric/diesel train		0.0115
Ocean shipping	0.017	0.0088

Transportation distances can be difficult to determine due to scarcity of data available in some places. Sweden and Finland both publish detailed reports on the forestry sector and include specific tonnages, distances and transport modes for both lumber and pulp, so we were able to come up with a national average transportation scenario for those countries. However, other countries do not publish similar data; the collection of these data represents a major undertaking beyond the scope of this report.

For those countries where data is either poor or nonexistent, a number of assumptions were made in order to complete the wood miles metric. Our general approach for these countries was to identify where the forest industry is centered and calculate the distances to the most likely seaport or rail node from which material would be shipped to the UK. In a country like Russia, for example, for which we could find very little information on production volumes or producing regions, and the regions can be very far apart, our choice of an average distance can at best be characterized as a "guesstimate" based on our experience with other regions and discussions with transport carriers. Since pulp and lumber mills tend to be located in the same general areas, transportation averages for pulp and lumber are assumed to be similar.

Transportation modes are also assumed where specific data is not available. For land distances over 1,000 km, we are assuming the mode of transport to be rail; for less than 1,000 km, we assume transportation by road. Shipping methods can also vary for different products. Lumber and pulp can both be shipped in containers or in bulk. It is assumed that 50% of pulp is shipped in bulk carriers and 50% in containers, and 100% of lumber is shipped in containers.

Return trips or back hauls are also a factor in transportation calculations. Bulk carriers and logging trucks tend to be designed for one product only (i.e., roundwood), so it is assumed that they make an empty return trip and hence the environmental impact of that return trip is included in the calculation. Specific data is not available on the effects of empty back hauls (they tend to be estimates of how much energy is used on an empty trip, versus a fully loaded trip and can vary anywhere from 50% to 80%). With this uncertainty, we've taken a conservative assumption that empty trips consume as much energy as full trips. In other words, we apply a "back haul factor" of two, meaning that we calculate transportation effects for two trips, not one (roundtrip vs one-way). So, roundwood transport from the forest to the mill, either by truck or bulk carrier, has a back haul factor of two. From the mill to the market, the transport mechanisms tend not to be specialised (i.e. shipping containers), and get used for other goods on return trips; we therefore do not have to account for the return trip, as those environmental impacts would be assigned to whatever product is being carried on the return. So, from mill to port, either by commercial trucking or rail, and from port to port by container ships, we are assigning a back haul factor of one (i.e., no backhaul).

Transportation masses have less uncertainty associated with them. The UK customs service publishes detailed statistics of trade flows in and out of the UK[40]. From these, we can identify how much wood and pulp are being imported in the UK and where it is coming from, going back to the year 2000. The Food and Agriculture Association of the UN (FAO) also publishes forestry trade flows[41]. For pulp, for the years 2000-2007, the FAO and UK customs were virtually identical. For wood, it is a little more difficult to compare the data because the UK reports wood in kilograms, but the FAO reports in cubic metres. To compare the two requires converting cubic metres to kilograms, which is a function of wood density (a property that varies by species and by wood product). If we apply some common averages to those properties, we find a general agreement in the two data source, for this time period. Thus, we are confident in the validity of the UK customs data, and it is the primary source used in our calculations.

The masses of product reported by UK customs are used directly in calculations from the mills to the UK, but from the forest to the mill, the masses need to be adjusted for moisture content. At the mill, moisture is removed as the wood dries, reducing the total mass of a given volume of wood. For wood, we are assuming that lumber has a final moisture content of 15% leaving the mill, and that it entered the mill at 60% moisture content. This means that the wood arriving at the mill is 1.39 times the mass of the same volume leaving the mill (1.60÷1.15).

Yield rates from roundwood to lumber are typically 50%, and the remaining 50% ends up as co-products or hog fuel. We're assuming that 50% of the roundwood ends up as chips used for pulp production. Looking now at pulp, we adjust for moisture content and yield rates (wood fibre to pulp). Typically, market pulp has a 10% moisture content leaving the mill while roundwood or pulp chips have a moisture content of 60% entering the mill. We are considering five different types of pulp, and each type of pulp has a different yield rate from wood fibre (chips) to market pulp.

40 https://www.uktradeinfo.com/
41 http://faostat.fao.org/site/626/default.aspx#ancor

The five types of pulp and their yield rates are as follows[42]:

- Mechanical pulp - 94%
- Chemical pulp, dissolving - 35%
- Chemical pulp, soda/sulphate - 50%
- Chemical pulp, sulphite - 45%
- Semi-chemical pulp - 78%

As an example, in the case of mechanical pulp, the wood chips transported to the mill are 1.55 times the mass of the pulp transported out of the mill ((1.60÷1.10) x (1÷0.94)).

4.5.1 Scenario Analysis

Using transportation data with various assumptions as described above, we explore several scenarios to examine the relative environmental footprint for Canadian forest product transportation to the UK as compared to Canada's competition in that market. From forest to mill, we assume 100 km of roundwood transported by truck to the mill for wood, and 125 km for pulp. This works well in countries like Canada, where the mills are using local wood stocks. The extra 25 km for pulp accounts for the transport of chips from a sawmill to a pulp mill. Sweden and Finland import some of their roundwood, for instance from the Baltic countries, and therefore there is a ship and a rail component to their transportation scenario to the mill. When that data is available, we have included it in our scenarios. We have also added 25 km of truck transport to the Swedish and Finnish pulp transportation scenario from forest to mill.

All scenarios end at a port of entry in the UK. Transport of wood and pulp within the UK is not considered as it would be identical to each scenario.

For Canada, we have developed three scenarios. "Western Canada 1" involves a 100 km truck leg from the forest to the mill, 80 km by truck from the mill to port, and over 16,000 kms by boat through the Panama canal. "Western Canada 2" again has 100 km by truck to the mill, then over 4100 km by train to Montreal, and over 6000 km by ship to the UK. The "Eastern Canada" scenario involves 100 km from forest to mill, followed by 1268 km over land to Halifax, then over 5000 km by ship to the UK. The 1268 km represents the distance from Montreal to Halifax and is used as an average distance for wood and pulp traveling to Halifax anywhere from Atlantic Canada, Quebec or Ontario. Some of these shipments will be by rail, (typically over 1000 km) and some will be by truck, so we're representing that split as 634 km by truck and 634 km by rail.

Table 6 shows the sensitivity of choosing 100% rail or 100% road as a transportation mode versus our base case of 50% rail and 50% road, for energy use and GWP on a per kg basis, for the Eastern Canada scenario. From Table 5 we see that truck transportation uses almost four times more energy and produces almost four times as much GWP as rail transportation. By changing the truck portion of the Eastern Canada scenario (634 km – see Table 7) entirely to rail, we achieve approximately a 20% reduction in both energy use and GWP. The reverse is true if we switch the rail portion entirely to truck. This illustrates the effect of different modes of transportation on the overall results, and the obvious advantage of rail transportation over truck. Simply by changing the transportation mode of a 634 km portion of a 6392 km journey (10%), the results are affected by 20%.

[42] Briggs, David George, *Forest products measurements and conversion factors : with special emphasis on the U.S. Pacific Northwest*, Table 8.1, http://www.ruraltech.org/projects/conversions/briggs_conversions/briggs_book.asp

Table 6 Energy use and GWP for shipping forest products from eastern Canada to the UK, rail vs road

	Energy use per kg (MJ/tonne)		Global Warming Potential per kg (kg CO_2 eq./tonne)	
Wood				
100% Rail	1,958	78%	147	78%
50% Rail, 50% Road	2,511	100%	188	100%
100% Road	3,064	122%	228	122%
Pulp				
100% Rail	2,411	81%	180	82%
50% Rail, 50% Road	2,964	100%	221	100%
100% Road	3,517	119%	262	118%

The UK customs data does not distinguish between western and eastern Canadian wood imports, so we have used data from Industry Canada to refine the customs data. Industry Canada data[43] on wood and pulp exports to the UK (on an export value basis) indicates that 63% of pulp comes from eastern Canada and 37% from the west, and for sawnwood the ratio is 39% from the east and 61% from the west. We have used these ratios to determine how much material is traveling in each scenario.

Table 7 shows the distances of each country's scenario.

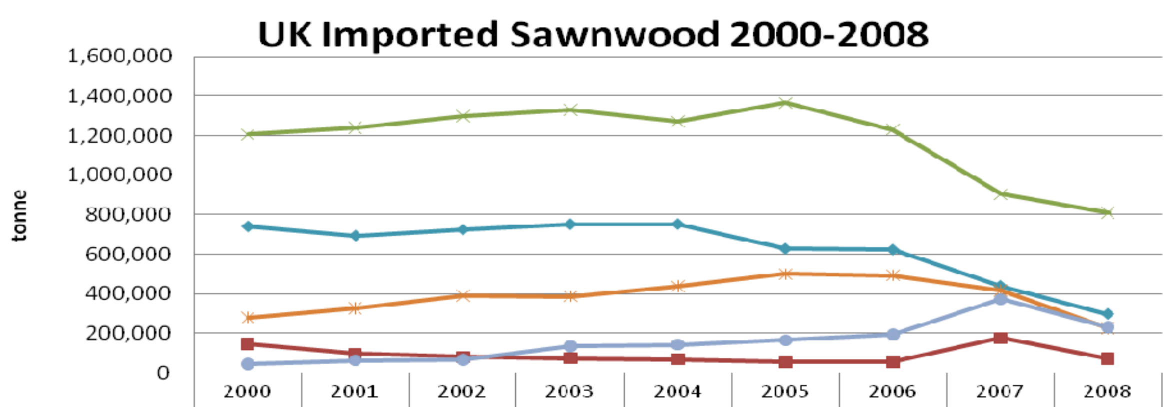
[43] Industry Canada's website, Information by Industrial Sector, Forest Industries, Statistics and Analysis, Trade Data On Line, Search by Product. Sawnwood product code 4407, Pulp product codes 4701, 4702, 4703, 4704, 4705. http://www.ic.gc.ca/sc_mrkti/tdst/tdo/tdo.php?lang=30&headFootDir=/sc_mrkti/tdst/headfoot&productType=HS6&cacheTime=962115865#tag

Table 7 Transportation distances and modes for forest products to the UK, various countries

	From Forest to Mill (km)			**From Mill to UK (km)**		
	Truck (add 25 for pulp)	Rail	Ship	Truck	Rail	Ship
WESTERN CANADA 1[44]	100	0	0	80	0	16447
WESTERN CANADA 2[45]	100	0	0	0	4186	6008
EASTERN CANADA[46]	100	0	0	634	634	5024
SWEDEN	85	0	222	450	0	1150
FINLAND	77	0	12	300	10	2650
RUSSIA	100	0	0	100	1800	2921
GERMANY	100	0	0	535	0	1500
USA (Eastern)	100	0	0	0	1000	8100
BRAZIL	100	0	0	500	0	8500
SPAIN	100	0	0	200	0	1300
NORWAY	100	0	0	260	0	1200

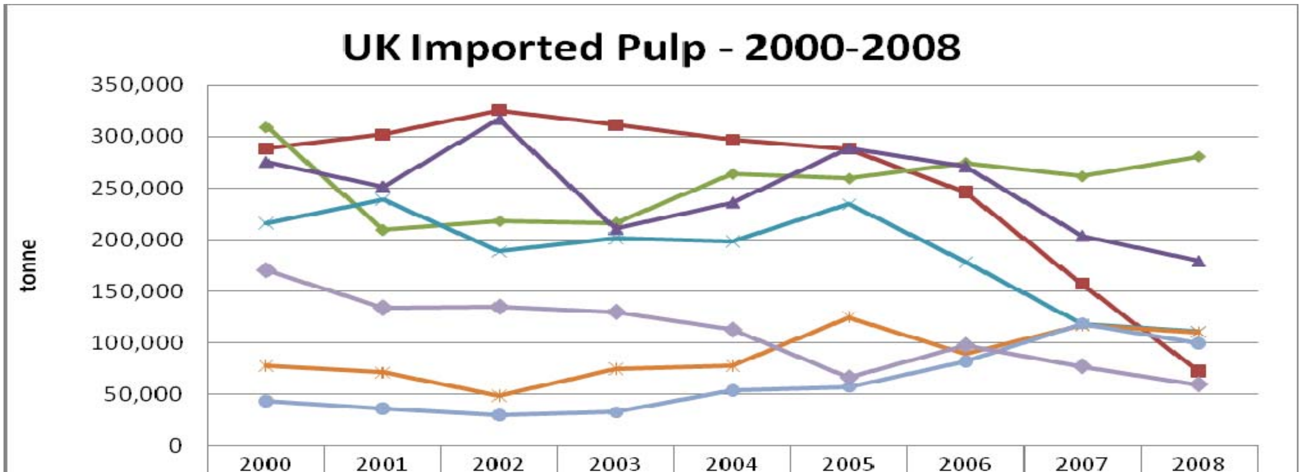
We have limited our analysis to those countries that account for at least 5% of the imported wood or pulp to the UK, in the 2005-2008 timeframe, and in the case of wood, the Canadian data which accounts for only 2%. Figure 2 shows the UK import totals of sawnwood from 2000 to 2008. As you can see, Sweden and Finland are the dominant players. It should also be noted the downward trend in the total imports, from a high of 4.9 Mtonnes in 2003 to 2.4 Mtonnes in 2008. Figure 3 shows the UK import totals of pulp from 2000 to 2008. The overall trend is downward since 2005 and Canada's market share has fallen dramatically since then. Over the period from 2005 to 2008 the Canadian market share is 13%. For the 2005 to 2008, the average yearly totals for softwood sawnwood and market pulp are shown in figures 4 and 5

[44] 100 km truck leg from the forest to the mill, 80 km by truck from the mill to port, and over 16,000 kms by boat through the Panama canal.
[45] 100 km by truck to the mill, then over 4100 km by train to Montreal, and over 6000 km by ship to the UK.
[46] 100 km from forest to mill, followed by 1268 km over land from Montreal to Halifax, then over 5000 km by ship to the UK.



	2000	2001	2002	2003	2004	2005	2006	2007	2008
CANADA	145,860	97,084	80,426	74,726	69,597	54,443	56,663	177,004	72,149
SWEDEN	1,206,675	1,238,730	1,297,208	1,329,547	1,272,510	1,365,807	1,230,461	903,695	809,990
FINLAND	740,890	694,315	724,718	751,758	752,595	627,966	623,405	439,473	297,784
RUSSIA	279,025	326,720	391,825	387,894	437,609	500,210	494,056	417,462	226,165
GERMANY	45,516	63,026	66,622	136,239	142,746	165,826	194,725	372,998	230,794

Figure 2 UK imports of sawnwood, 2000-2008, by country



	2000	2001	2002	2003	2004	2005	2006	2007	2008
CANADA	288,411	302,028	325,754	311,354	296,816	288,329	246,188	157,243	72,715
BRAZIL	309,382	209,527	218,124	216,547	264,218	259,459	274,819	261,664	280,997
USA	275,725	251,619	317,356	210,554	236,230	288,915	271,456	204,020	179,431
SWEDEN	216,148	238,792	188,648	201,402	198,253	234,425	178,470	117,954	110,616
SPAIN	77,860	71,255	48,885	74,894	77,780	124,871	88,790	116,942	110,610
NORWAY	43,767	36,389	29,911	32,946	53,969	57,306	82,178	118,910	99,613
FINLAND	170,541	134,013	134,953	130,012	112,702	66,182	97,694	77,239	59,665

Figure 3 UK imports of pulp, 2000-2008, by country

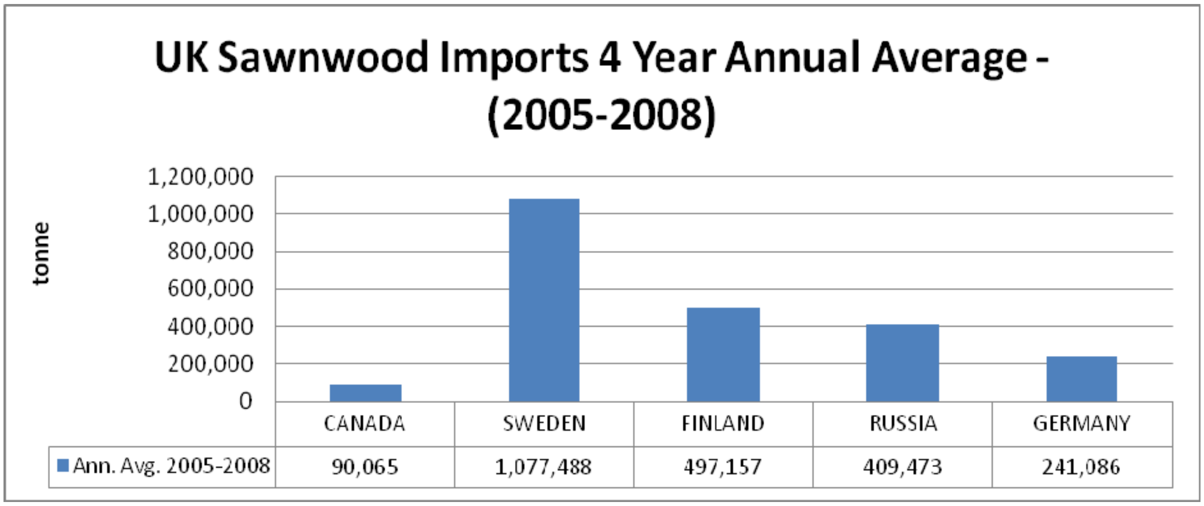


Figure 4 UK Sawnwood imports 2005-2008 average, by country

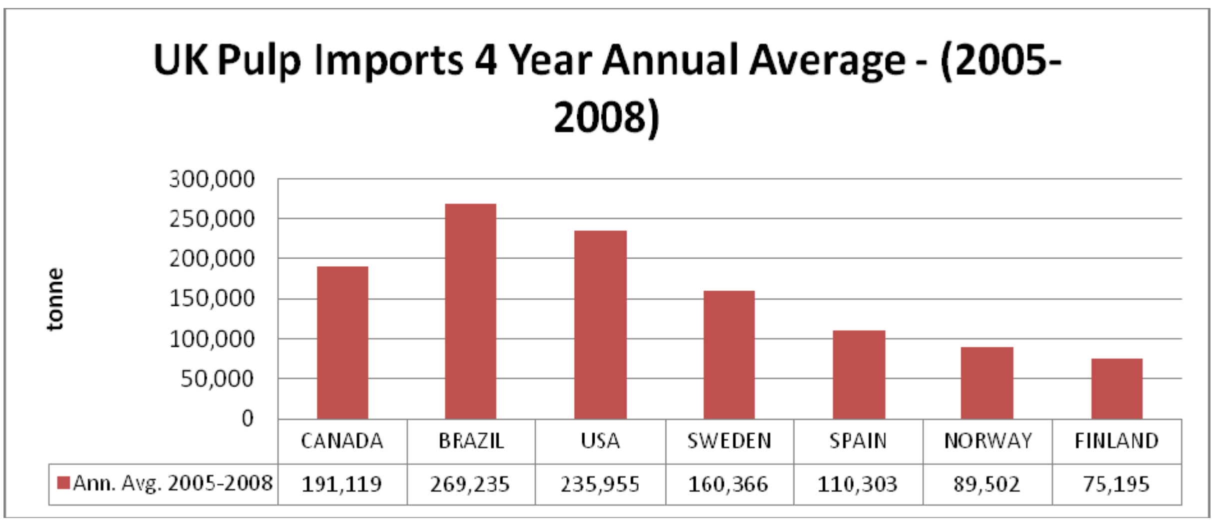


Figure 5 UK pulp imports 2005-2008 average, by country

Tables 8 and 9 show the results for energy use and GWP totals and on a per kg basis for our base case scenarios for each country, for wood and pulp respectively. The results are sorted by the energy use per kg column. It shows Canada at an obvious disadvantage in both energy use and GWP results, due to the distances that must be covered. Again, Canada fares poorly when compared to the closer European countries, in both energy use and GWP.

Table 8 Energy use and GWP per tonne of sawnwood shipped to the UK, by country

UK Sawnwood Imports 2005-2008				
Region	Total Transport Energy Use (GJ)	Energy Use per tonne (MJ/tonne)	Total Transport Global Warming Potential (tonne CO_2 eq.)	Global Warming Potential per tonne (kg CO_2 eq./tonne)
FINLAND	1,882,739	947	122,923	62
SWEDEN	4,757,672	1,104	285,063	66
GERMANY	957,728	993	66,137	69
RUSSIA	3,244,864	1,981	125,870	77
EASTERN CANADA	351,856	2,511	26,281	188
WESTERN CANADA 2	679,360	3,086	50,555	230
WESTERN CANADA 1	1,015,182	4,612	76,849	349

Table 9 Energy use and GWP per tonne of pulp shipped to the UK, by country

UK Pulp Imports 2005-2008				
Region	Total Transport Energy Use (GJ)	Energy Use per tonne (MJ/tonne)	Total Transport Global Warming Potential (tonne CO_2 eq.)	Global Warming Potential per tonne (kg CO_2 eq./tonne)
SPAIN	478,767	1,085	33,045	75
NORWAY	388,576	1,085	26,833	75
FINLAND	435,499	1,448	28,083	93
SWEDEN	1,122,638	1,750	64,526	101
EASTERN CANADA	1,623,662	3,382	121,335	253
USA (Eastern)	3,731,220	3,953	280,534	297
WESTERN CANADA 2	1,146,186	4,030	85,458	301
BRAZIL	4,626,041	4,296	347,781	323
WESTERN CANADA 1	1,884,358	6,626	142,455	501

4.5.2 Relative Importance of Lumber Transportation Footprint

In this section we put the environmental impacts of material transportation in some context, by comparing the scale of material transportation CO_2 emissions to the CO_2 emissions associated with heating a home. Based on a 100 m^2 home, we estimate there are 4,023 kg of sawnwood in a typical wood frame house. From Table 8, we see that this corresponds to 10.1 GJ of energy attributed to the transport of the wood from Eastern Canada to the UK and 12.4 GJ from Western Canada.

The total energy use for space heating a home in the UK in 2006 was 42.2 GJ/y[47]. Therefore, transportation of sawnwood amounts to 2.9 months of heating energy use in the Eastern Canada case and 3.5 months in the Western Canada case.

From Figure 1, the average annual CO_2 emissions per household are 5.64 tonnes of which 2.99 tonnes (53%) are attributed to space heating. The Eastern Canada case accounts for 754 kg CO_2 eq, or 3.0 months of emissions, and the Western Canada case accounts for 924 kg CO_2 eq., or 3.7 months of emissions. Table 10 shows the energy use and GWP due to transporting 4,023 kg of sawnwood to the UK from various countries and the equivalent number of months for heating the average household. Over a lifetime of home heating, the contribution to the home's carbon footprint due to material transportation is **minimal**.

Table 10 Lumber transportation energy and GWP compared to home heating energy and GWP

	Energy Use		**Global Warming Potential**	
	(MJ)	**Months of Space Heating Energy**	**(kg CO_2 eq.)**	**Months of Space Heating GWP**
FINLAND	3,808	1.1	249	1.0
SWEDEN	4,440	1.3	266	1.1
GERMANY	3,995	1.1	276	1.1
RUSSIA	7,969	2.3	309	1.2
EASTERN CANADA	10,100	2.9	754	3.0
WESTERN CANADA 2	12,415	3.5	924	3.7
WESTERN CANADA 1	18,552	5.3	1,404	5.6

[47] Domestic Energy Fact File 2008, J.L. Utley, L.D. Shorrock, BRE, Table 25, page 91.

5 Discussion and Conclusions

Canada is a marginal supplier of lumber to the UK and is also at distinct disadvantage to Scandinavian and continental Europe suppliers from a wood miles perspective. Canada is a major supplier of pulp to the UK, but its market share has been slowly eroding over the last few years due in part to the appreciation of the Canadian dollar. Brazil has become an important market pulp supplier to the UK despite its Woodmiles disadvantage. It has been generally acknowledged that the world fibre supply has been growing and hence commodity buyers, whether they purchase lumber or pulp, will have the upper hand over suppliers for the foreseeable future. As such, forest product commodity manufacturers will be price takers as opposed to price setters and need to find other product attributes that resonate with purchasers.

The UK's policy and accompanying regulatory shift towards a low carbon economy holds promise for wood products. Wood-based construction assemblies are already acknowledged in the UK as preferred products from an environmental perspective, and biomass energy has gained a preferred carbon neutral or offset status in the UK. The Canadian opportunities in the UK rest upon increasing market share for wood (i.e., more substitution of wood over non-wood) rather than competing with others for existing market share. Canada is in a difficult position to compete with other wood suppliers to the UK based on environmental footprint.

One key element in market growth for wood in the UK relates to recognition of carbon value. If carbon storage in wood products were allocated credit in the Code for Sustainable Housing, this might spur stronger demand for wood framing in the residential market (wood framing is estimated at only 22% of new home construction in the UK). An increased demand may be spread across all the global suppliers to the UK, including Canada (regardless of distance) or perhaps even preferentially to Canada.

For example, as a supplier of certified legal, sustainable and chain-of-custody certified forest products, Canada is well-positioned to compete against some of the world's other suppliers of wood products. Canada's continued involvement in and support of PEFC will be helpful.

Canadian suppliers of wood pellets may find the carbon credit for biofuel in the Code for Sustainable Housing spurs increased demand. Alternatively, UK domestic or other European fibre supply may be somewhat redirected to pellets, leaving a larger lumber and panel market available for Canada.

Suppliers of Canadian Super-E housing could make it easier for customers to how Super-E technology helps in compliance with the Code for Sustainable Housing. These suppliers may wish to demonstrate how these homes meet the "Building Fabric" performance requirements in the Code.

Canadian exporters may wish to differentiate themselves as market leaders regarding recognition of carbon concerns by providing a carbon footprint of their products as delivered to the UK, following the PAS 2050 methodology. While this footprint won't hide the impacts of transportation, it may be advantageous for Canadians to perform the analysis themselves rather than allowing it to be done for them.