# A Triple Bottom Line and Footprint Analysis of WWF-UK (Panda House)


CenSA
Centre for Sustainability Accounting

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Thomas Wiedmann & John Barrett

**Centre for Sustainability Accounting**
Innovation Centre
Innovation Way
York Science Park
York, YO10 5DG
United Kingdom
E: info@censa.org.uk
W: www.censa.org.uk



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# Executive Summary and Key Findings

This report provides a triple bottom line analysis of the operations of WWF-UK's Panda House headquarters, including a quantification of the associated annual Ecological Footprint, carbon footprint, climate footprint and other economic, social and environmental indicators.

For carbon, the analysis undertaken is consistent with the Greenhouse Gas Protocol, established by the World Business Council for Sustainable Development. Under the GHG Protocol, Scope 1 includes direct emissions for an organisation, Scope 2 includes emissions from power generation (electricity) and Scope 3 includes the remaining indirect emissions in the supply chain triggered by an organisation's expenditure. This study has provided a boundary free analysis of all these levels ensuring that the results are comprehensive, comparable and complete. This process has been undertaken for all the indicators.

The key findings being:

- In terms of environmental impacts, the majority appear in Scope 3 (about 97% for the carbon footprint for example, and 95% for the Ecological Footprint), i.e. indirect impacts along the supply chain. Direct emissions are extremely low reflecting good in-house management of energy. Scope 2 emissions are also extremely low relating to the fact that electricity consumption is low and obtained from sustainable sources.
- WWF-UK will always spend the funds obtained through donations and other sources on their mission. Therefore, while the total impact is obviously important, it is more important that the impact per £ spent is as low as possible, reflecting sound environmental purchasing choices. This indicator of environmental intensity should be considered over time as a clear guideline of improvement within WWF-UK.
- WWF-UK's carbon footprint is considerably lower per £ spent when compared with the charity sector. In other words, the decisions made on how to spend WWF-UK's funds deliver a lower impact than the average for this sector. In terms of energy use, WWF-UK uses 68% less than the sector average. This is reflected in lower carbon dioxide emissions (also 68% lower). The total Ecological Footprint is 82% lower than the sector average. In terms of health related pollutants such as benzene, VOCs and particulate matter, the impact of WWF-UK is considerably lower.
- Of the total greenhouse gases for 2007, 43% of the 1,968 tonnes can be attributed to organisations funded by WWF-UK to carry out work that delivers their mission. The remainder occurs in activities to deliver this mission, such as production of promotional and campaign material etc. This demonstrates a need to engage with both project partners and suppliers.
- If the analysis had been limited to the carbon footprint alone no increase in the particular areas related to the use of paper and forest resources would have been noticed. Only by monitoring a wider range of TBL impact categories – 30 in this study – has it been possible to pick up a sharp increase in the indicators 'paper products', 'forest footprint', and 'volatile organic compounds' between 2005 and 2007, due to an steep increase in WWF-UK's expenditure on 'printing and publishing'.

- WWF-UK's relative performance in economic and social areas is less good than the sector average. It generates less profits, pays less wages and salaries and employs less people per £ than other "Membership organisations"; thereby reflecting the special nature of the organisation.
- There is a need for WWF-UK to adopt a strategic level sustainable procurement strategy. The final recommendations of this study outline the stages that WWF-UK need to go through to ensure low environmental impact through the supply chain.

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# Introduction

## WWF-UK's commitment

This report was commissioned to inform WWF-UK's strategic objective 'Changing the way we live'. As a follow up to the WWF internal footprint report completed in 2005, we are now working with Waverley Borough Council to explore how best to support staff in taking action to reduce the Footprint of both organisations and this report will be used as a baseline for this project, and also inform the wider work of the Sustainable Consumption team.

## Scope of this report

This report provides a triple bottom line analysis of the operations of WWF-UK's Panda House headquarters, including a quantification of the associated annual Ecological Footprint, carbon footprint, climate footprint and other economic, social and environmental indicators. The analysis refers to WWF-UK's financial year 2006/07 (FY2007) which spans from 1 July 2006 to 30 June 2007. For comparison, some results are also shown for the financial year 2004/2005 (FY2005, 1 July 2004 to 30 June 2005) for which an analysis was carried out in parallel.

"Triple bottom line" is a term originally coined by John Elkington[1] in 1994 to describe corporations moving beyond reporting only their financial "bottom line", to assessing and reporting on the three spheres of sustainability: economic, social and environmental. TBL can be viewed as a reporting device (e.g. information presented in annual reports) and/or an approach to improving decision-making and the fundamental functioning of organisations (e.g. the provision of tools and frameworks for considering the economic, environmental and social implications of decisions, products, operations, future plans, etc).

TBL provides a framework for measuring and reporting an organisation's performance against economic, social and environmental benchmarks. Reporting on the triple bottom line makes transparent the organisation's decisions that explicitly take into consideration impacts on the environment and on people, as well as on financial capital. It has been recognised that managing sustainability performance and successfully integrating social, environmental and economic objectives in proactive operational strategies go hand-in-hand with the competitiveness of a business (Schaltegger et al. 2006; Schaltegger and Wagner 2006).

Thirty TBL indicators were chosen from more than 100 possible triple bottom line indicators available to CenSA so as to represent major environmental impact and resource use issues as well as some economic performance. The indicators 'Employment' can be seen as a social indicator

[1] His book "Cannibals with Forks: The Triple Bottom Line of 21st Century Business" (Elkington 1997) introduced the concept of the Triple Bottom Line to a wider audience, asking whether capitalism itself was sustainable and looking at the ways in which TBL thinking would transform (financial) accounting.

showing WWF-UK's contribution to job creation through its activities. Table 13 in the Appendix provides details for each of the thirty indicators chosen in this study.[2]

# Results

## Overview of TBL impacts

In this section the total impact for each TBL indicator is presented. '**Total**' in this context means that the reported value includes both 'direct' and 'indirect' impacts:

- **Direct** impacts are those occurring within an organisation through all the activities that it directly controls and all the assets that it directly owns. In other words, the impacts occur 'on-site' or 'in-house', i.e. direct emissions from heating premises or driving vehicles, but also direct employment and payments to own staff.
- **Indirect** impacts are those generated by an organisation's suppliers or partners. For every £ spent by the organisation on any good or service provided by someone from outside the organisation, there are associated impacts. These can be emissions embodied in goods such as office equipment or services such as electricity or legal advice. Or jobs and income created somewhere in the supply chain.

It is important to be aware of double-counting along supply chains or life cycles. Direct impacts of one agent are indirect impacts of another and vice versa. For example, if a power plant operator reports its emissions as direct (on-site) emissions and purchasers of electricity (such as WWF-UK) report them as indirect emissions, then they are double counted. In this report, the full direct *and* indirect impacts are presented in order to show the full scale of TBL impacts. However, one has to bear in mind that WWF-UK cannot be held responsible for all of these impacts alone and that some of the indirect impacts might be reported by other organisations.[3] For more details see also 'Requirements' in the Methodology section.

[2] Note that we chose to include the category 'Nuclear Energy Footprint' in the list. Although the global network of Footprint practitioners has come to the conclusion that this category is not to be included as part of a standardised EF methodology (Kitzes and et al. 2007), we show it as a separate piece of information that gives some indication of WWF's use of electricity. All other EF categories follow the GFN standards (see www.footprintstandards.org).

[3] The correct way of dealing with this issue is to apply the concept of shared responsibility and split the emissions between agents of a supply chain (Lenzen et al. 2007; Wiedmann and Lenzen 2006). This is not least because there are significant implications on carbon trading and carbon offsetting when accounting for the carbon footprint. If carbon emissions were to be traded or offset, a shared responsibility approach needs to be applied.

Table 1 below shows the total impact for all 30 TBL indicators and Figure 1 illustrates the proportions of direct versus indirect impact. The ranges of uncertainty are based on a Monte-Carlo analysis and give an indication of the possible variation through uncertainty in input data.

Main findings for the Financial Year 2007 are:

- WWF-UK's operations lead to a total compensation of employees of £13.1m. 60% of this (£7.9 m) is paid directly by WWF-UK to its own employees whereas the rest (£5.2m) is paid by partners of WWF-UK to pay for their own staff.
- WWF-UK helps to create £3.1m of profit (gross operating surplus) in other organisations. As a non-profit organisation WWF-UK has no 'on-site' (direct) profits on its own.
- For each person that WWF-UK employs in-house, it helps to create about one other job in other organisations. The indicator 'Employment' can be seen as a 'job footprint': of the total of 478 full time equivalents (FTE), 243 FTE are located in Panda House (51% direct impact) and 235 FTE are sustained elsewhere in the UK economy (49% indirect impact).
- Panda House activities trigger a release of about 1,968 tonnes of greenhouse gas emissions, most of which is carbon dioxide. Only around 3% (54 t $CO_2$-e) of this amount is generated on-site (direct emissions from the building); the vast majority (97%) is embodied in goods and services bought or paid for by WWF-UK!
- This low proportion of only a few percent of direct impact can be observed in most energy related indictors (see Figure 1). For most of the other indicators, WWF-UK has no on-site impacts at all, i.e. 100% of the TBL impact is generated by other agents that provide goods and services for WWF-UK.
- The total Ecological Footprint of WWF-UK is 703 global hectares (gha). 63% of this is due to the fossil fuel energy Footprint (484 gha). Only 4.5% of the total EF occurs on-site, i.e. directly at Panda House.
- Some of the other environmental impacts indirectly caused by WWF-UK are: 16 tonnes of air pollutants ($SO_2$, $NO_x$ and $NH_3$), 200 tonnes of total paper use, over 300 kg of pesticide use and over 200 kg of lead emissions.

**Table 1: Total (direct + indirect) impact of TBL indicators for Panda House, FY2007**

| Indicator | **Impact of Panda House FY2007** | Unit | Lower Uncertainty | Upper Uncertainty | Uncertainty Unit |
|---|---|---|---|---|---|
| Compensation of employees | **13.1** | £million | 12.2 | 14.1 | £million |
| Profits (Gross operating surplus) | **3.13** | £million | 2.33 | 4.21 | £million |
| Employment | **478** | emp-y | 434 | 525 | emp-y |
| Material flow | **1,195** | t | 1,005 | 1,406 | t |
| Energy consumption | **830** | toe | 724 | 941 | toe |
| Ecological Footprint | **703** | gha | 596 | 821 | gha |
| Greenhouse gases | **1,968** | t CO2-e | 1,462 | 2,623 | t CO2-e |
| Air pollutants | **16.3** | t | 12.3 | 21.5 | t |
| Fossil fuel energy Footprint | **447** | gha | 380 | 521 | gha |
| Nuclear energy Footprint | **22.7** | gha | 14.6 | 34.9 | gha |
| Crop land Footprint | **19.9** | gha | 14.6 | 27.0 | gha |
| Pasture Footprint | **6.7** | gha | 4.9 | 9.1 | gha |
| Built land Footprint | **133** | gha | 88 | 200 | gha |
| Sea Footprint | **9.3** | gha | 6.7 | 12.7 | gha |
| Forest Footprint | **64.3** | gha | 38.8 | 102.2 | gha |
| Carbon dioxide, CO2 | **1,861** | t | 1,580 | 2,170 | t |
| Methane, CH4 | **2,193** | kg | 1,298 | 3,556 | kg |
| Nitrous oxide, N2O | **198** | kg | 107 | 352 | kg |
| Sulphur dioxide, SO2 | **3.4** | t | 2.6 | 4.3 | t |
| Nitrogen Oxides, NOx | **4.3** | t | 3.4 | 5.4 | t |
| Ammonia, NH3 | **0.5** | t | 0.2 | 1.1 | t |
| Particulate matter | **293** | kg | 188 | 452 | kg |
| Carbon monoxide | **5.0** | t | 3.7 | 6.7 | t |
| Volatile organic compounds | **2.9** | t | 2.0 | 4.0 | t |
| Benzene | **19.8** | kg | 12.9 | 30.2 | kg |
| Natural gas use | **2,954** | MWh | 2,497 | 3,459 | MWh |
| Paper products | **197** | t | 109 | 343 | t |
| Pesticides | **311** | kg | 189 | 508 | kg |
| Cadmium | **16.3** | kg | 12.2 | 21.4 | kg |
| Lead | **226** | kg | 187 | 272 | kg |

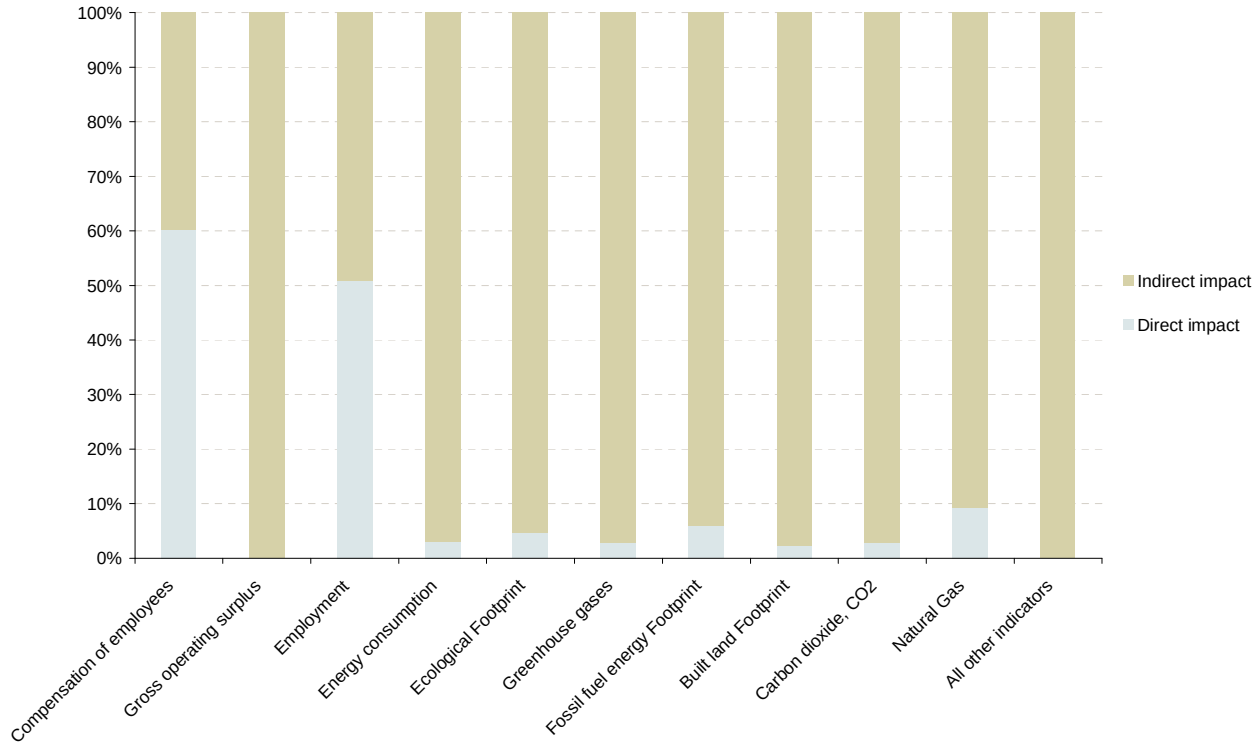



**Figure 1: Percentage of direct (on-site) versus indirect (embodied) impacts of TBL indicators, FY2007**

Table 2 and Figure 2 below compare the results for FY2007 with those from FY2005. Almost all impacts have increased which can be attributed to an absolute growth of expenditure[4] of WWF-UK in this period. The only indicator that shows a decline is employment: In 2005, 331 people were based at Panda House (giving a full time equivalent of 289.02) whereas in 2007 this number dropped to 282 (FTE of 242.71).

[4] Expenditure data was corrected for inflation.

**Table 2: Comparison of TBL impacts from Panda House in 2005 and 2007 (financial years)**

| Indicator | Impact of Panda House FY2005 | Impact of Panda House FY2007 | Unit | % Change from FY2005 to FY2007 |
|---|---|---|---|---|
| Compensation of employees | 11.96 | 13.14 | £million | 10% |
| Gross operating surplus | 2.80 | 3.13 | £million | 12% |
| Employment | 484 | 478 | emp-y | -1% |
| Material flow | 797 | 1,195 | t | 50% |
| Energy consumption | 703 | 830 | toe | 18% |
| Ecological Footprint | 642 | 703 | gha | 10% |
| Greenhouse gases | 1,790 | 1,968 | t CO2-e | 10% |
| Air pollutants | 12.1 | 16.3 | t | 35% |
| Fossil fuel energy Footprint | 418 | 447 | gha | 7% |
| Nuclear energy Footprint | 20.5 | 22.7 | gha | 11% |
| Crop land Footprint | 16.3 | 19.9 | gha | 22% |
| Pasture Footprint | 5.5 | 6.7 | gha | 22% |
| Built land Footprint | 128 | 133 | gha | 4% |
| Sea Footprint | 8.3 | 9.3 | gha | 12% |
| Forest Footprint | 26.1 | 64.3 | gha | 146% |
| Carbon dioxide, CO2 | 1,702 | 1,861 | t | 9% |
| Methane, CH4 | 1,839 | 2,193 | kg | 19% |
| Nitrous oxide, N2O | 159 | 198 | kg | 24% |
| Sulphur dioxide, SO2 | 2.56 | 3.36 | t | 31% |
| Nitrogen Oxides, NOx | 3.3 | 4.3 | t | 31% |
| Ammonia, NH3 | 0.38 | 0.50 | t | 34% |
| Particulate matter | 233 | 293 | kg | 25% |
| Carbon monoxide | 4.09 | 4.98 | t | 22% |
| Volatile organic compounds | 1.50 | 2.85 | t | 90% |
| Benzene | 14.9 | 19.8 | kg | 33% |
| Natural Gas | 2,361 | 2,954 | MWh | 25% |
| Paper products | 63 | 197 | t | 211% |
| Pesticides | 256 | 311 | kg | 22% |
| Cadmium | 11.6 | 16.3 | kg | 40% |
| Lead | 163 | 226 | kg | 39% |

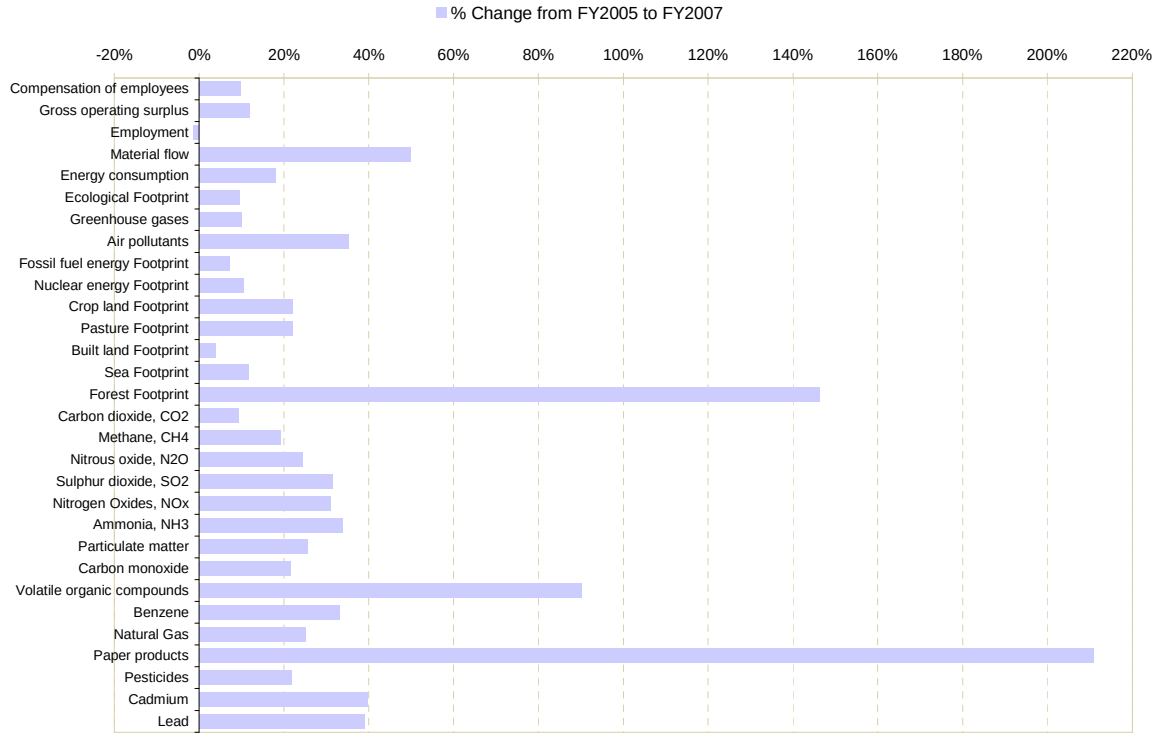



**Figure 2: Percentage change of TBL impacts from 2005 to 2007 (financial years)**

The total expenditure at Panda House in real terms was £35.1m in the financial year 2005 and £44.7m in 2007. In order to make the calculated impacts comparable the 2007 expenditure was corrected for inflation to 2005 prices, resulting in £42.9m, an increase of 23% compared to 2005. This increase in absolute expenditure explains well the increases in TBL impacts as shown in Table 2 and Figure 2. More then half (16 out of 30) are below 23%, most below 40%. However, three indicators in particular show much higher increases: Forest Footprint (+146%), Volatile organic compounds (+90%) and Paper products (+211%). As we will demonstrate in the supply chain section below, all these three increases are caused by a sharp increase in expenditure on 'printing and publishing'. The total spent in this category rose by almost a factor of ten, mainly due to a massive increase in expenditure on 'media' and 'printing', see Table 3. Spending more on printing and publishing triggers impacts higher up in the supply chain. This is why there is such a noticeable increase in some TBL indicators that are closely related to the printing and publishing industry, such as the use of paper and forestry resources or the release of volatile chemicals from the printing process.

**Table 3: Change of WWF-UK's expenditure on 'printing and publishing' between 2005 and 2007**

| Costs for printing and publishing | FY2005 | FY2007 | Change in expenditure |
|---|---|---|---|
| ARCHIVE, STORAGE & BOOKS | £ 46,823 | £ 45,325 | -3% |
| DESIGN COSTS | £ 78,896 | £ 393,130 | 398% |
| MEDIA | £ 49,412 | £ 2,837,037 | 5642% |
| PHOTOCOPIER EXPENSES | £ 24,013 | £ 15,850 | -34% |
| PRINTING | £ 121,693 | £ 1,044,262 | 758% |
| PUBLICATIONS | £ 81,396 | £ - | -100% |
| **Total** | **£ 402,233** | **£ 4,335,603** | 978% |

## Breakdown by commodity group

The tables and charts below provide a breakdown of WWF-UK's TBL indicators in 2007 by 'commodity group', i.e. by broad expenditure categories. In essence, this is a translation of expenditure on every good or service into an economic, social or environmental impact indicator. Generally, the more is spent the higher the impact becomes, as showed the increase from the year 2005 to 2007. However, different goods and services have different impacts per £ spent and this also varies across different indicators.

**Table 4: WWF-UK's direct and indirect compensation of employees (wages and salaries) by commodity group**

| Rank | Commodity | Total Impact of Panda House FY2007 | Unit | % of total |
|---|---|---|---|---|
| 1 | Panda House (on-site) | 7.90 | £million | 60.1% |
| 2 | Project grants (consulting & campaigning) | 1.66 | £million | 12.6% |
| 3 | Project grants (conservation) | 1.47 | £million | 11.2% |
| 4 | Media (publishing) | 0.47 | £million | 3.6% |
| 5 | Consultancy | 0.31 | £million | 2.4% |
| 6 | Printing | 0.17 | £million | 1.3% |
| 7 | Post and telecommunications | 0.12 | £million | 0.88% |
| 8 | Employers national insurance | 0.099 | £million | 0.75% |
| 9 | Education | 0.095 | £million | 0.72% |
| 10 | Agency fees | 0.092 | £million | 0.70% |
| 11 | Computer services | 0.086 | £million | 0.65% |
| 12 | Design costs | 0.066 | £million | 0.50% |
| 13 | Employers pension contributions | 0.065 | £million | 0.49% |
| 14 | Staff recruitment | 0.043 | £million | 0.33% |
| 15 | Fulfilment | 0.039 | £million | 0.29% |
| 16 | Research and development | 0.038 | £million | 0.29% |
| 17 | Legal & professional expenses | 0.032 | £million | 0.24% |
| 18 | Real estate activities | 0.028 | £million | 0.21% |
| 19 | Events | 0.026 | £million | 0.20% |
| 20 | Insurance | 0.026 | £million | 0.20% |
| 21 | Renting of machinery etc | 0.025 | £million | 0.19% |
| 22 | Hotels and restaurants | 0.022 | £million | 0.17% |
| 23 | Meetings, seminars & conferences | 0.022 | £million | 0.17% |
| 24 | Banking and finance | 0.018 | £million | 0.13% |
| 25 | Railway transport | 0.017 | £million | 0.13% |
| 26 | Depreciation (consulting & campaigning) | 0.017 | £million | 0.13% |
| 27 | Advertising | 0.014 | £million | 0.10% |
| 28 | Wholesale distribution | 0.013 | £million | 0.10% |
| 29 | Exhibitions & venues | 0.013 | £million | 0.10% |
| 30 | Marketing | 0.012 | £million | 0.09% |
| | All other commodities | 0.111 | £million | 0.8% |
| | **Total** | **13.1** | **£million** | **100%** |

Table 4 shows the salaries and wages ("compensation of employees") that are directly and indirectly paid by WWF-UK. Panda House paid a total of £7.9m to their own employees. This is only 60% of the total impact though as WWF-UK also paid for services and goods outside of Panda House. It indirectly helped to pay another £5.2m in salaries and wages in other organisations. Table 4 provides the breakdown: most of this indirect pay is through project grants followed by expenses for media, consultancy and printing purposes.

Just as contributing to the compensation of employees, WWF-UK also creates employment in other organisations when sponsoring them or buying goods and services from them. Table 5 lists these contributions. In FY2007, Panda House employed 282 people, equivalent of a full time employment of 242.7 FTE. Almost the same number of jobs (234 FTE) is created outside of WWF-

UK, most notably through project grants for conservation, consulting and campaigning. More jobs are created indirectly in other sectors, mostly service industries.

**Table 5: WWF-UK's direct and indirect contribution to employment by commodity group** (in full time equivalents)

| Rank | Commodity | Total Impact of Panda House FY2007 | Unit | % of total |
|---|---|---|---|---|
| 1 | Panda House (on-site) | 242.7 | FTE | 50.8% |
| 2 | Project grants (conservation) | 75.7 | FTE | 15.9% |
| 3 | Project grants (consulting & campaigning) | 71.4 | FTE | 15.0% |
| 4 | Media (publishing) | 17.4 | FTE | 3.6% |
| 5 | Consultancy | 13.4 | FTE | 2.8% |
| 6 | Printing | 6.41 | FTE | 1.3% |
| 7 | Post and telecommunications | 4.74 | FTE | 1.0% |
| 8 | Education | 4.36 | FTE | 0.9% |
| 9 | Employers national insurance | 4.31 | FTE | 0.9% |
| 10 | Agency fees | 3.95 | FTE | 0.8% |
| 11 | Computer services | 3.69 | FTE | 0.8% |
| 12 | Employers pension contributions | 2.83 | FTE | 0.6% |
| 13 | Design costs | 2.41 | FTE | 0.5% |
| 14 | Staff recruitment | 1.86 | FTE | 0.4% |
| 15 | Fulfilment | 1.66 | FTE | 0.3% |
| 16 | Research and development | 1.65 | FTE | 0.3% |
| 17 | Hotels and restaurants | 1.44 | FTE | 0.3% |
| 18 | Legal & professional expenses | 1.36 | FTE | 0.3% |
| 19 | Real estate activities | 1.28 | FTE | 0.3% |
| 20 | Events | 1.13 | FTE | 0.2% |
| 21 | Insurance | 1.12 | FTE | 0.2% |
| 22 | Renting of machinery etc | 1.08 | FTE | 0.2% |
| 23 | Meetings, seminars & conferences | 0.94 | FTE | 0.2% |
| 24 | Wholesale distribution | 0.83 | FTE | 0.2% |
| 25 | Motor vehicle distribution and repair | 0.79 | FTE | 0.2% |
| 26 | Banking and finance | 0.76 | FTE | 0.2% |
| 27 | Depreciation (consulting & campaigning) | 0.72 | FTE | 0.2% |
| 28 | Exhibitions & venues | 0.66 | FTE | 0.1% |
| 29 | Advertising | 0.58 | FTE | 0.1% |
| 30 | Marketing | 0.49 | FTE | 0.1% |
| | All other commodities | 5.1 | FTE | 1.1% |
| | **Total** | **477.7** | **FTE** | **100%** |

In FY2007, Panda House had a total Ecological Footprint of 703 gha. Only 4.5% of this impact is caused directly by WWF-UK through the burning of natural gas (32 gha on-site EF). Most of the Ecological Footprint is embodied in activities for conservation projects (161 gha or 23%), other projects (151 gha or 22%) and publishing (media) activities (105 gha or 15%). Air transport creates about the same EF as heating Panda House (32 gha or 4.5%) whereas railway transport contributes just over 8 gha (1.2%) to the total EF. Further details are listed in Table 6 below. Thanks to WWF-UK purchasing electricity generated from renewable resources the EF of electricity is very small (6.7 gha) and contributes only 1% to the total. However, it is not zero as even electricity from green

sources requires some upstream production inputs (e.g. wind turbine manufacturing, built-up area for hydro dams, etc.) which have an Ecological Footprint attached to them. The EF results are also depicted in Figure 3.

**Table 6: WWF-UK's direct and indirect Ecological Footprint by commodity group**

| Rank | Commodity | Total Impact of Panda House FY2007 | Unit | % of total |
|---|---|---|---|---|
| 1 | Project grants (conservation) | 160.9 | gha | 22.9% |
| 2 | Project grants (consulting & campaigning) | 151.4 | gha | 21.5% |
| 3 | Media (publishing) | 104.9 | gha | 14.9% |
| 4 | Printing | 38.6 | gha | 5.5% |
| 5 | Panda House (on-site) | 31.8 | gha | 4.5% |
| 6 | Air transport | 31.6 | gha | 4.5% |
| 7 | Consultancy | 28.5 | gha | 4.0% |
| 8 | Design costs | 14.5 | gha | 2.1% |
| 9 | Employers national insurance | 10.2 | gha | 1.5% |
| 10 | Post and telecommunications | 10.2 | gha | 1.5% |
| 11 | Education | 8.95 | gha | 1.3% |
| 12 | Agency fees | 8.37 | gha | 1.2% |
| 13 | Railway transport | 8.34 | gha | 1.2% |
| 14 | Hotels and restaurants | 7.98 | gha | 1.1% |
| 15 | Employers pension contributions | 6.73 | gha | 1.0% |
| 16 | Electricity production and distribution | 6.71 | gha | 1.0% |
| 17 | Pulp and paper | 5.83 | gha | 0.8% |
| 18 | Office machinery and computers | 5.77 | gha | 0.8% |
| 19 | Computer services | 4.58 | gha | 0.7% |
| 20 | Staff recruitment | 3.95 | gha | 0.6% |
| 21 | Fulfilment | 3.53 | gha | 0.5% |
| 22 | Furniture and misc. manufacturing | 3.52 | gha | 0.5% |
| 23 | Legal & professional expenses | 2.88 | gha | 0.4% |
| 24 | Insurance | 2.66 | gha | 0.4% |
| 25 | Events | 2.39 | gha | 0.3% |
| 26 | Meetings, seminars & conferences | 1.98 | gha | 0.3% |
| 27 | Depreciation (consulting & campaigning) | 1.53 | gha | 0.2% |
| 28 | Exhibitions & venues | 1.41 | gha | 0.2% |
| 29 | Advertising | 1.23 | gha | 0.2% |
| 30 | Marketing | 1.05 | gha | 0.1% |
| | All other commodities | 31.6 | gha | 4.5% |
| | **Total** | **703** | **gha** | **100%** |

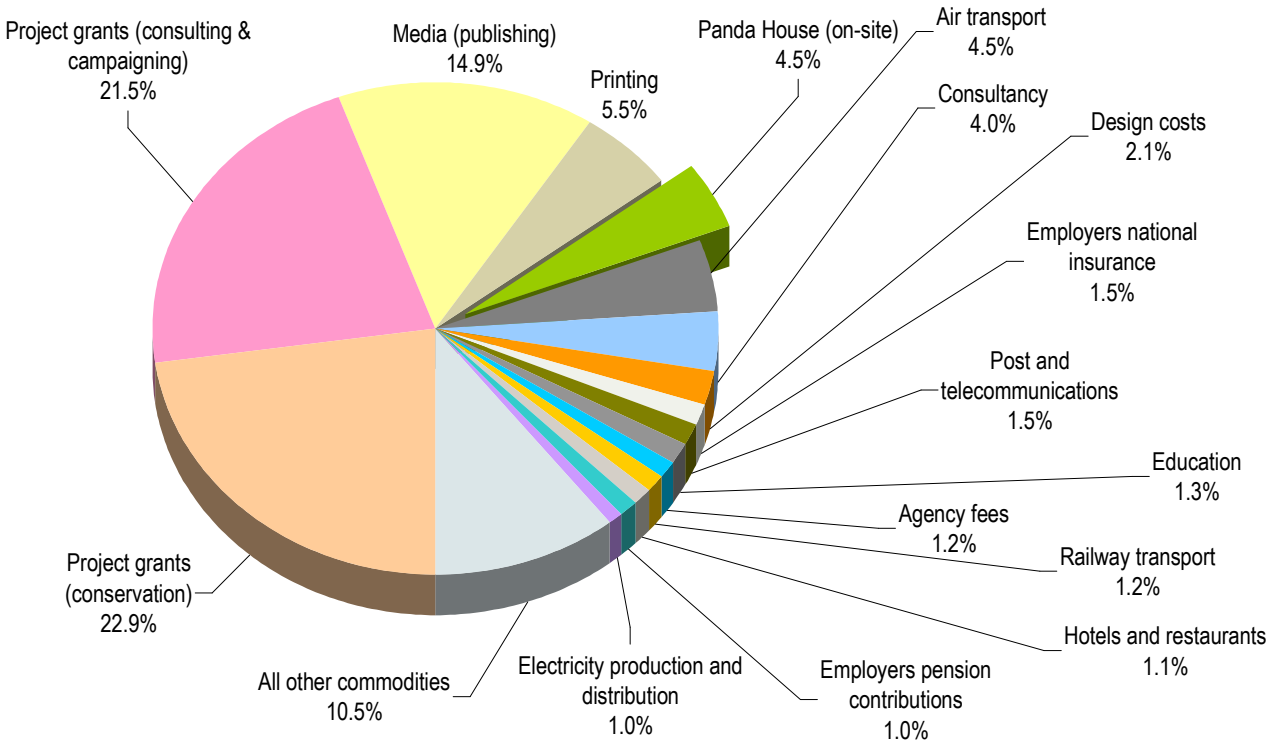



**Figure 3: Ecological Footprint of Panda House by commodity group, FY2007**

A breakdown of the total climate footprint of Panda House, i.e. all direct plus indirect emissions of greenhouse gases provides a similar picture to the Ecological Footprint. This is not surprising as the EF is dominated by the 'Fossil Fuel Energy Footprint' component which is directly proportional to carbon dioxide emissions (which is also the dominating greenhouse gas, see Table 1). Table 7 shows details of the climate footprint breakdown. Air transport contributes here 8.2% to the total climate footprint (161 t $CO_2$-e) and comes on fourth place. Direct (on-site) emissions from Panda House play a minor role with 2.7% of the total climate footprint (54 t $CO_2$-e).

**Table 7: WWF-UK's direct and indirect greenhouse gas emissions (climate footprint) by commodity group**

| Rank | Commodity | Total Impact of Panda House FY2007 | Unit | % of total |
|---|---|---|---|---|
| 1 | Project grants (conservation) | 529.9 | t CO2-e | 26.9% |
| 2 | Project grants (consulting & campaigning) | 320.6 | t CO2-e | 16.3% |
| 3 | Media (publishing) | 297.8 | t CO2-e | 15.1% |
| 4 | Air transport | 161.4 | t CO2-e | 8.2% |
| 5 | Printing | 109.6 | t CO2-e | 5.6% |
| 6 | Consultancy | 60.2 | t CO2-e | 3.1% |
| 7 | Panda House (on-site) | 53.9 | t CO2-e | 2.7% |
| 8 | Design costs | 41.3 | t CO2-e | 2.1% |
| 9 | Post and telecommunications | 38.6 | t CO2-e | 2.0% |
| 10 | Employers national insurance | 34.4 | t CO2-e | 1.7% |
| 11 | Education | 23.2 | t CO2-e | 1.2% |
| 12 | Employers pension contributions | 22.6 | t CO2-e | 1.1% |
| 13 | Office machinery and computers | 21.0 | t CO2-e | 1.1% |
| 14 | Electricity production and distribution | 20.3 | t CO2-e | 1.0% |
| 15 | Agency fees | 17.7 | t CO2-e | 0.9% |
| 16 | Computer services | 16.2 | t CO2-e | 0.8% |
| 17 | Pulp and paper | 16.1 | t CO2-e | 0.8% |
| 18 | Railway transport | 14.4 | t CO2-e | 0.7% |
| 19 | Renting of machinery etc | 11.5 | t CO2-e | 0.6% |
| 20 | Furniture and miscellaneous manufacturing | 11.4 | t CO2-e | 0.6% |
| 21 | Insurance | 8.9 | t CO2-e | 0.5% |
| 22 | Staff recruitment | 8.4 | t CO2-e | 0.4% |
| 23 | Fulfilment | 7.5 | t CO2-e | 0.4% |
| 24 | Legal & professional expenses | 6.1 | t CO2-e | 0.3% |
| 25 | Events | 5.1 | t CO2-e | 0.3% |
| 26 | Exhibitions & venues | 4.6 | t CO2-e | 0.2% |
| 27 | Meetings, seminars & conferences | 4.2 | t CO2-e | 0.2% |
| 28 | Depreciation (consulting & campaigning) | 3.2 | t CO2-e | 0.2% |
| 29 | Archive & storage | 3.0 | t CO2-e | 0.2% |
| 30 | Advertising | 2.6 | t CO2-e | 0.1% |
| | All other commodities | 92.4 | t CO2-e | 4.7% |
| | **Total** | **1,968** | **t CO2-e** | **100%** |

## Breakdown by production layer

The impacts that are embodied in the goods and services bought by WWF-UK are created by other agents in the economy, other organisations and businesses that "supply" WWF-UK with products. Some of the embodied impacts come from the direct suppliers to WWF-UK, some come from higher up in the supply chain. The contribution of each 'layer' of suppliers can be determined with a 'production layer decomposition' and the results of such an analysis is shown in the following charts. 'Layer 1' is Panda House itself, i.e. impacts that occur "on site", like direct employment or direct emissions from heating the building etc. These direct, on-site impacts appear on the left side of the diagrams. The whole rest of the economy is represented by 18 broad categories, ranging

from 'Agriculture' through to 'Personal services'[5]. Their contributions to indirect embodied impacts are shown in Layers 2 to 8.

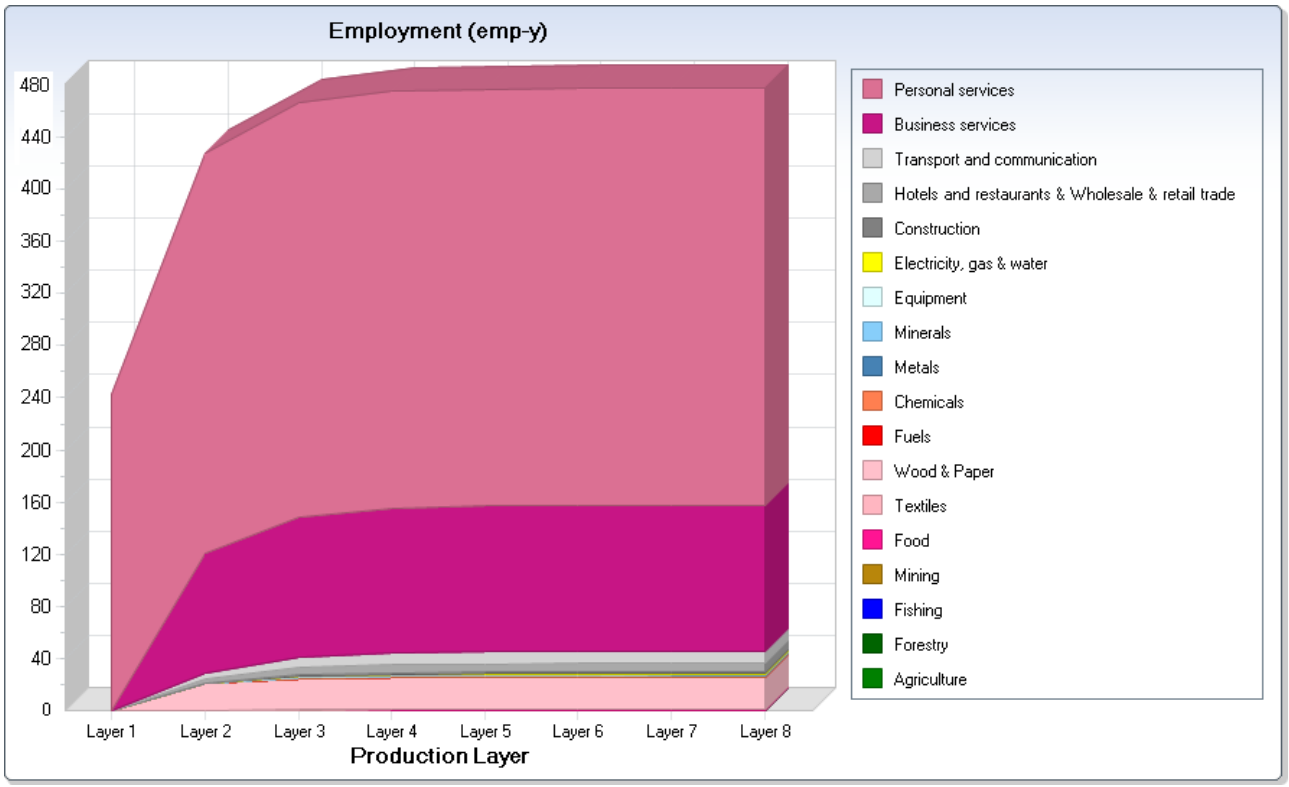



**Figure 4: Employment creation by Panda House operations by production layer, in FTE** (WWF-UK as part of the sector 'Membership Organisations' falls under the category 'Personal services'. Layer 1 = on-site impacts from Panda House; Layer 2 and higher = indirect impacts from suppliers)

Figure 4 shows WWF-UK's "job footprint" by production layer. In 2007 Panda House employed 242 people (FTE). This is shown in Layer 1. Through its operations, WWF-UK helps to maintain another 181 FTE with its direct suppliers, of which 92 are in Business services, 66 in other Personal services, 20 in the Wood & paper sector and 8 in other sectors. Another 50 jobs (FTE) are created in businesses that supply the suppliers of WWF-UK (Layer 3 and higher), adding up to a total "job footprint" of 478 FTE. In summary it can be said that Panda House supports to employment of about as many people in other parts of the economy as it employs directly in-house.

Figure 5 shows a decomposition of WWF-UK's Ecological Footprint. Panda House itself (Layer 1) only contributes a very small on-site Footprint of 32 gha or 4.5% of the total. In Layer 2 – the direct suppliers to WWF-UK – organisations from the sectors Business services, Transport & communication and Wood & paper. The EF from direct electricity suppliers is close to zero as

[5] WWF-UK is classified under the category 'Personal services'. We have summarised the following sectors under this category: Public administration and defence, Education, Health and social work, Sewage and refuse services, Membership organisations (to which WWF-UK belongs), Recreational services, Other service activities and Private households with employed persons.

WWF-UK purchases electricity from renewable energy sources. Interestingly however, the contribution from other electricity suppliers rises quickly further away from WWF-UK. This is because the goods and services that WWF-UK buys do require electrical power at some stage of their production and it is not in the hands of WWF-UK or its direct electricity supplier to control these inputs. Examples are the use of electricity from coal-fired power stations for the production of steel for wind turbines that are used to generate the power for Panda House.

In Layer 3 and higher all economic sectors add more to the Ecological Footprint and other players enter the picture, e.g. Agriculture, Forestry and Chemicals. The impact from those last three sectors can mainly be attributed to WWF-UK's expenditure on printing and publishing. The total EF of 703 global hectares is approximately reached in Layer 5, underlining the fact that impacts can occur "far away" from the organisation that triggers them in the first place.

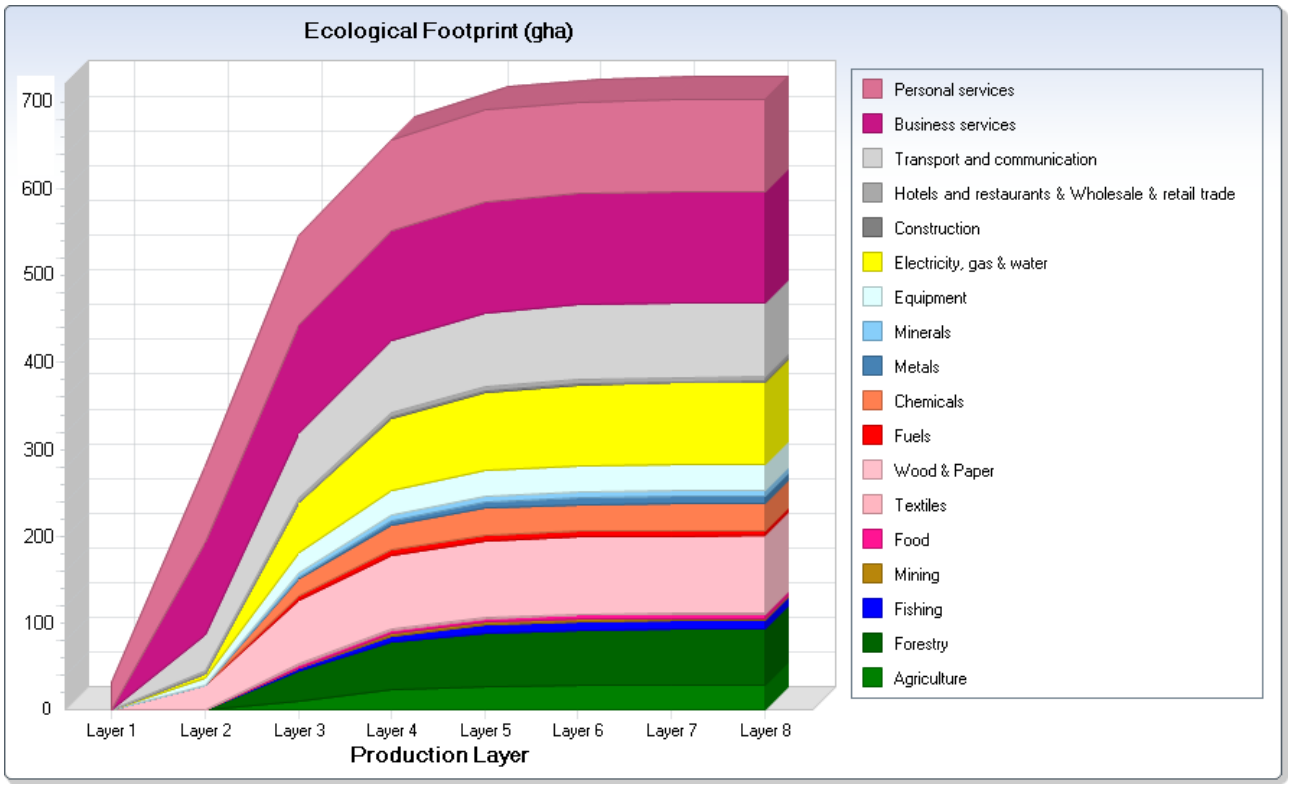



**Figure 5: Ecological Footprint of Panda House by production layer**

The climate footprint, i.e. total direct and indirect greenhouse gas emissions, shows a similar production layer composition as the Ecological Footprint, see Figure 6. When looking at the right end of the graph, the top five contributing sector groups to the total climate footprint can be identified as (in descending order): Transport & communication, Wood & paper, Personal services, Electricity and Chemicals. Again, more than half of the climate footprint originates from Layer 3 or higher – WWF-UK itself contributes less than 3% to the total of 1,970 t $CO_2$-e and its direct suppliers (Layer 2) only around 37% (730 t $CO_2$-e)!

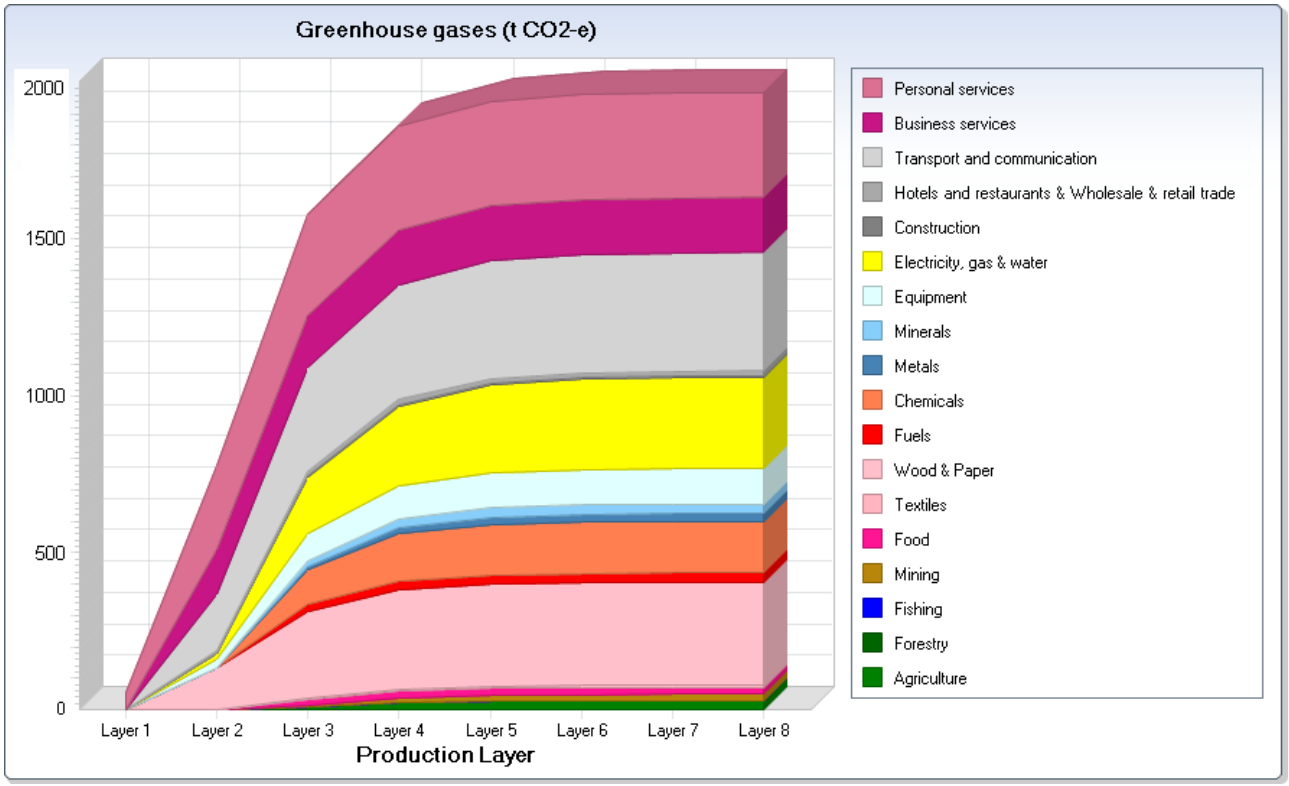



**Figure 6: Climate footprint of Panda House by production layer**

Finally, a decomposition of the material flows indicator provides an interesting picture (Figure 7). This indicator shows the amount of materials in terms of physical quantities of products from the primary (raw materials) and secondary (manufactured goods) sector of the economy. Naturally, services sectors (tertiary) don't play a role here as they don't produce any physical output. WWF-UK itself doesn't either, so the on-site impact (Layer 1) is zero. In Layer 2 only 'Wood & paper' appears which represents the amount of paper directly supplied to Panda House, mainly for the purpose of photocopying and printing. In Layer 3 more sectors contribute to the total material flow, most notably Mining, Food, Mineral, Chemicals and Wood & paper again. Most of these material flows can be attributed to the indirect requirements of conservation and other projects funded by WWF-UK. At Layer 3 still only half of the total material flows are accounted for, the second half occurs higher up in the production / supply chain.

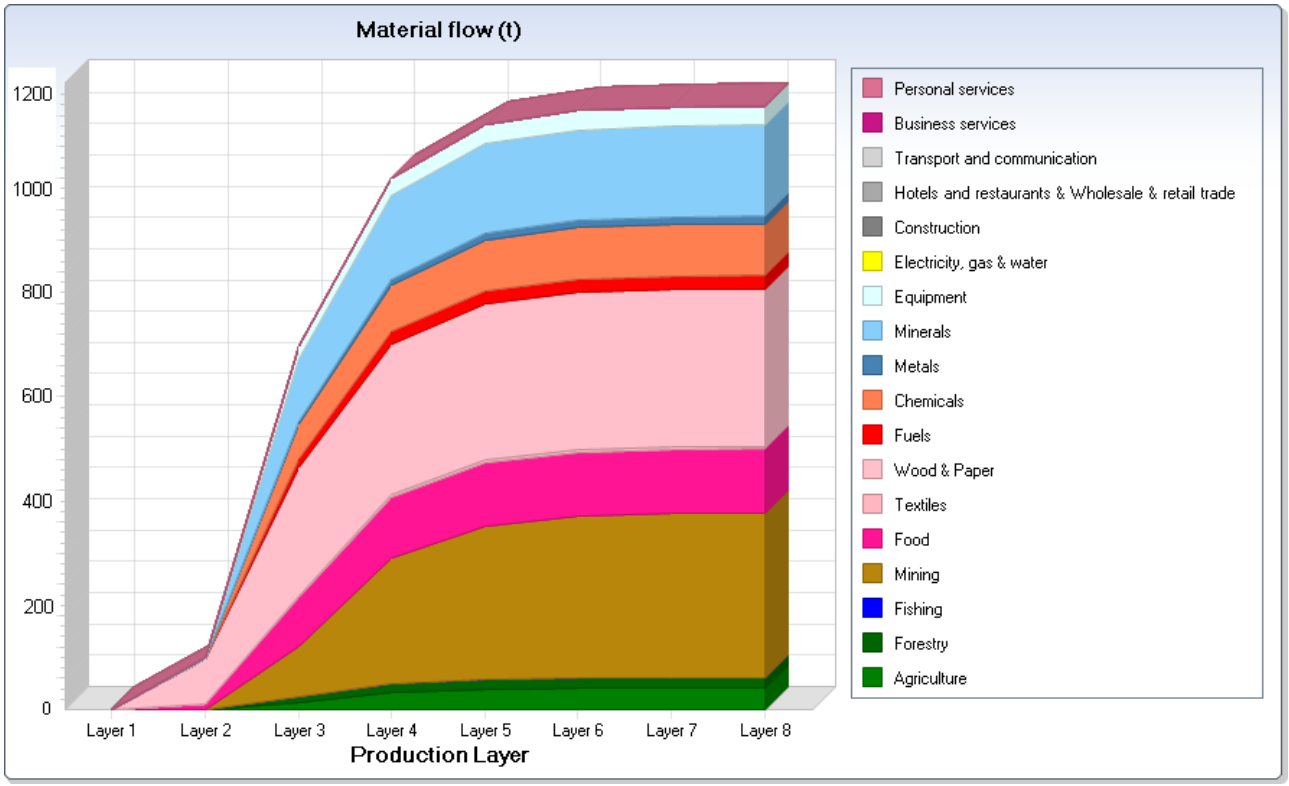



**Figure 7: Indirect material flows induced by Panda House operations by production layer**

## Supply chain analysis

The results shown above can be further disaggregated and analysed by using a technique called Structural Path Analysis. In the following we briefly explain how this is done.

All sectors in an economy trade with each other and thus are interlinked through an immense and finely woven web of financial and physical transactions. This highly complex structure is best depicted as an ever-expanding "tree of interdependence" that starts at a particular economic entity, and stretches across upstream production processes – or 'layers' – containing sectors at different production stages linked together by supply chains.

Individual supply chains can be seen as 'paths' leading through the web of suppliers and recipients of transactions. The following picture shows a simplified example: A family that wants to make a train journey requires a service, e.g. the purchase of a train ticket. The train company requires a product, the train, in order to provide the service. The train itself requires steel – amongst many other things – and the steel manufacturer would have bought iron ore which would have required land for mining in the first place.

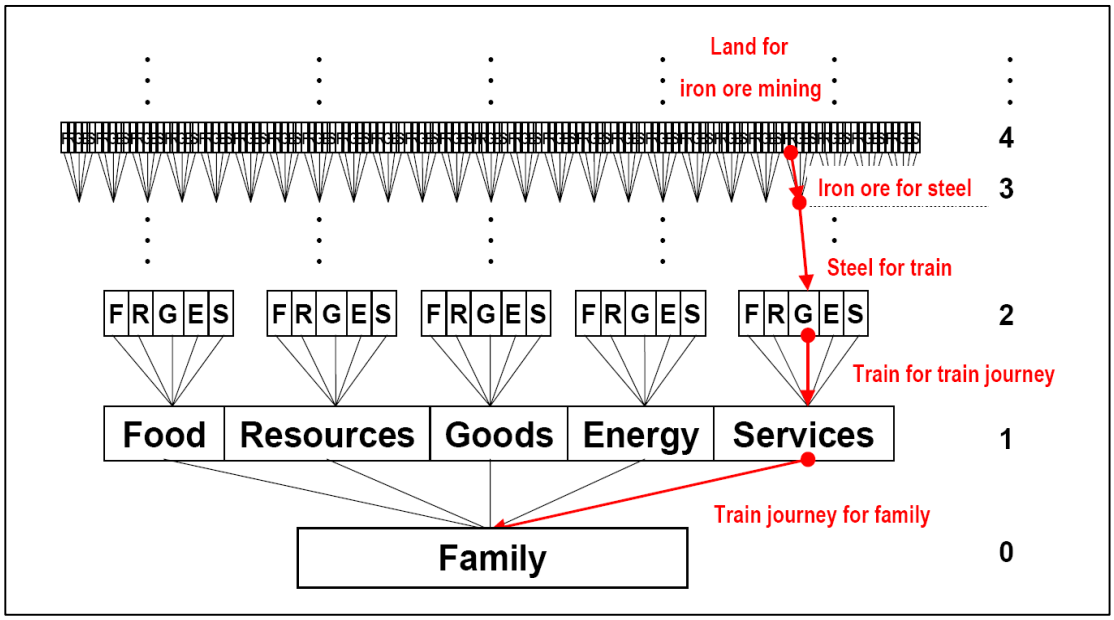



**Figure 8: Depiction of one particular structural path (supply chain) leading through layers of economic transactions**

A particular impact – e.g. $CO_2$ emissions – associated with a good or a service cascades from primary industries producing raw materials, via secondary (manufacturing) industries into the sector or company that delivers the final product to the consumer.

It is mathematically possible to 'trace' this impact through the various stages of production processes. This is because all financial transactions in an economy are described in the input-output tables which are part of the national economic accounts compiled by many countries.

The analytical method used for the quantification of supply chain impacts is called Structural Path Analysis (or SPA) and was introduced into economics and regional science in 1984. SPA allocates (environmental) impacts to individual transactions between sectors in the entire upstream supply chain. It "unravels" an organisation's impacts into single contributing supply paths. It gives extensive detail of the impact of a sector's or company's activities. It allows investigating the location of impacts within the supply chain. In the case of a company, the control over the input procurement process then provides the possibility of substituting impact-intensive suppliers with more sustainable suppliers.

A structural path (or supply chain) analysis is particularly helpful if one is interested in one particular 'hot spot' of an impact and wants to know more about the origin of this impact. In the first section we have seen that WWF-UK increased its expenditure on printing and publishing by almost a factor of ten between 2005 and 2007 and that this results in significant increases in the indicators Forest Footprint, Volatile organic compounds and Paper products. We will now use SPA of these indicators to investigate the links to expenditure on printing and publishing.

The following tables show that printing and publishing (P&P) commissioned by WWF-UK is responsible for the single biggest impact in the use of paper products (60% of total impact, Table

8), the release of volatile organic compounds[6] (32%, Table 9) and the Forest Footprint (44%, Table 10). The funding of conservation projects as well as expenditure on consultancy and other business services also contribute indirectly to the use of paper products, forest resources and the release of volatile organic compounds. Some of the paths in the tables below are of fourth or fifth order, indicating that impacts can occur high up in the supply chain.

**Table 8: Use of paper products in the supply chains of Panda House (structural path analysis)** ('P&P' stands for 'printing and publishing').

| Rank | Path Description | Path Value | Unit | Path Order | % of total impact |
|---|---|---|---|---|---|
| 1 | Paper products > P&P > Panda House 07 | 118.97 | t | 3 | 60.30% |
| 2 | Paper products > Panda House 07 | 14.26 | t | 2 | 7.23% |
| 3 | Paper products > Paper products > P&P > Panda House 07 | 11.80 | t | 4 | 5.98% |
| 4 | Paper products > P&P > P&P > Panda House 07 | 9.30 | t | 4 | 4.71% |
| 5 | Paper products > Consultancy / business services > Panda House 07 | 9.25 | t | 3 | 4.69% |
| 6 | Paper products > Conservation projects > Panda House 07 | 5.48 | t | 3 | 2.78% |
| 7 | Paper products > P&P > Consultancy / business services > Panda House 07 | 3.85 | t | 4 | 1.95% |
| 8 | Paper products > P&P > Conservation projects > Panda House 07 | 1.94 | t | 4 | 0.99% |
| 9 | Paper products > Insurance and pension funds > Panda House 07 | 1.48 | t | 3 | 0.75% |
| 10 | Paper products > Paper products > Panda House 07 | 1.41 | t | 3 | 0.72% |
| 11 | Paper products > Paper products > Paper products > P&P > Panda House 07 | 1.17 | t | 5 | 0.59% |
| 12 | Paper products > Paper products > P&P > P&P > Panda House 07 | 0.92 | t | 5 | 0.47% |
| 13 | Paper products > Paper products > Consultancy / business services > Panda House 07 | 0.92 | t | 4 | 0.47% |
| 14 | Paper products > Business services > Consultancy / business services > Panda House 07 | 0.91 | t | 4 | 0.46% |
| 15 | Paper products > P&P > P&P > P&P > Panda House 07 | 0.73 | t | 5 | 0.37% |
| 16 | Paper products > P&P > Insurance and pension funds > Panda House 07 | 0.71 | t | 4 | 0.36% |
| 17 | Paper products > Food and drink > Conservation projects > Panda House 07 | 0.56 | t | 4 | 0.28% |
| 18 | Paper products > Paper products > Conservation projects > Panda House 07 | 0.54 | t | 4 | 0.28% |
| 19 | Paper products > Conservation projects > Conservation projects > Panda House 07 | 0.52 | t | 4 | 0.26% |
| 20 | Paper products > Paper products > P&P > Consultancy / business services > Panda House 07 | 0.38 | t | 5 | 0.19% |

[6] Volatile organic compounds (VOC) are a mix of volatile chemicals such as aerosols or solvents used in various industrial processes, e.g. printing. Often, they are released into the atmosphere after use where they can have a lifespan of days to months. They are classified as air pollutants because they contribute to the photochemical creation of ozone ("summer smog").

**Table 9: Volatile organic compounds in the supply chains of Panda House (structural path analysis)** ('P&P' stands for 'printing and publishing').

| Rank | Path Description | Path Value | Unit | Path Order | % of total impact |
|---|---|---|---|---|---|
| 1 | P&P > Panda House 07 | 901.62 | kg | 2 | 31.60% |
| 2 | Consultancy / business services > Panda House 07 | 122.46 | kg | 2 | 4.30% |
| 3 | Paper products > P&P > Panda House 07 | 116.00 | kg | 3 | 4.07% |
| 4 | Forestry > P&P > Panda House 07 | 88.50 | kg | 3 | 3.10% |
| 5 | P&P > P&P > Panda House 07 | 70.45 | kg | 3 | 2.47% |
| 6 | Conservation projects > Panda House 07 | 56.48 | kg | 2 | 1.98% |
| 7 | Food and drink > Conservation projects > Panda House 07 | 55.97 | kg | 3 | 1.96% |
| 8 | Motor vehicle distribution and repair > Panda House 07 | 50.71 | kg | 2 | 1.78% |
| 9 | Paints, varnishes, printing ink etc > P&P > Panda House 07 | 34.83 | kg | 3 | 1.22% |
| 10 | P&P > Consultancy / business services > Panda House 07 | 29.18 | kg | 3 | 1.02% |
| 11 | Food and drink > Consultancy / business services > Panda House 07 | 22.41 | kg | 3 | 0.79% |
| 12 | Petrol > Consultancy / business services > Panda House 07 | 21.15 | kg | 3 | 0.74% |
| 13 | Motor vehicle distribution and repair > Consultancy / business services > Panda House 07 | 16.77 | kg | 3 | 0.59% |
| 14 | P&P > Conservation projects > Panda House 07 | 14.74 | kg | 3 | 0.52% |
| 15 | Furniture and misc. manufacturing > Consultancy / business services > Panda House 07 | 14.61 | kg | 3 | 0.51% |
| 16 | Furniture and misc. manufacturing > Conservation projects > Panda House 07 | 13.99 | kg | 3 | 0.49% |
| 17 | Oil and gas extraction > Petrol > Consultancy / business services > Panda House 07 | 13.90 | kg | 4 | 0.49% |
| 18 | Paper products > Panda House 07 | 13.90 | kg | 2 | 0.49% |
| 19 | Furniture and miscellaneous manufacturing > Panda House 07 | 13.88 | kg | 2 | 0.49% |
| 20 | Road transport > Consultancy / business services > Panda House 07 | 13.34 | kg | 3 | 0.47% |

**Table 10: Forest Footprint in the supply chains of Panda House (structural path analysis)** ('P&P' stands for 'printing and publishing').

| Rank | Path Description | Path Value | Unit | Path Order | % of total impact |
|---|---|---|---|---|---|
| 1 | Forestry > P&P > Panda House 07 | 28.04 | gha | 3 | 43.60% |
| 2 | Forestry > Conservation projects > Panda House 07 | 3.98 | gha | 3 | 6.19% |
| 3 | Forestry > Paper products > P&P > Panda House 07 | 2.89 | gha | 4 | 4.49% |
| 4 | Forestry > Wood products > Conservation projects > Panda House 07 | 2.71 | gha | 4 | 4.22% |
| 5 | Forestry > Consultancy / business services > Panda House 07 | 2.55 | gha | 3 | 3.97% |
| 6 | Forestry > Forestry > P&P > Panda House 07 | 2.41 | gha | 4 | 3.74% |
| 7 | Forestry > P&P > P&P > Panda House 07 | 2.19 | gha | 4 | 3.41% |
| 8 | Forestry > Wood products > Consultancy / business services > Panda House 07 | 1.59 | gha | 4 | 2.48% |
| 9 | Forestry > Wood products > Paper products > P&P > Panda House 07 | 1.03 | gha | 5 | 1.60% |
| 10 | Forestry > P&P > Consultancy / business services > Panda House 07 | 0.91 | gha | 4 | 1.41% |
| 11 | Forestry > Wood products > P&P > Panda House 07 | 0.81 | gha | 4 | 1.26% |
| 12 | Forestry > P&P > Conservation projects > Panda House 07 | 0.46 | gha | 4 | 0.71% |
| 13 | Forestry > Insurance and pension funds > Panda House 07 | 0.44 | gha | 3 | 0.68% |
| 14 | Forestry > Conservation projects > Conservation projects > Panda House 07 | 0.38 | gha | 4 | 0.59% |
| 15 | Forestry > Paper products > Panda House 07 | 0.35 | gha | 3 | 0.54% |
| 16 | Forestry > Forestry > Conservation projects > Panda House 07 | 0.34 | gha | 4 | 0.53% |
| 17 | Forestry > Paper products > Paper products > P&P > Panda House 07 | 0.29 | gha | 5 | 0.44% |
| 18 | Forestry > Wood products > Conservation projects > Conservation projects > Panda House 07 | 0.26 | gha | 5 | 0.40% |
| 19 | Forestry > Consultancy / business services > Consultancy / business services > Panda House 07 | 0.25 | gha | 4 | 0.39% |
| 20 | Forestry > Forestry > Paper products > P&P > Panda House 07 | 0.25 | gha | 5 | 0.38% |

These findings are an excellent example for the benefits of looking at a range of indicators. If the analysis had been limited to the carbon footprint alone no increase in the particular areas related to the use of paper and forest resources would have been noticed. Only by monitoring a wider range of TBL impact categories – 30 in this study – has it been possible to pick up a sharp increase in the indicators 'paper products', 'forest footprint', and 'volatile organic compounds' between 2005 and 2007, due to an steep increase in WWF-UK's expenditure on 'printing and publishing'.

## Benchmarking

How does WWF-UK's TBL performance compare with similar organisations in the UK? This question is not an easy one to answer. Different organisations, even those with a similar remit, have different sizes and provide different services, leading to different impacts on the environment. As a boundary for the analysis we have chosen the total expenditure of Panda House to derive the indirect TBL impacts. The same boundary can be applied to the economic sector to which WWF-UK belongs.

Data on total expenditure and on-site emissions from the UK sector "Membership organisations" is available from the Office for National Statistics. When expressing the TBL performance as total impact per £ spent, a comparison between the different entities becomes possible. The tables and figures below show the results of this comparison. The figures are shown as the impact per £ spent, therefore providing a comparable measure with the sector irrespective of total spend.

**Table 11: Total impact intensity of TBL indicators in comparison to the benchmark sector of Membership Organisations, FY 2007**

| Indicator | **Impact Intensitiy of Panda House FY2007** | Unit | Lower Uncertainty | Upper Uncertainty | **Total Sector Intensity** |
|---|---|---|---|---|---|
| Compensation of employees | **37.6** | p/£ | 34.9 | 40.4 | **58.1** |
| Gross operating surplus | **8.95** | p/£ | 6.66 | 12.03 | **22.15** |
| Employment | **1.70** | emp-min/£ | 1.55 | 1.87 | **3.78** |
| Material flow | **33.2** | g/£ | 26.1 | 44.6 | **69.0** |
| Energy consumption | **894** | kJ/£ | 715 | 1,073 | **2,859** |
| Ecological Footprint | **0.20** | g-m2/£ | 0.15 | 0.25 | **1.15** |
| Greenhouse gases | **56.3** | g CO2-e/£ | 41.5 | 91.1 | **174.6** |
| Air pollutants | **443** | mg/£ | 332 | 554 | **3,845** |
| Fossil fuel energy Footprint | **0.124** | g-m2/£ | 0.107 | 0.179 | **0.393** |
| Nuclear energy Footprint | **0.0013** | g-m2/£ | 0.0010 | 0.0017 | **0.0107** |
| Crop land Footprint | **0.0057** | g-m2/£ | 0.0038 | 0.0086 | **0.0182** |
| Pasture Footprint | **0.0019** | g-m2/£ | 0.0013 | 0.0029 | **0.0061** |
| Built land Footprint | **0.0380** | g-m2/£ | 0.0228 | 0.0634 | **0.7007** |
| Sea Footprint | **0.0026** | g-m2/£ | 0.0017 | 0.0040 | **0.0051** |
| Forest Footprint | **0.0184** | g-m2/£ | 0.0093 | 0.0365 | **0.0153** |
| Carbon dioxide, CO2 | **53.4** | g/£ | 42.7 | 64.1 | **165.3** |
| Methane, CH4 | **62.7** | mg/£ | 30.9 | 127.1 | **131.2** |
| Nitrous oxide, N2O | **5.65** | mg/£ | 2.55 | 12.56 | **21.03** |
| Sulphur dioxide, SO2 | **87.9** | mg/£ | 66.8 | 137.8 | **115.7** |
| Nitrogen Oxides, NOx | **113** | mg/£ | 89 | 172 | **344** |
| Ammonia, NH3 | **14.4** | mg/£ | 4.8 | 42.9 | **25.3** |
| Particulate matter | **7.4** | mg/£ | 4.9 | 14.4 | **19.0** |
| Carbon monoxide | **142** | mg/£ | 95 | 213 | **3,172** |
| Volatile organic compounds | **81.5** | mg/£ | 51.7 | 128.5 | **164.0** |
| Benzene | **0.57** | mg/£ | 0.34 | 0.96 | **2.81** |
| Natural gas use | **0.084** | kWh/£ | 0.065 | 0.110 | **0.271** |
| Paper products | **5.64** | g/£ | 2.60 | 12.24 | **1.66** |
| Pesticides | **8.89** | mg/£ | 4.90 | 16.15 | **29.58** |
| Cadmium | **0.47** | mg/£ | 0.32 | 0.68 | **0.78** |
| Lead | **6.47** | mg/£ | 4.85 | 8.63 | **10.02** |

Many of the indicators demonstrate that the environmental impact of WWF-UK is significantly lower than the sector average. This clearly demonstrates WWF-UK's commitment to the environment. Table 12 provides a meaningful comparison documenting the percentage difference between the sector and WWF. Further information on benchmarking can be found in the Appendix.

**Table 12: Relative intensity of TBL impacts, FY2007**
(a relative impact of over 1 means "worse" than sector average, smaller than 1 means "better" than average)

| Indicator | **Relative Impact Intensity of Panda House FY2007** | Lower Uncertainty | Upper Uncertainty | Normalised intensity of benchmark sector |
|---|---|---|---|---|
| Compensation of employees | **1.55** | 1.44 | 1.67 | 1.00 |
| Gross operating surplus | **2.48** | 1.84 | 3.33 | 1.00 |
| Employment | **2.22** | 2.02 | 2.44 | 1.00 |
| Material flow | **0.48** | 0.38 | 0.65 | 1.00 |
| Energy consumption | **0.31** | 0.25 | 0.38 | 1.00 |
| Total Ecological Footprint | **0.18** | 0.13 | 0.22 | 1.00 |
| Greenhouse gases | **0.32** | 0.24 | 0.52 | 1.00 |
| Air pollutants | **0.12** | 0.10 | 0.14 | 1.00 |
| Fossil fuel energy Footprint | **0.32** | 0.27 | 0.46 | 1.00 |
| Nuclear energy Footprint | **0.13** | 0.09 | 0.16 | 1.00 |
| Crop land Footprint | **0.31** | 0.21 | 0.47 | 1.00 |
| Pasture Footprint | **0.31** | 0.21 | 0.47 | 1.00 |
| Built land Footprint | **0.05** | 0.03 | 0.09 | 1.00 |
| Sea Footprint | **0.52** | 0.34 | 0.79 | 1.00 |
| Forest Footprint | **1.21** | 0.61 | 2.39 | 1.00 |
| Carbon dioxide, CO2 | **0.32** | 0.26 | 0.39 | 1.00 |
| Methane, CH4 | **0.48** | 0.24 | 0.97 | 1.00 |
| Nitrous oxide, N2O | **0.27** | 0.15 | 0.49 | 1.00 |
| Sulphur dioxide, SO2 | **0.76** | 0.58 | 1.19 | 1.00 |
| Nitrogen Oxides, NOx | **0.33** | 0.26 | 0.50 | 1.00 |
| Ammonia, NH3 | **0.57** | 0.19 | 1.70 | 1.00 |
| Particulate matter | **0.39** | 0.26 | 0.75 | 1.00 |
| Carbon monoxide | **0.04** | 0.03 | 0.07 | 1.00 |
| Volatile organic compounds | **0.50** | 0.32 | 0.78 | 1.00 |
| Benzene | **0.20** | 0.12 | 0.34 | 1.00 |
| Natural gas use | **0.31** | 0.24 | 0.41 | 1.00 |
| Paper products | **3.39** | 1.56 | 7.36 | 1.00 |
| Pesticides | **0.30** | 0.17 | 0.55 | 1.00 |
| Cadmium | **0.60** | 0.41 | 0.87 | 1.00 |
| Lead | **0.65** | 0.48 | 0.86 | 1.00 |

WWF-UK is performing well in most environmental areas. In terms of energy use, WWF-UK uses 68% less than the sector average. This is reflected in lower carbon dioxide emissions (also 68% lower). The total Ecological Footprint is 83% lower than the sector average. In terms of health related pollutants such as benzene, VOCs and particulate matter, the impact of WWF-UK is considerably lower.

One issue, already highlighted above, in the demand for publishing and printing. This is considerably higher than other sectors. It should be mentioned that this reflects the impact of an average £ spent on this industry sector and existing policy by WWF-UK may mean that through the selection of specific suppliers this impact could be different.

Interestingly, WWF-UK's performance in economic and social areas is not so well (best seen in Table 11). Of course it can be expected that WWF-UK generates 60% less (8.95 p/£) profit than the average sector (22.2 p/£) as it is a non-profit organisation. In fact it has no 'in-house' profit at all, the number in Table 11 all comes from indirect profits from other organisations. But WWF-UK also employs less people per £ (45% of sector average) and pays it staff less wages and salaries per £ of total output (65% of sector average). This is presumably due to the special nature of the organisation, making it distinctly different from other "Membership organisations".

# Recommendations

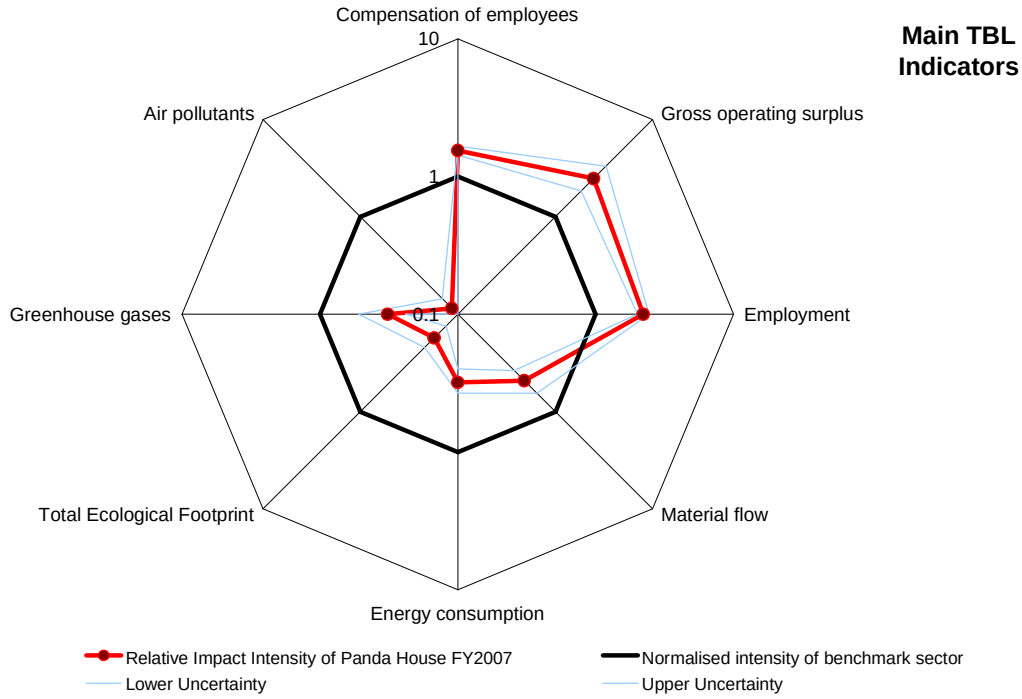
When looking at carbon related emissions, the on-site emissions from Panda House are extremely low. Even though they are small, it is important that this remains the case in the future. With existing energy management in place this should remain the case. The impact on nearly all the indicators occurs down the supply chain. While it is easier for an organisation to influence their own direct emissions, it is not impossible to influence the emissions that occur through the supply chain. This has to be done through the implementation of a comprehensive sustainable procurement strategy. Opening dialogue with suppliers about delivery of low impact products has to be the starting point.

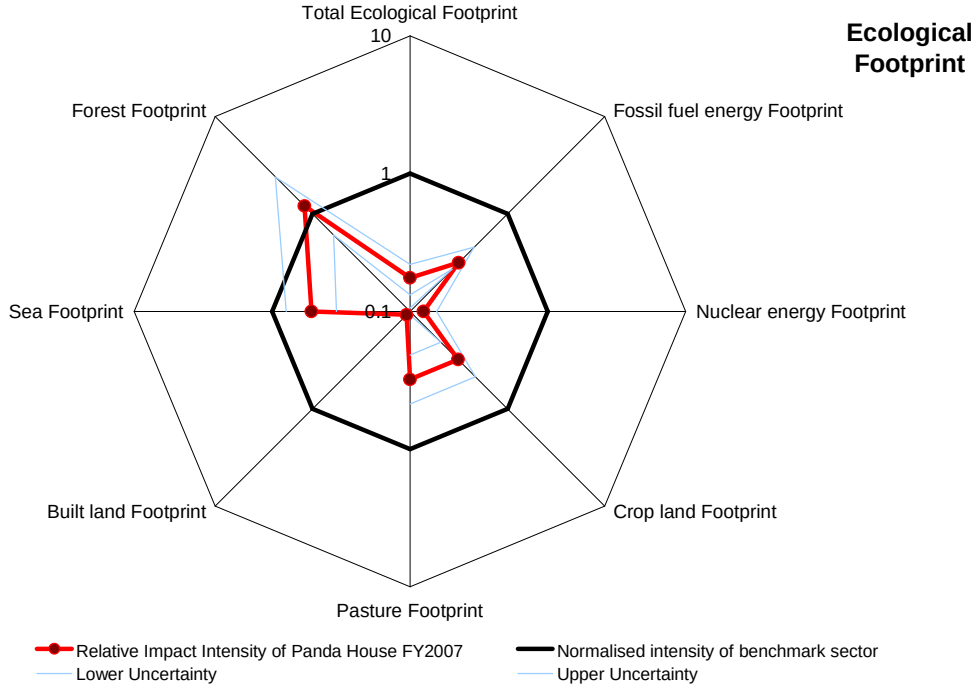
We acknowledge that WWF-UK already has a track record in ensuring that suppliers deliver low impact products and have suggested a structure below to continue and expand on this.

We suggest that the following steps are required:

| Stage | Task | Completed |
|---|---|---|
| **1** | Determine which companies your business spends its money with. | Yes |
| **2** | Categorise your expenditure into sector groupings by SIC code. | Yes |
| **3** | Assess the typical environmental impacts (carbon footprint and other relevant indicators). | Yes |
| **4** | Determine where to focus your efforts. Clearly some suppliers, even suppliers in the same sector, have more significant environmental impacts than others. It is important to prioritise your suppliers in a way that takes into account both the amount of money you spend with them and the relative environmental impact they have. Printing and publishing is clearly a priority. | No |
| **5** | Engage with your suppliers. Encourage your suppliers to report on the environmental impact of their company, focusing on the key issues from the environmental assessment. | No |
| **6** | Establish a process enabling suppliers to record, measure and report back on their environmental impact. | No |
| **7** | Influence purchasing decisions with the information gathered. Improvements in your suppliers' environmental performance will be more likely if they know that their environmental performance is a factor in WWF-UK buying decisions. | No |
| **8** | Consider post-contract supplier development to focus on engaging suppliers in continuous improvement in environmental management. | No |

# Appendix: Benchmark Results



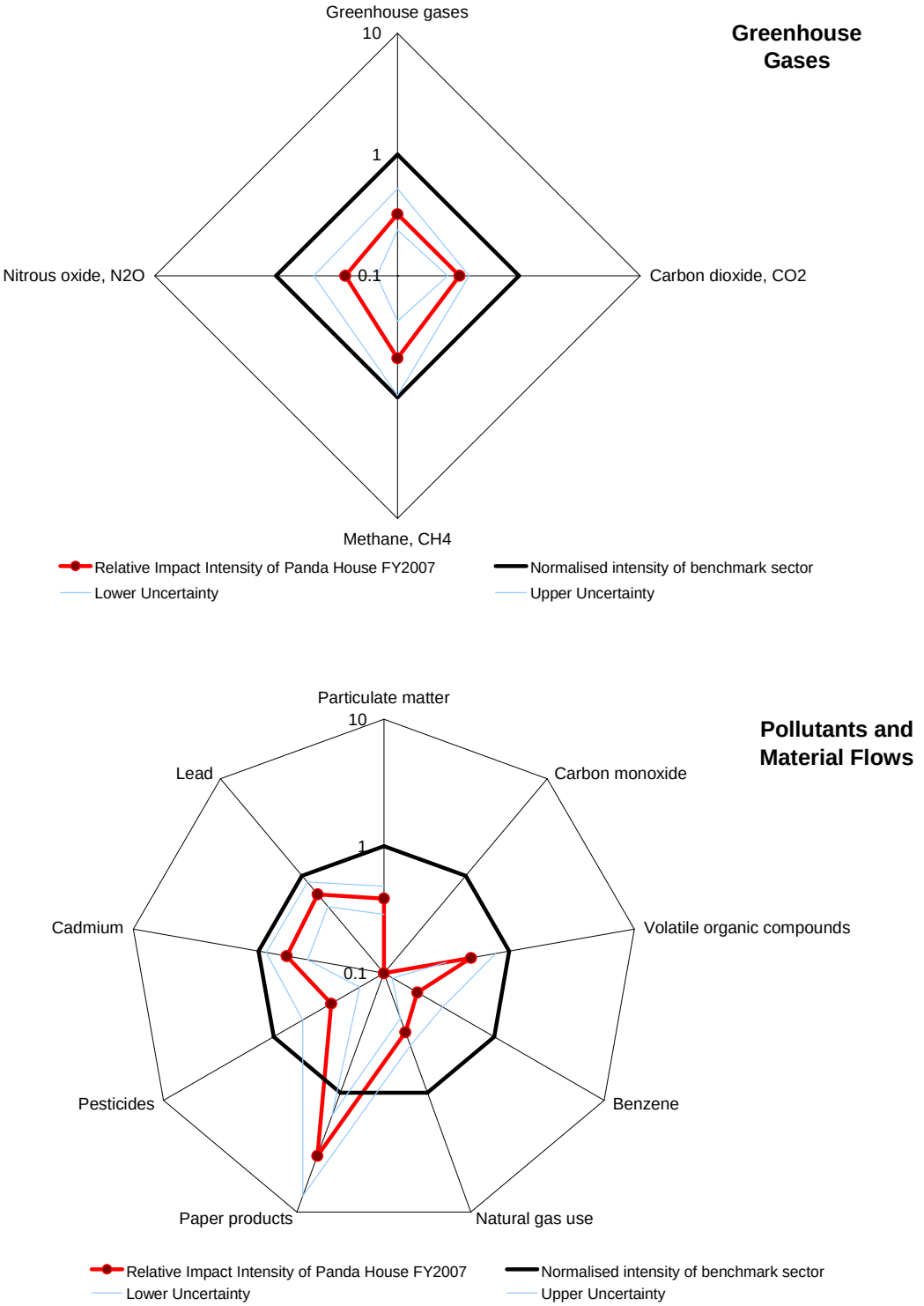



**Figure 9: Benchmark spider diagrams of total (direct + indirect) impact intensities.**
The thick red line shows WWF-UK's performance for each TBL indicator. The regular polygon in the middle of the diagram (thick black line) shows the average performance of 'Membership organisatgions', allowing a benchmark comparison between WWF-UK and the economic sector under which the organisation is classified. A performance better than average is closer to the centre ("the smaller the area encircled by the red line, the smaller the footprint").

# Appendix: Methodology

## Background

Recently the calculation of embodied GHG emissions has prominently featured in the public debate and on the policy level. For example, Tesco, the biggest retailer in the UK, has announced to put carbon labels on every one of its 70,000 products and has put money towards the development of a methodology, which enables the determination of the embodied carbon emissions of its goods and services. At the same time the Carbon Trust has started developing a carbon labeling approach for products in cooperation with various stakeholder groups and put efforts into the development of a standard methodology for the estimation of the carbon footprints of goods and services in the UK (PAS 2050)[7]. Similar efforts to calculate the life-cycle climate change impacts of products have mushroomed in other countries and the wider international life-cycle assessment (LCA) community.

However, there is confusion as to how exactly the carbon footprint should include and how it can reliably be quantified. The Stockholm Environment Institute and the University of Minnesota have recently carried out a thorough review of methodologies for the PAS 2050 on behalf of Defra. The report[8] is a review of methodological options to estimate product life-cycle GHG emissions ("product carbon footprints"). The main conclusion is, that in order to enable embedded emissions measurement to be used for applications requiring a high level of robustness and comparability, e.g. product labelling, an ISO-compliant Hybrid LCA was deemed the most suitable method. A key reason for this was that this includes the supply chain flows picked up in input-output analysis but which is cut off in Process-LCA due to system boundary limits.

Exactly the same principles hold true for all other TBL indicators examined in this study.

## Introduction to TBL accounting and footprinting

The **carbon footprint** takes a 'consumption perspective'. This means that is does not just measure the carbon dioxide emissions generated 'on-site' from the burning of fossil fuels but it takes a more holistic view and also accounts for emissions that are generated somewhere else in the country or even somewhere else in the world when goods or services are consumed. In this respect the term 'footprint' can be seen as a synonym for 'life cycle', meaning that all indirect emissions occurring during the life cycle of a product or service are taken into account. Such a comprehensive perspective allows identifying the 'carbon hotspots' in an organisation's operations and prioritising actions for an effective climate change strategy.

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[7] http://www.bsi-global.com/en/Standards-and-Publications/How-we-can-help-you/Professional-Standards-Service/PAS-2050/?id=89725

[8] Links to the report: http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=15520#RelatedDocuments and http://www.bsi-global.com/en/Standards-and-Publications/How-we-can-help-you/Professional-Standards-Service/PAS-2050/PAS-Current-Status---regular-updates-to-be-provided-by-BSIDefraCT/.

We define the '**carbon footprint**' as a measure of the exclusive total amount of carbon dioxide emissions that is **directly and indirectly** caused by a human activity or is accumulated over the life stages of a product (Wiedmann and Minx 2008). This includes activities of individuals, populations, governments, companies, organisations, processes, industry sectors etc. Products include goods and services. In any case, all direct (on-site, internal) and indirect emissions (off-site, external, embodied, upstream, downstream) have to be taken into account. If other greenhouse gases (GHG), such as methane or nitrous oxide, are added to the carbon footprint we call the resulting measure a '**climate footprint**' in order to express its purpose: to indicate the combined global warming impact of various emissions.

Carbon footprint accounting is still a young area of research and only very few organisations have ventured into measuring their total carbon footprint from a life-cycle perspective. Most studies have so far focussed on the direct (on-site) emissions only. This work is a novel and ground-breaking attempt of a truly comprehensive assessment of the total carbon and climate footprint of an organisation such as Highlands and Islands Enterprise.

The same principles hold true for all other TBL indicators examined in this study, including the Ecological Footprint. Our EF calculations are in line with GFN standards (www.footprintstandards.org) and are based on the methodology described in (Wiedmann et al. 2006). However, in contrast to the current recommendations by the global network of Footprint practitioners (Kitzes and et al. 2007) we chose in this study not to exclude the category 'Nuclear Energy Footprint' from the list. Instead we show it as a separate piece of information that gives some indication of WWF-UK's use of electricity.

## Requirements

An organisation such as WWF-UK is embedded in a complex web of suppliers and clients, each of which contribute their own GHG emissions to the total impact. Calculating the total resource use impacts (the "footprint" in short) of WWF-UK has therefore to fulfil certain requirements. It must take into account the '**on-site**' impacts such as **direct emissions** from heating premises or driving vehicles, equivalent to 'Scope 1' of the Greenhouse Gas Protocol (WBCSD and WRI 2004). It must also take account of **indirect emissions** that are embodied in all the products and services purchased by WWF, for example electricity ('Scope 2') or office equipment etc ('Scope 3'). The approach that we have applied in this project has proved to fulfil both requirements in numerous studies and covers all three scopes in a consistent, comprehensive and comparable manner.

It is a relatively easy to calculate direct emissions. A set of standard coefficients have been published by DEFRA that are taken from the International Panel on Climate Change (IPCC). We have used these coefficients to convert the total use of natural gas and petrol/diesel by WWF-UK into the associated GHG emissions.

A crucial characteristic of the carbon footprint, however, is the inclusion of all **indirect emissions** embodied in supplies on top of direct, on-site emissions of WWF. There are considerably more methodological difficulties when estimating indirect emissions. This aspect gains a particular importance and precariousness when it comes to carbon offsetting. It is obvious that a clear definition of scope and boundaries is essential when projects to reduce or sequester $CO_2$ emissions are sponsored. When accounting for indirect emissions, methodologies need to be applied that avoid under-counting as well as double-counting of emissions.

Why is it important to include these indirect emissions? An ideal accounting system must trace all the interactions that took place to produce a product or service. In the case of WWF, it is the support and regional investment that is of service to the regional economy. WWF-UK is merely part of an "integral chain" in this economy. No company works in isolation and to account for its direct impacts only will always provide an underestimate of the costs and benefits associated with its wider actions.

The methodology used in this study does exactly that; it takes into account all the indirect emissions of WWF. The methodological approach used is an Environmental Input-Output Analysis (EIOA).

## Our approach: Environmental Input-Output Analysis

The calculation model used in this project is based on an environmentally extended input-output life-cycle analysis (EIO-LCA) on the national (UK) level, using official data from the ONS National (economic) Accounts and ONS Environmental Accounts. This means that all results all fully consistent with standard accounting and fully comparable amongst each other. The sophisticated methodology is based on year-long scientific research, has been field-tested over five years, has been published in numerous journal articles, and has recently been incorporated into a software tool named Bottomline³ (www.bottomline3.co.uk).

The comprehensive nature of EIO-LCA means that the whole (UK) economy, including imports and exports, are the system boundary, which is a major advantage to a life-cycle analysis based on Process Analysis (PA) where only on-site, most first-order, and some second-order impacts are considered (Minx et al. 2008). This truncation of the system boundary in PA-based LCA can lead to a significant underestimation of the true impact (boundary problem). Using input-output analysis, the error caused by this truncation can be avoided. Process analysis on the other hand is more specific to individual products or services, a level of detail which is not easily achievable with the top-down approach of input-output analysis.

The software tool Bottomline³ was developed at the University of Sydney and has been adapted to the UK economy by the Centre for Sustainability Accounting. This tool is based on a static, single-region, open, basic-price, 76-sector industry-by-industry input-output model of the UK economy, augmented with a database of environmental, social and economic indicators. Bottomline³ provides total (**direct + indirect**) impact quantification, sector benchmarking, supply chain analysis, production layer decomposition and quantification of 'shared responsibility' for over 100 economic, social and environmental indicators.[9] Most importantly, a direct and valid comparison is possible between company/organisation, sector and national economy performance.

Whatever method is used to calculate carbon footprints, it is important to be aware of double-counting along supply chains or life cycles. Direct emissions of one agent are indirect emissions of another and vice versa. For example, if a power plant operator reports its emissions as direct (on-site) emissions and purchasers of electricity (such as WWF) report them as indirect emissions, then they are double counted. In this report, the full direct and indirect emissions are presented in order

[9] The model framework is described in (Foran et al. 2005a) with a summary available in (Foran et al. 2005b). A short summary of the methodology can also be found in (Wiedmann and Lenzen 2006a) and further details are available from http://www.isa.org.usyd.edu.au/publications/index.shtml and from http://www.isa.org.usyd.edu.au/research/tbltwo.shtml.

to show the full scale of climate impacts. However, one has to bear in mind that WWF-UK cannot be held responsible for all of these emissions alone and that some of the indirect emission might be reported by other businesses.

The correct way of dealing with this issue is to apply the concept of shared responsibility and split the emissions between agents of a supply chain (Lenzen et al. 2007; Wiedmann and Lenzen 2006). This is not least because there are significant implications on carbon trading and carbon offsetting. If carbon emissions were to be traded or offset, a shared responsibility approach needs to be applied.

## Data preparation

Two types of input data are required for this type of analysis, **financial accounts** and **on-site impact data**.

Financial accounts include all expenditure (and revenue) data from one financial year, e.g. spending on (purchasing of) equipment, materials, furniture, computers, food, etc but also services like transport, insurance, banking & financing, legal advice, research etc. Ideally, these categories should be broken down in 50 to 100 different sub-categories. WWF-UK supplied Panda House accounts data for the financial year 2006/07 which we matched to the standard 82 sector categories in Bottomline[3].

Data for direct (on-site) energy consumption include fossil fuels needed for heating and vehicles. Consumption data for natural gas and electricity as well as floor space and employment for Panda House was supplied by WWF-UK.

**Table 13: Description of 30 TBL indicators chosen for this study**

| TBL indicator | Description of indicator and data source |
|---|---|
| Compensation of employees | Income as general compensation of employees including wages, salaries, superannuation and workers' compensation payments. Interpretation: This is a positive indicator and is related to employment, but in addition can indicate whether parts of the supply chain receive unequal wages and salaries. Data source: ONS (2003), United Kingdom National Accounts, Input-Output Supply and Use Tables, 2000 (2003ed.). http://www.statistics.gov.uk/about/methodology_by_theme/inputoutput |
| Gross operating surplus | Gross operating surplus is defined as the residual of an industry's total inputs, after subtracting all intermediate inputs, compensation of employees, and net taxes and subsidies. It consists of operating profits, and consumption of fixed capital for capacity growth and replacement (depreciation). Interpretation: This is a positive indicator because it indicates the capacity to invest in innovation and technological progress through turnover of the capital stock as well as the capacity for expansion and investment. Data source: ONS (2003), United Kingdom National Accounts, Input-Output Supply and Use Tables, 2000 (2003ed.). http://www.statistics.gov.uk/about/methodology_by_theme/inputoutput |
| Employment | Employment means full-time-equivalent employment measured as full-time employment plus 50% part-time employment of employees, including employers, own account workers, and contributing family workers. Units: employment-years (e-y) and employment minutes (min) are used. Data source: UK Census of Population, Employment by sectors. Interpretation: Employment is a critical TBL factor with its implications for social cohesion, government, transfer payments, international credit ratings and taxation. It is a positive TBL factor and one for which there are demonstrable trade-offs with material and energy use. Data source: Census of Population; Employment by sectors, UK ; All people aged 16-74 in employment; Table KS011a (see http://www.census.ac.uk, http://census.ac.uk/casweb, http://census.ac.uk/cdu/). http://www.census.ac.uk |
| Material flow | Material flow describes the mass of resources and other biomass extracted from the natural environment in order to produce industrial output. Interpretation: This is a negative indicator because it shows for example how much iron ore has to be initially extracted in order to make steel, and ultimately for example, cars. Because it deals in mass extracted from the natural environment, material flow can be used as an indicator of resource depletion. Data source: e-Appendix to REAP Report No. 4; Wiedmann, T., Moro, M., Hammer, M., |

| TBL indicator | Description of indicator and data source |
|---|---|
| | Barrett, J. (2005) "National and Regional Physical Accounts (Material Flows) for the United Kingdom". REAP Report No. 4, Resources and Energy Analysis Programme, Stockholm Environment Institute, York, December 2005 (http://www.wwflearning.org.uk/data/files/e-appendix-reap-report-4-327.xls). http://www.ecologicalbudget.org.uk |
| Paper products | Material flow, by mass, associated with the industrial output of these products. Data source: e-Appendix to REAP Report No. 4; Wiedmann, T., Moro, M., Hammer, M., Barrett, J. (2005) "National and Regional Physical Accounts (Material Flows) for the United Kingdom". REAP Report No. 4, Resources and Energy Analysis Programme, Stockholm Environment Institute, York, December 2005 (http://www.wwflearning.org.uk/data/files/e-appendix-reap-report-4-327.xls). http://www.ecologicalbudget.org.uk |
| Pesticides | Material flow, by mass, associated with the industrial output of these products. Data source: e-Appendix to REAP Report No. 4; Wiedmann, T., Moro, M., Hammer, M., Barrett, J. (2005) "National and Regional Physical Accounts (Material Flows) for the United Kingdom". REAP Report No. 4, Resources and Energy Analysis Programme, Stockholm Environment Institute, York, December 2005 (http://www.wwflearning.org.uk/data/files/e-appendix-reap-report-4-327.xls). |
| Natural Gas | Primary energy value of the combustion of this non-renewable fossil fuel Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Carbon fuel use by fuel type, . http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Ecological Footprint | The original global Ecological Footprint approach (Rees and Wackernagel 1992), incorporating a bioproductivity and a greenhouse gas component. Unit: global hectares. Interpretation: This is deemed a negative TBL indicator because it reflects the amount of global bioproductivity appropriated through human consumption. In order to be able to make international comparisons of consumption irrespective of local yields, this approach adjusts agricultural yields to global averages, so that consuming one tonne of wheat grown on large areas in arid climates has the same Ecological Footprint as one tonne of wheat grown on smaller areas in temperate moist climates. For information on greenhouse gas emissions, see indicator listing above. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input-output analysis; Ecological Economics, 56(1):28-48. http://www.footprintnetwork.org |
| Fossil fuel energy Footprint | The fossil fuel energy component of the Ecological Footprint. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input-output analysis; Ecological Economics, 56(1):28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012 |
| Nuclear energy Footprint | The nuclear fuel energy component of the Ecological Footprint. Note: the nuclear energy Footprint is not longer part of the standard Ecological Footprint. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input-output analysis; Ecological Economics, 56(1):28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012 |
| Crop land Footprint | The crop land component of the Ecological Footprint. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input-output analysis; Ecological Economics, 56(1):28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012 |
| Pasture Footprint | The pasture component of the Ecological Footprint. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input-output analysis; Ecological Economics, 56(1):28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012 |
| Built land Footprint | The built land component of the Ecological Footprint. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input-output analysis; Ecological Economics, 56(1):28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012 |
| Sea Footprint | The sea component of the Ecological Footprint. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input-output analysis; Ecological Economics, 56(1):28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012 |
| Forest Footprint | The forest component of the Ecological Footprint. Data source: Global Footprint Network (2004) National Footprint Accounts United Kingdom v2004.95 + calculations as described in: Wiedmann, T., Minx, J., Barrett, J., and Wackernagel, M. (2006) Allocating ecological footprints to final consumption categories with input- |

| TBL indicator | Description of indicator and data source |
|---|---|
| | output analysis; Ecological Economics, 56(1):28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012 |
| Greenhouse gases | The combined effect of all greenhouse gases in the atmosphere is expressed in terms of the equivalent amount of carbon dioxide which would produce the same effect. Units: In accordance with guidelines set out by the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas emissions are expressed in tonnes of CO2-equivalents (CO2-e) and calculated as a weighted sum of nominal emissions of various gas species using gas-specific global warming potentials. Interpretation: This is a negative TBL indicator. Greenhouse gas emissions cause climate change. Emissions analyses can be used as a guide to the 'carbon risk' (including risk of future constraints on carbon emissions) faced by companies including via their supplying sectors. Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. |
| Carbon dioxide, CO2 | Carbon dioxide emitted to the atmosphere (by mass). Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Methane, CH4 | Methane emitted to the atmosphere (by mass). Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Nitrous oxide, N2O | Nitrous oxide emitted to the atmosphere (by mass). Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Air pollutants | Indicators relating to air pollution. Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Acid rain precursors | Aggregation of the three acidifying air pollutants SO2, NOx and NH3. Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Sulphur dioxide, SO2 | This represents the mass of emissions of sulphur dioxide released to air. Units: tonnes. Sulphur content is always measured in terms of the mass of elemental sulphur, usually as a mass percentage. ONS. Interpretation: This is a negative TBL indicator. The most important man-made sources of sulphur dioxide are fossil fuel combustion, smelting, manufacture of sulphuric acid, conversion of wood pulp to paper, incineration of refuse and production of elemental sulphur. Under normal combustion conditions with excess air, it can be assumed that all sulphur is oxidised to SO2. Major health concerns associated with exposure to high concentrations of SO2 include: effects on breathing, respiratory illness, and aggravation of existing cardiovascular disease. Environmental concerns include: damage to trees and crops; acid rain contributing to the acidification of lakes and streams, accelerated corrosion of buildings and reduced visibility. Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Nitrogen Oxides, NOx | NOx is the mass of emissions of nitrogen oxides released to air, including nitric oxide and nitrogen dioxide, but excluding nitrous oxide (already covered under greenhouse gas emissions). Units: tonnes. Interpretation: This is a negative TBL indicator. Nitrogen oxides (also known as oxides of nitrogen, and abbreviated as NOx) is a collective term used to refer to two species of oxides of nitrogen: nitric oxide (NO) and nitrogen dioxide (NO2). Nitrogen dioxide is a strong oxidizing agent that reacts in the air to form corrosive nitric acid, as well as toxic organic nitrates. It can be deposited as acid rain. NOx is one of the main ingredients involved in the formation of ground-level ozone. NOx also contributes to nutrient overload that deteriorates water quality. Health implications: damage to lung tissue and reduction in lung function; premature death. Environmental implications: damaged vegetation and reduced crop yields (from ozone); deterioration of cars, buildings, lakes and streams (from acid rain); acceleration of "eutrophication," leading to oxygen depletion and reduced fish and shellfish populations (from nutrient overload). Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Ammonia, NH3 | Ammonia emitted to the atmosphere (by mass). Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Particulate matter | Particulate matter emitted to the atmosphere (by mass). Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Carbon monoxide | Carbon monoxide emitted to th e atmosphere (by mass) Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. |

| TBL indicator | Description of indicator and data source |
|---|---|
| | http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Volatile organic compounds | Volatile organic compounds emitted (by mass) Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Benzene | Benzene emitted to the atmosphere (by mass) Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Lead | Emissions of Lead (Pb) into the atmosphere. In general, the most important sources of heavy metal emissions are combustion of fossil fuels and waste. According to the UNECE Heavy Metal Protocol the priority metals are Pb, Cd and Hg and the objective is to further reduce the emissions of these heavy metals. Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |
| Cadmium | Emissions of Cadmium (Cd) into the atmosphere. In general, the most important sources of heavy metal emissions are combustion of fossil fuels and waste. According to the UNECE Heavy Metal Protocol the priority metals are Pb, Cd and Hg and the objective is to further reduce the emissions of these heavy metals. Data source: ONS (2005) United Kingdom Environmental Accounts: 76 Industry data (2005ed.), Air emissions. http://www.statistics.gov.uk/statbase/datasets2.asp?th=3&B1=Show+Linked+Datasets |

# References


Elkington, J. (1997). Cannibals with Forks: The Triple Bottom Line of 21st Century Business. Oxford, UK, Capstone Publishing.

Kitzes, J. and et al. (2007). A Research Agenda for Improving National Ecological Footprint Accounts. International Ecological Footprint Conference, 8-10 May 2007. Cardiff, Wales, UK. http://www.brass.cf.ac.uk/uploads/fullpapers/Kitzes_et_al_M65.pdf.

Lenzen, M., Murray, J., Sack, F. and Wiedmann, T. (2007). Shared producer and consumer responsibility - Theory and practice. Ecological Economics 61(1): 27-42. http://dx.doi.org/10.1016/j.ecolecon.2006.05.018

Minx, J., Wiedmann, T., Barrett, J. and Suh, S. (2008). Methods review to support the PAS process for the calculation of greenhouse gas emissions embodied in goods and services. Report to the UK Department for Environment, Food and Rural Affairs by Stockholm Environment Institute at the University of York and Department for Bio-based Products at the University of Minnesota. Project Ref.: EV2074, February 2008. Defra, London, UK. http://randd.defra.gov.uk

Schaltegger, S., Bennett, M. and Burritt, R., Eds. (2006). Sustainability Accounting and Reporting. Eco-Efficiency in Industry and Science , Vol. 21 Dordrecht, NL, Springer. http://www.springer.com/west/home/environment/management?SGWID=4-10004-22-173660143-detailsPage=ppmmedia%7Ctoc.

Schaltegger, S. and Wagner, M., Eds. (2006). Managing the Business Case for Sustainability - The Integration of Social, Environmental and Economic Performance. Sheffield, UK, Greenleaf Publishing. http://www.greenleaf-publishing.com, http://www.uni-lueneburg.de/eman/publications/publications_i.htm.

WBCSD and WRI (2004). The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard. March 2004. World Business Council for Sustainable Development and World Resources Institute. http://www.wbcsd.org/web/publications/ghg-protocol-revised.pdf.

Wiedmann, T. and Lenzen, M. (2006). Sharing Responsibility along Supply Chains - A New Life-Cycle Approach and Software Tool for Triple-Bottom-Line Accounting. The Corporate Responsibility Research Conference 2006, 4-5 September 2006. Trinity College, Dublin, Ireland. . http://www.isa-research.co.uk/docs/Wiedmann_Lenzen_2006_CRRC_paper.pdf, http://www.crrconference.org/downloads/2006wiedmannlensen.pdf.

Wiedmann, T. and Minx, J. (2008). A Definition of 'Carbon Footprint'. In: C. C. Pertsova, Ecological Economics Research Trends: Chapter 1, pp. 1-11, Nova Science Publishers, Hauppauge NY, USA. https://www.novapublishers.com/catalog/product_info.php?products_id=5999, also available as Research Report 07/01 from the Centre for Sustainability Accounting, http://www.censa.org.uk/reports.html.

Wiedmann, T., Minx, J., Barrett, J. and Wackernagel, M. (2006). Allocating ecological footprints to final consumption categories with input-output analysis. Ecological Economics 56(1): 28-48. http://dx.doi.org/10.1016/j.ecolecon.2005.05.012.