

OPEN (One Planet Economic Network)

*Building the evidence base,
applications and capacity to
support sustainable consumption
and production*

TECHNICAL REPORT - Part E

Products & services

A report to WWF-UK

June 2006



Centre for Urban & Regional Ecology,
School of Environment & Development,
Manchester University, Oxford Rd, M13 9PL, UK
Tel: +44 (0)161 275 6879 / 6938
Fax: +44 (0)161 275 6893
joe.ravetz@man.ac.uk - joe.ravetz@gmail.com
www.sed.manchester.ac.uk/research/cure/
www.eco-region.org

Status of this report

This report is a consultation draft version 0.9 as of August 2006.

Consultation responses will be compiled, together with the results of a consultation workshop, and incorporated in the final version. There are 3 key documents available for consultation:

1. OPEN – Consultation questions
2. OPEN – Prospectus (main report)
3. OPEN – Technical Report:
 - Part A – policy & research framework
 - Part B – macro-economic modelling
 - Part C – food & international trade
 - Part D – built environment
 - Part E – products & services
 - Part F – energy & waste

This last is available as a set of pdf files from www.ecologicalbudget.org.uk Hard copies are available by request.

NOTES

All rights reserved. All material appearing in this publication is subject to copyright, and may be reproduced for non-profit purposes with permission. Any reproduction of this publication in full or in part must credit the principal author as the copyright holder.

The views of the authors expressed in this publication do not necessarily reflect those of WWF, to whom this report is submitted.

The authors have used all reasonable endeavors to ensure that the content of this report, the data compiled, and the methods of calculation and research are consistent with normally accepted standards and practices. However, no warranty is given to that effect nor any liability accepted by the authors for any loss or damage arising from the use of this report by WWF-UK or by any other party.

Research Team

Joe Ravetz, principal author:
With assistance from Serban Scricciu

Centre for Urban & Regional Ecology,
School of Environment & Development,
Manchester University, Oxford Rd, M13 9PL,
t.+44 (0)161 275 6879 / 6938: f. 275 6893
www.sed.manchester.ac.uk/research/cure/
www.eco-region.org

with contributions from:

Cambridge Econometrics
Covent Garden, Cambridge CB1 2HS
Tel: +44 (0)1223 460760
Fax: +44 (0)1223 464378
www.camecon.com

and drawing on data supplied by:

Stockholm Environment Institute
Sally Baldwin Building, Block D,
University of York,
York YO10 5DD UK
Tel: 01904 434403
www.sei.se

ACKNOWLEDGEMENTS

The research team wishes to thank the Biffaward fund for its support for this project. We would also thank the staff of WWF-UK for their support and backup for the research. The contribution of the many experts and stakeholders who participated in interviews and workshops is also gratefully acknowledged.

For further information, please contact:

Stuart Bond
WWF-UK, Panda House, Godalming
Surrey GU7 1XR
Tel: 01483 426444
Fax: 01483 426409
www.wwf.org.uk

Contents

1. Introduction	7
1.1 The One Planet Economy Network.....	7
1.1.1 The Ecological Budget UK.....	7
1.1.2 Role of this paper	8
1.2 Consultation questions	8
1.3 Activity sector framework.....	10
1.3.1 Resource flow template.....	10
1.3.2 Abbreviations in tables	12
2. Goods & products	13
2.1 Goods and products.....	13
2.1.1 Profile of the sector.....	13
2.1.2 Towards Factor 4	13
2.1.3 Summary & questions.....	14
2.1.4 Limits to research & policy.....	14
2.2 Products – policy framework	15
2.2.1 Issues for the sector.....	15
2.2.2 Summary of economic strategy.....	15
2.2.3 Sustainable materials program.....	16
2.2.4 Sustainable products program.....	16
2.2.5 Sustainable appliance program	17
2.2.6 Sustainable ICT program	17
2.3 Products – modelling framework	17
2.3.1 KEY scenario trends & drivers	17
2.3.2 Products: resource flow model.....	19
2.3.3 Products: activity model settings	20
2.3.4 Products: economic policy model.....	20
3. Commercial services	21
3.1 Commercial services	21
3.1.1 Profile of the sector.....	21
3.1.2 Summary & questions.....	21
3.2 Services: policy framework.....	22
3.2.1 Policy framework themes	22
3.2.2 Commercial services program	23
3.2.3 Sustainable tourism program	23
3.2.4 Sustainable finance program.....	24
3.3 Services: model framework.....	25
3.3.1 Services: resource flow framework.....	25
3.3.2 Activity model settings	26

3.3.3 Services: economic model settings	26
4. Public services.....	27
4.1 Public Services	27
4.1.1 Profile of the sector.....	27
4.1.2 Towards Factor 4	27
4.1.3 Summary & questions.....	28
4.2 Public services: policy framework	28
4.2.1 Health service program.....	29
4.2.2 Public services program.....	29
4.2.3 Defence & security program.....	29
4.3 Public services: model framework	30
4.3.1 Public services: resource flow effects.....	30
4.3.2 Public services: activity model settings	31
4.3.3 Public services: economic model settings.....	31
5. Appendix.....	32
5.1 Glossary	32

1. Introduction

This section is an introduction to the Ecological Budget UK project, the OPEN program, and the OPEN consultation.

1.1 THE ONE PLANET ECONOMY NETWORK

In a world of accelerating climate change, deforestation, urbanization, water scarcity and a host of other problems, it is clear that new models of sustainable development are needed.

The “*One Planet Economy Network*” (OPEN) is working towards a more sustainable future for the UK and its place in the world. This is based on the ‘*One Planet*’ agenda for transformation of the economy, to one which works within global resources and limits.¹

The OPEN Prospectus and main report highlights the challenges and targets to 2050, and the scale of the changes needed in the UK economy. It shows the beginning of an evidence base in the UK accounts, and the applications to setting targets and actions. It sets out a process for building of intelligence, and invites contributions to help achieve this.

The One Planet Economy is a huge concept, with many dimensions and many uncertainties. This is why it is set out as a ‘framework’ method and ‘network’ process – not aiming at fixed solutions, so much as a coordinated investigation and discussion, taking these questions forward step by step.

1.1.1 The Ecological Budget UK

The Ecological Budget UK is a unique evidence base for sustainable consumption and production. The project was funded by the Biffaward trust and others, and run by WWF-UK, in collaboration with the Stockholm Environment Institute and the Centre for Urban & Regional Ecology.

At the core of the Ecological Budget UK is a method of calculating the flows of carbon, materials and eco-footprint, from every type of consumption and production in the UK economy, allocated by regions and devolved countries (Wales, Scotland, Northern Ireland).²

The Ecological Budget UK is unique in that it shows:

- the total global impact of UK production in 123 sectors, and consumption in 68 categories, including imports and exports:
- the upstream and downstream impacts of each sector or activity:
- the distribution of consumption impacts between regions, local authorities, and social classes.

1 There general foundation for this is in the One Planet Living program of WWF – www.wwf.org and its application in the Global Footprint Network – www.gfn.org

2 See the report ‘Counting Consumption’ and further details on www.ecologicalbudget.org.uk

Each of these is shown by three key measures: material flow, climate emissions (CO₂) and eco-footprint.

The UK Baseline Report “*Counting Consumption*” presents a comprehensive set of physical accounts, covering carbon, resource flows and ecological footprint from consumption and production in the UK regions and devolved countries. Several regional applications were drawn from this in the North West, North East and West Midlands. Interactive access to this data is provided through the “*REAP toolkit*”, a software package for analysis and assessment of future scenarios and policy options.

1.1.2 Role of this paper

This paper forms part of a series comprising a lengthy Technical Report, to be continued as work in progress. It is designed to fit within the methodology of the OPEN program and the Ecological Budget UK: further details can be found in the OPEN main report and Technical Report Part A. All materials are available on www.ecologicalbudget.org.uk and www.eco-region.org

This paper is a demonstration of the *framework approach* and the *network process*. Clearly, global supply chains have huge impacts, from developed to developing nations, and the challenge of increasing overall resource efficiency by a Factor Four seems an almost impossible dream. Yet the need is clear, if humanity is to survive and prosper equitably on the resources of one planet. There are also many technological and institutional solutions around, as well as barriers, conflicts, policy traps and so on. To put these together needs a *framework approach* – an open minded coordination of many kinds of evidence from different sectors and bodies at various levels. It also needs a *network process* – building the capacity of stakeholders for foresight and learning.

Overall, this paper is work in progress for the framework approach to evidence building, pointing the way to lines of research and action for the coming years.

- We do not claim to present final solutions, as the significance is more in the debate and research process.
- We do not show very detailed quantitative outputs, at this point, as the focus of discussion is more on institutional questions.

1.2 CONSULTATION QUESTIONS

The questions below are raised for each of the sectors in the Technical Report: i.e. food & farming: built environment: transport: goods & products: commercial services: public services: energy & emissions: resources & waste.

Please supply your responses on the sectors wherever you have expertise, using the forms overleaf as a guide. Each response might be anything from a short note marked up on the form, to an extended discussion. The main form is reproduced in each of the technical reports.

Where possible the research team will follow up selected responses by phone. Otherwise, respondents are invited to submit a marked up form and/or extended responses by email. Responses will be treated in strict confidence, unless permission is given for attributed quotes. When complete, please return email responses and/or marked up forms to:

Stuart Bond, WWF-UK, Panda House, Godalming, Surrey GU7 1XR
sbond@wwf.org.uk

Question	Example	Response
1. What is your estimate of the most probable trend in resource use in your sector, by 2020 and/or 2050?	(e.g. rapid rise: some increase: no change: reduction: rapid fall)	
2. What is the likelihood of achieving a Factor 4 resource efficiency in your sector, by 2020 or 2050?	(e.g. very strong, probable, possible, unlikely, impossible)	
3. What are the main priorities for action in achieving a Factor 4 efficiency in your sector?	(e.g. new technology: tax & spend policy: infrastructure: behaviour change: regulation & planning, etc).	
4. What are the most significant barriers and challenges to achieving a Factor 4 efficiency in your sector?	(e.g. too expensive, too risky, consumer resistance etc).	
5. If there is a realistic chance of achieving a Factor 4 efficiency, who has the main responsibility for making this happen?	(e.g. government, local authorities, businesses, retailers, consumers, media, new technology).	
6. If government needs to take a lead, what are the most important actions they should take?	(e.g. taxes, subsidies, investment, procurement, regulations, infrastructure: local, regional or national?)	
7. If business needs to take a lead, what are the most important actions they should take?	(e.g. new technology, pollution control, longer product life, higher efficiency, changes to retail etc?)	
8. If consumers and retailers are involved, how can current trends of growing material consumption be altered?	(e.g. ethical trading, health scares, education & marketing, media features, community action, spiritual change?),	
9. If international trade is significant in your sector, what are the most important changes which are needed?	(e.g. trade liberalization, ethical trading, economic partnerships, overseas investment, tariffs & quotas?)	
10. Are there any other issues which are important to the question of achieving / not achieving a Factor 4 efficiency in your sector, by 2020 and/or 2050?		

1.3 ACTIVITY SECTOR FRAMEWORK

1.3.1 Resource flow template

To structure the research process we use a *'framework' approach* to coordinate a wide range of physical, economic and political issues. This is based on summary tables of resource flow effects and fiscal policy to move towards the Factor Four (F-4) goals, in each of the activity sectors, as arranged by the resource flow chain. Note that the F-4 scenarios contain 2 main variations, for high / low fossil fuel prices.

The modelling challenge is then to consider which of these measures is directly represented, proxied or assumed by other means, in each of the potential modelling methods.

Below is the 'general' template which shows the expected pattern of change in resource flows and their implications, right across the economy and policy landscape. This is then interpreted in detail for each of the 8 activity sectors, as shown in other sections of the Technical Report series.

Each of the activity sectors then divides into 2-3 *'policy programs'*, i.e. clusters of supply chains and demand types, as follows. Each of these programs is identified with a *fiscal balance*:

This shows either *'net income to public'* or *'net expenditure from public'*. This is a summary of the anticipated pattern of fiscal flows in the F-4 scenario, which looks at the potential for a strategic redistribution and re-investment, from one sector to another.

	Material sources	Manufacturing	Logistics	Services	Demand side 1	Demand side 2	Products in use	Externalities
PHYSICAL	Import %, source, extraction mode	Energy in production	Transport distance & mode	Tertiary activity & value added	Intensity & utilization factors	Consumption / mode choice	Product life: energy efficiency	Waste, recycling, emissions
F1 – projection	Import % growth:	Decoupling rate = growth rate	Air freight growth					Continuing disposal
F4 - scenario	Import reduction	Rapid energy efficiency	Low impact modes	Increased material recirculation	Increased utilization	Switch to low impact products	Increased product life & re-use: higher efficiency	Integrated resource management
Policy options	Resource protection	New processes: new products	Integrated supply chain mgmt	ICT based markets / exchanges	Utilization incentives	Integrated planning & resource mgmt	Regulation / quotas / labelling	Regulation / legal liability
ECONOMIC	Commodity prices: market effects	Fuel costs: factor & finance cost	Int. transport fuel / transaction cost	labour costs: investment costs	Consumer exp / saving: discount rate	Market behaviour: stock turnover	Product life: energy prices in operation	External costs / impact charges
F1 – projection	Prices stay low	Fuel / material costs level	Fuel costs level	Service sector growth	High time preference & short term investment	Efficiency gains overtaken by increased spend	Fixed capital increases	UK costs internalized, others externalized
F4 - scenario	Prices rise	Fuel / material costs rise	Fuel costs rise	Investment & share value linked to CSR	Low time preference & long term investment	Lower quantity, higher quality purchases	Increased product life & re-use: higher efficiency	Total costs internalized & marketized
Policy options	Commodity levies / tariffs	Carbon tax: public procurement for clean technology	transport fuel tax: Multi-lateral aviation tax	Incentives for CSR & environ.mgmt	Public procurement for market transform	Incentives for demand side management	Eco-labels & incentives for product life & efficiency	Emission & eco-services trading schemes
INSTITUTIONAL				Service economy / social economy	Utilization choices	Behavioural choices	Operational choices	Waste practices
Policy options	International developmt: ethical trading	Producer responsibility & env management	CSR & Env.managem ent	CSR	Social economy & civic society	Social economy & civic society		

- Horizontally, the template is arranged from material sources to production, distribution, consumption and externalities, in the order of the input-output tables.
- Vertically, the template is arranged by the two main scenarios, F1 baseline and F4 target: and then the ‘policy options’ i.e. the range of likely measures which may achieve the transition from F1 to F4 scenario.
- *Physical effects* are to be tested and calibrated in the REAP modelling system, as far as possible.
- *Economic effects* are to be tested and calibrated in the MDM modelling system, as far as possible (see section below).
- *Social / institutional* issues are there for reference and for the scenario narratives. It is not expected that these can be modelled directly.

Also, there are relationships between the physical options and economic policy options, as on the template. In some cases the economic policy is a means to achieve the physical policy (e.g. new technology in production). In other cases the physical policy is a means to achieve the economic policy (e.g. spatial planning in order to reduce transaction costs, in turn to promote

recycling). Arguably, most options available to government fall into the first category, and most available to business are in the second, but there are many exceptions to this.

1.3.2 Abbreviations in tables

In addition to the general ‘resource flow scenario’ table above, there are two further tables shown for most sectors:

- ***Activity model setting*** table: this shows sample figures for the main scenario variables and policy levers. These are intended to be built into the REAP ‘***activity model***’ in the next phase.
- ***Economic policy table***: this shows the broad shape of fiscal policy and identifies the items with significant macro-economic implications.

Within the tables, the abbreviations include –

Italics shows exogenous / endogenous effects - % refers to annual change from baseline in the F-4 scenarios.

Bold type shows fiscal policy, with direct model links –

x%:y% refers to x% of total sector GVA in tax: then y% annual growth in tax rate.

Normal type shows other related policy measures: z% refers to approx proportion of total revenue in that sector which is to be re-invested.

‘MT’ = market transformation

‘CCL’ = Climate Change Levy

2. Goods & products

2.1 GOODS AND PRODUCTS

2.1.1 Profile of the sector

This covers a huge variety of material goods and products to meet final demand by households and government: i.e. any material items not included in food, shelter or transport. For this variety there is a wide range of disparate information, and in practice the majority of material flows comprise intermediate products used in other industries. We can divide the sector by life cycle profiles and material intensities:

- Consumables: generally items with a short life, of between zero and 1 year.
- Peripherals: generally, items which are part of a larger system, e.g. ink for printers
- Durables: generally items with more than 1 year lifetime: this latter includes appliances and media items which are significant energy users. There are saturation effects for some of these.
- For each of these there are different balances of material intensity, economic added value, life cycle impact and so on.

For all these there are supply side issues, in technology, logistics, business practice etc. Technological innovation tends to drive obsolescence and hence turnover, i.e. products are increasingly outmoded before they are physically worn out. Such innovation involves a combination of performance, processes, logistics, cost advantage, brand name and market creation. For most manufactured product types a globalized market and logistics system now applies, where the manufacturing process is in reality more like assembly of components from around the world: and for many such products the material content is reducing in relation to economic added value. In other words, manufacturing is in many ways approaching the pattern of the service sectors.

On the demand side there are equally challenging issues. Demand by consumers is highly dependent on culture, psychology, fashion, advertising, consumer affluence etc. It is also technologically driven in terms of functions and symbols, e.g. so that demand increases for clothes which are 'streetwise' or cars with 'attitude'. Products also operate their own infrastructure systems with peripherals, spares,

2.1.2 Towards Factor 4

Despite the complexity, there are some clear directions towards a Factor 4 approach to goods and products, and these are shown up in the general templates in the previous sections. The average product would be longer life, shared and adaptable: designed for re-use, reconditioning and recycling: composed of non-toxic and lower-impact materials, more energy efficient in use. Wherever possible it would be locally sourced or distributed on low-impact logistics. Consumer demand would favour ecological and social responsibility through ethical trading, and financial investment would encourage sustainable enterprises and trading markets.

2.1.3 Summary & questions

Main resource effects:

- Reduced energy & resource demands in manufacturing
- All manufactured products designed for re-use & recycling
- Longer product life & higher energy efficiency
- All packaging designed for re-use and recycling
- Increased secondary owners' markets, with real-time distribution logistics

Main economic effects:

- Fuel levies on manufacturing & distribution: re-invested in innovation strategy.
- Public procurement incentives for market transformation
- Subsidy / levy incentives for energy efficient goods.
- Taxes and charges on products with toxic content e.g. batteries
- Economic structural shift from resource added to value added activity.
- Likely fiscal effect on the average household: saving on household expenditure on longer life & more efficient goods: balanced by higher unit prices.

Key public messages and issues for opinion surveys:

- "Live longer with long life goods
- "Ethical trade in the global village
- "Would you pay more for higher quality / more sustainable products?"

Key issues & questions to be addressed:

- Public acceptability of lifestyle constraints:
- Willingness to buy lower impact
- Willingness to share, re-use and recycle

2.1.4 Limits to research & policy

Clearly the problems of great diversity of products and supply chains are not to be solved with one single fixed policy or program. So the policy and fiscal measures proposed in the next sections are on a strategic experimental basis. In other words, the type of problem and context, tend to suggest a type of policy response, which demands a type of research and evidence base, which would be applied in a type of policy appraisal. The situation of course is not only due to policy but to the whole community of business, finance, media, science / technology, education etc. So this is a good example of the '*framework approach*' to complex agenda-centred mutual learning situations.

2.2 PRODUCTS – POLICY FRAMEWORK

2.2.1 Issues for the sector

Manufactured products cover a huge diversity of products, substances, trading situations, business types, consumer profiles and so on. To simplify the case we just look at four broad classes:

- Sustainable processes
- Sustainable products
- Sustainable appliances
- Sustainable ICT

In the UK manufacturing sector there are particular issues with

- international trade and the dominance of cheap imports in many sectors:
- high proportion of inter-industry trading and assembly operations:
- the vulnerability of many producer industries in the UK:
- high rates of technological innovation and obsolescence in many sectors:
- and on the demand side, with fashion and lifestyle issues.

So the resource - economic strategy here is a very rough cut, which can only hint at the many possible measures.

2.2.2 Summary of economic strategy

Measures specific to product manufacturing:

- End fate levies to consumer on products with toxic content as post consumer waste e.g. batteries
- End fate levies to producers on toxic semi-manufactured goods & materials, as industrial waste
- Lifetime levies to consumers buying appliances or equipment which is energy demanding through its lifetime
- Public procurement incentives for market transformation, i.e. all public procurement will specify zero-waste / zero-emissions, by supporting R&D program

General measures as applied to product manufacture:

- Fuel levies on manufacturing & distribution: re-invested in innovation strategy.
- General economic structural shift from resource added to value added activity.

Likely fiscal effect on the average household: saving on household expenditure on longer life & more efficient goods: balanced by higher unit prices. Key public messages:

- “Live longer with long life goods
- “Ethical trade in the global village

Key issues & questions to be addressed:

- Public acceptability of lifestyle constraints:
- Willingness to pay for quality
- Willingness to share, re-use and recycle in the community.

2.2.3 Sustainable materials program

This focuses on the raw materials, precursors or components of products, generally at the stage of inter-industry trading.

- ‘Virgin material levy’: this reflects the depletion of resources, where the public sector acts as the stake-owner. The tax would be levied by default unless clear evidence that impacts were minimized, renewable resources conserved etc. Current measures with minerals / aggregates tax could be extended and sharpened up in terms of the revenue. Obvious extensions would be to forestry, agro-products, marine products, other mineral substances etc.
- the principle of ‘end fate levy’ could apply where materials and substances enter or leave the industrial system – see notes at the beginning.
- The principle of tradeable permits could be extended to other substances, as with sulphur in the US. As with the carbon ETS, we propose that the public sector should be an active steward and stake-owner, in order to smooth the market, achieve targets, and release investment funding where needed.

2.2.4 Sustainable products program

In the great diversity of products there are underlying issues at each stage through the supply chain:

- Material sources and extraction impacts:
- Production impacts on a life-cycle basis:
- Operational impacts in use:
- Demand side satisfaction / utilization – how far the products are ‘needed’ and how far alternative products or services would be viable to fill the need.
- Logistics & distributional issues
- Production waste & other downstream impacts
- Post consumer waste and other downstream impacts

The policy package is likely to address several fronts, reflecting the complexity of the supply chains involved:

- impact permit trading: e.g. sulphur or other emissions trading from industrial processes
- Producer responsibility credit / permit schemes:

- Product accreditation linked with upstream guarantees: ethical / fair trading / sustainable forestry certificates etc
- Product accreditation for operational use: eco-labelling, linked with incentivized take-back schemes, preferential finance for eco-efficient products etc
- Producer responsibility for downstream impacts i.e. waste and other emissions in use: requires take-back or deposit return schemes as in the waste management system: also requires incentives for consumers to contribute to downstream management by sorting, returning etc. These incentives need to be clear and strong in terms of e.g. offset of replacement purchase price. There is a role for public sector support in this.

2.2.5 Sustainable appliance program

- The appliance & equipment market is more concerned with operational impacts, which may be up to 90% of the total life-cycle. So for these there is a case for a stronger and more detailed eco-labelling system, as in the existing DEFRA Market Transformation MT program. The public sector could intervene and offer credits from old appliances to enter a recycling stream, to offset against the energy savings on new appliances.
- There is also a case for re-instating community & collective use of appliances, especially in higher density urban living situations. Again the public sector should promote better utilization by offering buy-in schemes and other preferential terms for appliances which are likely to have higher levels of utilization.

2.2.6 Sustainable ICT program

- this agenda might start with the WEEE directive and work backwards, to the principle of producer responsibility, and the effects on product design, supply chains, innovation and obsolescence etc.
- the principle of ‘end fate levy’ still applies however, and this should form a powerful incentive for product supply chains to build in the disassembly and remanufacturing as far as possible.

2.3 PRODUCTS – MODELLING FRAMEWORK

2.3.1 KEY scenario trends & drivers

- **import %**: the proportion of products which are imported: this implies greater travel distances and possible less efficient production;
- **consumables intensity: hh cons/£income**: this is the basic purchasing parameter, i.e. the propensity of households to consume new items, relative to their total income.
- **EF in production**: this is an aggregate measure of the efficiency of production:
- **efficiency in use**: this is relevant to energy-intensive devices, not only kitchen appliances, but also tv and computing with continuous electrical loads.
- **turnover/stock %**: this is another way to express the ‘residence time’ or ownership life, this may be determined by functional wear and tear, by aesthetic demand, or by technological innovation as above.
- **Re-use and recycling %**: this measures the proportion of products discarded or put to one or other form of high-level recovery.

There are variations when dealing with household *consumables*: i.e. items with less than 3 years average lifetime.

- ***'Efficacy' factor***: this is an innovative feature which aims to represent something of the perceived satisfaction, utility or welfare derived from the consumption of any particular class of items. For instance it is clearly the case that the value of clothing depends not only on its function but on its aesthetic, cultural and symbolic appeal. Retail activity is now seen as much as 'therapy' as anything more substantial. The point here is that it may be possible to provide greater satisfaction with less material throughput, and the adjustment of this factor can reflect that.
- ***Packaging %***: this is fairly obvious, except where related to the note on efficacy, in the sense that the packaging becomes part of the product.
- ***recycling %***: this is an aggregated figure which represents an average of the different levels of re-use, re-manufacture, high / low level recycling, and so on.

2.3.2 Products: resource flow model

PRODUCTS	Material sources	Manufacturing	Logistics	Services	Demand side 1	Demand side 2	Products in use	Externalities
PHYSICAL	Import %, source, extraction mode	Energy in production	Transport distance & mode	Tertiary activity & value added	Intensity & utilization factors	Consumption / mode choice	Product life: energy efficiency	Waste & emissions
F1 – projection	Import % growth:	Decoupling rate = growth rate	Air freight growth					Increase waste disposal
F4 - scenario	Import reduction	Increase in energy efficiency & waste minimization	Low impact modes & logistics management	Increased service economy	Increase product utilization	Switch to long life low impact products	Increased product life & re-use: higher efficiency	Full cycle resource management
Policy options	Resource protection	Low impact technology innovation	Integrated supply chain mgmt	ICT based markets / exchanges	Utilization incentives	Integrated planning & resource mgmt	Regulation / quotas / labelling	Regulation / legal liability
ECONOMIC	Commodity prices: market effects	Fuel costs: factor & finance cost	Int. Transport fuel / transaction cost	labour costs: investment costs	Consumer exp / saving: social discount rate	Market behaviour: stock turnover	Product life: energy prices in operation	External costs / impact charges
F1 – projection	Fuel / material costs level	Fuel / material costs level	Fuel costs level	Service sector growth	High time preference & short term investment	Efficiency gains overtaken by increased spend	Fixed capital increases	UK costs internalized, others externalized
F4 - scenario	Fuel / material costs rise	Fuel / material costs rise	Fuel costs rise	Investment & share value linked to CSR	Low time preference & long term investment	Lower quantity, higher quality purchases	Increased product life & re-use: higher efficiency	Total costs internalized & marketized
Policy options	Commodity levies / tariffs	Carbon tax: public procurement for clean technology	Multi-lateral aviation tax / emissions trading	Incentives for CSR & environ.mgmt	Public procurement for market transform	Incentives for demand side management	Eco-labels & incentives for product life & efficiency	Emission & eco-services trading schemes
INSTITUTIONAL				Service / social economy	Utilization choices	Behavioural choices	Operational choices	Waste practices
Policy options	International development: ethical trading	Producer responsibility: env management	CSR	CSR	Social economy for product life & sharing	Social economy for product life & sharing		

2.3.3 Products: activity model settings

PRODUCT									
	Import %, source, extraction mode	Manufact & material productn	Logistics & distribution	Tertiary activity & value added	Demand intensity & utilization	Demand type / mode choice	Product operation	Waste / emissions	Overall trend projection
Ratios		X	X	X	X	X	X	X	=
Core factors	Energy int. of av. extraction	Energy int of manuf.	Trans distance in supply chain	Energy int. of service value add.	Social utilization in demand	Total demand	Energy int. in use	% total MF to waste	Av energy per unit material demand
Linked factors	Material options		Transport mode	Energy int distribution chain	Stock / consumption level	Product type choice	Utilization factor in use	% waste not recycled	
Other linked factors	Other impact of extraction	Other impact of manuf.	Other impacts by mode	Packaging etc		Product life turnover			
F1 – core factors	+0.5%	-0.5%	+1%	+1%	+0.5%	+0.5%	-1%	-0.5%	1.5%
F1 – linked			+1%	+1%	0	0	-0.5%	-0.5%	
F1 – other				+1%		1%			
F4 – core factors	-0.5%	-1%	0	+0.5%	0	0	-1%	-1%	-3% (target)
F4 – linked									
F4 – other									

2.3.4 Products: economic policy model

Details to follow

PRODUCTS											
POLICY PROGRAMMES	Primary sources	Manufact & material productn	Logistics & distributn	Tertiary activity & value added	Demand intensity & utilization	Demand type / mode choice	Product operation	Waste / emissions	Overall projection	Revenue policy	Revenue policy
Substance program											
Product program											
Appliance program											
ICT program											

3. Commercial services

3.1 COMMERCIAL SERVICES

3.1.1 Profile of the sector

The resource flow metabolism of consumer services is different from the previous sectors above. It is apparently more indirect and further down the supply chain: however the total indirect effects are as great as upstream secondary sectors. There is lower direct material intensity, with greater added value from labour & information.

The services sector categories also include economic 'factors' i.e. transport, buildings and utility supplies, and these generate the largest direct impact sources in the service sectors. However by looking at the supply chains upstream, we can see that the indirect effects of sectors such as banking and finance are more than 10 times the direct effects. Otherwise the material flow in the service sectors is more difficult to track, as the public accounts are limited to primary and manufacturing: clearly some sectors such as catering have large material flows and waste arisings, which need to be estimated.

There are various special and unique cases to consider.

- Retail and distribution are instrumental for the flow of other products and goods.
- Real estate and letting sectors are instrumental to the construction industry.
- Tourism is a special case, in both accounting and modelling terms: following the consumer responsibility principle, the Ecological Budget UK accounts include for the travel and consumption by UK tourists abroad: and domestic tourism is allocated by residence.
- Financial services are influential on investment in other sectors right across the economy
- ICT services are

Construction, transport and others are classed as services, although they involve much higher material intensity than other sectors.

In policy terms, commercial services tend to be more embedded in a free market approach to individual choice: In some areas there is direct overlap or competition with with the public services economy; e.g. in health, care, education etc. There is an interesting area of overlap with the social / household economy, for instance in the balance of catering vs home cooking, where a similar mix of food could be either in economic production or in private consumption. Arguably, the first priority should focus on financial services, for their instrumental role in providing incentives for other sectors.

3.1.2 Summary & questions

Main resource effects

- Stabilize commercial demand for energy & transport

- Accelerate material recycling & recovery
- Shift in local labour markets etc.
- Upstream responsibility for supply chain production impacts
- Downstream responsibility for supply chain consumption impacts

Main economic effects;

- Tradable quotas on commercial energy use
- Accessibility incentives for new commercial development
- Packaging deposit levies for retail & distribution
- Tourism & leisure constrained by transport levies
- Shift to recycling & recovery economy with rising waste costs.
- Shift to knowledge-added for resource / energy intensive sectors
- Budget effect on the average family: no net change: increased material efficiency, increased intermediate / social labour market.

Key public messages, and questions for the survey:

- “Green tourism in the global backyard
- “Ethical banking – so you know where your money is going
- “Would you pay 10 pence extra on your meal so the farmer can feed her family?
- “Would you like to support your local economy?

Key issues & questions:

- How far can CSR activity be shifted to the service sector?
- What are the macro-economic implications of a shift towards intermediate labour market / social economy?

3.2 SERVICES: POLICY FRAMEWORK

Services sectors cover a huge diversity of activities, some of which are included in other supply chains such as food, transport, construction etc. Most of the rest we put together as ‘general services’, except for two which are particularly significant because of their impacts and/or their influence on other activities:

- General services program
- Sustainable tourism program
- Sustainable finance program

3.2.1 Policy framework themes

Given the mainly indirect resource flows in the service sectors, there is naturally more focus on Corporate Social Responsibility (CSR), environmental management systems, ethical trading, ethical finance and consumer protection. In various sectors there would be versions of green

tourism, low impact logistics, responsible retailing and so on. In this way the greening of the service sectors can provide incentives and structures, as an instrumental force in the Factor 4 programme for other more material-intensive sectors.

This supply chain thinking can be summarized:

- Upstream responsibility for supply chain production impacts
- Downstream responsibility for supply chain consumption impacts

This increases the priority for supply chain tools for analysis and benchmarking: and for policy incentives which work for such indirect chain effects.

- One example would be where planning permissions and levies for retail or leisure developments should include a measure of the private travel impacts which would be generated.
- A further example is where a 'service' for instance in catering, is strongly linked to a 'product' from food processing: where the packaging impacts are strongly dependent on the logistics in the service sector.

The underlying theme is that of stewardship i.e. as above from the public sector. In the commercial sector this then extends the 'producer responsibility' and 'consumer responsibility' to a 'supply chain responsibility', which may be more or less indirect.

3.2.2 Commercial services program

This summarizes the above themes:

- Building use: procurement and operation
- Transport use: covered by employer travel schemes: vehicle fleet management, as in the transport section.
- Local environmental impacts: this covers other effects such as
- Indirect environmental impacts: both upstream and downstream effects are best covered through CSR, ethical trading, environmental auditing and so on. Many of these may not be economic policy issues as such:

3.2.3 Sustainable tourism program

- Tourism has its own policy agenda for green or eco-tourism. This covers the buildings, transport & other issues above. It also has other dimensions - international development: nature conservation: cultural responsibility: labour exploitation etc. As far as economic policy goes, we would propose
- a stronger link between tourism development, overseas development and the economic partnership agreements. This could be done through the financial regulation system
- convergence of international air travel towards full costing of impacts.

- Redistribution of tourist activity in the UK, via local taxes, subsidies, differentials and incentives.

3.2.4 Sustainable finance program

Financial services (finance, insurance and real estate) are particularly important as they underpin all the other sectors and policies on this agenda – therefore the focus is on downstream effects. As regards economic policy, there are several kinds of issues:

- Direct investment & lending: issues about policy uncertainty, payback periods etc. The public sector may be able to promote its goals by a greater willingness to underwrite risks, advance collateral etc.
- Equity finance: issues on risk avoidance, corporate responsibility & shareholder value: the public sector may help with firm criteria and guidelines in public procurement etc.
- Effect on international financial trading: see the discussion in the main section on

3.3 SERVICES: MODEL FRAMEWORK

3.3.1 Services: resource flow framework

SERVICES	Material sources	Logistics	Manufacturing	Services	Demand side 1	Demand side 2	Products in use	Externalities
PHYSICAL	Import %, source, extraction mode	Transport distance & mode	Energy in production	Tertiary activity & value added	Intensity & utilization factors	Consumption / mode choice	Product life: energy efficiency	Waste, recycling %: waste mgmt: emissions
F1 – projection	Import % growth:	Air freight growth	Decoupling rate = growth rate					Continuing disposal
F4 - scenario	Import reduction	Low impact modes	Rapid energy efficiency		Increased utilization		Increased product life & re-use: higher efficiency	Integrated resource management
Policy options	Resource protection	Integrated supply chain mgmt	New processes: new products	ICT based markets / exchanges	Utilization incentives	Integrated planning & resource mgmt	Regulation / quotas / labelling	Regulation / legal liability
ECONOMIC	Commodity prices: market effects	Int. transport fuel / transaction cost	Fuel costs: factor & finance cost	labour costs: investment costs	Consumer exp / saving: social discount	Market behaviour: stock turnover	Product life: energy prices in operation	External costs / impact charges
F1 – projection	Prices stay low	Fuel costs level	Fuel / material costs level	Service sector growth	High time preference & short term investment	Efficiency gains overtaken by increased spend	Fixed capital increases	UK costs internalized, others externalized
F4 - scenario	Prices rise	Fuel costs rise	Fuel / material costs rise	Investment & share value linked to CSR	Low time preference & long term investment	Lower quantity, higher quality purchases	Increased product life & re-use: higher efficiency	Total costs internalized & marketized
Policy options	Commodity levies / tariffs	Multi-lateral aviation tax	Carbon tax: public procurement for clean technology	Incentives for CSR & environ.mgmt	Public procurement for market transform	Incentives for demand side management	Eco-labels & incentives for product life & efficiency	Emission & eco-services trading schemes
INSTITUTIONAL				Service economy / social economy	Utilization choices	Behavioural choices	Operational choices	Waste practices
Policy options	International development: ethical trading	CSR	Producer responsibility: env management	CSR	Social economy & civic society	Social economy & civic society		

3.3.2 Activity model settings

SERVICES	Import %, source, extraction mode	Manufact & material productn	Logistics & distribution	Tertiary activity & value added	Demand intensity & utilization	Demand type / mode choice	Product operation	Waste / emissions	Overall trend projection
Ratios		X	X	X	X	X	X	X	=
Core factors	Energy int. of av. extraction	Energy int of manuf.	Trans distance in supply chain	Energy int. of service value add.	Social utilization in demand	Total demand	Energy int. in use	% total MF to waste	Av energy per unit material demand
Linked factors	Material options		Energy int.of transport mode	Energy int distribution chain	Stock / consumption level	Product type choice	Utilization factor in use	% waste not recycled	
Other linked factors	Other impact of extraction	Other impact of manuf.	Other impacts by mode	Packaging etc		Product life turnover			
F1 – core factors	+0.5%	-0.5%	+1%	+1%	+0.5%	+0.5%	-1%	-0.5%	1.5%
F1 – linked			+1%	+1%	0	0	-0.5%	-0.5%	
F1 – other				+1%		1%			
F4 – core factors	-0.5%	-1%	0	+0.5%	0	0	-1%	-1%	-3% (target)
F4 – linked									
F4 – other									

3.3.3 Services: economic model settings

Details to follow

SERVICES	Primary sources	Manufact & material productn	Logistics & distributn	Tertiary activity & value added	Demand intensity & utilization	Demand type / mode choice	Product operation	Waste / emissions	Overall projection	Revenue policy	Revenue policy
General services											
Retail & distribution											
Sustainable tourism											
Financial services											

4. Public services

4.1 PUBLIC SERVICES

4.1.1 Profile of the sector

The resource flow metabolism of public services has similarities and differences from that of commercial services. As with the commercial above, these activities are generally more indirect and further down the supply chain, with greater added value from labour, capital & information. As above, the factors of production are the largest direct impact source – buildings, energy and transport. However, some services – health, defence and so on – are also major material and capital consumers, and also major occupiers of land and buildings.

However, the policy context or political economy for public services is quite different to that of commercial services. Health, education, defence and so on are generally structured in large organizations/ consortiums, so that forward planning, integrated asset management and green chain management are more feasible. Therefore public services are the first priority for advancing the programme of public procurement for market transformation.

However public services at all levels are subject to financial efficiency criteria, which does not necessarily coincide with environmental policy. There are major questions on the privatization, franchising, devolving and otherwise marketizing of health, education and many other services: this brings up the role of public / private partnerships (PPP, PFI, DBFO etc) in adding value on both sides. Apart from the many political and economic issues, there are environmental issues involved in this shift towards a ‘devolved’ public service estate.

4.1.2 Towards Factor 4

The Factor 4 programme for public services would include several layers from direct to indirect. Firstly there is scope in environmental policy for direct impacts: transport, buildings, energy, waste. The health and education sectors are becoming aware of the greening agenda, although as yet it is secondary to service and management issues. The Building Schools for the Future investment programme has the potential to produce ultra low impact buildings with enhanced educational value. A recent analysis of a Manchester school showed that building construction, energy use, staff travel, and school dinners each had roughly similar portions of the total ecological footprint.

There is also an agenda for indirect and induced impacts: i.e. where provision of services may increase or substitute for material consumption. For instance, health professionals have realized that providing some types of patient with a room with a view may have more effect than prescribing drugs. Each of the service agendas above then applies, i.e. ethical trade, finance, CSR, environmental management systems etc.

The difference is the huge potential of public procurement, which in public services should be able to be coordinated and strategic, like nowhere else. This represents the leading edge of the

OPEN strategy, which depends on a pro-active role by government in the stewardship of a One Planet Economy.

4.1.3 Summary & questions

Main resource effects:

- Stabilize demand for energy & transport
- Accelerate material recycling & recovery
- Shift towards local labour markets etc.

Main economic effects:

- Tradable quotas on public energy use
- Accessibility criteria for public services
- Shift towards recycling & recovery economy.
- Budget effect on the average family: no net change in public taxation: increased material efficiency, increased intermediate / social labour market.

Key public messages and questions for survey:

- “Sustainable healthcare – makes you healthier
- “Walk your way to your local neighbourhood centre
- “Would you pay a penny on income tax to ensure a greener NHS?”

Key issues & questions:

- Consumer convenience vs system efficiency / cost reduction
- Allocation of CSR to public service functions
- Shift towards intermediate labour market / social economy.

4.2 PUBLIC SERVICES: POLICY FRAMEWORK

The resource flow profile in public services is similar to commercial services - activities are generally more indirect and further down the supply chain, with greater added value from labour, capital & information. As above, the factors of production are the largest direct impact source – buildings, energy and transport. However, some services – health, defence and so on – are also major material and capital consumers, and also major occupiers of land and buildings.

However the policy context and political economy is often different. Health, education, defence and so on are generally structured in large organizations / consortiums, so that strategic planning, integrated asset management and green supply chain management are more feasible (in principle). Therefore public services are the first priority focus, for public procurement for market transformation (see recent DEFRA report ‘*procuring the future*’).

Public services programs are structured here as follows:

- Sustainable health service: the largest organization in the UK with 1.2 million employees: also includes private health firms
- Sustainable public services: the largest component is education
- Sustainable defence & security: this is distinctive, due to the very large material demands of the defence services. However this also presents extreme difficulty in obtaining information.

4.2.1 Health service program

Details to follow

4.2.2 Public services program

Details to follow

4.2.3 Defence & security program

Details to follow

4.3 PUBLIC SERVICES: MODEL FRAMEWORK

4.3.1 Public services: resource flow effects

PUBLIC								
	Material sources	Logistics	Manufacturing	Services	Demand side 1	Demand side 2	Products in use	Externalities
PHYSICAL	Import %, source, extraction mode	Transport distance & mode	Energy in production	Tertiary activity & value added	Intensity & utilization factors	Consumption / mode choice	Product life: energy efficiency	Waste, recycling %: waste mgmt: emissions
F1 – projection								Continuing disposal
F4 - scenario	“	As for products -	“		Increased utilization		Increased product life & re-use: higher efficiency	Integrated resource management
Policy options				ICT based markets / exchanges	Utilization incentives	Integrated planning & resource mgmt	Regulation / quotas / labelling	Regulation / legal liability
ECONOMIC	Commodity prices: market effects	Int. transport fuel / transaction cost	Fuel costs: factor & finance cost	labour costs: investment costs	Consumer exp / saving: social discount	Market behaviour: stock turnover	Product life: energy prices in operation	External costs / impact charges
F1 – projection	“	“	“	Service sector growth	High time preference & short term investment	Efficiency gains overtaken by increased spend	Fixed capital increases	UK costs internalized, others externalized
F4 - scenario				Investment & share value linked to CSR	Low time preference & long term investment	Lower quantity, higher quality purchases	Increased product life & re-use: higher efficiency	Total costs internalized & marketized
Policy options				Incentives for CSR & environ.mgmt	Public procurement for market transform	Incentives for demand side management	Eco-labels & incentives for product life & efficiency	Emission & eco-services trading schemes
INSTITUTIONAL				Service economy / social economy	Utilization choices	Behavioural choices	Operational choices	Waste practices
Policy options	International development: ethical trading	CSR	Producer responsibility: env management	CSR	Social economy & civic society	Social economy & civic society		

4.3.2 Public services: activity model settings

PUBLIC									
	Import %, source, extraction mode	Manufact & material productn	Logistics & distribution	Tertiary activity & value added	Demand intensity & utilization	Demand type / mode choice	Product operation	Waste / emissions	Overall trend projection
Ratios		X	X	X	X	X	X	X	=
Core factors	Energy int. of av. extraction	Energy int of manuf.	Trans distance in supply chain	Energy int. of service value add.	Social utilization in demand	Total demand	Energy int. in use	% total MF to waste	Av energy per unit material demand
Linked factors	Material options		Energy int.of transport mode	Energy int distribution chain	Stock / consumption level	Product type choice	Utilization factor in use	% waste not recycled	
Other linked factors	Other impact of extraction	Other impact of manuf.	Other impacts by mode	Packaging etc		Product life turnover			
F1 – core factors	+0.5%	-0.5%	+1%	+1%	+0.5%	+0.5%	-1%	-0.5%	1.5%
F1 – linked			+1%	+1%	0	0	-0.5%	-0.5%	
F1 – other				+1%		1%			
F4 – core factors	-0.5%	-1%	0	+0.5%	0	0	-1%	-1%	-3% (target)
F4 – linked									
F4 – other									

4.3.3 Public services: economic model settings

Details to follow

PUBLIC											
POLICY PROGRAMMES	Primary sources	Manufact & material productn	Logistics & distributn	Tertiary activity & value added	Demand intensity & utilization	Demand type / mode choice	Product operation	Waste / emissions	Overall projection	Revenue policy	Revenue policy

5. Appendix

5.1 GLOSSARY

BATNEEC	‘best available technology not entailing excessive cost’
BAU	‘business as usual’ scenarios
BPEO	‘best practicable environmental option’
CAP	Common Agricultural Policy
CE	Cambridge Econometrics
COICOP	national database of household expenditure
CSR	corporate social responsibility
CURE	Centre for Urban & Regional Ecology
DA	devolved administration, i.e. Wales, Scotland, Northern Ireland
DBFO	design, build, finance & operate scheme
DCLG	Department of Communities & Local Government
DEFRA	Department of Environment, Food and Rural Affairs
DPSIR	‘driving forces, pressures, state, impact, response’ framework for indicators
DOT	Department of Transport
DTI	Department of Trade and Industry
EA	Environment Agency
EEA	European Environment Agency
EFTA	European Free Trade Area
ETS	Emissions Trading Scheme
EU	European Union
F-4	factor four reduction scenario
GDP	Gross Domestic Product
IA	integrated assessment
IO	input-output methodology
ICT	information & communications technology
IPCC	Inter-Governmental Panel on the Scientific Assessment of Climate Change
IPPC	‘integrated pollution prevention and control’
ISEW	‘Index of Sustainable Economic Welfare’
LCA	‘life-cycle analysis’ of environmental impacts
NHS	National Health Service
ODPM	Office of the Deputy Prime Minister
ONS	Office of National Statistics
OPEN	One Planet Economy Network
OST	Office of Science & Technology
PFI	Private Finance Initiative
RDA	Regional Development Agency
REEIO	Regional Economy-Environment Input-Output (software model)
REAP	Resource Analysis Programme (software model)
RSS	Regional Spatial Strategy

RSDf	Regional Sustainable Development Framework
SA	sustainability appraisal
SCPnet	'Sustainable Consumption & Production network'
SEA	strategic environmental assessment
SEI	Stockholm Environment Institute
WFD	EU Water Framework Directive
WTO	World Trade Organization
WDA	waste disposal authority