

Longer Product Lifetimes

Chapter 3 - Impact Assessment of Potential Measures

Final Report

February 2011

Defra


Longer Product Lifetimes

Chapter 3 – Impact Assessment of Potential Measures

Final Report

February 2011

Prepared by Jackie Downes, Bernie Thomas,
Carina Dunkerley and Howard Walker (Bridge
Economics)

For and on behalf of Environmental Resources Management
Approved by: Simon Aumônier _____
Signed:  _____
Position: Partner _____
Date: February 2011 _____

This report has been prepared by Environmental Resources Management the trading name of Environmental Resources Management Limited, with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

CONTENTS

1	INTRODUCTION	1
1.1	STRUCTURE OF THIS CHAPTER	1
2	PRACTICAL STEPS TO ACHIEVE LONGER PRODUCT LIFETIMES	2
2.1	INITIAL STAKEHOLDER ENGAGEMENT	2
2.2	DEFINING THE MEASURES	3
3	APPROACH TO DEVELOPMENT STAGE IMPACT ASSESSMENT OF MEASURES	9
3.1	INTRODUCTION	9
3.2	WHAT IS A DEVELOPMENT STAGE IA?	9
3.3	THE IA PROCESS	10
3.4	RATIONALE FOR INTERVENTION	15
3.5	PRODUCT CHARACTERISTICS	19
3.6	STOCKS AND SALES FORECAST MODEL	22
4	FINDINGS OF IMPACT ASSESSMENTS	29
4.1	INTRODUCTION	29
4.2	IMPACTS OF THE MEASURES ON THE UK ECONOMY	29
4.3	IMPACTS OF THE MEASURES ON THE ENVIRONMENT	36
4.4	IMPACTS OF THE MEASURES ON UK CONSUMERS AND WIDER SOCIETAL IMPACTS	41
4.5	SENSITIVITY TESTING ON ECONOMIC IMPACTS	44
4.6	LIMITATIONS ON THE FINDINGS OF THE IAS	49
5	APPROPRIATE MEASURES FOR APPROPRIATE PRODUCTS	50
5.1	CHAPTER 1 PRODUCT GROUPS	50
5.2	ALTERNATIVE PRODUCT GROUPINGS	50
5.3	PRODUCT FEATURES AND SUITABILITY OF MEASURES	52
6	MAIN OBJECTIVES OF MEASURES AND CRITICAL SUCCESS FACTORS	58
6.1	OBJECTIVES OF MEASURES	58
6.2	THE POINT OF INTERVENTION	59
6.3	LIKELIHOOD OF LONGER PRODUCT LIFETIMES/CRITICAL SUCCESS FACTORS	60
6.4	COMPATIBILITY OF MEASURES	67
7	CONCLUSIONS	68
7.1	IMPACTS OF SPECIFIC MEASURES ON SAMPLE PRODUCTS	68
7.2	EFFECTIVENESS OF MEASURES	70
7.3	FUTURE WORK	71

1 INTRODUCTION

1.1 STRUCTURE OF THIS CHAPTER

This is the third chapter in Environmental Resources Management (ERM) Limited's report for Defra on Extended Product Lifetimes.

Chapter 1, entitled *the Scoping Report*, details ERM's initial evidence review. This explains the background to this research into extending product lifetimes, and describes the process taken by ERM to select nine sample products for detailed review.

Chapter 2, entitled *Life Cycle Impacts of Nine Products*, describes in detail the scoping product life cycle assessment studies (LCAs) which quantified the environmental benefits associated with extending the life of these sample products. Additionally, it includes a more detailed discussion on one environmental impact of products – waste arisings. It looks at a first estimate of the total quantity of waste (in tonnes) which could be prevented in the UK if around 10% of the selected products had extended lifetimes.

This Chapter, *Impact Assessment of Potential Measures*, focuses on what practical steps or measures could be put in place to extend the life of products. It looks at the rationale for introducing particular measures to extend product lifetimes and presents ERM's approach to defining and to evaluating the effect of specific measures on the example products. It presents our conclusions on the potential environmental, economic and social impacts of implementing the specific measures and goes on to explain which measures are likely to be effective in extending the life of particular products.

The chapter contains the following sections:

Section 2: Practical Steps to Longer Product Lifetimes

Section 3: Approach to Development Stage IAs

Section 4: Findings of IAs

Section 5: Appropriate Measures for Appropriate Products

Section 6: Main Objectives of Measures and Critical Success Factors

Section 7: Conclusions

This chapter is supplemented with the following Annexes:

Annex D Stakeholder Workshop Materials

Annex E Stocks and Sales Model

Annex F Development Stage IAs

2.1 INITIAL STAKEHOLDER ENGAGEMENT

At this stage of the research, the focus moved to the practical steps or measures which could be taken to extend the life of products. This stage of the work began with some initial stakeholder engagement.

Two full-day workshops were held in June 2010. The first focused on the sample electronic products and the second on non-electronic products. Stakeholders representing product manufacturers, brand owners, retailers, trade associations, government departments, government bodies and academics were invited. Over 50 participants attended over the two days.

The objectives of the workshops were to:

- introduce the project to stakeholders and present the environmental evidence for longer product lifetimes (see *Chapter 2: Life Cycle Impact of Nine Products*);
- present the consumer perspective on longer product lifetimes (ie, the findings of the parallel study being undertaken by Brook Lyndhurst as described in *Chapter 1*);
- present a business case study of longer product lifetimes:
On Day 1 ISE presented their business case for manufacturing and retailing long-life washing machines.
On Day 2 Interface presented their commercial flooring leasing model.

The stakeholders then worked in small groups (according to sample product) in order to answer five key questions. These questions and a summary of stakeholder responses are provided in *Table 2.1*. A more detailed summary is provided in *Annex D*.

Table 2.1 *Summary of Stakeholder Responses*

<p>How important are product lifetimes? How do they factor in business planning and strategy?</p> <ul style="list-style-type: none"> • Important for business planning • Important for some brands/reputation not important for others • Important for CSR • Not important as public demand is for new products and fashion items. • Important to ensure warranty period is achieved.
<p>What are the barriers to extending the life of products?</p> <ul style="list-style-type: none"> • Technological innovation • Lack of consumer demand/fashion • Loss of revenue linked to reduced sales • Repairs/servicing too expensive • Consumer/Customer behaviour and care of product
<p>What could encourage businesses to make products last longer?</p> <ul style="list-style-type: none"> • Increased consumer demand (suggested by all groups) • Ability to remain profitable • Business customers/public procurement initiatives • Costs and /or availability of materials
<p>What actions could businesses take to make products last longer?</p> <ul style="list-style-type: none"> • Consumer education (suggested by all groups) • Develop brands around durability • Facilitate repair through provision of spare parts • Design/Specification for higher end products • Provide aftercare services/Changing business model to leasing/ servicing
<p>What would drive businesses to do this?</p> <ul style="list-style-type: none"> • Legislation (including mandating durability and producer responsibility) • Fiscal instruments, particular VAT relief on specific products • Product labelling • Procurement policies

2.2 *DEFINING THE MEASURES*

Following the stakeholder meetings, ERM collated a long list of suggestions for possible measures from the feedback and internal discussions. All of these suggestions were considered and reviewed with the aim of selecting a manageable number of measures for further detailed assessment.

Table 2.2 provides the long list of measures which were reviewed. It also highlights which measures were included and excluded from the further evaluation.

In terms of extending product lifetimes, a series of key themes or strategies for lifetime extension emerged (see *Figure 2.1*). This is in addition to the theme of optimising product lifetime or product use through leasing arrangements.

Figure 2.1 Strategies for Lifetime Extension

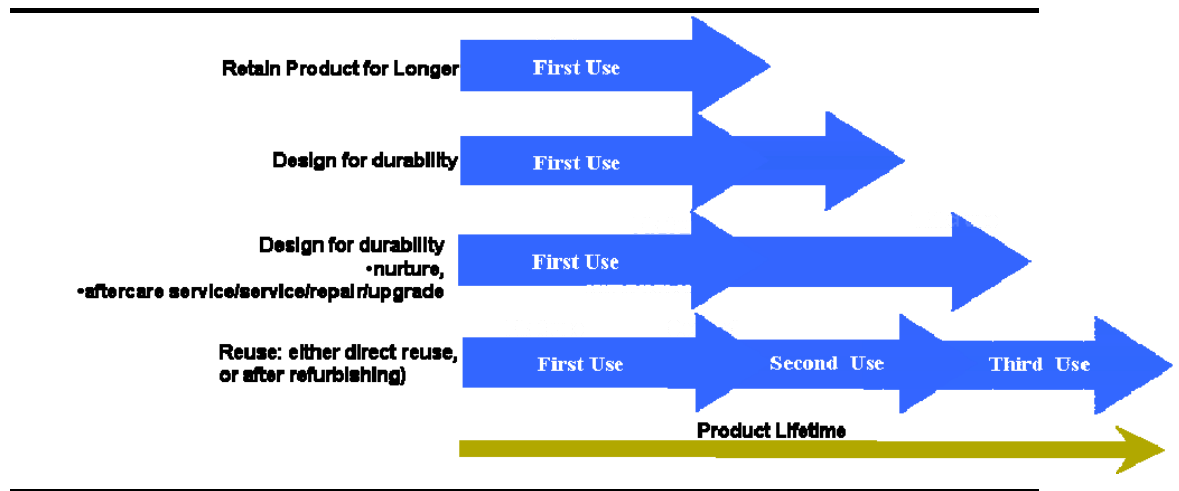


Table 2.2 Long List of Measures and Reasons for Short listing

Stakeholder Feedback/Suggested Measures	Included/ Excluded	Reasons for inclusion/exclusion in short list/ explanatory notes
1. Educate the consumer about maintenance and correct product use	Excluded	This measure was excluded but was considered as part of another measure (row 17) which looks at educating the consumer about expected product lifetime. Correct product use and maintenance were considered as part of the information campaign to encourage consumers to use products optimally and for their full lifetime.
2. Educate the consumer on products' lifecycle and environmental impacts	Excluded	This measure was excluded as WRAP research suggests that the provision of environmental information to consumers is unlikely to contribute significantly to behaviour change by itself.
3. Educate the consumer on expected product lifetime	Excluded	This proposed measure was described as an industry led campaign. ERM included a government led information campaign on product lifetimes, and excluded an industry led, as the impacts were deemed to be similar and wider conclusions on this measure could be reached without a detailed IA.
4. Change consumer expectation on longevity, through marketing and changes in branding - making long-lasting products 'trendy'	Excluded	This measure was deemed to be of too limited applicability to be usefully studied in an IA. It was thought to be restricted to 'up to date' products for a limited group of consumers (typically the youth market).
5. Promote British products of higher craftsmanship	Excluded	This measure was excluded as it applies to a small number of higher end products.
6. Develop new business models: retain product ownership and rent/ lease it the product to customers	Included	This measure was included.
7. Develop new business models: showing the cost of the product to the consumer (where it is currently 'hidden' by a monthly payment contract)	Excluded	This measure was excluded as it applies to a limited number of products (eg, products with monthly payments under a contract arrangement, such as mobile phones and commercial printers)
8. Offer better quality, longer-lasting products, including testing for durability	Included	This measure was included and approached both as measures encouraging (a) the design and manufacture of better products (b) voluntary/mandatory durability standard
9. Design products for repair-ability, disassembly and/or reuse	Excluded	This measure was excluded but product design that includes the potential for repair-ability, disassembly and re-use was considered as a potential quality of a 'better, quality' longer lasting product in row 8.
10. Design products for upgrades, eg introduce modularity to allow them to be updated (new function, design features)	Excluded	This measure as defined was excluded as it was deemed to be suitable for only a limited number of products. However the capacity to be upgraded was considered as a potential requirement in government procurement (row 18), and the potential to be upgraded was also considered as a potential characteristic for a better designed product.
11. Make repairs cheaper and easier: increase the availability of spares and parts, including	Excluded	This measure was excluded but the availability of spares was considered in a number of other measures. As spares are already available, it was deemed more pertinent to consider the measures by which their availability could be significantly

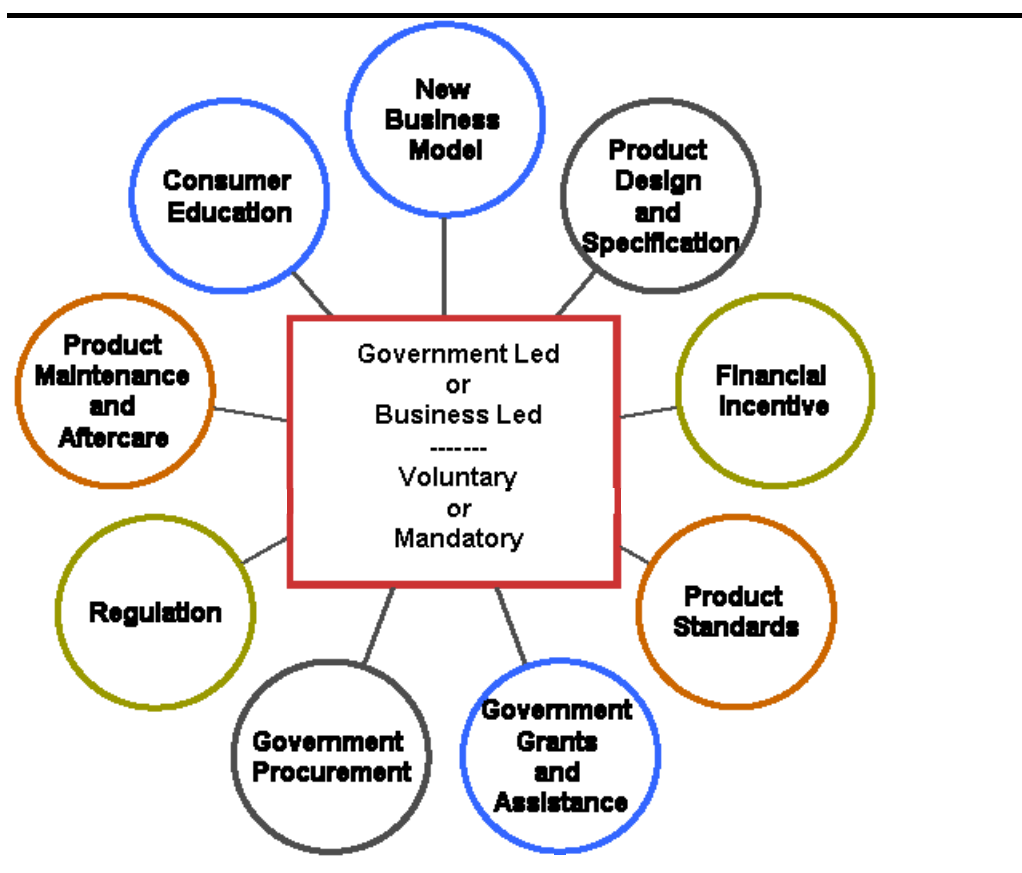
Stakeholder Feedback/Suggested Measures	Included/ Excluded	Reasons for inclusion/exclusion in short list/ explanatory notes
standardising components		increased. These issues were considered in other measures (rows , as assess those measures (eg, including after-care services, product design and product standard)
12. Provide customers with after-care service, including repairs and ongoing maintenance	Included	This measure was included. As these services already exist, the measure was approached in a novel way, with products including aftercare services in their initial retail price.
13. Extend returns policy and warranties	Included	This measure was included as mandatory extended warranties.
14. Support the growth of social enterprises focused on product recovery and re-use	Excluded	This measure was excluded as such, but measures to promote the growth of the product recovery, refurbishment and re-use sectors were considered through a number of other measures (such as product buy-back, producer responsibility)
15. Recover and refurbish products	Excluded	This measure was excluded, but the recovery and refurbishment of products was considered through other measures- eg, deposit schemes, a producer responsibility scheme that includes an obligation to recover and refurbish
16. Provide customers with a buy-back service	Included	This measure was considered as a deposit scheme.
17. Educate the consumer on product expected lifetime, including labelling	Included	This measure was included.
18. Extend government green procurement	Included	This measure was included.
19. Regulate on producer responsibility for product end of life	Included	This measure was included, but product responsibility was approached as an obligation to recover and refurbish products. 'Traditional' product responsibility schemes encourage recycling, but this would not necessarily extent product life.
20. Include product re-use/ extended life as a credit under the CRC Energy Efficiency scheme	Excluded	This measure was excluded due to uncertainties about the future of the CRC Energy Efficiency Scheme (currently under consultation in view of simplifying the scheme)
21. Promote traditional skills and craftsmanship	Excluded	This measure was excluded as it applies to a small number of typically higher end products.
22. Develop product durability standards	Included	This measure was included. Both a mandatory and a voluntary standard were included for comparison. A mandatory standard is also a pre-requisite for other measures (eg, to establish which products are 'longer-lasting' and could benefit from VAT incentives for example)
23. Provide VAT incentives for durable goods	Included	This measure was included. A financial incentive scheme for the commercial sector was also included.
24. Introduce scrappage schemes on certain products if upgrade is to a longer-lasting product	Excluded	This measure was excluded as it was deemed it could have unintended consequences. If a scrappage scheme allowed consumers to obtain a financial reward when replacing a product after a specified period of time, consumers may be encouraged to stockpile products, without necessarily using it, to allow the reward to be claimed later.
25. Support British products	Excluded	This measure was excluded as it suggested protectionist measures to limit foreign exports.

Three additional measures were added following discussions with the Defra project team. These were:

- **Mandatory durability standards**, to act as a comparison with voluntary durability standards.
- **Enhanced Capital Allowances (ECAs)** as a fiscal incentive in a commercial context, to act as a comparison with VAT incentives for consumers.
ECAs provide a fiscal incentive for businesses to invest in specific equipment or products. Businesses are able to claim a 100% first year capital allowance on these investments and are able to write off the whole cost against their taxable profits in the period during which they make the investment.
- **Government grants**, as a broader support measure, encompassing other potential support measures identified by stakeholders (eg, supporting skill development).

The final 13 measures represent a range of different characteristics and approaches as illustrated in *Figure 2.2*

Figure 2.2 Characteristics of Measures



The final short list of measures (see *Box 2.1*) was chosen to allow broader conclusions to be drawn regarding the possible impacts of other similar measures. Further details on these measures are provided in *Table 3.1 Detail of the 13 Measures*)

Box 2.1 *Short List of Measures*

-
1. Design for durability
 2. Leasing business models
 3. After-care services
 4. Deposits schemes/ product buy-back
 5. Consumer awareness campaigns
 6. Government support
 7. Enhanced Capital Allowances (ECAs)
 8. VAT incentive
 9. Voluntary product durability standards
 10. Mandatory durability declaration
 11. Green public procurement
 12. IPR
 13. Extended warranties
-

3 *APPROACH TO DEVELOPMENT STAGE IMPACT ASSESSMENT OF MEASURES*

3.1 *INTRODUCTION*

This section describes ERM's approach to carrying out Impact Assessments (IAs) of the 13 selected measures on eight of the sample products, namely:

1. T-shirts
2. Mobile phones
3. Washing machines
4. Sofas
5. Printers
6. Laptops
7. Toasters
8. Commercial flooring

The detail of each IA is presented in a spreadsheet containing a series of worksheets. These are included in *Annex F*.

Note: The ninth sample product, domestic carpet, was not used as a sample product in these IAs. This was due to the findings from the Life Cycle Optimisation Modelling (Chapter 2), wherein ERM identified uncertainties regarding the environmental impacts associated with the production of UK wool for the durable wool carpet. The results suggest, for the typical product lifetimes assumed in the modelling, that it is environmentally preferable to replace nylon-based carpets more frequently than to use longer-lived wool-based carpets. However, it is important to understand that other lifetime extension scenarios for carpets (ie with different assumed lifetimes) could well show environmental benefits although ERM has not assessed any further scenarios.

This section contains the following sub-sections:

Section 3.2 What is a Development Stage IA?

Section 3.3 The IA process;

Section 3.4 Rationale for intervention;

Section 3.5 Product characteristics; and

Section 3.6 Stocks and sales model.

3.2 *WHAT IS A DEVELOPMENT STAGE IA?*

A Development Stage Impact Assessment (IA) focuses on: the policy challenge; the rationale for government intervention; the identification of policy objectives; and the gathering of evidence ⁽¹⁾. Once a development stage IA has been developed, a more detailed IA involves refinement of the quality of the data being used and the depth of analysis, in order to make it more specific to the proposals, and to improve its accuracy.

(1) <http://www.bis.gov.uk/assets/BISCore/better-regulation/docs/10-901-impact-assessment-toolkit.pdf>

For example, at the development stage of an IA, it may be adequate to use summary data only when identifying and appraising options. However, at later stages of the IA process, the rigour of the analysis should increase – especially before committing significant funds or making major regulatory decisions⁽¹⁾.

For each Development Stage IA, ERM developed initial estimates of economic, environmental and social costs and benefits in order to inform a qualitative discussion of the costs and benefits of each measure. It should be noted that the quantitative analysis was specific to the sample products so does not fulfil the requirement of an Options Stage IA.

3.3

THE IA PROCESS

Each IA involved the following:

- identifying baseline conditions for a range of economic, environmental and social issues in 2010, the ‘Baseline’ scenario;
- projecting these conditions to 2030, based on current trends, as a ‘business as usual’ or ‘do nothing’ scenario;
- projecting these conditions to 2030, with a ‘measure on’ scenario; and
- comparing the economic, social and environmental conditions in 2030 under ‘measure on’ and ‘do nothing’ for our sample product.

Note that each IA compares the forecast situation in 2030 under ‘do nothing’ and ‘measure on’. It does not compare cumulative impacts from 2010-2029. (see *Section 4.5.5*)

In conducting each IA, it was necessary to:

- (a) select a sample product which was appropriate for the measure; and
- (b) define the measure in sufficient detail to allow the consequences/impacts of the measure to be assessed.

In defining each measure, and in assigning a sample product, it was necessary to consider the practicalities of implementing individual measures.

- How is the measure going to work in practice?
- How will the market for the particular product change – what will be the incentive to change?
- Who is going to implement the measure? business, government?

It was recognised that all measures would face implementation challenges and if any measure were to be pursued further it would necessitate detailed

(1) <http://www.bis.gov.uk/assets/biscore/better-regulation/docs/i/10-1269-impact-assessment-guidance.pdf>

stakeholder engagement to ensure that solutions are workable and correctly targeted.

In relation to these IAs, ERM contacted specific stakeholders by phone and/or email following the stakeholder events. This allowed ERM to investigate and sense-check issues raised during the workshops, confirm industry data and/or assumptions (eg market share of standard and longer life products and potential for change in a market).

Whilst the stakeholder engagement process was key to informing the study, certain key limitations should be noted:

- Sample products were not equally represented at the workshops; considerably more industry representatives from the electronic products attended the workshops than representatives from non-electronic products.
- Representatives were not always in a position to provide accurate, specific industry data

Table 3.1 provides the detail of the final 13 measures, along with the selected sample product.

Table 3.1 *Detail of the 13 Measures*

Lead	Measure name (referred to throughout this document)	Measure	Sample product	
1	Industry	Design for durability	The measure involves a change in the design of a basic T-shirt, which leads to increased product lifetime through a change to the basic fabric. It is a voluntary measure by industry to offer longer-lasting products to the consumer. In order to be successful, such a measure would have to be cost neutral to industry. For example, with the longer-lasting T-shirt having a higher retail price than the standard life T-shirt. The measure may also have to be supported through government intervention, ie incentives for longer-lasting products, consumer awareness campaigns etc	T-Shirts
2	Industry	Leasing business models	This measure involves the introduction of Product Service System (PSS) business models. Manufacturers/Distributors produce and retain products as assets and lease them to a number of consumers during their full useful life. In effect, business is leasing the product's functionality to the consumer, rather than selling the product. Business can also provide product maintenance services to the consumer.	Commercial flooring
3	Industry	After-care services	The measure aims to increase product lifetime through product aftercare provided by the retailer or the manufacturer (eg by providing maintenance services or facilitating repair and maintenance through increased availability of spares and parts). The relationship between the consumer and retailer, or the manufacturer, is therefore extended after sale. The measure could take several forms, including: (a) a certain number of maintenance or repair activities included as standard over a specified time period in the product price; (b) spares and parts included in the product price, and provided at point of sale or as and when necessary; (c) the extension of existing repair services, possibly directly affiliated with retailers (ie provided in partnership with department stores or supermarkets).	Sofa
4	Industry	Deposits schemes/ product buy-back	The measure involves the reuse of products by manufacturers/distributors. Businesses collect products in order to refurbish them and to redeploy them to a second market. The measure ensures that products are used during their full useful life, by several consumers, avoiding premature disposal. Business take-back of products at the end of their first use could take the form of an optional buy-back service, or a deposit scheme for products. In this work, the measure takes the form of a deposit scheme.	Mobile phones
5	Government	Consumer awareness campaigns	The measure involves a government consumer awareness campaign. The campaign would use simple messaging, encouraging consumers to keep their products longer, and for their full useful life. The campaign messages focus on expected lifetime of particular products, correct product use and maintenance (eg 'Did you know that with the right care and attention, you could double the life of your 'x''?) The campaign will include messages on the possible 'full life' cost savings that are achievable if more durable, expensive products are purchased.	Toasters
6	Government	Government support	This measure is a government grant given to one sector, to encourage businesses to work together to establish a standard approach to calculating the whole life costs associated with a product. The measure will result in product	Printers

Lead	Measure name (referred to throughout this document)	Measure	Sample product
		information regarding the expected lifetime and how this relates to product price (eg annual price or price per cycle/copy). Participant businesses would commit to making the costs known to the customer at point of sale and in advertising. Participant businesses could offer extended warranties on the product to cover the full expected life once the method was agreed. The government grant would support the development of the method, a consumer awareness campaign and related public recognition (eg through a standard) of the initiative.	
7	Government Enhanced Capital Allowances (ECAs)	This measure introduces an ECA scheme for products that are both longer-lived and resource-efficient in their use. ECAs currently provide a fiscal incentive for businesses to invest in energy- and water-efficient capital and equipment. Business is able to claim a 100% first year capital allowance on investments which meet a description defined by the Treasury/Carbon Trust (as opposed to a % over the anticipated lifetime of the product, eg 20% each year over five years under normal capital allowances arrangements for ICT). Hence, businesses are able to write off the whole cost of their investment against their taxable profits in the period during which they make the investment. The scheme is underpinned by technology lists which define products which meet defined operational criteria for energy and water efficiency. This measure would define more stringent green public procurement buying standards which would also include criteria on product longevity and these would provide the basis for qualification for the ECA scheme. The measure would be led, supported and encouraged by government and would be voluntary for the private sector.	Laptops
8	Government VAT incentive	The measure involves a VAT reduction on products with anticipated extended lifetimes: the reduced VAT rate of 5% is applied to these products.	Toasters
9	Government /industry Voluntary product durability standards	This measure involves a voluntary industry standard for product longevity which is led, supported and encouraged by government. The standard would be applied to products when certain longevity criteria have been reached. If the standard is met, the product is awarded a label that certifies the standard has been reached. This acts as a third party accreditation, and would be managed by Defra (or, if the standard is European, by the EU). This label is a clear indication to the consumer that the product is more durable than comparable products. It is anticipated that the product durability standard would work in a similar way to the EU Ecolabel. It would be product focused, ie set standards for the use phase of the product - rather than criteria for product manufacturing (as would an EMS standard).	Washing machines
10	Government Mandatory durability Declaration	This measure is a mandatory product durability declaration which is led by the European Commission and supported by the UK government. All products would be required to declare the expected lifetime of a product under a typical consumer use profile. Manufacturers would be required to declare the number of years that the product is designed to last, or number of product uses. A third party accreditation system would be managed by the EU, or a nominated European authority to verify manufacturer test claims. The label would provide a clear indication of the expected lifetime of the product. For energy using consumer appliances and energy related products, it is envisaged a durability declaration would be given within the existing EU Energy Label. For other types of products, the product	Washing Machines

Lead	Measure name (referred to throughout this document)	Measure	Sample product
		durability label would be declared alongside other consumer labelling in the same format as that designed for the EU Energy Label.	
11	Government Green public Procurement	This measure is a mandatory green public procurement standard on product longevity as well as energy efficiency (which is already incorporated into GPP) which is led, supported and encouraged by government. It would be mandatory for central government. The specification comprises a certain set of longevity criteria, eg a product designed to last a certain number of cycles or years, a product designed for upgrades, a product that has a proportion of its functionality that is upgradeable or a product for which spare componentry is kept for a minimum number of years. When the standard is reached, the product is permitted to display (on a voluntary basis) a green procurement label that certifies the standard. This label provides an indication that the product is more energy efficient and durable (resource efficient), than comparable products. We would anticipate the standard would operate in tandem with the EU Ecolabel and other labelling efforts. It would be product focused - ie an operational criteria for the product - rather than criteria for product manufacturing (as would an EMS standard).	Laptops
12	Government IPR	The measure is the introduction of Individual Producer Responsibility (IPR), ie producers or importers of products have legal responsibilities regarding the management of their products at end of life. IPR has been applied collectively in the electronic sector through the WEEE directive. However, this measure envisages IPR: (a) applied to non electronic products; (b) designed in a way as to create an incentive to remove the lowest quality/ least durable products from the market; (c) to encourage the refurbishment and selling of products on the second market where possible; and (d) to encourage design innovation for product refurbishment. Under the measure, producers and importers are responsible for the collection of their products at the end of their first life, the assessment of their suitability for refurbishment/ secondary market, the refurbishment/ repair of products where suitable, and for the recycling and disposal of products that cannot be refurbished/resold.	Sofas
13	Government Extended warranties	This measure is a mandatory durability standard set by the government and supported by consumer trading standards. Under existing consumer protection law, manufacturers are required to guarantee the conformity of their products for two years in the European marketplace and retailers are required to arrange refunds, replace or repair products where an inherent fault in the product is identified at the point of sale. Under the measure, the UK government (or the EC since this would apply to a larger market) would set a more stringent consumer protection standard; a compulsory minimum warranty/guarantee period for different types of products, and the strengthening of the implementation of existing EU law. These could take the form that the manufacturer is required to make a clear guarantee statement for the product, ie in a standard legal form, defining what the expectation of normal wear and tear is, and/or the onus of proof is on the retailer to take forward prosecutions where an inherent fault is discovered. The protection period would only be increased/strengthened for products where there is evidence it makes sense to do so, eg market failure, demand for critical finite resources, lifetime extension desired by European consumers, reuse markets available etc.	Washing Machines

Section 2 of Chapter 1 of this work provides background on the economic rationale for intervening into the free functioning of the market and provides examples of market failures which are relevant to context of sustainable consumption and production; namely imperfect information, externalities, and imperfect competition.

- All measures aimed at extending product lifetime help to address the high environmental externalities (such as emissions, noise, local pollution etc associated with the extraction of resources and their disposal) of standard products relative to longer life products. These externalities are not currently reflected in the price of the product.
- Provision of consumer information through standards, labelling or information campaigns, allow the consumer to compare higher and lower quality products, and provide an indication of the cost of the product over its full lifetime. This is particularly useful at point of purchase, and helps consumers make more informed purchasing decisions.
Measures supporting the development of consistent product declarations on life cycle and cost information enable manufacturers to bring their products to market on a level playing field. It enables manufacturers to communicate accurately with consumers on the attributes of their products.

If specific measures are to be considered further, there needs to be a clear understanding of the economic and environmental rationale for intervention.

It is important to recognise that some aspects of the market already provide longer lifetime products or services which reflect those evaluated in our measures. This was initially reflected upon in *Section 2 of Chapter 1* of this work. Part of this work was to evaluate future scenarios where the relative market share of these longer product lifetime services or products increases. ERM has listed existing initiatives similar to those being assessed in each IA spreadsheets (see 'Generic Measure' worksheets in *Annex F*).

Table 3.2 provides further detail on the economic rationale for the specific measures and the environmental rationale for product selected as part of the IAs.

Table 3.2 Economic and Environmental Rationale

Measure	Economic Rationale: Market Failure			Environmental Rationale: Example Product		
	Externality	Imperfect information	Imperfect competition	Comments	Description	Comments
1. Design for Durability	✓			Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle	T-Shirt	Resource-intense production, disposable fashion (ie increasing waste problem)
2. Leasing Business Models	✓			Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle	Commercial flooring	Resource-intense production
3. After-care services	✓			Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle	Sofa	Resource-intense production, bulky waste problem
4. Deposits / Product buy-back	✓			Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle	Mobile phone	Resource-intense production, loss of critical finite resources
5. Consumer Awareness Campaigns	✓	✓		Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle Imperfect information: information asymmetry concerning life cycle impacts	Toaster	Waste problem (a household product that is discarded prematurely)
6. Government Support	✓	✓	✓	Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale and concerning peripherals Imperfect competition: potential for oligopoly	Printer	Increasing waste problem (polarised market at lower and upper end)

Measure	Economic Rationale: Market Failure			Environmental Rationale: Example Product		
	Externality	Imperfect information	Imperfect competition	Comments	Description	Comments
7. ECAs	✓	✓		<p>Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle</p> <p>Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale</p> <p>Draft government IA on revised buying standards for ICT in Government lists additional market failures and behavioural barriers which can justify intervention specific to procurement, where this is cost-effective. These are:</p> <ul style="list-style-type: none"> • Principal-agent failure - where the procurer may have different incentives to those with responsibility for an organisation's finances. • Behaviour barriers - where there is a tendency to take purchasing decisions according to what has been done before. • Positive externalities - where Government (or large private sector firms) can use spending power to show leadership and influence the market. 	Laptop	Resource-intense production, waste problem, functionality increasingly depending on software rather than hardware
8. VAT Incentive	✓	✓		<p>Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle</p> <p>Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale</p>	Toaster	Waste problem (a household product that is discarded prematurely)
9. Voluntary Product durability standards	✓	✓		<p>Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle</p> <p>Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale</p>	Washing Machine	Resource-intense production, bulky waste problem
10. Mandatory Durability Declaration	✓	✓		<p>Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle</p> <p>Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale</p>	Washing Machine	Resource-intense production, bulky waste problem

Measure	Economic Rationale: Market Failure			Environmental Rationale: Example Product		
	Externality	Imperfect information	Imperfect competition	Comments	Description	Comments
11. Green Public Procurement	✓	✓		<p>Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle</p> <p>Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale</p> <p>Draft government IA on revised buying standards for ICT in Government lists additional market failures and behavioural barriers which can justify intervention specific to procurement, where this is cost-effective. These are:</p> <ul style="list-style-type: none"> • Principal-agent failure - where the procurer may have different incentives to those with responsibility for an organisation's finances. • Behaviour barriers - where there is a tendency to take purchasing decisions according to what has been done before. • Positive externalities - where Government (or large private sector firms) can use spending power to show leadership and influence the market. 	Laptop	Resource-intense production, waste problem, functionality increasingly depending on software rather than hardware
12. IPR	✓	✓		<p>Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle</p> <p>Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale</p>	Sofa	Resource-intense production, bulky waste problem
13. Extended Warranties	✓	✓		<p>Environmental externality costs: Loss of finite resource not reflected in price, polluter pays principle</p> <p>Imperfect information: information asymmetry concerning life cycle impacts and adverse selection concerning consumer awareness of durability of product at point of sale</p>	Washing Machine	Resource-intense production, bulky waste problem

For each measure, a range of data assumptions were developed in order to progress the IA. These included the physical characteristics of a standard life and longer life product and the supply chain route (eg country of manufacture, distribution process and end of life management).

The baseline assumptions regarding product lifetime for each of the 13 measures are shown in *Table 3.4*. *Table 3.3* shows the physical characteristics of both the standard and longer life product for the eight products used in our IAs.

Table 3.3 *Physical Characteristics of Products*

	Standard Life	Longer Life
1. T-shirts	Knitted T-shirt 100% cotton fibre 250g	Knitted poly-cotton T-shirt 50% polyester, 50% cotton 250 g
2. Commercial Flooring Tiles	Modular carpet with mid-level tufted loop surface pile (pile fibre, pre-coat and backing fibre). Total carpet weight: 4400 g/m ²	Modular carpet with ultra-low surface pile tufted using Microtuft technology (pile fibre, pre-coat and backing fibre). Total carpet weight: 4060 g/ m ²
3. Sofas	Two seater model with wooden frame, phosphorus-based flame retardant, treated decorative cotton cover and melamine FR treated PUR foam. Weight 60 kilograms	Same sofa, refurbished replacing the cotton covers with phosphorus-based FR treated made-to-measure loose decorative cotton covers.
4. Mobile Phones	Mobile phone weighing 81g with a lithium-ion (Li-ion) battery (27g) and charger/adapter 272g)	Same phone, refurbished (testing, cleaning, cover replacement, software update, battery replacement and few replacements of LCD/Keypad) and battery replacement
5. Toasters	2 slice toaster with no availability for repairs or spares	2 slice durable toaster with steel casing and free repairs during the 2 year warranty period, and availability of modular spares thereafter for an indeterminate period
6. Printers	Mid-range multi-functional inkjet printer, inclusive of its starter cartridge.	Inkjet multi-functional printer, inclusive of its starter cartridge, tested and warranted to last 5 years, last 17,290 pages
7. Laptops	15' screen, 1.7GHz processor, good 3-dimensional graphic performance, 512MB RAM and 60GB HDD, weight 2.8kg	Same laptop upgraded by increasing memory (changing the integrated circuit (IC)) and changing the hard disk drive (HDD)
8. Washing Machines	Low range machine, Hotpoint Aquarius WMF760P	High end machine, guaranteed to last 4000 cycles, ISE10 1606W

Table 3.4 *Baseline Assumption on Lifetimes*

Measure and Sample Product	Standard Life Product	Longer Life Product	% Lifetime Increase	Source of Data/Assumptions on Lifetimes
1. Design for durability T-shirts	A standard cotton T-shirt lasts 2 years	A longer life poly-cotton T-shirt lasts 3 years	50%	Product lifetimes from <i>Well dressed? The present and future sustainability of clothing and textiles in the United Kingdom</i> , Biffaward Programme on Sustainable Resource Use, University of Cambridge Institute for Manufacturing, 2006 and International Fair Claims Guide for Consumer Textiles Products, International Fabricare Institute.
2. Leasing business models Commercial flooring tiles	A standard carpet tile lasts 6 years	A longer life tile is a more durable tile supplied under a leasing model. It lasts 13 years due to regular maintenance and tile rotation.	117%	Existing lifetimes for standard and longer life model informed by stakeholder consultation and Environmental Product Declaration. (2010) InterfaceFlor, Microtuft modular carpet, Elevation II: contains pre-consumer recycled material (backing).
3. After-care services Sofas	A standard sofa is a two seater model with a lifespan of 8 years	A longer life sofa is the same sofa which includes aftercare services; namely one clean and one replacement of loose cushioning. It lasts 12 years .	50%	Product lifetimes estimates informed by Short Survey of Directors of the Association of Master Upholsterers and Soft Furnishers.
4. Deposits schemes/ product buy-back Mobile Phones	A standard mobile phone is used once and has a lifespan of 2 years	A longer life mobile phone handset is collected and redeployed (reused) twice. Hence it lasts 6 years	200%	Lifetimes informed by various stakeholder feedback that typical design life of handset is ~6 years and typical contract periods in the literature.
5. Consumer awareness campaigns Toasters	A shorter lived toaster is discarded after only 4 years	The toaster is reused so that it lasts 8 years	100%	Lifetime informed by range of consumer expectation of lifetime in parallel Brook Lyndhurst (2010) Defra Research on product lifetimes.
6. Government support Printers	A standard printer is a mid-range multi-functional inkjet printer with a 3 year lifetime	The longer life printer is an inkjet multi-functional printer and is warranted to last 5 years	67%	Lifetimes informed by EuP Preparatory Studies “Imaging Equipment”, Lot 4, Final Report on Task 5 “Definition of Base Cases”, 2007, Fraunhofer IZM & PE Europe, MTP and stakeholder consultation.
7. ECAs	A standard laptop is used for 3	A longer life laptop is upgraded once	67%	Product lifetimes informed by <i>MTP What if? Tool</i> . Reference

Measure and Sample Product	Standard Life Product	Longer Life Product	% Lifetime Increase	Source of Data/Assumptions on Lifetimes
Laptops	years	and lasts 5 years		scenario for 2010 and stakeholder consultation.
8. VAT Incentive Toasters	A standard toaster lasts 5 years	A more durable longer life toaster that is refurbished once in its lifetime lasts 16 years	220%	Lifetimes informed by stakeholder feedback based on design life assumptions for standard product. Longer life product assumed trebling on lifetime based on concerning replacement of worn parts.
9. Voluntary product durability standards Washing Machines	A standard washing machine lasts 6 years	A more durable longer life washing machine that is serviced lasts 15 years	150%	Lifetimes informed by stakeholder consultation and <i>Cooper and Mayers (2000) E-Scope report 'Prospects for household appliances' ISBN: 086339 9134</i> , indicated that 50% of UK households surveyed in the research possessed functioning Washing machines (and dishwashers and tumble dryers) were <6 years of age and 50% >6 years. GfK (2006) average age of a washing machine reduced from 13.8 years old to 8.8 years between 2001-2006, MTP What If? tool data and stakeholder consultation.
10. Mandatory durability declaration Washing Machines	A standard washing machine lasts 6 years	A more durable longer life washing machine that is serviced lasts 15 years	150%	As above
11. Green public procurement Laptops	A standard laptop is used for 3 years	A longer life laptop is upgraded once and lasts 5 years	67%	Product lifetimes informed by <i>MTP What if? Tool</i> . Reference scenario for 2010 and stakeholder consultation.
12. IPR Sofas	A standard mid-range sofa is used for 8 years	A longer life sofa is taken back after 8 years and reupholstered so that it has a 16 year lifespan	100%	Product lifetimes estimates informed by Short Survey of Directors of the Association of Master Upholsterers and Soft Furnishers and Brook Lyndhurst (2010) consumer expectations concerning median lifetime—and effective reupholstery (doubles original lifetime).
13. Extended warranties Washing Machines	A standard washing machine lasts 6 years	A more durable longer life washing machine that is serviced lasts 15 years	150%	As above

A critical part of the IA process was to look at the impact on sales of new products if products lasted longer and need replacement less frequently.

The stock and sales forecast model demonstrates how the introduction of longer-lasting products year on year from 2010 to 2030 (ie as a result of 'measure on') is expected to affect product sales in 2030. This model was used in each IA and tailored according to the sample product being assessed. The stock and sales forecast can be changed to experiment with different assumptions as follows:

- the current stock and projected stock;
- current and forecast sales figures; and
- the lifetime of the standard sample product, and the extended life sample product.

In each case, ERM has assumed that a certain number of products will be in use at any one time. This is irrespective of whether the demand is met by standard or by longer life products. The number of products owned will be dependent on different factors, including the type of product, population size, number of households etc. It was assumed that product ownership patterns would remain the same. We did not consider ways to reduce overall demand- eg having several households share a product.

These estimates were based on a range of evidence in the public domain, or, if no data were available, ERM made assumptions to allow the IA to be progressed.

Table 3.5 provides these baseline assumptions for each of the eight products used in the IAs.

A significant factor which influences the impacts of any measure is the extent to which a measure changes the market by 2030. *Table 3.6* provides ERM estimates and assumptions concerning the shift in the market as a consequence of the measure. These estimates were based on a range of evidence in the public domain, or, if no data were available, ERM assumptions to allow the IA to be progressed.

Table 3.5 *Total Number of Products Owned to Satisfy UK Demand*

Product	2010	2030	Assumptions
1. T-shirts	1.100 m	1.255 m	<ul style="list-style-type: none"> • 61.8 m UK inhabitants in 2010 • 70.5 m UK inhabitants in 2030 • Each UK inhabitant owns 15 T-shirts.
2. Commercial flooring tiles	240m m ²	247.2m m ²	<ul style="list-style-type: none"> • Source: Towards a Resource Efficiency Plan (2009), Thomas P, The Contract Flooring Association. • Market growth assumed from HM Treasury GDP growth projections to 2014
3. Sofas	53.590m	64.042m	<ul style="list-style-type: none"> • 26.795m UK households in 2010 • 32.021m UK households in 2030 • Each UK household has 2 sofas
4. Mobile phones	55.6 m	63.5 m	<ul style="list-style-type: none"> • 61.8 m UK inhabitants in 2010 • 70.5 m UK inhabitants in 2030 • Assumption based on 90% ownership rate in 2010 • 95% ownership rate in 2030
5. Toasters	26.795m	32.021m	<ul style="list-style-type: none"> • 26.795m UK households in 2010 • 32.021m UK households in 2030 • 1toaster per household
6. Printers	11m	13.145 m	<ul style="list-style-type: none"> • Annual UK sales of multijet inkjet printers are 3.5 m - 90% are domestic printers according to stakeholders. • Assuming a 3-year lifetime there is a stock of approximately 11 million domestic multijet inkjet printers in the UK (back calculated using the stock and sales baseline model). • 26.795 million UK households in 2010. • 32.021 million UK households in 2030. • Growth in number of printer units in line with growth in number of households.
7. Laptops	13.715 m	21.426 m	<ul style="list-style-type: none"> • 61.8 m UK inhabitants in 2010 • Stock of 12.173 million units in 2008 and 21.426 million units in 2030 (Extrapolated from non-domestic laptop stock provided by MTP). • Regards demand, it is recognised that there is not a perfect between the assumptions taken in this assessment and those of the MTP. The MTP estimated sales of 5.678 million units in 2008 and 8.722 in 2020 using a life expectancy of 2.5 years.
8. Washing machines	21. 082m	25.617m	<ul style="list-style-type: none"> • Data and projections provided by the MTP

Table 3.6 Market Share Assumptions

	2010		2030		Increase in Longer Life Model	Assumptions
	Standard Model	Longer Life Model	Standard Model	Longer Life Model		
1. Design for durability T-shirts	50%	50%	20%	80%	30%	Consultant assumptions to indicate the effect of a change in market.
2. Leasing business models Commercial flooring tiles	99%	1%	75%	25%	24%	Consultant assumption concerning shift in market without complimentary measures. Existing market for standard and longer life model informed by stakeholder consultation and Environmental Product Declaration. (2010) InterfaceFlor, Microtuft modular carpet, Elevation II: contains pre-consumer recycled material (backing).
3. After-care services Sofas	100%	0%	80%	20%	20%	Consultant assumption given measure is likely to be unworkable in lowest end products, given their low unit price Market information informed by Short Survey of Directors of the Association of Master Upholsterers and Soft Furnishers.
4. Deposits schemes/ product buy-back Mobile Phones	100%	0%	50%	50%	50%	Based on suggestions that ~50% of handsets are stockpiled in the home (Regeneris (2009) Used and surplus mobile phones: Enabling stakeholders to make responsible decisions and GSMA (2006) Mobile Phone Lifecycles; Use, Take-back, Reuse and Recycling). For the baseline scenario it is recognised that buy back schemes run by third parties do operate in the UK, exporting principally to overseas markets, rather than redeploying handsets in UK.
5. Consumer awareness campaigns Toasters	54%	46%	47%	53%	7%	54% of toasters are discarded prematurely (when they are still functioning (33%) or in need of repair (21%)), only 46% are discarded when they are beyond repair. Ref: <i>The state products are in when disposed by the consumer, Cooper 2004</i> . Change in market informed by effectiveness of WRAP's love food hate waste campaign.
6. Government support Printers	70%	30%	40%	60%	30%	Baseline market information provided by stakeholder. Consultant assumption concerning shift in market without complimentary measures.
7. ECAs Laptops	90%	10%	40%	60%	50%	Baseline market assumptions and shift informed by proportion of IT spend in draft IA of revised 'Government Buying Standards' specification for Information and Communication Technology - Computers. Defra v1 (Unpublished) , 10/10/2010 and Treasury & Defra, MTP sales data 'Evaluation of Enhanced Capital Allowance (ECA) for Energy Saving Technologies', HM Revenue & Customs, May 2008 reference.
8. VAT incentive Toasters	80%	20%	70%	30%	10%	ERM assumptions - indication of stratified market informed by stakeholder consultation. EC research: The use of differential VAT rates to promote changes in consumption and innovation <i>www.ec.europa.eu/environment/enveco/taxation/pdf/vat_summary.pdf</i> suggest demand for eco products like to be less than 10%

9. Voluntary product durability standards Washing machines	75%	25%	70%	30%	5%	<p>Conservative degree of change of 5% in the market assumed by ERM based on stakeholder opinion and behavioural survey information that circa 10% of consumers are interested in environmental issues http://efficient-products.defra.gov.uk/ReferenceLibrary/Factors%20influencing%20the%20penetration%20of%20energy%20efficient%20electrical%20appliances%20into%20national%20markets%20in%20Europe-1.pdf.</p> <p>Durability ranks tenth on list of purchasing decisions (WRAP, 2010) and following its implementation, between 2002 and 2004 sales of A rated Energy efficiency machines increased by 10% http://www.endseurope.com/docs/90922a.pdf.</p>
10. Mandatory durability declaration Washing machines	75%	25%	65%	35%	10%	<p>Degree of change of 10% in the market increased over voluntary label, as informed by references concerning voluntary label and confidential stakeholder data provided concerning stratification of washing machine market.</p>
11. Green public procurement Laptops	90%	10%	78%	22%	12%	<p>Baseline market assumptions and shift informed by proportion of IT spend in draft IA of revised 'Government Buying Standards' specification for Information and Communication Technology - Computers. Defra v1 (Unpublished), MTP sales data and assumption 80% of publically owned machines would adopt longer life model.</p>
12. IPR Sofas	100%	0%	50%	50%	0%	<p>Market information informed by Short Survey of Directors of the Association of Master Upholsterers and Soft Furnishers and Brook Lyndhurst (2010) consumer expectations concerning median lifetime from Brook Lyndhurst (2010) study -and effective reupholstery (doubles original lifetime).</p>
13. Extended warranties Washing machines	75%	25%	0%	100%	75%	<p>Informed by confidential stakeholder data concerning stratification of washing machine market. IA provides an indication of radical mandatory market shift for the purposes of illustration change in impacts.</p>

3.6.1 *How the model works*

The model uses an assumed number of ‘stock’ (number of particular product in UK ownership) for the baseline year 2010. It is assumed that, in the first year (2011), a certain number of these will be replaced. To calculate how many products will be replaced in 2011, the model works on the basis that the 2010 opening stock has been sold at a steady rate over previous years and the stock has simply been divided by the lifetime in years of the standard product.

It would be more accurate if the model included market growth and demand in the years prior to the baseline year. However, for the purposes of this Development Stage IA, which does not need to include quantitative assessment of the impacts, this simplified approach was considered more than adequate.

Figure 3.1 provides an example screenshot from the model ‘under a business as usual scenario’. In this case, all products are the same and have a standard lifetime of eight years. As we are starting with product stock equally distributed in age, this means that, until this has all been replaced, the same number of units are replaced every year – resulting in a flat line graph. The step change when it comes in year nine is the annual market growth. In this case, around 500,000 new products are required to meet the growth in the market that year. This means that, in year nine, we see the demand increase by twice the annual market growth, as the model reports replacement of all the products that wore out in year one, as well as the market growth for years one and nine.

Figure 3.1 *Standard and Longer Product Lifetime Model Demand Split Under ‘Do Nothing’*

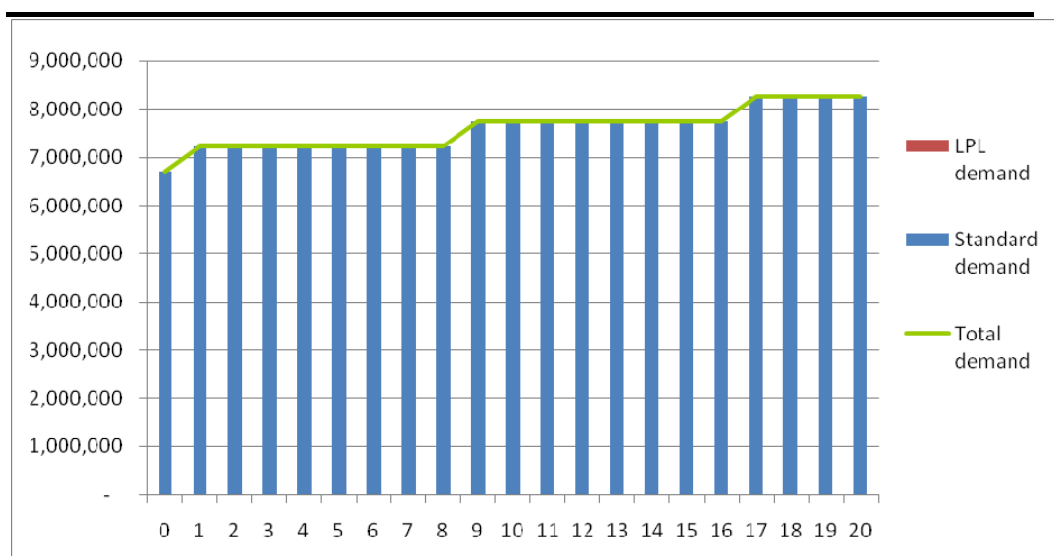
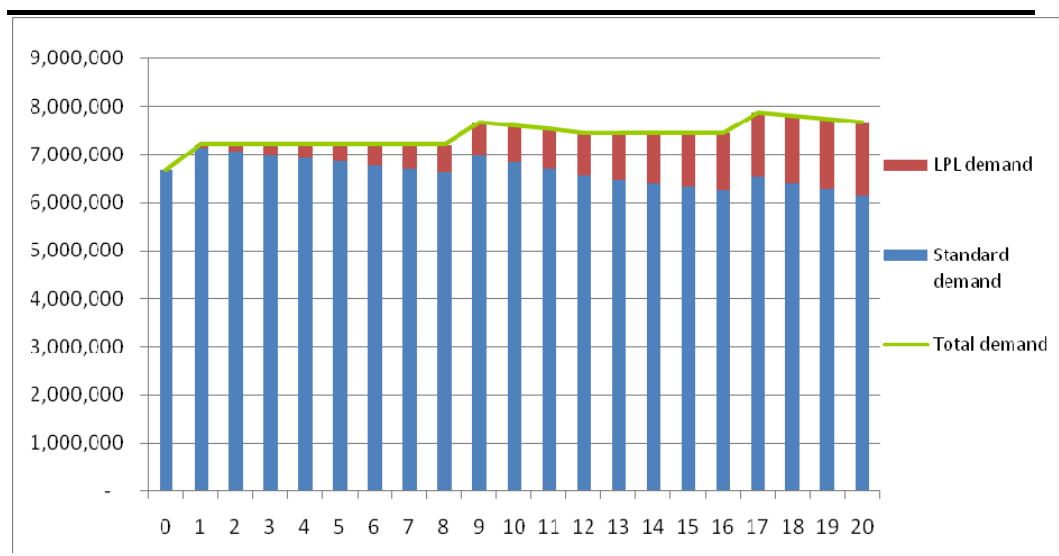


Figure 3.2 provides an example screenshot for a scenario where longer lifetime products (12 year lifetime) are introduced into the market. The stock is now replaced with both standard and longer product lifetime (LPL) products. In 2010, 100% of products sold are standard lifetime products. However, by 2030 this has dropped to 80%.

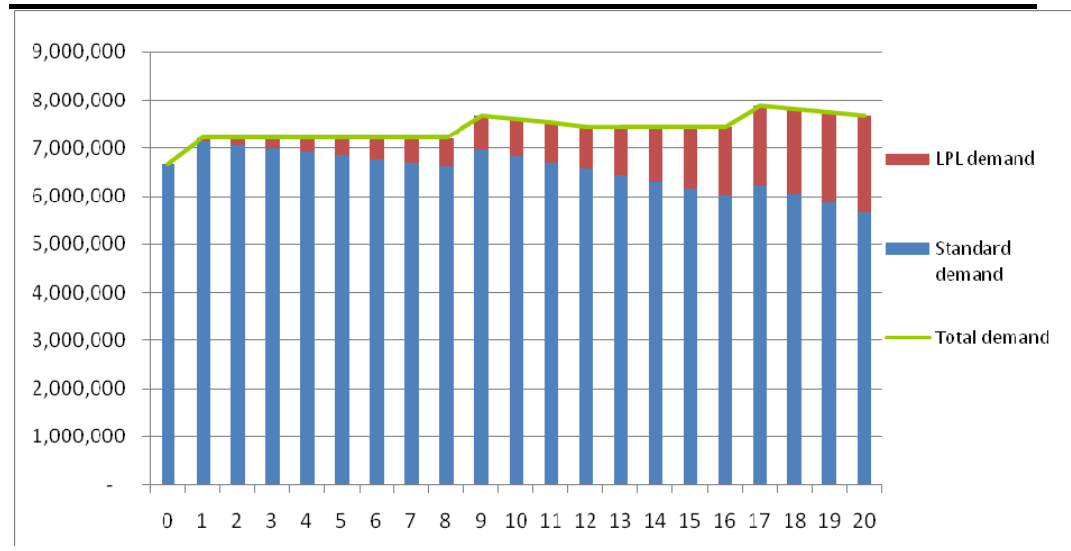
Figure 3.2 shows that total demand across the first eight years (1-8) is static as before, although with an increasing proportion of LPL products as their market share increases (assuming a linear increase). At year nine, the first raft of LPL products need replacing, so there is a jump in overall demand. However, this drops over the second cycle of eight years, as seen in the increase in demand each year. This is because the model reports replacement of standard lifetime products that were bought over the previous eight year cycle, of which an increasing proportion were 'lost' to LPL products.

Figure 3.2. Standard and LPL Model Demand Split Under 'Measure On'



Note that in this scenario (Figure 3.2) the split of product types is maintained at the market share level. However, ERM's model allows the user to assume that longer lifetime products are always replaced by the longer lifetime product. This results in little change to the overall demand in this time period, but a split that more rapidly leans toward longer product lifetimes, as seen in Figure 3.3). It is only in the later years that the difference becomes apparent, as more LPL products require replacement due to their increasing market share over time.

Figure 3.3. Standard and LPL Model Demand Split Under 'Measure On'



4.1 INTRODUCTION

This section summarises ERM's findings of the IAs which were carried out for the 13 measures as described in *Table 3.1*. It is particularly important to bear in mind the assumptions used to inform the process as detailed in *Table 3.4* to *Table 3.6*.

In summary.

- All of the measures have been applied to a single type of product, so the resulting impacts on the UK are relatively small when considered individually.
- However, the lifetime extension achieved in each case can be significant. For some IAs, it has been assumed that longer life products last more than twice as long as standard products (see *Table 3.4*).
- The 2030 market for each product still offers both longer life and standard life models (see *Table 3.6*). In eight out of the 13 IAs, the 2030 scenario assumes that 50% or less of available products have an extended lifetime. Only one measure assumes that in 2030 *only* extended lifetime products are available on the market.

This section contains the following sub-sections:

Section 4.2 Impacts of the measures on the UK economy;

Section 4.3 Impacts of the measures on the environment

Section 4.4 Impacts of the measures on UK consumers and wider impacts;

Section 4.5 Sensitivity testing; and

Section 4.6 Limitations on the findings of the IAs.

4.2 IMPACTS OF THE MEASURES ON THE UK ECONOMY

For each measure, the IA estimated which sectors might be affected most in absolute terms; and to what extent. This is expressed as a proportion of the sector's likely activity under a 'policy off' scenario. The main net economic impacts by measure are summarised in *Table 4.1*.

The sectors are listed in descending order of level of impact in each column. In other words, a listing of '*Distribution and retail* followed by *VAT* and then *repair business*' indicates that the absolute impact of the measure is expected to be largest on the distribution and retail sector, then on VAT take, and finally on the repair business sector.

Table 4.1 *Main Net Economic Impacts by Measure*

Measure	Key Areas of (Net) Economic Impact in Descending Order	Direction and Size of Impact Relative to Business as Usual
Consumer Awareness Campaign, Toasters	Distribution and retail	Negative (less than 10%)
	VAT	Negative (less than 10%)
	Repair businesses	Positive (approx 10%)
Overall impact small across all.		
ECAs,	Refurbishment	Positive (more than 100%)
Laptops	Distribution and retail	Negative (less than 20%)
After Care Service,	Repair businesses	Positive (more than 100%)
Sofas	Distribution and retail	Negative (negligible)
Design for Durability,	Distribution and retail	Negative (less than 20%)
	VAT	Negative (less than 20%)
T-shirts	Secondhand market	Positive (more than 20%)
Green Public Procurement,	Refurbishment	Positive (more than 100%)
Laptops	Distribution and retail	Negative (less than 10%)
Extended Warranties,	Repair business	Positive (more than a half)
	VAT	Positive (more than a third)
Washing Machines	Distribution and retail	Positive (more than a third)
Leasing Models,	Distribution and retail	Negative (less than 20%)
	Repair business	Positive (more than 100%)
Commercial Flooring	Manufacturing	Negative (less than 20%)
Government Support,	Repair business,	Positive (more than 100%), in both cases, but overall impact still small
	Printers	
Mandatory Durability Declaration, Washing Machines	Secondhand market	
	Repair business	Positive (less than 20%)
Voluntary Durability Standard, Washing Machines	VAT	Positive (less than 10%)
	Distribution and retail	Positive (less than 10%)
Voluntary Durability Standard, Washing Machines	Repair business	Positive (less than 10%)
	VAT receipts	Positive (less than 10%)
	Distribution and retail	Positive (less than 10%)

Measure	Key Areas of (Net) Economic Impact in Descending Order	Direction and Size of Impact Relative to Business as Usual
VAT Incentives,	VAT	Negative (less than 50%)
Toasters	Distribution and retail	Positive (less than 20%)
IPR,	Distribution and retail	
Sofas	Manufacturing	Negative (less than a third in all cases)
	VAT	
Deposit schemes,	Refurbishment	Positive (from unquantified base)
Mobile Phones		

Nature and Magnitude of Economic Impacts

Overall, the economic impact of the measures is mixed in terms of their effect on the UK economy. Most of the relative changes are fairly small in proportionate terms in nearly all cases, of the order of up to 10% either up or down. ERM believes it is inappropriate to emphasise particular figures as the IAs are only at a early development stage, however impacts of the order of eight figures (between £10m-£99m) appear to be common, with some IAs exceeding this.

Looking across the measures, the effect on manufacturing is broadly negative but limited (probably because UK exposure is limited in this sector), and R&D is also lightly affected across the piece. The measures' impact on distribution and retail is negative in seven cases and positive in five, though on balance the negative impacts are likely to be deeper. Repair, refurbishment and maintenance does well (no negatives at all, and some significant positives as well), while the second hand market is similarly advantaged, though to a lesser extent.

The measures also present UK growth opportunities in a number of areas, including high skilled research and development activities, and low-skilled or semi-skilled repair and maintenance activities.

Research, Design and Product Development

Both positive and negative impacts on this sector are mitigated due to the relatively small amount of R&D and product development activity (for the products involved) taking place in the UK. The measures are forecast to have negligible or positive impacts on UK research and development activities. However, there is a counter argument here that increasing the length of design cycles (especially in the most innovative products (eg mobile phones)), could lead to less R&D effort.

Beneficial impacts are expected from measures aiming to extend product lifetime at the design stage, such as product durability standards and other

measures requiring product declarations. These measures are likely to boost high worth research and development activities. However for the specific products examined, absolute impacts (relative to the Do Nothing scenario) are expected to be negligible.

Manufacturing

The measures have limited impacts on UK manufacturing, due to the fact there is no or little domestic manufacturing of the representative products. In more than half of the measures considered there were no impacts on UK manufacturing. Exceptions among the products examined were found for sofas and commercial flooring; in both sectors the measures considered are expected to lead to significant negative impacts, though in the case of sofas, this was only true of the IPR measure, and not the after-care measure.

Negative impacts for these products are associated with the decreased demand for new products (as longer lasting products gain a larger market share), linked to less frequent replacements. However, measures aimed at better product design could also represent an opportunity for UK manufacturers of higher end products, such as upholstered sofas, for which the UK may have a reputation for high levels of craftsmanship or specialist manufacturing services.

Only five of our assessed measures were expected to have any impact at all on UK manufacturing, and in four of these cases the impact was negative. In the case of toasters under the VAT incentive the impacts were expected to be positive. This measure bucks the trend because the reduction in the retail price of the longer lasting toaster leads to increased demand, which feeds through to UK manufacturers. However the relatively small market share of UK companies in the market ensures that this impact, although positive, is like most of the impacts of other measures on manufacturing – relatively insignificant.

Distribution and Retail

The analysis which has been carried out apportions a share of the value of the standard/longer lasting goods to the retailer, separate to the manufacturer (to avoid double counting). The shares are apportioned based on feedback from stakeholders and ERM's judgement. For most measures, negative impacts on distribution and retail can be anticipated, due to the reduced volume of product sales, as a result of reduced frequency of product replacement.

However, the magnitude of the impact on retail depends largely on the relative costs of the standard and longer life products, and their relative lifetime (ie, the frequency of their replacement). For one product in particular, longer lasting washing machines, the higher cost of the longer life product is sufficient to recoup or exceed the reduced sales volume under all three of the measures examined. For printers (government support to companies developing longer lasting printers) there is a marginal benefit (of less than one percent) to retailers. VAT incentives for longer lasting toasters also produces

increases in revenues for distribution and retail, though this measure is unusual in that it reverses the price relationship between the longer lasting product and standard product by making the former cheaper relative to the latter.

There are relatively large absolute losses predicted for the retail/distribution sector under several of the measures. Most notably these are for ECA measure (laptops), IPR measure (sofas), design for durability measure (t-shirts), and to a lesser extent, the leasing measure for commercial flooring. All these losses are due to revenues falling off as items are replaced less frequently. Other measures produce either gains or relatively small losses.

Set against this, it is likely that some measures will present opportunities for the retail sector, in particular measures that extend the retailer-consumer relationship past the point of purchase. Examples include:

- For some specific sectors, where the retailer is actually selling the service rather than the product (eg, mobile phone operators), the introduction of measures aimed at encouraging product collection and redeployment through the retailer (eg, deposit schemes) present opportunities for increased footfall and therefore profit for retailers ;
- Leasing models may sometimes (but not always) present growth opportunities for retailers turned lessors. Leasing revenues are repeatedly created in the UK- rather than UK retailers purchasing products manufactured abroad for retail. However, leasing models place a considerable logistical and administrative burden on retailers, and the switch from a retail to a leasing model is not always viable. In the measure considering leased commercial flooring, the price differential between the longer life and standard life carpet tile was too low to cover the cost of maintaining the tiles as assets.
- Aftercare services could also present growth opportunities for retailers. In our example, retailers offered products (eg, sofas) that include an aftercare and repair service as standard. This would provide opportunities for differentiation for specialist stores, or, on the contrary, could be offered by department stores or supermarkets, where products offered with aftercare services are amongst a wider portfolio, mitigating risk associated with experimenting with this model. For these types of measures, retailers could benefit from upfront payments for more expensive products, inclusive of the aftercare service;
- The development of strong customer loyalties, as the customer returns to the same retailer when he requires a product replacement, deposit collection or after sales service, may result in opportunities for retailer to make additional sales.

Repair, Refurbishment and Maintenance Services

Except the Design for Durability measure (applied to t-shirts) for which there was no quantified impact on repair, refurbishment and maintenance services, all of the remaining 12 measures had a positive impact on repair, refurbishment and maintenance services in the UK. Furthermore, the impact on repair, refurbishment and maintenance from all of the measures was generally very significant.

Of the 12 measures having an impact on this sector, in nine cases, growth in repair, refurbishment and maintenance is expected to be larger than the growth (or losses) in research and development, manufacturing and distribution and retail put together. There were three measures where this was not the case: two measures on toasters (VAT incentives and consumer awareness), both of which were predicted to have negligible effects across all sectors) and leasing of commercial flooring. In the latter case the positive impact on repair, refurbishment and maintenance was significant, but while it was comparable to forecast losses in the retail / distribution sector, it was not sufficient to overhaul manufacturing losses as well (probably because of the strong UK manufacturing presence for this product).

Measures providing information on expected product lifetimes or measures aiming to make repairs more commonplace, could be particularly helpful at encouraging consumers to keep products longer and persuade them that products are worth repairing. **A key challenge to the success of these measures is the relative cost of new products and cost of repair and maintenance.**

The Second Hand Market

The second hand market is already well established in the UK, be it through consumer-to-consumer channels (eg Ebay), charity shops, or second hand business and could be extended further. The IAs of most measures appeared to have a positive impact on the second hand market in the UK, with the design for durability measure (t-shirts) having the largest impact (a positive one), and only three measures expected to have a negative impact.

As a rule, better designed, longer lasting products are more likely to be sold on a second market than standard life products, as they may still have value after their lives with a first consumer. Measures that aim to provide more information on expected product lifetimes, be they standards, declarations, or consumer awareness campaigns, could be especially useful at supporting the growth of the second hand market.

Whilst this rationale usually holds, it appears not to be universally the case. Paradoxically the next two largest impacts on the second hand market after design for durability are expected to result from green procurement and ECAs (assessed for laptop) and these are predicted to be negative. Additional research to review existing assumptions within the model on likelihood of disposal and second hand values (which are currently based on published

evidence within the IT sector) might be useful to help confirm these findings. However, on the basis of the existing assumptions, for laptops, it seems that if the laptop is designed to last longer in the first place, it might be less, rather than more likely, to reach a second hand market, with the original purchaser preferring to keep it instead, until it is life expired.

End of Life Services

All measures reduce the volumes of waste created at product end of life, thereby reducing activity in product end of life management, including recycling and landfill disposal.

However, some measures, such as IPR would require product collection at the end of its first life, presenting growth opportunities for collection and sorting services.

Employment and Employment Distribution

The impacts of the measures on employment vary from measure to measure. Overall however, impacts on employment numbers are expected to be small. The key impact anticipated is a change in employment distribution.

Most measures are likely to lead to a decrease of workers employed in the retail sector. Often however, it is anticipated that a fall in retail employment numbers can be partly or fully compensated by employment opportunities created in repair and maintenance and the second hand market (while recognising the compensation is in employment numbers only, and that the skills of workers may not be transferable to those other sectors)

Moreover, measures that extend the retailer-customer relationship (such as leasing models and provision of aftercare services) create opportunities in customer service roles, which could help mitigate loss of retail employment.

Except the Design for Durability measure (applied to t-shirts) for which there was no quantified impact on repair, refurbishment and maintenance businesses, all the measures lead to positive impacts on repair and maintenance, with associated new opportunities for employment in these areas. For measures such as the provision of aftercare services, or leasing models inclusive of maintenance, growth opportunities could be considerable. This is due to the labour intensive nature of some maintenance activities. The measures are therefore likely to stimulate enterprise in these areas, and create opportunities for small and medium size businesses (SME). Some of this employment created could be skilled, as there could be a rise in demand for professional repair, refurbishment and upgrade skills such as upholstery.

For some measures, such as IPR schemes that encourage refurbishment, employment opportunities associated with logistics of product collection and refurbishment could be created.

A few of the measures may have a negative impact on UK SMEs. For all measures requiring product declarations or durability standards, SMEs that design and manufacture products may not have in-house test facilities to establish anticipated product lifetime- and may not therefore be in a position to take part in such schemes.

4.3 *IMPACTS OF THE MEASURES ON THE ENVIRONMENT*

Table 4.2 summarises the life cycle impacts calculated for the example products and the measures examined. It lists the products/ measures in order according to the degree of change relative to the baseline, and not by changes in absolute values. Only list impacts which are greater than 1% are shown.

It should be noted that the estimates are a product of assumptions made concerning the product impacts in the LCO modelling and the assumed market shift.

Table 4.2 *Main Net Environmental Impacts by Measure*

Measure	Environmental Impact Indicators	Direction and Size of Impact Relative to Business as Usual
Deposit schemes, Mobile Phones	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by ~40%)
Extended warranties, Washing machines	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by ~30%)
Leasing Models, Commercial Flooring	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by ~20%)
ECA, Laptops	Climate change, resource use and water use (Production, maintenance and disposal impacts)	Benefit (reduced ~10%)
	Waste generation (Production, maintenance and disposal)	Benefit (reduced by ~20%)

Measure	Environmental Impact Indicators	Direction and Size of Impact Relative to Business as Usual
Design for Durability, T-shirts	Climate change, Resource use, Waste generation (Production, maintenance and disposal)	Benefit (reduced by less than 10%)
	Water use (Production, maintenance and disposal)	Benefit (reduced by ~30%)
	Climate change, Resource use (Consumer use)	Benefit (reduced by less than 10%)
Government Support, Printers	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by ~10%)
IPR, Sofas	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by less than 10%)
	Waste generation (Production, maintenance and disposal)	Benefit (reduced by ~30%)
After Care Service, Sofas	Climate change, Resource use (Production, maintenance and disposal)	Benefit (reduced by less than 10%)
	Waste generation (Production, maintenance and disposal)	Benefit (reduced by ~30%)
Green Public Procurement, Laptops	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by less than 10%)
Mandatory Durability Declaration, Washing Machines	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by less than 10%)
Voluntary Durability Standard, Washing Machines	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by less than 10%)

Measure	Environmental Impact Indicators	Direction and Size of Impact Relative to Business as Usual
Consumer awareness, Toasters	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by less than 10%)
VAT Incentives, Toasters	Climate change, resource use, water use and waste generation (Production, maintenance and disposal impacts)	Benefit (reduced by less than 10%)

Nature and Magnitude of Environmental Impacts

All measures lead to environmental savings, but these tend to be relatively small overall, since the market shift to longer life products is comparatively small in most instances, especially for voluntary measures. In general terms, the magnitude of the reduction in impact varies from measure to measure and by product, depending on the place of manufacture, UK or overseas, how impactful it is to manufacture the product, whether the product is energy using product or not, and the ownership pattern of the product in the UK.

For all measures, the environmental savings are largely due to a decrease in product manufacturing volumes. As such, environmental savings are particularly significant for products where the product is resource intense to manufacture and the product lifetime is extended significantly.

As manufacturing activities for consumer products tend to take place overseas, most environmental benefits, reduced materials use and manufacturing and materials extraction energy are achieved overseas in the country of manufacture, or of raw material extraction. For some types of products, for example hi-tech, the extended lifetime measures will result in less demand be placed on critical raw materials (ie rare or supply constrained materials).

UK product distribution, retail and disposal impacts will also be reduced marginally, due to reduced volumes handled in the supply chain.

There are two specific issues for 'UK Plc', environmental savings associated with the introduction of the measures as follows.

- a) Measures which stimulate maintenance and aftercare services will increase UK-attributed environmental impacts. The magnitude of the impact depends on the level of servicing performed, but the LCO modelling undertaken for this study indicated these to be insignificant relative to the scale of environmental savings abroad. For UK manufacturer products, net reduced UK environmental impacts would be expected, as a consequence of longer product lifetimes.
- b) For measures aimed at extending the lifetime of the product, environmental impacts associated with the use of the product may, or may not, be increased as a consequence of lifetime extension. For example, in the case of a T-shirt designed for durability, this could be made of a fibre

that retains less moisture after washing, dries more quickly, using less energy to dry in a tumble drier. In those example energy using products analysed in the study, the LCO modelling suggested that the small incremental improvements in energy efficiency foreseen would lead to an increase in the UK impacts associated with energy use, but that these are insignificant relative to the environmental savings associated with the avoiding the manufacture of new products.

Climate Change Impacts

All measures lead to a reduction in GHG emissions. The majority of GHG emissions savings would occur overseas, because in most cases, consumer products are manufactured overseas, as are the main global mining and extraction activities.

Measures that encourage the retention of products by the consumer can have some negative or positive environmental impacts in the UK, as previously explained. For energy using products, an increase in electricity usage will result, as a consequence of not replacing products with more energy efficient models. However, the LCO modelling indicated that these impacts are likely to be small. The extended lifetimes tend to be short, since energy using products are not kept over generations, and a proportion of the UK product stock is constantly being replaced. Moreover, the modelling indicated that, as the UK electricity production mix decarbonises in future, the affect of energy efficiency innovation on the impact profile of products will diminish.

Resource Depletion

As a result of reduced manufacturing volumes, a reduction in the use of finite resources is achieved in the country of manufacture/raw material extraction.

For some products, resource efficiency is particularly relevant due to the rarity or environmentally deleterious nature of the raw materials used. For instance, resource efficiencies achieved through the introduction of a deposit scheme on mobile phones reduce new handset manufacture and the need for rare metals. In this instance, there is an additional social benefit, as these metals have been linked to conflict zones and to poor labour conditions.

There will be reduced impacts observed for products that have some domestic manufacturing, and a comparatively small increase in UK based impact associated with energy production.

Water Resources

All measures result in a small positive or negligible effect on water resources.

At the production stage, the manufacturing of more durable, longer-lasting products sometimes requires additional water consumption, relative to a shorter-lived counterpart. Overall impacts are usually negligible, as increased consumption is offset by the reduction in volumes of products manufactured.

Measures that increase product lifetime at the use phase in the UK sometimes are likely to have a small negative impact on domestic water resources. For example, maintenance of older commercial flooring tiles may necessitate more water than maintenance of newer tiles, representing a small detrimental impact. However, this impact is best considered in the wider context of reduced waste volumes as a result of the measures, and broader environmental savings overseas.

Waste Generation

All measures examined reduced the amount of waste generated in the UK. The reduction is due to reduced product replacement rates.

Measures that encourage longer product retention and reuse also help to reduce waste. Deposit schemes, for example, reduce the amount of waste produced, by keeping products in use until the end of their useful lives, rather than stockpiling the product in homes for a proportion of the products useful life.

Rebound Effects

Some potential 'rebound' effects were not considered in the IA, but should nonetheless be flagged, due to their potential negative environmental impacts, as follows.

- For measures that stimulate repair and refurbishment activities, we have assumed that these activities take place in the UK. However, there would be additional environmental impacts associated with transport should products be taken abroad for repair or refurbishment, whilst also negating the positive effect on UK employment and enterprise.
- For measures that encourage retailers or manufacturers to collect products after use, such as deposit schemes, we have assumed that products will be refurbished, reused or brought to a second market. However, the retailer or manufacturer could dispose of these products to avoid competition with newer models. This would result in an unforeseen negative impact on UK waste volumes generated. In practice, this might prompt the introduction of mandatory requirements on product reuse.
- For measures that enable consumers to make cost savings on longer-lasting products, through financial incentives or cost saving achieved over the product's lifetime, there is a risk that the monies saved may be spent on other goods and services. These goods and services may even be more environmentally deleterious than the short lived products that might otherwise have been consumed.
- The lower price of longer-lasting products could also encourage their more frequent replacement, before the end of their useful lives. This could have particularly detrimental environmental impacts if the longer-lasting product itself is replaced early, insofar as its manufacture is likely to be more energy and resource intensive than that of the standard product.

- A decrease in production of products in general could have a wider effect on global trade.

4.4 *IMPACTS OF THE MEASURES ON UK CONSUMERS AND WIDER SOCIETAL IMPACTS*

Impacts on aggregate household expenditure

As described in above, aggregate economic impacts of the measures are mixed, but can be significant. The distribution of these impacts is important because they may fall equally or unequally on households, businesses and/or government.

A *reduction* in aggregate household expenditure is considered to be a positive impact-*ie*, it costs UK households less to purchase/lease and derive functionality out of the product. This overall reduction could lead to some unforeseen consequences as described in the section on *Rebound Effects* (Section 4.3). For public sector procurement, the reduction in expense could have the indirect wider social benefit linked to public savings.

Table 4.3 presents the direction and size of the impact on aggregate household expenditure under the 'measure on' scenario relative to the 'do nothing' scenario, and flags any other key social impact, and the direction of its change when quantified.

Table 4.3 *Impacts on Aggregate Household Expenditure*

Measure	Direction and Size of Impact Relative to the 'do nothing' scenario for aggregate household/business expenditure
Design for Durability, T-shirts	Positive (more than 10%)
Leasing Models, Commercial Flooring	Negative (less than 10%) Note: the household expenditure would be spread over a longer period of time, mitigating this impact
After Care Service, Sofas	No change (less than 1%)
Deposit schemes, Mobile Phones	No change
Consumer Awareness Campaign, Toasters	Positive (less than 10%)
Government Support, Printers	No change (less than 1%)
ECAs, Laptops	Positive (less than 10%)
VAT Incentives, Toasters	Negative (less than 10%)
Voluntary Durability Standard, Washing Machines	Negative (less than 10%)
Mandatory Durability Declaration, Washing Machines	Negative (less than 10%) Note: Direction of impact twice that of voluntary standards
Green Public Procurement, Laptops	Positive (less than 10%)
IPR, Sofas	Likely to be positive (but not quantified)
Extended Warranties, Washing Machines	Negative (more than 30%)

Given the assumptions taken, for some of the measures (most notably, ECAs on laptops and design for durability on t-shirts), there are very substantial gains expected for business and household consumers, respectively. However the effect of this is that their lower spends are reflected in lower turnover for

retailers and lower VAT receipts for Government. Elsewhere, the measures encouraging green procurement on laptops, after care services on sofas and government support on printers, are not expected to substantially impact on businesses or household consumers.

It is worth noting that for measures that negatively affect aggregate household income expenditure, the cost of products to households will be particularly high in instances where products are not used to their full potential.

Distributional Impacts and Measure Beneficiaries

While all consumers would benefit from measures that aim to provide more accurate information about product lifetime (such as voluntary standards), measures do not affect all households equally. Sometimes they may disproportionately benefit middle and higher income households.

Lower income households are less likely to be in a position to pay deposits or upfront for longer-lasting products that can be up to four times as expensive as the standard life product (for some of our sample products). Therefore, these lower income families are likely to miss out on the cost savings that could typically be achieved over the lifetime of the longer-lasting product. Financing arrangements could be put in place to help lower income households access the benefits of longer-lasting products.

A leasing model, which effectively spreads the cost of the product use over the lifetime of the product, makes longer lasting products as accessible to higher and lower income households, as there are no upfront costs associated with their purchase (although some leasing models include an upfront membership fee, that may be prohibitive)

Lower income families may benefit from the anticipated growth in the second hand market as a result of the measures, as the availability of high quality, longer-lasting products would be increased, available at a reduced price on the second hand market.

Measures that aim to increase demand for longer-lasting products through financial incentives such as VAT reductions are likely to benefit middle and higher income families. This is because the reduction in VAT is unlikely to reduce the price of the longer-lasting product enough to make it comparable to the price of a standard life product.

Moreover, measures such as VAT reductions could be seen to have wider and indirect detrimental social impacts, by reducing public revenues, disproportionately affecting lower income households.

In the case of public procurement, the procurement of a longer-lasting product such as a laptop would be cheaper over its lifetime than the procurement of a standard life laptop. This measure could be seen to have the wider beneficial impact of reducing public expenditure.

Product Functionality and Quality

The measures tend to have no or little effect on product functionality. Therefore, introduction of a longer-lasting product is not expected to have an effect on consumers and their use of products.

Some measures could have positive impact on product functionality for consumers. Leasing models inclusive of a maintenance service could help consumers derive full functionality from their product, as the product is maintained and replaced as soon as necessary and its functionality does not decline over time.

Other measures that extend product lifetime in the UK may benefit consumers who only want basic functions from their product. Deposit schemes on up-to-date products such as mobile phones could keep older models in circulation longer, benefiting consumers who want to pay less for simpler product functions.

In most cases, the longer-lasting product is expected to be of overall higher quality, eg made with more resistant materials. However, for one of the sample products, it was anticipated that consumers could perceive the longer-lasting product, a T-shirt made of polycotton, to be of lower quality than the standard product, a cotton T-shirt.

Measures aimed at improving product design could heighten the overall quality of the UK product stock, as products may have been manufactured with better materials, or designed to facilitate repair. A number of the measures, including product declarations, could help drive the lowest quality products from the UK market.

Wider Societal Impacts

Measures that encourage retailers or producers to retain their products as assets, and to collect them back, under a deposit scheme or an IPR obligation, could have a positive effect on the quality of the local environment, by reducing instances of irresponsible product disposal or fly tipping.

All the measures can be seen to have the wider beneficial impact of encouraging sustainable behaviour, including encouraging consumers to factor durability in their purchasing decisions, repair products, bring them to second market, and recycle them. The behavioural shift encouraged by all measures could be effectively supported and furthered by consumer awareness campaigns.

4.5

SENSITIVITY TESTING ON ECONOMIC IMPACTS

ERM carried out sensitivity analysis to explore the impact on results of changing some of the key variables.

The assessment was limited only to measuring economic (monetised) impacts. *Section 1.2 of Chapter 2 (Life Cycle Impacts of Nine Selected Products)* and *Annex C* detail the sensitivity analysis carried out as part of the product life cycle assessments.

A variety of different factors were chosen to be tested for their affect on the model outcomes, as follows.

- Changes in market size, modelled as the core case, +20% and -20%. In each case, the volume changes were assessed as step changes, ie +20% means that all sales throughout the period were increased by a flat 20%. Assumptions about the proportionate mix of standard and longer-lasting products were retained as in the core case.
- Changes in project lifetimes. Each measure was examined under the core scenario and under two further assumptions: one in which the typical 'standard' product lasted a year longer than under the core case; and the other in which the longer-lasting product typically lasted a year less than in the core case.
- Market share. To assess changes in these, a second scenario was developed in each case, where the assumed market penetration of the longer-lasting product by 2030 was halved. For example, if a longer-lasting product was expected to have achieved a 40% market share by 2030, with the standard product having the balance of the market, the sensitivity test assumed that the longer-lasting product had only achieved a 20% market share by the end of the period.
- An increase in the market price of the longer-lasting product of 10% relative to the core scenario. For the purpose of the assessment, the impact on VAT was not neutral. Rather, VAT was applied to the new price.

As this work only involves 'Development Stage IA', full sensitivity testing was not completed for all measures, but was carried out selectively on the following measures:

- Consumer awareness campaign, Toasters;
- ECAs, Laptops;
- Aftercare service, Sofas;
- Design for durability, T-shirts;
- Green public procurement, Laptops;
- Extended warranties, Washing machines;
- Leasing models, Commercial flooring.

Initially, an additional measure, the provision by government of research grants to printer manufacturers to encourage printer declarations concerning their design life, was explored. However, as the indicative output in the 'core' case of the Development Stage IA for this measure suggests that the costs of the measure itself amounted to some 60% of the total estimated economic

impact of the measure, it was considered that this measure was not suitable for further analysis.

Findings are reported as follows.

4.5.1 *Changes in Market Size*

This test involved changing the size of the market in terms of the number of products which are required to satisfy demand, ie population size etc. Regardless of whether the size of the market across the study period was lifted or reduced, there were no substantial changes in outcome. In each case, the direction of change was as expected. There were no cases where, as a result of an increase in market size, one of the impacts which had previously been negative, became positive, or vice-versa. As the model is largely a linear model, changes in the level of sales led to absolute changes in all the variables modelled. Consequently, and as expected, there were changes in the level of net impact, defined as the 2030 difference in 'measure on' versus 'do nothing'. However, the percentage change between these differences remained substantially the same.

4.5.2 *Changes in Product Lifetimes*

Reduction in Typical Life of Longer-Lasting Product by One Year

This test involved reducing the life of longer-lasting products by one year. For each measure, this scenario results in economic impacts tending towards the 'without measure' results. These impacts are driven by substantial reductions in losses for the distribution and retail sector and in VAT collected compared to the core case. In the case of aftercare services for sofas, the losses for distribution and retail become benefits. Reflecting these rises, aggregate consumer/business expenditure rises under this scenario.

The reason for these cost rises (and associated higher revenues) is that as product life gets shorter, consumers buy more goods over the period of analysis. However, this reveals a limitation in the IA, which predicts that consumers continue to pay the higher prices for the longer-lasting products, regardless of the fact that the lifetime of these goods has been shortened by a year. In reality, the rational consumer should be less willing to pay for a longer-lasting product that lasts a year less. This would especially be the case in the case of laptops, where this test reduces the difference between the standard and longer-lasting product to only a year.

Increase in Typical Life of Standard Product by One Year

This test involved increasing the life of the standard product by one year. For some measures/products, this was less straightforward. For T-shirts, both products now have a lifetime of three years, and for laptops the longer-lasting product now only lasts a year longer.

However, the evidence indicates that regardless of whether the measure is on or off, there are clear reductions in distribution and retailer revenues under the new scenario of longer-lasting standard products. This is to be expected, as people replace their standard products less frequently. The reductions appear particularly strong under the 'do nothing' scenario, which could be because under 'do nothing' there are fewer sales of longer-lasting products to help balance the loss of sales in standard products.

Interestingly, because the revenue reductions brought in by this scenario are more severe under 'do nothing' than under 'measure on', the net losses for retail and distribution are smaller under the four year scenario than they are under the core, three year, case.

4.5.3 *Changes in Market Share*

This test involved changing the market share of standard and longer-lasting products. It looked at the effects of halving the market penetration of longer-lasting products. For example, in the case of Extended Warranties, the market share for longer-lasting washing machines was adjusted from 100% to 50% by 2030.

In general, the net economic impacts of introducing the measures were also reduced by a proportion close to a half. This reflects the linear nature of the demand model. The proportionate differences between the measure on and do nothing scenarios, eg measure on leads to a 10% increase/decrease in costs relative to the do nothing, were also quite similar across the measures considered.

There were a few exceptions, principally concerning repairs, refurbishments, and industry and government costs, which are fixed and/or non linear, but for the most part the relationship held.

The major exception related to after sales service and sofas, in which case there were disproportionately large reductions in revenues for distribution and retail operators, and similarly large savings for householders. One explanation for this unusually large change is that the cost of the longer-lasting sofa includes an annualised cost for the aftercare service, which accrues to retailers. When sales rates for longer-lasting sofas are cut, the retailer loses the higher revenues associated with these items, and the aftercare service fees.

4.5.4 *Increase in Market Price of Longer-Lasting Product of 10%*

This test involved increasing the market price of the longer-lasting product by 10%. This test does not affect many of the key variables tested, such as repair, refurbishment, second-hand market and government/industry costs relating to measure implementation and operation.

Under some measures, such as the consumer awareness campaign for toasters, the market price feeds directly through to the results. For larger, high cost

and/or non essential products, this could indicate a weakness in the model, as touched on above. This is that, in reality, demand is subject to a concept known as 'price elasticity' and a 10% increase in costs would not usually be accepted by unquestioning consumers unless the product was 'price inelastic.' The demand for products like petrol and bread is said to be 'price inelastic', because these goods are viewed by many consumers as essentials and therefore changes in their prices have little effect on overall demand.

With regard to the price increase, in all cases examined, this led to higher VAT and retail revenues, lower VAT and retail losses, and in the case of the after sales service on, expensive, sofas measure, it brought the retailers a net benefit from the measure, where previously there was a small cost. The corollary was felt by consumers who move into a deficit in this measure under this scenario.

4.5.5 *Impact of 'Future Year' Selection on Results*

Given the modelling work was carried out for a Development Stage IA and the level of detail and accuracy has to be constrained, The IAs do *not* consider cumulative impacts, rather, they provide an estimate of impacts in 2010 and 2030.

The 'stocks and sales' model estimates annual stocks and sales under each measure and the choice of future year is not expected to unduly influence results. The findings have been fairly robust under sensitivity testing and while different volumes of goods predicted in different years affect the economic outcomes, the impacts are proportionate.

So while the actual volumes of demand/supply of goods may differ (both between forecast years and between the model and what might happen in the real world) the impacts will tend to be proportionate (eg 10% change in volume of goods leads to a similar change in the volume of distribution and retail, VAT receipts, refurbishment etc).

Five of the measures (IPR on Sofas; VAT incentives on toasters; voluntary standards on washing machines; extended warranties on washing machines; and mandatory declarations on washing machines) have products which have unusually long lives and for these the demand pattern has still not yet 'settled down' by the end of the modelling period.

Sensitivity testing was carried out at up to +/-20% of goods demanded/supplied for these (and the other) measures which confirmed that while optimism (or pessimism) bias would result in different outcomes, the outcomes were still reasonably predictable, they did not affect overall 'direction of travel', and even under the extreme ends of sensitivity testing, none of the signs changed. This suggests that the measure's impacts are not expected to suddenly turn from bad to good or vice versa, depending on selection of the forecast year.

The sensitivity testing carried out on the economic impacts indicates that the model appears to be reasonably robust in the face of changes to underlying assumptions. In general, where changes do take place, they are not sufficient to nudge sectors into 'deficit' or 'surplus'. It is important to recognise that the model is only intended to inform the Development Stage IAs and further refining would be necessary if any option or measure were to be pursued.

However, there are limitations which apply to the sensitivity testing and to the findings of the IAs in general. These include the following.

- Paucity of data, including current economic and employment data and projected growth relating to specific products.
- Unequal stakeholder representation, with some sectors better represented than others.
- Reliance on a number of assumptions, including assumptions about the sample products, and the effectiveness of the measures.
- The model does not account for the fact that changes in price will influence demand and supply of products. Rather, product demand is assumed to be realised based on a linear trajectory to an estimated 2030 stock and an assumed market split between standard and longer-lasting products at the end of that period.
- Environmental impacts not monetised, but expressed in unit terms only.
- Model does not estimate impacts over the period, but only impacts in the final year of the period.

These limitations and the indicative nature of the results at this stage suggests that quoting specific impact figures for specific measures and sectors could be misleading. ERM suggests using ranges, or better still 'strengths' and 'direction of travel' to describe the findings.

5.1 CHAPTER 1 PRODUCT GROUPS

The initial stage of this project involved ERM developing a framework of ten product groups, according to the physical and market characteristics of products (ie product type, physical size and propensity for technological innovation.) This framework is repeated in *Table 5.1*.

With the aid of this framework, ERM selected nine sample products. The objective was to evaluate:

- the environmental impacts of extending the life of these sample products; and
- the impacts of measures to extend the life of these sample products.

The ultimate aim was to apply the findings from these sample products to wider groups of products, according to the framework.

In *Chapter 1* it was recognised that the lifetime of any of these products could be extended through different means, although it was not clear at that stage what would make some products more suited to a particular measure or intervention.

5.2 ALTERNATIVE PRODUCT GROUPINGS

This IA stage of the work has shown that the appropriateness or effectiveness of a measure is not necessarily related to a product's group, as defined in the *Table 5.1* or in traditional product categories.

A simple example is the product group 'clothing' which would include low value, and frequently used, items such as T-shirts and underwear, but also high value, and generally less-frequently used, items such as ball gowns or dinner jackets. It seems reasonable that a leasing business model approach or measure is unlikely to be an effective measure for these low values, frequently used, items but already exists as an effective commercial model for higher value clothing items.

Table 5.1 *Scoping Study Framework of Product Groups (see Chapter 1)*

EuP/Non Eup	Rate of Innovation	Product Group	Sample Product in this Study
Energy using product	Rapid technological innovation	Large electronic appliances	Printer scanner
			Laptop
		Small electronic appliances and fittings	Mobile phone
		Vehicles/transport	-
		Large electrical appliances	Washing machine
Non energy using product	Lower levels of technological innovation	Small electrical appliances	Toaster
		Construction	Carpet tile
		Furniture and interiors	Domestic carpet
			Sofa
		Household consumables	-
		Clothing	T Shirt
		Food products, preservation and packaging	-

Stakeholder feedback (see Box 5.1) was useful in informing how best to consider products when attempting to develop product categorisations which aid the selection of appropriate measures to extend product lifetimes.

Box 5.1 *Stakeholder Feedback on Appropriateness of Measures*

ERM held further stakeholder meeting in December after the completion of some draft IAs. The principal aim of the workshop was to seek feedback and clarification from stakeholders on provisional findings and the measures.

In particular, stakeholders were asked to consider the following question for each of the measures, for their particular product:

- Could this measure be effective in increasing the lifetime of your product?
- Under which conditions would your industry take up this measure ?
- What government intervention could help create suitable conditions for uptake of this measure?

As groups, stakeholders were also asked to consider the following questions for each measure:

- What type of products do you think the measure should work for?
- What opportunities does the measure provide for UK businesses?
- What are the risks to UK businesses associated with the measure?
- Is the measure achievable?

The findings from the December workshop was used to inform the broader, non-product specific conclusions reached about each individual measure. The detailed findings are provided in Annex D.

5.3 *PRODUCT FEATURES AND SUITABILITY OF MEASURES*

Eight product features have been identified to categorise products in order to assess the suitability or appropriateness of measures. Some categorisations are subjective, as they rely on an individual consumer's perspective.

- The **product's consumer classification**. This is based on the consumer product categorisation identified in the Brook Lyndhurst study (2010) of the public understanding of product lifetimes and durability, namely: up-to-date products; investment products; and workhorse.

Up-to-date products are defined in the study as products routinely disposed of by consumers because of their desire to update, eg clothes, interior items, mobile phones, televisions.

Investment products are products worth spending extra on for either their style and/or their function.

Workhorse products are products which are relied upon for their function. Such products tended to be kept in use by most consumers until they break (for example certain large and small appliances such as washing machines, irons, lawnmowers).

It is important to recognise that consumers view expected product lifetime as a subjective and variable entity that changes according to the product and person. In other words, what one person considers a *workhorse* product, another might see as an *up-to-date* product.

- The **end user or customer** of the product will determine the appropriateness of various measures. ERM has grouped customers into

the following types commercial customers: householders/consumers; and public sector procurement organisations.

- The **purchase price** of the product, high or low unit cost.
- The **location of the design/production base**, whether there is a significant design and manufacturing base in the UK for the product, or whether it is largely imported.
- The **product consumes significant resources during its use**, termed non-energy using and 'energy using products' here for convenience.
- The **stability of the product in design terms**, whether the product is innovating rapidly with respect to the materials used, its performance, functionality, or look.
- The **frequency of care required**, whether the product needs to be frequently cleaned, serviced, repaired or upgraded to extend its useful life, or whether no care is required or it is infrequent/unscheduled.
- The **frequency of use**, whether the consumer uses the product on a daily basis, or whether the product is typically owned by a consumer but used infrequently.
- The **ease of reuse** in terms of how readily a product can be reused. Some measures are likely to be more effective for products where a resale market exists (ie there is a degree of second hand appeal) and the bulkiness of the product, the complexity of reuse (eg if refurbishment is required the labour and material costs).

Table 5.2 aims to present the appropriateness or effectiveness of the 13 measures for different products types/characteristics. It shows the following:

- There are fewer measures that are likely to be effective for up-to-date, low cost and rapidly innovating products. Up-to-date products are those which are routinely thrown away. It would seem reasonable that lower value, up-to-date products are perhaps even more likely to be discarded.
- All measures appear to be suitable for higher value, non-rapidly innovating and non EuP products.
- Most measures are suitable for domestic/consumer products the only exception is ECAs and Green Public Procurement.
- Leasing as a measure appears suitable for all product categories except 'low cost' items.

Table 5.2 Measures and Effectiveness According to Product Types (* less effective, ✓ more effective)

Type	Customer Type			Consumer classification of product			Purchase price		Location of design/ production		Product which consumes resources		Relative rate of innovation		Care/ Servicing requirement		Comments	
	Domestic	Commercial	Public sector	Workhorse	Investment	Up-to-date	High value	Low value	UK	Overseas	Non EUP	EUP	Comparatively stable	Innovating rapidly	Frequent or scheduled	Infrequent /unscheduled	Relatively Easy to Reuse	
1. Design for durability	✓	✓	✓	✓	✓	*	✓	✓	✓	✓	✓	✓	✓	*	✓	✓	-	<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products items where durability is not a key factor in the purchasing decision. products experiencing rapid innovation, ie new functionality, materials, fashion infrequently used consumer products, where the product is likely to last for a long time without the need for better design, due to its infrequent use pattern
2. Leasing business models	✓	✓	✓	✓	✓	✓	✓	*	✓	✓	✓	✓	✓	✓	✓	✓	✓	<p>Less suited to:</p> <ul style="list-style-type: none"> low value products as leasing costs are less financially/ commercially attractive to customers. frequently used consumer products, where occasional access to the product would be insufficient
3. Aftercare services	✓	✓	✓	✓	✓	*	✓	*	✓	✓	✓	✓	✓	✓	*	✓		<p>Unsuitable for:</p> <ul style="list-style-type: none"> products which cannot be nurtured to increase their lifetime. <p>Less suited to:</p> <ul style="list-style-type: none"> low value products, as servicing costs may be disproportionately high compared to cost of purchasing the product. up-to-date products items where the desire to

Type	Customer Type			Consumer classification of product			Purchase price		Location of design/ production		Product which consumes resources		Relative rate of innovation		Care/ Servicing requirement		Comments	
	Domestic	Commercial	Public sector	Workhorse	Investment	Up-to-date	High value	Low value	UK	Overseas	Non EUP	EUP	Comparatively stable	Innovating rapidly	Frequent or scheduled	Infrequent /unscheduled		Relatively Easy to Reuse
																		update is strong. <ul style="list-style-type: none"> infrequently used products that are less likely to require aftercare and maintenance services
4. Deposits / product buy-back	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓	✓	<p>Less suited to</p> <ul style="list-style-type: none"> workhorse products which are more likely to be used by consumers until the end of life. low value products where the price differential between new and second hand product could be insufficient to attract customers of second hand products products with no second hand market /low resale value
5. Consumer awareness campaigns	✓	✗	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	<p>Unsuitable for:</p> <ul style="list-style-type: none"> commercial or public sector customers <p>Less suited to</p> <ul style="list-style-type: none"> workhorse products which are more likely to be used by consumers until the end of life. functional or valued investment products which are not likely to be discarded prematurely
6. Government support	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	-	<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products where durability is not a key factor in the purchasing decision. imported electrical products with design and manufacturing bases outside UK
7. ECAs	✗	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	-	<p>Unsuitable for:</p> <ul style="list-style-type: none"> products purchased by consumers/householders. <p>Less suited to:</p>

Type	Customer Type			Consumer classification of product			Purchase price		Location of design/ production		Product which consumes resources		Relative rate of innovation		Care/ Servicing requirement		Comments	
	Domestic	Commercial	Public sector	Workhorse	Investment	Up-to-date	High value	Low value	UK	Overseas	Non EUP	EUP	Comparatively stable	Innovating rapidly	Frequent or scheduled	Infrequent /unscheduled		
																		<ul style="list-style-type: none"> low value purchases, although a high number of low value products would be suitable, where the value taxable benefits are insufficient to drive demand for the allowance.
8. VAT incentive	✓	✗	✗	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓		<p>Unsuitable for:</p> <ul style="list-style-type: none"> VAT registered commerce and public sector organisations <p>Less suited to:</p> <ul style="list-style-type: none"> low value products where the price differential between VAT-reduced longer life products and VAT- standard life products is insufficient to drive demand.
9. Voluntary Product durability standards	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗		<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products where durability is not a key factor in the purchasing decision. products where variables make it difficult to agree standards, eg uses per day, high innovation, routine care extends life.
10. Mandatory Durability Declaration	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✗	✓	✗	✓	✗		<p>Less suited to:</p> <ul style="list-style-type: none"> up-to-date products where durability is not a key factor in the purchasing decision. products where variables make it difficult to agree standards, eg uses per day, high innovation, routine care extends life.
11. Green Public Procurement	✗	✗	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓		<p>Unsuitable for:</p> <ul style="list-style-type: none"> commercial and domestic purchased products up-to-date products where durability is not a

Type	Customer Type			Consumer classification of product			Purchase price		Location of design/production		Product which consumes resources		Relative rate of innovation		Care/ Servicing requirement		Comments	
	Domestic	Commercial	Public sector	Workhorse	Investment	Up-to-date	High value	Low value	UK	Overseas	Non EUP	EUP	Comparatively stable	Innovating rapidly	Frequent or scheduled	Infrequent /unscheduled		
																	Relatively Easy to Reuse	
																		key factor in the purchasing decision. <ul style="list-style-type: none"> low value/low volume products, as there is an insufficient incentive to develop standard
12. IPR	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓	✓	Unsuitable for: <ul style="list-style-type: none"> products which cannot be refurbished. Less suited to: <ul style="list-style-type: none"> up-to-date products , especially where resale value is low/no effective secondhand market.
13. Extended Warranties	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	-	Less suited to: <ul style="list-style-type: none"> up-to-date and rapidly innovating products, since an outright ban could stifle innovation/lead to illegal import.
Ticks	11	10	11	11	13	5	13	6	13	10	13	11	13	5	12	11		

6.1 OBJECTIVES OF MEASURES

The overriding objectives of all the measures are to optimise the lifetime of the existing stock of products, or to increase the product design life of new products in the market. Some measures are primarily there to support or incentivise change in the market to bring about these changes. In each case, a successful measure will reduce the demand for new products, and it is this reduction in production that principally brings about overall environmental benefits.

Optimising product lifetime is defined here as ensuring a product once manufactured is used to its full potential. It does not specifically seek to change how a product is designed and manufactured, although any such measure may result in product design issues being reviewed. It does not mean that a product will necessarily be in use for a longer period of time. It aims to extend product life at the product use phase r.

- An example is **leasing**, which might actually reduce the period of time a product is in use, as it is used repeatedly by a number of different consumers. The advantage is that it prevents a higher number of products being manufactured in the first place.

Another example is **product aftercare services**, which helps ensure a product is not discarded or replaced prematurely but extends the life of a product through care and maintenance programmes.

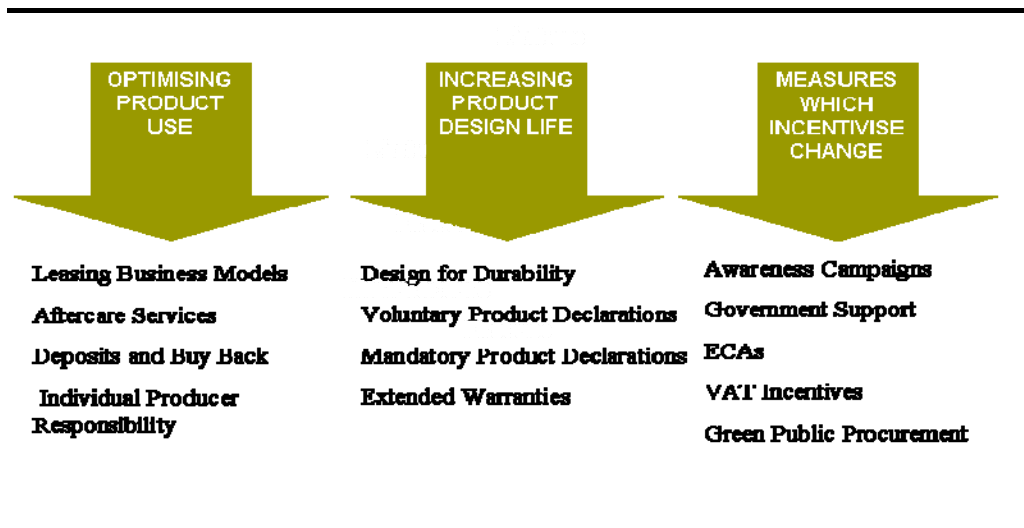
Increasing product design life is defined here as measures which seek to replace shorter life products with products with different specifications which are purposely designed to last longer.

- An example is either mandatory or voluntary product durability standards. Through public declaration/transparency, these may force companies to choose alternative materials or designs.

Measures which incentivise change seek to either encourage optimising product lifetime and/or increase product design life.

Figure 6.1 seeks to categorise the measures according to their principal objectives.

Figure 6.1 Principal Objectives of Specific Measures

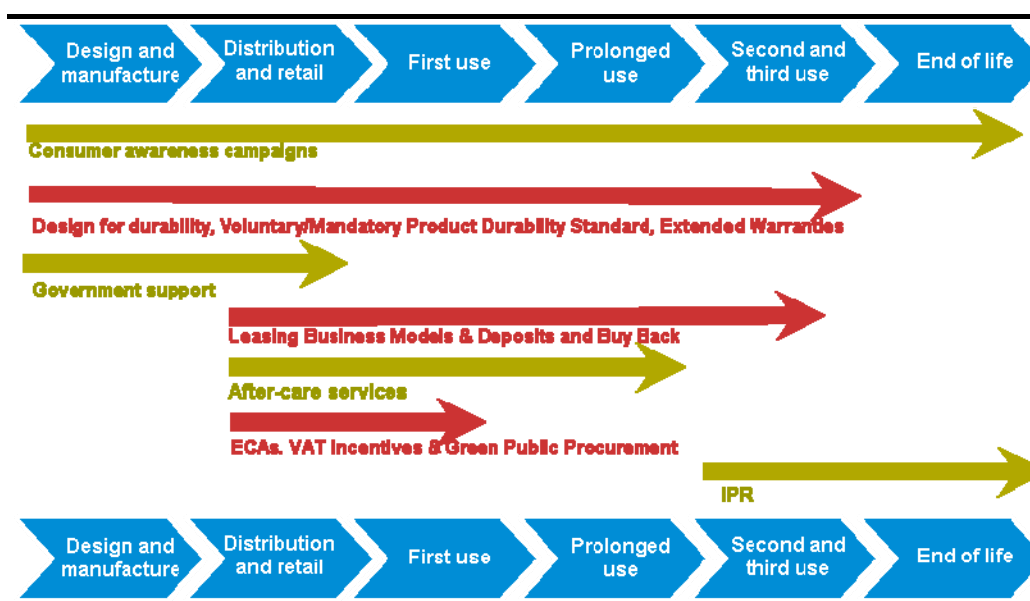


6.2 THE POINT OF INTERVENTION

Each of the measures assessed tackles a specific factor which if addressed could contribute to extending product lifetime.

Figure 6.2 aims to illustrate where in the product life cycle the different measures (as defined in this work) will have most impact. However, measures are likely to have effects further up and down the supply chain eg, IPR on end of life could effect product design and sales, leasing models and after case services could improve end of life management, a consumer awareness campaign can have impact on product design etc.

Figure 6.2 Measures to Extend/Optimise Product Lifetimes and Intervention Point



In conducting the IAs for each product, it was necessary to consider the practicalities, the strengths and weakness of each measure.

It is important to recognise that the development or introduction of any measure will need careful consideration and is unlikely to be straightforward. In ERM's work, a significant amount of time was spent defining measures and assigning an appropriate and workable sample product to the measure. The process highlighted that there are many factors which need to be considered if a measure is to work in practice.

A review of the principal issues across all 13 measures shows the following:

- ***A lack of consumer demand for longer-lasting products***
All measures (particularly those voluntary measures dependent on consumer choosing more durable products or services to extend life) will require an increase in consumer demand. Consumers will need to be interested in more optimal product use or extended product life, particularly if these measures are applied to 'up to date' products.
- ***The low cost of products***
Those measures that aim to optimise product lifetime with repair and maintenance activities are likely to be difficult to implement due to the current low cost of new products relative to the high cost of repair in the UK. The high volumes of low cost imports represent a significant barrier to the uptake of these measures. The issue of low cost imports would need to be addressed at supranational level, while measures could be put in place to make repairs cheaper in the UK, eg skills, training, support to repair businesses etc.
- ***The difficulty of defining durability***
Those measures that require durability standards to be produced, namely measures 8 to 11, are likely to face considerable difficulties associated with developing and maintaining standards for product durability. In ERM's view, this could be a significant barrier. The definition of durability standards for individual products is likely to be a time-consuming process requiring the investment of significant resources/time both from industry and from government, as well as cooperation amongst industry competitors. Standards will need to be reviewed regularly to ensure that they remain up-to-date and relevant.

Table 5.3 summarises the principal success factors of each measure. It also summarises the likelihood of the measure leading to extended product lifetimes in practice which is illustrated in *Figure 6.3*. It is important to note that some measures will only be suitable for certain types of product (*see Table 5.2*)

In ERM's opinion, the following appears to apply.

- The majority of the measures will face significant challenges in delivering longer product lifetimes or optimising existing product lifetimes and will require a change in consumer behaviour. Government support, VAT incentives, Green Public Procurement and ECAs will help to bring about significant changes in the market.
- Deposits/product buy back, leasing business models, consumer awareness campaigns and mandatory durability standards as types of measure may have some success in bringing about change if applied to appropriate products.
- The most likely measure to bring about changes to lengthening product lifetime is extended warranties since this is not dependent on consumer demand.

Figure 6.3 Likelihood of Change to Market

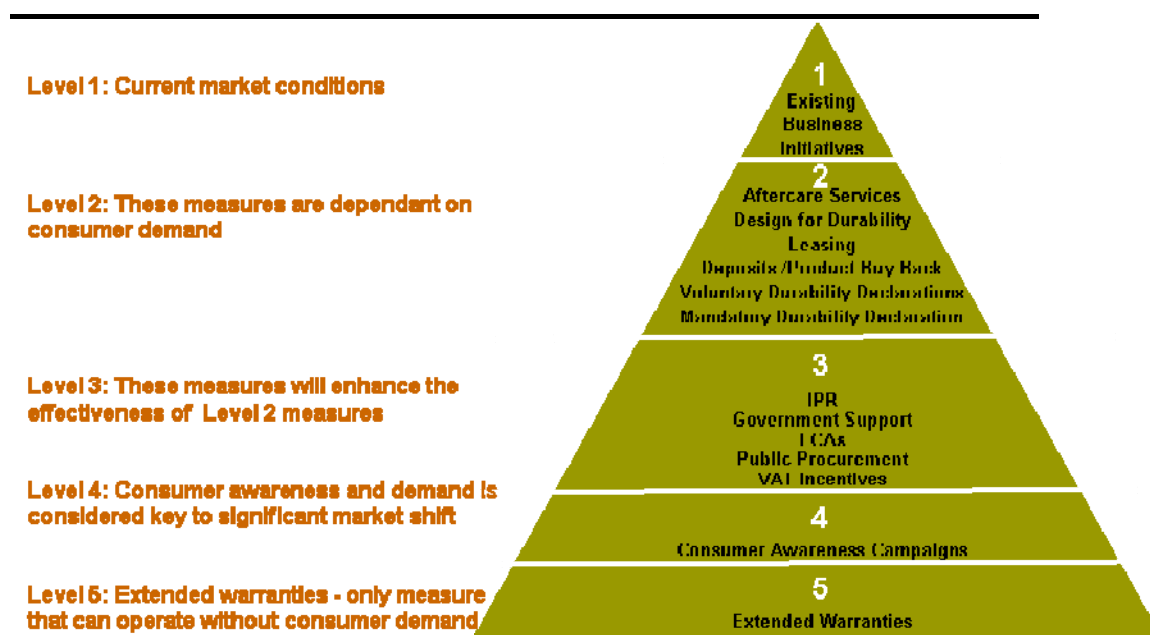


Table 6.3 Measures: Focus and Critical Success Factors (✗ less relevant, ✓ more relevant)

	Focus of measure			Critical stakeholders	Timescale to implementation	Likelihood of longer/optimal product lifetimes			Critical success factors							
	Increase design life	Optimise lifetime	Incentivise Change			Design/ manufacture	Retail/ distribution	Customer		Aftercare/ repair	Government	Short (1-3 yrs)	Medium (4-7 yrs)	Long (7+ yrs)	Low	Medium
1. Design for durability	✓			✓	✓	✓			✓				✓			<p>Key factors are:</p> <ul style="list-style-type: none"> retailer support for sales of more durable product consumer demand for longer lived products manufacturer desire to develop financially competitive longer lived designs longer-term increase in commodity prices/resource scarcity could encourage manufacturers to rethink sales-based business models <p>Likelihood of success - low:</p> <ul style="list-style-type: none"> durability as a factor in purchasing is generally low in consumer psyche, relative to costs. More durable products generally likely to cost more to produce and retail at higher prices in order to maintain margin retailers satisfy consumer demand
2. Leasing business models		✓			✓		✓	✓						✓		<p>Key factors are:</p> <ul style="list-style-type: none"> retailer interest in alternatives business model to unit sales customer willingness to lease products rather than to own them desire/practicability for more complex business models repeated hire/repair <p>Likelihood of success - medium:</p> <ul style="list-style-type: none"> requires fundamental change to PSS business model, possible in commerce and public sector low likelihood in domestic market because consumers like to own items
3. Aftercare services		✓			✓		✓	✓	✓				✓			<p>Key factors are:</p> <ul style="list-style-type: none"> retailer interest in extension to current business models and entering into long term relationship with customer customer recognition of life cycle cost savings and preparedness to pay upfront for services desire/practicability for more complex business models

	Focus of measure			Critical stakeholders			Timescale to implementation			Likelihood of longer/optimal product lifetimes			Critical success factors		
	Increase design life	Optimise lifetime	Incentivise Change	Design/ manufacture	Retail/ distribution	Customer	Aftercare/ repair	Government	Short (1-3 yrs)	Medium (4-7 yrs)	Long (7+ yrs)	Low	Medium	High	
															repair/servicing Likelihood of success - low: <ul style="list-style-type: none"> likelihood of success may be higher for expensive workhorse and 'on show' investment products, but limited for other products where purchase cost is low relative to repair services (labour costs) appears to be limited interest in 'care/repair' amongst many consumers.
4. Deposits / product buy-back		✓		✓	✓				✓				✓		Key factors are: <ul style="list-style-type: none"> retailer interest in providing deposit scheme setting cost of deposit, low enough for customer preparedness to pay up front, but high enough for them to want to return product financial and non-financial incentives to enter existence of wide consumer base with different expectations/tastes/purchasing power in order to enable multiple redeployment of product Likelihood of success - medium: <ul style="list-style-type: none"> with the exception of rapid turnover high tech electronics, and out-of-favour investment products, products are likely to have low inherent value at discard some consumers are adverse to reused products
5. Consumer awareness campaigns	✓		✓	✓	✓		✓		✓				✓		Key factors are: <ul style="list-style-type: none"> overcoming manufacturer/retailer/institutional resistance to such a campaign in what is likely to be perceived by many as anti economic growth effectiveness of design of campaign in hard to target groups and clear message - nudge theory, influencing amenable and leading social groups Likelihood of success - medium: <ul style="list-style-type: none"> essential to change consumer psyche if any voluntary measures are likely to be effective

	Focus of measure			Critical stakeholders			Timescale to implementation			Likelihood of longer/optimal product lifetimes			Critical success factors	
	Increase design life	Optimise lifetime	Incentivise Change	Design/manufacture	Retail/distribution	Customer	Aftercare/repair	Government	Short (1-3 yrs)	Medium (4-7 yrs)	Long (7+ yrs)	Low		Medium
6. Government support	✓		✓	✓	✓	✓		✓	✓			✓		<p>Key factors are:</p> <ul style="list-style-type: none"> requires partnership and joint working in industry requires customer demand and retailer interest for this measure to work specific measure demand consumer to consider life cycle costs of product rather than impulse buy or buy only on cost. Consumer attitudes research showed limited interest at present <p>Likelihood of success - low:</p> <ul style="list-style-type: none"> limited funding likely to be available, so only select products would be covered. limited number of products for which UK will have sufficient influence
7. ECAs			✓	✓		✓			✓			✓		<p>Key factors are:</p> <ul style="list-style-type: none"> promotion of measure and take up by procurers manufacturer interest in/ability to develop standards for more durable products <p>Likelihood of success - low:</p> <ul style="list-style-type: none"> promotion of measure and take up by procurers commerce focused labour costs, rather than product costs are main driver - limited impact on balance sheet of most companies
8. VAT incentive			✓	✓			✓		✓			✓		<p>Key factors are:</p> <ul style="list-style-type: none"> government willingness/ability to implement variable VAT on products. difficulties/costs associated with developing/revising product specific standards <p>Likelihood of success - low:</p> <ul style="list-style-type: none"> limited impact on low value products.
9. Voluntary product durability standards	✓			✓		✓	✓		✓			✓		<p>Key factors are:</p> <ul style="list-style-type: none"> difficulties/costs associated with developing/revising product specific standards. lack of incentive for industry to engage.

	Focus of measure			Critical stakeholders			Timescale to implementation			Likelihood of longer/optimal product lifetimes			Critical success factors	
	Increase design life	Optimise lifetime	Incentivise Change	Design/manufacture	Retail/distribution	Customer	Aftercare/repair	Government	Short (1-3 yrs)	Medium (4-7 yrs)	Long (7+ yrs)	Low		Medium
														<p>Likelihood of success - low:</p> <ul style="list-style-type: none"> durability factor are generally low in the consumer psyche, relative to costs. more durable products generally likely to cost more to produce and retail at higher prices in order to maintain margin retailers satisfy consumer demand
10. Mandatory durability declaration	✓			✓	✓		✓		✓			✓		<p>Key factors are:</p> <ul style="list-style-type: none"> difficulties/costs associated with developing/revising product specific standards. <p>Likelihood of success - medium:</p> <ul style="list-style-type: none"> durability factor generally low in consumer psyche, relative to costs. more durable products generally likely to cost more to produce and retail at higher prices in order to maintain margin retailers satisfy consumer demand
11. Green public procurement			✓	✓	✓		✓		✓			✓		<p>Key factors are:</p> <ul style="list-style-type: none"> restricted to government procurers. difficulties/costs associated with developing/revising product specific standards. <p>Likelihood of success - low:</p> <ul style="list-style-type: none"> more durable products generally likely to cost more to produce, causing difficulties for public sector procurers. may fail unless in conjunction with mandatory government standard due to lack of significant incentive for industry to develop standards.
12. IPR			✓	✓	✓	✓	✓		✓			✓		<p>Key factors are:</p> <ul style="list-style-type: none"> restricted to products with high value and high potential for refurbishment, otherwise will not be a mechanism for extending product life. difficulties in enforcement, ensuring reuse/refurbishment potential is achieved. <p>Likelihood of success - medium:</p>

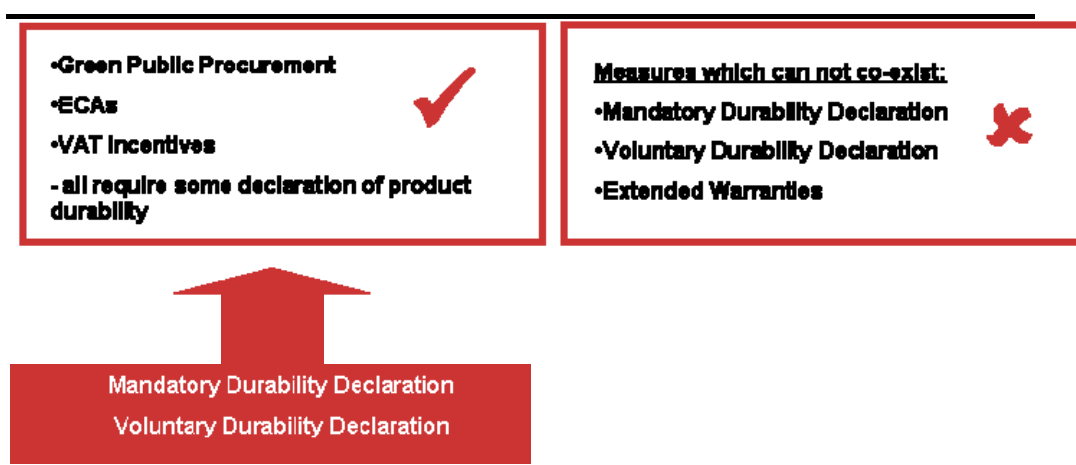
	Focus of measure			Critical stakeholders			Timescale to implementation			Likelihood of longer/optimal product lifetimes			Critical success factors		
	Increase design life	Optimise lifetime	Incentivise Change	Design/ manufacture	Retail/ distribution	Customer	Aftercare/ repair	Government	Short (1-3 yrs)	Medium (4-7 yrs)	Long (7+ yrs)	Low	Medium	High	
															<ul style="list-style-type: none"> measure may not increase refurbishment/extended life if waste management costs significantly cheaper. could result in refurbishment of products without subsequent market for products.
13. Extended warranties	✓			✓			✓		✓						<p>Key factors are:</p> <ul style="list-style-type: none"> raises the 'bar' for all products independent of consumer choice /demand significant opposition from industry. <p>✓</p> <ul style="list-style-type: none"> uncompetitive for UK industry - so EU wide implementation encouraged. <p>Likelihood of success - high:</p> <ul style="list-style-type: none"> legally defined, not standards based

ERM has reviewed 13 potential measures which aim to extend or optimise product lifetime. Importantly, some measures are reliant on a definition of durability for them to function effectively (see Figure 6.4).

The measures described as green public procurement, enhanced capital allowances and VAT incentives would all require a definition of durability or some declaration of durability to function correctly, since they essentially encourage or incentivise the take up of defined longer life products.

Measures which would not co-exist effectively are mandatory and voluntary durability declarations and extended warranties.

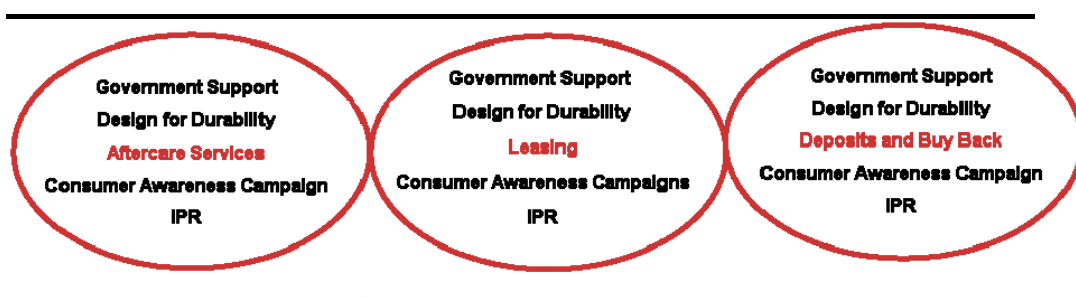
Figure 6.4 Measures which rely on a Definition of Product Durability



The measures are not all suitable for all product types and for this reason alone a combination of measures will be more effective about bring market changes to the UK. In developing these measures it has become clear that some could co-exist with other measure and thereby improve the likelihood of changes to the market.

Some measures which ERM consider compliment each other well are shown grouped in Figure 6.5

Figure 6.5 Groups of Measures



An objective of this work was to assess the impacts of particular measures on specific products, with the aim of drawing conclusions about the economic, environmental and social impacts of measures for a wider selection of products.

ERM has carried out a development stage IA process for 13 measures (across eight different sample products).

7.1

IMPACTS OF SPECIFIC MEASURES ON SAMPLE PRODUCTS

The level of environmental, economic and social impact of any measure which is introduced to extend product lifetime is directly related to the likely change to the market (ie the extent to which longer-lasting products take up a larger share of the market relative to standard life products) and the size of the market to which the measure is being applied.

In order to progress the IAs, it has been necessary to make a range of assumptions about each specific sample product including:

- the physical characteristics of both the standard and longer life product;
- the lifetime in years of the specific standard and longer life products;
- the number of products required to satisfy demand now and in the future;
- the relative market share of standard to longer life products both now and in the future; and
- the financial value of both standard and longer life products.

Preliminary sensitivity analysis shows that the direction of travel appears not to change if the main variables are varied. However, ERM's findings are limited to those preliminary IAs we have carried out.

ERM has assessed specific measures on specific products, as it was impractical to assess generic impacts on a group of products. The assessment of the 13 measures/approaches to extend product lifetime shows the following.

- All measures lead to **environmental savings**, but these tend to be relatively small overall, since the market shift to longer life products is comparatively small in most instances, especially for voluntary measures. In general terms, the magnitude of the reduction in impact varies from measure to measure and by product, depending on the place of manufacture, UK or overseas, the impact associated with manufacture of the product, whether the product is an energy using product or not, and the ownership pattern of the product in the UK.

For all measures, the environmental savings are largely due to a decrease in product manufacturing volumes. As such, environmental savings are

particularly significant for products where the product is resource intense to manufacture and the product lifetime is extended significantly.

As manufacturing activities for consumer products tend to take place overseas, most environmental benefits, reduced materials use and savings in manufacturing and materials extraction energy are achieved overseas in the country of manufacture, or of raw material extraction. For some types of products, for example hi-tech, the extended lifetime measures will result in less demand being placed on critical raw materials (ie rare or supply constrained materials).

UK product distribution, retail and disposal impacts will also be reduced marginally, due to reduced volumes handled in the supply chain.

- Overall, the **economic impact** of the measures is mixed in terms of their effect on the UK economy. Most of the relative changes are fairly small in proportionate terms in nearly all cases: of the order of up to 10% either up or down. ERM believes it is inappropriate to emphasise particular figures as the IAs are only at an early development stage, however impacts of between £10m-£99m appear to be common, with some IAs exceeding this.

Looking across the measures, the effect on manufacturing is broadly negative but limited (probably because UK exposure is limited in this sector), and R&D is also lightly affected across the piece. The measures' impacts on distribution and retail are negative in seven cases and positive in five, although on balance the negative impacts are likely to be deeper. As would be expected, repair, refurbishment and maintenance does well (no negatives at all, and some significant positives as well) and the second hand market is similarly advantaged, though to a lesser extent.

The measures also present UK growth opportunities in a number of areas, including high skilled research and development activities, and low-skilled or semi-skilled repair and maintenance activities.

- In terms of **household/consumer expenditure**, for some measures (most notably, ECAs on laptops and design for durability on t-shirts), there are very substantial gains expected for business and household consumers, respectively. However the effect of this is that their lower spends are reflected in lower turnover for retailers and lower VAT receipts for Government. Elsewhere, the measures encouraging green procurement on laptops, after care services on sofas and government support on printers, are not expected to impact substantially on businesses or household consumers.

The measures are expected to have negligible or small impacts on UK society. The measures are not expected to affect product functionality, but could increase product cost. The measures could increase household expenditure on products, particularly if longer-lasting products are not used to their full potential. Moreover, without compensating mechanisms, the measures could disproportionately benefit higher and middle income

households, as they are more likely to pay the higher upfront cost of the longer lasting product. Compensating mechanisms could include payments for products being spread over several years.

7.2 *EFFECTIVENESS OF MEASURES*

This section attempts to draw together the conclusions regarding those measures which are likely to be most effective in shifting the market to longer life products.

The measures assessed in this work were all assessed in respect of one sample product. The scope of applicability of any future measure will significantly affect the measure's effectiveness in extending the life of products *per se* and the resulting impacts on the UK economy, society and the environment.

In terms of likely shift in the market, ERM has grouped the measures into 5 levels as illustrated in *Figure 6.3*.

- The majority of the measures will face significant challenges in delivering longer product lifetimes or optimising existing product lifetimes and will require a change in consumer behaviour.
- Government support, VAT incentives, Green Public Procurement and ECAs will help to bring about a level of change to the market.
- The most likely measure to bring about changes to lengthening product lifetime is extended warranties since this is not dependent on consumer demand.
- Deposits/product buy back, leasing business models and mandatory durability standards as types of measure may have some success in bringing about change if applied to appropriate products.
- Consumer awareness is key to the success of many measures.

The IA process has shown the following.

- While ERM has been able to evaluate which measures are likely to work for different types of products, these types of products are not aligned to traditional product groups. It is unreasonable to assume that you can apply one measure to all products to the same degree of effectiveness.
- The effectiveness of any measure is more closely aligned to a range of product characteristics.

These characteristics include:

- customer type (household, business or government);
- consumer view of product (workhorse, investment, up-to-date);
- relative purchase price;
- geographical location of product design/production (UK or non UK);

- product which does/does not consume resource during use phase;
- relative rate of innovation;
- care/servicing requirements; and
- how readily a product can be reused.

A consumer's view of a product and the relative purchase price can not easily be pre-defined.

- It appears that fewer measures are likely to be effective for up-to-date, low cost and rapidly innovating products. The principal reason for this is that consumers are more likely to want to replace these products and are less likely to demand that these products are more durable and they are less likely to use services which encourage 'nurturing' of these products.
- All measures appear to be suitable for higher value, non-rapidly innovating and non EuP products.
- Measures which rely on the development of durability standards will be more difficult to implement for products where the design function is controlled overseas, eg where the same models are manufactured for multiple international markets.
- As the measures are not all suitable for all product types, a combination of measures will be more effective in bringing about market changes across the UK.
- Mandatory measures will bring change more rapidly than voluntary measures for the products to which they are applied.
- The mandatory measures evaluated here, primarily the Extended Warranties, and to a lesser extent the Mandatory Durability Standards, are expected to be successful at extending product lifetime. However, both are likely to face opposition from industry. The mandatory IPR measure will need careful design to meet the objectives of extending product lifetime as IPR has tended to be used as an instrument to improve waste management of specific products.
- The financial incentives demonstrated in the measures, particularly the proposed measure on reduced VAT, but also the ECA arrangements, may not prove to be sufficiently effective to drive purchasing of more durable goods. In both cases, additional resources are required to establish the system, ie defining which products qualify for the arrangements.

7.3

FUTURE WORK

Based on our work, ERM suggests that a focus of future policy could be prioritised as follows:

Rationale for Intervention

Future policy should naturally focus on market situations where there is clear rationale for intervention. ERM has not identified any market situation in this

study where economic or environmental rationale does not appear to exist to extend the lifetime of products (see *Table 3.2*) in some segment of the market.

Products

Future policy may choose to select particular products to be an area of focus.

- If the geographical focus of environmental, economic and social impacts is limited to the UK, it seems appropriate to tackle those products which are manufactured, used and disposed of in the UK first.

It has not been within the scope of this study to consider which UK manufactured products have the greatest environmental impact in the UK. In our view, it is not readily apparent what these products might be, although they would not include EuPs. However, ERM recommends that the UK needs to account more effectively for the embedded carbon in the products it imports, ie to consider global impacts.

- It would make sense to focus on any products which are discarded prematurely and which are in working order. From an environmental perspective, it is critical that consumers use all products to their full potential, so focusing on products which are discarded prematurely, which are still in working order, or which can be refurbished, should be prioritised. This approach is illustrated in these IA for a Government Awareness Campaign and the Deposit Return System measure. This is also the approach undertaken by WRAP's Love Food, Hate Waste Campaign.
- In relation to products purchased by consumers, the Brook Lyndhurst work has shown that consumers have in most cases little interest in product durability, with the exception of workhorse products. However, where consumer demand exists for longer life products, these products this should be a focus for future work. Further research could be conducted to pinpoint which kind of products this would apply to.
- A research suggestion is to understand better the relationship between prolonging the lifetime of a product and the impact this could have on potential loss of utility, or increased servicing costs. Electronic equipment is an obvious candidate for some research to look at scenarios of where retaining a product over a certain amount of time becomes unfavourable.

Measures

- To counterbalance the reduced economic activity in UK manufacturing of new products, it would seem reasonable to focus on measures stimulating economic activity, ie in UK repair and refurbishment, and optimising product lifetime. This would include leasing, deposit systems, IPR etc.
- The measures show that there are economic advantages to be gained from the development of the repair, refurbishment and maintenance activities. Further research could be carried out to fully understand what this sector

needs to develop and expand in the UK. ERM expects that a significant barrier is the cost differential between buying new goods and repairing products.

- The Extended Warranties measure appears to show significant opportunity for shifting the market without the need to rely on consumer demand for longer lasting products. Further work should be conducted to consider the feasibility of extending warranties.

Consumers

- Consumers view products in different ways. For example, a mobile phone will be considered a 'workhorse' product for some and an 'up-to-date' product for others. Measures are more likely to be effective for workhorse or investment products. Further work could be carried out to understand what influences or motivates individuals' 'classifications' of products and what can be done to encourage customers to consider their products as 'investment' or 'workhorse' products.
- All of the measures would be supported by increased consumer demand for longer-lasting products. Likewise a consumer understanding of the importance of using products to their full potential, either themselves or through reuse and refurbishment channels is important. Any small increase in product lifetimes will have environmental advantages. Further work should be carried out to establish the most appropriate and effective means of increasing consumer awareness of the issue.