

Green Guide Update: BRE Response to Comments on the Energy Briefing Paper

Comments in **bold** have been provided by our Life Cycle Assessment Peer Reviewers. A list of all those who have provided comments is given at the end of the document.

Clarifications

- No mention is made of nuclear power in the mix.

The electricity models include nuclear power within the mix where relevant.

- Are CO₂ emissions from non-fuel sources (e.g. carbon anodes in smelting, burning limestone in cement production) taken into account somewhere?

Yes, these process emissions are considered as part of the Environmental Profiles Methodology.

- A significant amount of gas is imported from Norway (mainly). Over the next 5 to 10 years there will be increasing imports by pipeline through Europe (but from a number of mainly non-European countries including Russia and Algeria) - and also as LNG, probably from Trinidad, Egypt, Qatar. Each of these will carry different overheads.

Ecoinvent gas models include information on the supply of natural gas via pipeline from different sources with different impacts.

- Oil is more of a global market place, but with imports of crude (which, when converted into product, should carry UK refining overheads) and product (which ought to carry refining and transport overheads appropriate to the source).

Ecoinvent crude oil models include information on the supply of oil via pipeline and tanker from different sources with different impacts.

Transport

- There is no reference to the energy used to source the materials and transport the materials from the country of origin to the UK. Again, different countries have different emissions legislation. How is this to be dealt with in the BRE methodology?

Where materials are imported to the UK, BRE includes the impact of transport and any extraction or manufacturing impacts incurred outside of the UK and within the UK.

Where possible, BRE try to use models appropriate to the source location. The Data Briefing Note (which can be downloaded from www.bre.co.uk/greenguide/update) provides more information on the sourcing of data and BRE's approach in the absence of relevant datasets.

- **If product X only comes from one region, then the electricity system is what it is and should be reflected in the data, just as the import of a**

product from a distant source (say Canada) should reflect the true transportation burden, not some artificial average burden.

- The inclusion of transport data within the Life Cycle Inventory (LCI) used to create the environmental profiles acknowledges that the location of production facilities IS relevant to the associated environmental impact. So removing location-dependence by using EU-average data for electricity instead of country-specific data, while preserving location-dependence through the inclusion of transport data in the LCI, appears to be inconsistent. If fears about barriers to trade are correct, the profiles might have to be developed without data covering the transport of raw materials, which would rather defeat the idea of basing them on life cycle data.

For materials with high energy intensity, for example metals and plastics, the impact of transport is very small in comparison to the impact of product manufacture and the source of the material is not particularly relevant. However for materials with low energy intensity, such as timber or aggregates, then the impact of transport can be much more important.

Most of BRE's Environmental Profiles are for UK produced products. The exceptions are for:

- *Sawn timber, where profiles have been generated for UK consumed softwood and hardwood, based on transport from the countries where the UK imports timber (Forestry and sawmill data are based on the UK whether occurring here or overseas);*
- *Plastics, where data is produced by the industry to represent European production;*
- *Steel, where data is produced by the industry to represent global production and*
- *Aluminium, and steel section, where data is based on the mix of primary and recycled content based on UK consumption.*

Other uses of energy

- Special attention should be given to use of the environmental profile of energy use and that of the installations (heat, warm tap water, air conditioning) within the building, thus avoiding double-counting or neglecting.

Energy use within buildings is considered by other tools such as BREEAM, EcoHomes and Envest. The Green Guide and Environmental Profiles do not consider these aspects, except to include energy use within office and administration areas within factories within Environmental Profiles.

Ecoinvent models

- **Please use the writing "ecoinvent" instead of "EcoInvent".**

BRE apologise for misformatting the ecoinvent database and have amended references to ecoinvent throughout this document.

- It is reasonable to use the energy models provided in the ecoinvent database, as the best available information on impacts from particular generation methods.

- The VLCA agrees completely with the proposal to use energy and electricity models provided in the ecoinvent database and all numbered guidelines in the proposal.
- **I support your choice to use ecoinvent data.**

European Average

- BRE are appears to be proposing to average out energy impacts across all European countries for products made anywhere in Europe. Surely it would be more reasonable to allow factories in any countries with 'green' generation to take competitive advantage of that fact. This would provide another incentive to switch to green generation. Far from being undesirable, it is quite appropriate that *'manufacturers can gain advantage or be disadvantaged through their location because of the electricity mix'*. If companies can benefit from their own energy generation investments, why is this not applicable at a national level also?
- As an example of a similar approach, the FSC does not certify timber on a national or even regional level exactly because this gives no incentive or reward for individual forest management units to convert, and sanctifies bad producers.
- I know that a complication is that Europe now shares electricity widely, especially the UK with France. But if the information exists, as it apparently does as part of ecoinvent, I personally think it would be better to reflect national energy mixes.
- While it may make sense to use European values for some products, it doesn't seem very appropriate for energy (except perhaps for energy inputs to products produced in Europe - and even here the emissions intensities will vary quite a lot from country to country).
- The UK electricity system has very limited interconnection with mainland Europe so I don't think that using average European emissions intensities is appropriate.
- **The location of a manufacturer relative to electricity grids is a reality that directly affects the environmental impacts associated with production. The avoidance of national or regional energy models because of the 'barrier to trade' argument means that true environmental effects are being masked. The logic for using a European energy model for electricity could equally extend to the fuels used in cement kilns, or to other process inputs that differ regionally. I therefore do not agree with this decision.**
- **My understanding is that the Green Guide works at the level of representative data (i.e., generic as opposed to brand specific) for the products going into construction elements. There must therefore be some averaging of LCI data to properly represent the market basket for product X going into a given construction element. That weighting could reflect the relative contributions to the market basket from different regions and will tend to level out the effects of differing electricity generation systems in different regions. If product X only comes from one region, then the electricity system is what it is and should be reflected in the data, just as the import of a product from a distant source (say Canada) should reflect the true transportation burden, not some artificial average burden.**
- A European model where all products are going to be assumed to draw their energy from a standard European mix (of coal, oil, gas, nuclear, hydro etc) of

power sources seems guaranteed to skew the results. Electricity is traded across Europe, so when a manufacturer draws power from the grid, it is often best to treat it as coming from various power stations. But there is a limit to how far this can be taken. For example, French manufacturers would have a much higher nuclear component in the mix than anyone else, and the Swiss a much higher hydro component (perhaps). We hope the figures you use will reflect this.

- Products made in the UK should reflect the UK mix of power sources.
- **I am not sure whether it is justified to calculate with an average European electricity mix. One country's mix (and its performance) is also an expression of the environmental policy of that country. Furthermore, trade across countries may well be modelled (and is in ecoinvent Data). It is also somehow inconsistent with the approach to allow for company specific mixes (an approach that I support). If however, it is a product that is traded all over Europe and manufactured all over Europe, a European electricity mix is justified.**
- Received strong disagreement with the move to an euro-electric model. The point has been made that, all other impacts are based on exactly what a manufacturer uses and where it is transported from, so why take an average figure for energy? Furthermore, by adopting a euro-energy model, it is possible that market distortion will take place, consider a mid-European manufacturer operating in a coal burning economy, they would have a cost advantage with a lower manufacturing cost even though they would have a greater environmental impact as a result of emissions from burning coal. By creating a euro-model the mid-European manufacturer not only would have a cost advantage but its ecoprofile would also be improved.
- Overall, we believe that the current methodology should continue, and instead of making pre-emptive changes, wait and see if the lack of a European wide energy model does become a barrier to trade.
- We do not feel that there is a potential problem looming if national energy models do become a barrier to trade, the fact is that there is no free market in energy other than in UK, therefore national energy models are of the up-most importance. As such, any change to the methodology should still include the ability to use a UK energy model for materials produced in the UK. This should be achievable since it is proposed that location specific models will be used for other countries or geographical areas wherever possible.
- We suggest that national (not EU-wide) electricity figures should be used.

There appears to be overwhelming opposition from our consultation to the proposed move to a European electricity model. In the light of this, BRE will continue to use national models for energy production, but will use the ecoinvent models which include imports and exports of power between countries. BRE attach a table showing how the impacts of different European countries electricity production.

Percentage of Electricity produced by various technologies for the year 2000.

	Fossil %	Nuclear %	Renewable %	Imports %
Austria	14.8	0	58.6	26.6
Belgium	33.8	50.2	3.2	12.8
Bosnia Herzegovina	46.7	0	44	9.3
Croatia	23.8	0	33.9	42.3
Czech Republic	68.4	16.5	3.8	11.3
Denmark	66.3	0	14	19.8
Finland	27.5	27	29.5	16.1
France	8.9	75.9	14.4	0.9
Germany	56.8	27.7	6.7	8.7
Greece	87.7	0	9	3.3
Hungary	45.7	31.1	0.6	22.6
Ireland	93.4	0	6.5	0
Luxemburg	2.8	0	12.3	84.8
Macedonia	78.4	0	15.5	6.1
The Netherlands	70.2	3.5	4.8	21.6
Norway	0.2	0	98.7	1
Poland	94.4	0	3.3	2.3
Portugal	61.1	0	28.8	10
Serbia and Montenegro	60.5	0	32.5	7.1
Slovakia	24.2	43.8	13.9	18
Slovenia	23.9	24.7	20.8	30.6
Sweden	3.2	34.2	51.3	11.4
Switzerland	1	23.4	38	37.5
United Kingdom	71.9	20.9	3.4	3.8

Source: "Life Cycle Inventories of Energy Systems: Results for Current Systems in Switzerland and other UCTE Countries: Data v1.1 (2004)",

Roberto Dones, Christian Bauer, Rita Bolliger, Bastian Burger, Thomas Heck, Alexander Röder, PSI and Mireille Faist Emmenegger, Rolf Frischknecht, Niels Jungbluth, ESU-services.

- For products from Asia, mixing in China (coal) and Japan (nuclear) won't give sensible results for products made in China, for example. Again, national mixes should be used, if not something finer in certain cases. If Chinese or UK impacts are higher than French or Japanese for the same type of product, then so be it. The Green Guide tables are going to have to distinguish between 'specifications', with perhaps a UK-sourced version and a French-sourced version.

In the light of the adoption of national models within Europe, the same approach will be taken when BRE undertake Environmental Profiles within other countries outside Europe. Where possible BRE will try to source electricity profiles based on production at a similar geographical level – eg for the United States at state rather than national level.

- Where there are no regional models or information available, how do BRE propose to deal with materials that are produced in countries that have poor, or less rigorous environmental legislation and will have a greater environmental impact than in the UK or Europe?

Whereecoinvent has not produced a model, BRE will try to source data on the electricity mix and any relevant emissions data to try to model the electricity on the same basis. If BRE are not able to source such data then they would be unable to undertake an Environmental Profile.

- The UK model will need to be flexible to take account of the continuous changes in our free market.
- How relevant or correct is this data in light of the current situation and the spiralling cost of gas and the record high prices for gas? Does 2000 data still reflect the current situation for the production of electricity? We feel that data from 2000 for energy production is now woefully out of date for the reasons outlined above. We accept that this is a UK problem due to our free market and this reinforces the need for flexible national models. For example, recent increases in the cost of oil and gas have changed the economics for coal fired power stations in the UK. This comment is expanded upon under the heading National or Regional mix.

BRE will consider the updated energy models when new data becomes available.

- The inclusion of transport data within the Life Cycle Inventory (LCI) used to create the environmental profiles acknowledges that the location of production facilities IS relevant to the associated environmental impact. So removing location-dependence by using EU-average data for electricity instead of country-specific data, while preserving location-dependence through the inclusion of transport data in the LCI, appears to be inconsistent. If fears about barriers to trade are correct, the profiles might have to be developed without data covering the transport of raw materials, which would rather defeat the idea of basing them on life cycle data.

BRE do not intend to ignore transport within the methodology.

- The use of EU-average electricity data appears to make the inclusion of an impact assessment category for radioactive waste emissions almost irrelevant. Such emissions arise almost solely from the operation of nuclear power plants. If EU-average data is used for all electricity in any product system, 1kWh of electricity will give rise to the same amount of radioactive waste wherever it is used. So the radioactive waste emissions impact appearing in any profile will be proportional to total electricity in the Life Cycle Inventory, except in any cases where there is direct production of radioactive wastes in some part of the production chain (somewhat unlikely for construction products).

If an EU average was used, then the nuclear waste category would be important in terms of the proportion of electricity to other energy sources, and for materials sourced from outside the EU. Now we are intending to use national models, the nuclear waste category may become more significant (depending on weighting).

- We suggest that national (not EU-wide) electricity figures should be used. LCA's for insulation include energy savings made during the operational phase, which uses the UK national mix of fuel types and generation methods (oil, gas, electricity, renewables, etc).

The BRE methodology does not include energy savings from insulation within the Environmental Profile – this is because a common thermal resistance is used to compare insulation materials, providing the same function, as per ISO rules.

Fuels

- We have a specific interest in the distribution of waste heat from power generation and the carbon content of the waste heat. If this waste heat is to be used then it is essential the appropriate carbon signal is given. Circumstances arise where it is economic to produce power from a high carbon source such as coal or in a power plant that is of lower efficiency but is appropriate for the purpose. Example one could be an existing coal or oil fired plant. Example two could be a motor car engine. In example one the waste heat going to the cooling towers is carbon free. In example two the heat used to heat the car is carbon free. The signal in each case to use the heat should be carbon free as the marginal fuel burn for the power if the heat is use is zero.
- The potential for carbon saving is huge using waste heat from power generation this potential will not be achieved unless the correct signals are given.

Where the waste heat is used within the same system process, then it is not necessary to consider the carbon emission from the use of the waste heat. All impacts will be included within the process and allocated to the products of the system according to their value. Where the waste heat is used in another process outside the system boundary, then it will be treated as another product of the system, and impact allocated on the basis of the relative value of the products and waste heat (if the heat is given away, then it will attract no impact). A process that a) finds a use for its waste heat or b) is able to sell it will therefore benefit as a) it will reduce the amount of other fuel required and b) the impact will be reduced through allocation. In either case this will encourage the use of waste heat.

- Can you please provide me with the information that you have on how CHP is modelled at present in relation to the carbon content of the heat? We are also interested in how power is modelled.

Again, where the power and heat from CHP are both used within a process, then there will be no need to consider the relative impacts of the power and heat – all impacts will be included within the system and allocated to the products according to value. Where either heat or power are exported to other systems, then the heat or power will be treated as another product of the system and impacts allocated on the basis of the relative value of the products.

For CHP within the national energy models, ecoinvent currently allocate on the basis of Exergy (availability of energy to perform useful work) rather than value. Using exergy means 77% of the system impacts are allocated to electricity whereas 66% of the impact would be allocated to electricity on the basis of value. As most countries have only very small (less than 0.5%) proportions sourced from CHP there shouldn't be any significant change and BRE don't believe it will be worthwhile adapting the models to reflect this. However Denmark (1.29%), Finland (11.4%), UK (1.1%), Portugal (2.1%) and Sweden (2.2%) have CHP production above 1% of production and the choice of allocation method may be significant and BRE will change the models to use value allocation instead for these countries.

- There is a strong case for signalling coal fired plant to indicate the carbon savings or carbon burden when you reduce or increase demand for electricity.

BRE does not consider the implications of increasing or reducing demand for electricity within its Environmental Profiles methodology – the goal of which is to assess the impact

of products. It may however be relevant to consider the marginal fuels when conducting LCAs for the purpose of developing policy or considering site location for a new plant.

- Can the methodology deal with self-fuelled processes, such as firing fuels for Smeed Deans yellow London stock bricks (organic material in the clay is the fuel used to fire these bricks).

Yes, the methodology can deal with this – the inherent fuel will not have any fossil fuel burdens, but any emissions will be included within the system.

Biofuels

- Global warming gases aren't the only emissions – other pollutants will arise from burning biofuels (and other fuels) – we presume these will be taken into account.

Yes, other emissions will be included within the assessment of biofuels. Only the emission of CO₂ arising from sequestered carbon will not be included as the net CO₂ emission is zero over a 100-year time period.

Waste Fuels

- **The sentence, “Where a manufacturer buys or is given a waste fuel, then the emissions from the use of waste fuels are all allocated to the fuel user”, would be much easier to understand if it read as follows: “Where a manufacturer buys or is given a waste fuel, then the emissions from the use of that waste fuel are all allocated to the manufacturer”.**

BRE agree this is clearer.

- The use of waste derived fuel also appears to be covered in the Waste Briefing Note. This has resulted in a lack of clarity, and appears to have given rise to the following contradiction: The approach described in point 6 of the Energy Briefing Paper implies that if a manufacturer is paid to take waste fuel, then their emission allocation associated with the fuel will be based on the income received from taking the fuel. In contrast, in the Waste Briefing Note it states that if a manufacturer is paid to take waste fuel, then the waste producer is responsible for ALL the emissions associated with the fuel.

The text from the Waste Briefing Note is included below:

“Note that any impacts from a waste fuel used within a process will be included within that process system and waste fuels will be considered to emit Carbon Dioxide unless the carbon has been sequestered within the previous 100 years (eg timber, paper waste). But if a manufacturer is paid to treat or dispose of waste as part of their manufacturing process, for example by burning waste fuel, then this waste treatment process is considered as any other co-product from the process, and impacts from the whole system will be allocated back to the waste producer on the basis of value as above.”

BRE believes this approach is entirely consistent with that described in the Energy Briefing note, text again included below:

“If the manufacturer is paid to take a waste fuel, then the emissions from the use of the fuel and the process are allocated between the waste producer and the manufacturer based on the income received by the manufacturer – for example if they receive 10% of their income from taking waste fuel, and 90% from selling

product, then 10% of the process emissions (including waste fuel use) will be allocated back to the waste producer.”

- **On a more substantive level, it seems to me that the allocation of all emissions to the manufacturer who bought the waste fuel denies the fact that the waste fuel was therefore a co-product to the producer of that waste. In other words, it was not a waste at all. Should the producer of that fuel not carry some of the burdens based on the revenue earned from its sale? Economic allocation would say ‘yes’, would it not?**

BRE agree that if a manufacturer is able to sell his waste for use as a fuel, then it is a co-product of his system. As such, as with waste or a product which he sells for use as a raw material in another process, some of the impacts of primary manufacture can be allocated to the waste fuel. No impacts from the secondary process (be it using the waste as a fuel or a raw material) are allocated back to the original manufacturer. This approach is consistent for both wastes and products used as raw materials and as fuels.

- **In the case of the secondary producer being paid to take the waste, he is in fact providing a waste treatment service (a co-product) and it is proper to allocate burdens accordingly.**

As with any situation where a manufacturer pays for a service, the impacts of that service should be allocated back to the manufacturer. The amount that is allocated should be on the basis of the value of the waste treatment service for the manufacturer compared to the value of any other services offered by the secondary producer.

- We would like to suggest a more practical approach to the treatment of waste fuels: Income should not form the basis for the emissions allocation. It should instead be based on the value of the waste fuel relative to the value of the fuel it is replacing.

BRE do not feel there is any reason to consider using this alternative allocation approach as the BRE Methodology is clear and consistent.

Electricity

- **I want to highlight that grid losses etc. should be included in case electricity stems from one particular power plant technology (e.g., wind power) in a manufacturing process.**
- Why use an LCA model for low voltage supply – manufacturers won't be using this? This would be relevant if the Green Guide was going to deal with engineering services, such as lighting and heating, which require operational energy, but our understanding is that this is not planned
- I am surprised that you think that the distinction between HV, MV and LV transmission losses is significant, given the other sources of variation.

The differences vary from country to country, but the overall transmission loss within Europe is over 1% between high and medium voltage, and 10% between medium and low voltage. In addition, the models include the impact of the infrastructure (eg maintenance and repair of pylons, cables etc). Most manufacturers will use Medium Voltage, but low voltage electricity may be used by some small scale manufacturing enterprises, and should be taken into account within the operation phase when modelling whole buildings, for example within BREEAM or Envest. The use of onsite generation will not involve any grid losses.

- If the LCA can pick up a purpose-made private power plant, then it can surely also deal with single external power plants (e.g. for aluminium smelters as previously discussed).

The intention of Point 6 stating, "Where a company has invested in the construction of a specific power plant from which it takes the majority or all of the supply, then BRE will consider using a specific LCA model for that power plant rather than the European mix." was intended to apply, for example, to aluminium smelters, where they were taking the majority of generation from a specific plant.

- What about the need, current and in the future, to treat by products of production so as to reduce environmental impact.

The impacts of waste treatment or impact mitigation should be included within the system. Where treatment results in a product for another process, then the BRE methodology will be used to allocate between products.

- Finally what about the environmental impacts of decommissioning plant especially nuclear.

The ecoinvent models include the construction and maintenance of infrastructure and include the decommissioning of nuclear power plants.

Renewables

- **With regard to green tariffs, it strikes me that the treatment is at odds with your treatment of regional generation systems. The producer fortunate enough to access to green tariffs gets the benefit, while the producer with access to hydroelectricity does not get the benefit. One is deemed a barrier to trade and the other is not! I agree with your approach to green tariffs and am even more convinced that your approach to generation system models is not defensible.**

As a result of the change to national models, this should no longer be a concern.

"Onsite generation – if a manufacturer has invested in the generation of renewable electricity on site and uses the majority of supply, then the appropriate renewable electricity model will be used for that supply."

- These systems must also be subject to the same LCA considerations included in the ecoinvent methodology e.g. the environmental impact associated with the manufacture of the equipment and its anticipated lifespan.

The methodology will ensure that these impacts are also included for these types of systems.

Allocation

"BRE are still checking what allocation method was used by ecoinvent for the co-products of electricity production, namely pulverised fuel ash (PFA), furnace bottom ash (FBA) and flue gas desulphurisation gypsum. A preliminary study by BRE has shown that no significant alteration to the electricity profile is detectable if either allocation by value or system expansion is used."

- Once this has been resolved we would appreciate a Briefing Note from BRE to explain the outcome.

BRE can now confirm that the ecoinvent database treats ashes as by-products that bear no loads when leaving the electricity production system. However they also do not expect a significant change if economic revenues would be applied to allocate between electricity and ashes. BRE do not therefore propose to alter the electricity models.

Avoided Burdens/Displacement

- It is very clear that at a world level the marginal plant displaced on interconnected electricity systems is coal fired with a high carbon burden per unit of power. At a local level say in Norway it could be Hydro. In the UK current methods are based on using average emissions for power generation to signal its carbon content.

The choice of marginal plant is significant where a study is considering the implications of significant changes to energy use, for example in improving energy efficiency across the UK housing sector. However the goal and scope of the Environmental Profiles methodology is to compare the impacts of products and construction systems at the level of an individual building rather than in terms of a whole region. In this case, it is not appropriate to consider the implications of increasing or decreasing demand for a product and associated energy/raw materials etc. If BRE were asked to undertake a study looking at the implications of larger scale changes to industry practice, then the issue of marginal plant and raw materials sources and processes would need to be considered and the existing Environmental Profiles Methodology would not be appropriate.

Consultees who provided comment: (* Methodology Peer Reviewer)

Rolf Frischknecht, ESU-services, Switzerland*
W. B. Trusty, Athena Sustainable Materials Institute*
Andrew Frost & Tom De Saulles, The Concrete Centre / British Cement Association /
British Ready Mix Concrete Association
John Gelder, NBS
Malcolm Stroud, Nightingale Associates
Roger Hitchin, BRE
Rob Rouwette, Dutch Society for LCA in Building and Construction (VLCA)
Ieuan Compton, Kingspan Insulation Limited
Carol Houghton, Eurisol UK Ltd
William Orchard, Orchard Partners London Ltd.
Chris March, Coventry University

Process regarding BRE response to Stakeholders feedback on briefing notes

The following process will be adopted for the communication of BRE's position on stakeholders feedback to this briefing note:

- Feedback from all respondents has been collated by BRE and a response prepared. This document is BRE's position on the points raised, including a justification and rationale for the position taken.
- Any disagreement should in the first instance be immediately tabled to BRE, by response to this mail and by **23 September 2005**.
- BRE will then consult with the relevant parties to try to seek resolution.
- If there is still a disagreement on BRE's position, the issue will be tabled to the Project Steering Group (PSG), either via email, or at the next meeting (which ever is soonest) to seek resolution.
- If resolution cannot be achieved, any member of the PSG can take the issue further by tabling the issue (with BRE support) to the Sustainable Construction Board, an independent committee of industry representatives who will make the final decision (see PSG Terms of Reference for governance structure).

Please direct all further responses to:-

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