WASTE PLANS

Report on Categorisation and Pilot Studies

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Executive Summary

The main objective of the RELIFT project is to promote a reduction in resource use arising from retail packaging.

The project was originally granted funding from the Sustainable Technologies Initiative (STI) programme, with match funding from the project's partners in terms of time and materials. Subsequently, a successful application for funding has been made to the Edinburgh Environmental Partnership Grants Scheme Ltd (EEP).

This study is focussed on the management of **Primary Retail Packaging** after its first use. In the UK, the majority of this packaging will eventually end up in the household waste stream.

The main aim of this study is to assess the management of packaging waste through activities at the top of the waste hierarchy, specifically focussing on reuse.

A reduction in the growth of household waste is recognised as central to meeting UK government and EU landfill reduction targets. The increased use of 'reusable', or 'refillable' packaging is often put forward as one measure to minimise the amount of waste produced. However, at present few reuse schemes for primary packaging exist in the UK and the majority of retail goods sold in the UK are packed in non-returnable packaging.

It is evident that a number of reuse schemes successfully operate in Europe and other developed countries around the world. Could such a scheme work in the UK? Are obstacles identified by some in industry insurmountable? Do other countries have differing regulations or market forces that make reuse schemes more viable?

The methodology for the project was based around the following:
1. The Categorisation Study to investigate good reuse practice abroad
2. Pilot Scheme to create theoretical reuse systems in the UK
3. Backcasting by industry representatives to identify optimal business conditions for reuse models.

Overall findings of the project have characterised the conditions under which packaging reuse models would be optimised in the UK, and are as follows:

Logistics to Support Reuse Models
- Reuse schemes seem to work most efficiently when there is a limited number of retail channels and short supply chains. They work particularly well for local or regional products.
- Pools systems have benefits for small to medium sized businesses wishing to implement reuse.

- Closed loop system can work well in situations where the producer is situated close to the points of retail. Thus reducing transportation distance.

Marketing/Customer Behaviour for Reuse

- Reuse systems operate most effectively when there is consumer support and recognition for the use of reusable packaging. The use of reusable packaging is viewed by the consumer to add value to the product and encourages loyalty to the product.
- Regional or local products attract higher return rates.

Legislation to Enable Reuse Models

- The schemes which receive the broadest industry support have been set up 'voluntarily' i.e. without the influence of strict regulation. Bans of certain types of packaging invoke strong opposition from packaging and retail industries.
- Maximum return rates are achieved where a deposit system exists.

Packaging Reuse

1. The use of standardized packaging has the potential to reduce costs of a reuse system for retailers, or other responsible for collection, and producers.
2. Glass and PET are the most common materials used in reusable packaging.

In summary, the following conclusions have been drawn:

1. Reuse models work least well for nationally distributed products with long and complex supply chains and where consumers have the opportunity to confuse reuse with recycling.
2. In the consumer market, reuse models have most potential to add value to small to medium-sized businesses, offering more specialist items to local/regional markets, where supply chains are short and businesses get the financial benefits of reuse systems that control packaging costs and take advantage of local logistical and distribution systems.
3. The greatest chance for success of reuse models occurs when the consumer is aware of the reuse model and perceives that reuse of the packaging adds to the character/ uniqueness of the product.
4. Aligning packaging reuse models with other emerging policy areas e.g. sustainable farming and food production, food miles, sustainable production and consumption patterns, provides both good business practice and the waste management dimension to these policies.
5. Financial incentives to support reuse schemes would be most beneficial when directed to allow smaller producers to reap the financial benefits of reuse models e.g. financial incentives for washing equipment, local logistics networks and pool systems to create economies of scale that generate financial benefits for local producers.
6. Taking this scoping study forward, there is clearly the need to develop a REUSE AUDIT methodology that will allow packaging reuse models to be developed by small to medium-sized businesses offering locally produced products to local/ regional markets. With a shift towards local production patterns in the future, this

new approach would offer business advantages and make a significant contribution to local waste management priorities.

Acronyms

BMW - Biodegradable Municipal Waste
CRI - Container Recycling Institute
DEFRA - Department for Environment Food and Rural Affairs
EC - European Community
EEP - Edinburgh Environmental Partnership
EU - European Union
GDB - Genossenschaft Deutscher Brunnen
HDPE - High Density Polyethylene
INCPEN - Industry Council for Packaging and the Environment
ISB - Industry Standard Bottles
LCA - Life Cycle Analysis
LCC – Life Cycle Concepts
PET - Polyethylen-terephthalat
R&D - Research and Development
PRN - Packaging Waste Recovery Note
RRFB - Resource Recovery Fund Board
RVM - Reverse Vending Machine
SEPA - Scottish Environment Protection Agency
STI - Sustainable Technologies Initiative
SWAG - Scottish Waste Awareness Group
UK - United Kingdom
WRAP - Waste Resources Action Programme

Contents

1 Introduction

1.1 Packaging and Waste Management

Packaging serves to protect, and conserve, the product during transit to the customer, as well as playing an important marketing function.

Packaging is commonly divided into three different 'types':

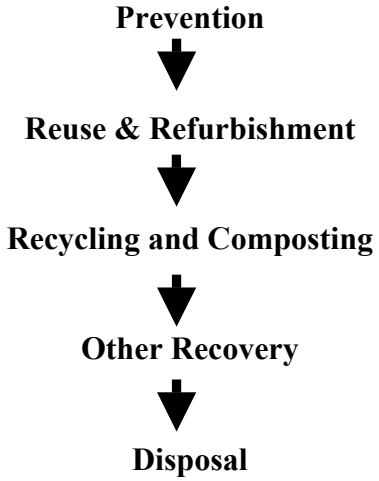
Primary packaging - the packaging around the individual items at the point of sale e.g. the mineral water bottle.
Secondary packaging - packaging surrounding groups of products for storage or for display at the point of sale e.g. cardboard boxes.
Tertiary packaging - packaging for transport purposes e.g. pallets.

This study is focused on the management of Primary Retail Packaging after its first use. The majority of this packaging currently ends up in the household waste stream.

In the UK, approximately 25 million tonnes of household waste is generated each year (Cabinet Strategy Unit; 2002), of which about 45% is thought to comprise of waste packaging (SEPA, 2002). In Scotland households will produce around 900,000 tonnes of packaging annually[1]. Edinburgh households will produce in the region of 73,000 tonnes a year[2].

The main aim of the RELIFT project is to promote a reduction in resource use arising from retail packaging.

The waste hierarchy is intended to guide choices on the most sustainable options for waste management. The recent '*National Waste Strategy for Scotland'* (SEPA, 2003a) lays out the hierarchy as follows:



[1] Based on total household waste collected in Scotland = 2 million tonnes / year (SEPA, 2003b).
[2] Based on total household waste collected in Edinburgh of 162,954 tonnes / year (SEPA, 2003b).

This project will focus on the management of packaging waste through activities at the top of the waste hierarchy. Specifically focusing on reuse.

Reuse means the multiple use of a product in its original form. Reuse forms a common part of most people's lives - be it from handing down clothes between siblings or the purchase of 'second-hand goods' such as cars. In certain sectors, reuse of primary packaging has in the past been commonplace. For example, doorstep delivery and collection services accounted for 75% of the all milk sales at the end of the 1990's (Golding; 1998). However, as supermarkets continue to increase sales this figure is now below 30%. Although ever increasing effort is being put into recycling and recovery of materials from domestic waste, few reuse schemes for primary packaging remain in the UK.

A reduction in the growth of household waste is recognised as a key contributor to meeting UK government and EU landfill reduction targets. The National Waste Strategy for Scotland has set a target of zero growth in municipal waste by 2010. A number of measures have been identified for tackling waste at source, including the promotion of reuse and joint working with local retailers and manufacturers to promote responsible product design.

A report by the Cabinet Strategy Unit report - '*Waste not, Want not'* (Cabinet Strategy Unit; 2002) has identified four key investment measures to bring about a 1% per annum reduction in the rate of growth in household waste.

1. An extension of home composting participation.
2. Greater use of re-usable nappies.
3. A retailer initiative focussed on the top 5 supermarkets.
4. Increased R&D on waste minimisation through better product development and design.

Initiative (3) would include the introduction of reusable bottles. This is accompanied by a recommendation that Department for Environment, Food and Rural Affairs (DEFRA) and Waste Resources Action Programme (WRAP) consider options for increasing incentives for reuse.

1.2 The Retail Supply Chain

The industries that make up the retail supply chain play a key role in the UK economy. The packaging industry has an annual turnover of £9 billion this makes it one of the largest UK manufacturing sectors and a significant contributor to GDP. As a whole the industry employs 3.75 million people (The Packaging Federation; 2003). UK retail sales were approximately £234 billion in 2002 and the industry employs 1 in 9 people in the UK (British Retail Consortium; 2003).

The combined effect of Packaging Producers Obligations and National Waste Strategies will have important implications for grocery retail packaging systems. Success will also depend on co-operation between other major players in the packaging supply chain - designers, manufacturers, waste management and logistical contractors, local authorities

and the consumer. Add to this the complex distribution patterns associated with Internet home shopping and there is an urgent requirement for industrial collaboration to increase the development and use of innovative and flexible packaging technology.

2 Project Aims and Objectives

The project was originally granted funding from the STI programme, with match funding from project partners in terms of time and materials. The projects aims were to:

1) To establish forum membership through individual contact with relevant participants from key sectors - retailers, retailers' suppliers, equipment and packaging manufacturers, local authorities, non-governmental organisations and local community groups;
2) To assess the current activities of forum members;
3) To develop cross-sector partnerships and a relevant pilot scheme. The results of the pilot scheme will be used to inform future research requirements;
4) To test the new practices and techniques, and encourage the development of integrated packaging products;
5) To analyse these practices and techniques assessing the economic, environmental and social benefits.

Subsequently, a successful application for funding was made to the Edinburgh Environmental Partnership Grants Scheme Ltd (EEP). This match funding allowed for expansion of the original projects aims to include:

a) Examination of '*best practice'* with relation to reuse of primary packaging in the UK and other countries (termed the 'Categorisation Study'); and
b) Research exploring the opportunities within local authority planning systems to encourage the development of innovative packaging design/service, waste management, waste management facilities, and education and awareness programmes.

Aim (b) of the EEP component is due to be completed in October 2003 and will not be detailed in this report. As a whole the project is referred to as 'Waste Plans'.

3 The RELIFT Forum

The forum is comprised of the following key members:

- The Logistics Research Centre at Heriot-Watt University
- Wincanton Logistics
- United Glass
- Industry Council for Packaging and the Environment (INCPEN)

A steering group of regulators and environmental organisations was also established to advise SISTech. This comprised:

- Scottish Waste Awareness Group (SWAG)

- Scottish Environment Protection Agency (SEPA)
- Lothians and Edinburgh Environmental Partnership (LEEP)
- City of Edinburgh Council Environmental Services

Each of these organisations was interviewed to assess their current activities in relation to the retail supply chain. Other organisations outside of the Forum were also interviewed to allow the views of all those in the retail supply chain to be taken into account. The interview format included a questionnaire to judge the participant's level of involvement in the packaging supply chain and then a packaging audit to assess the impacts of the participant's current activities.

Key points recorded during this process are provided below:

Logistics Research Centre
Logistics Research Centre has carried out research which indicates that even small changes to the product or packaging size can have significant implications on resource use.

Wincanton Logistics
Wincanton Logistics has comprehensive knowledge of returnable transit packaging. The carry high return rate for other secondary packaging and are interested in further initiatives and increasing return loading of vehicle.

United Glass
United Glass are involved in design and recovery of glass packaging. Could be key to future STI project if pilot scheme establishes a strong working link with retailers.

INCPEN
Industry Council for Packaging and the Environment (INCPEN) are involved in packaging life cycle analysis and development of EU legislation on integrated product policy.

SWAG
Scottish Waste Awareness Group (SWAG) involved in waste education and awareness programmes.

SEPA

Scottish Environment Protection Agency (SEPA) has delivered the National Waste Strategy for Scotland and needs more projects such as RELIFT which concentrate on waste minimisation through reduction at source and reuse of packaging rather than the current focus on end of the line waste management such as recycling, landfill and energy from waste.

CJ Lang / Spar

CJ Lang / Spar are active within a compliance scheme but limited opportunities due to size of premises.

AG Barrs

AG Barrs (soft drinks manufacturers) have excellent examples of primary packaging reuse is 750ml bottle and local distribution networks. However, while this method is losing popularity Barrs is keen to encourage growth due to quality and economic advantages.

ASDA

The issues of waste and reverse logistics are extremely important to the retail sector. ASDA have piloted a fabric conditioner bottle reuse scheme in Watford. However, health and safety issues have prevented this scheme becoming widespread.

After the interview process constant communication has been maintained between SISTech and the project's partners and other stakeholders through meetings, personnel interviews etc. From this process the following general points have been noted.

1. Retailers welcome any pilot scheme that increases customer loyalty.
2. None of the major retailers operate any schemes in the reuse of primary packaging.
3. In order to meet their obligations under Packaging Regulations retailers often focus their attention on recycling of secondary and tertiary packaging.
4. Some retailers are operating 'bring-back' recycling schemes.
5. All too often opinion amongst those involved in the retail supply chain is that reuse on a large scale would not work in this country due to: Health & Safety and Hygiene Regulations; the logistical complexities of a multi-directional supply chain; price of new packaging; and customer behaviour.

The pilot project would need to address the problems (either real or perceived) highlighted in (5).

4 Categorisation Study

4.1 Introduction

The aim of the categorisation study was to present examples of reuse systems from different countries. Each example will consider:

- The motivation for utilising a reusable packaging system: legislation; economics; environmental commitment; market benefit.
- The logistics system employed to return the bottles back to the packer/filler.

4.1.1 Terminology

The following terminology will be used in this section and throughout the remainder of the report:

Reuse System: A retail supply chain that accommodates reusable packaging.

Returnable Packaging: Packaging which has been designed to be returned to a manufacturer for reuse. Also referred to in other texts as 'refillable packaging'.

Non-Returnable Packaging: Packaging which has been designed to be used once. Also referred to in other texts as 'one-way packaging'.

Product Manufacturer: The company who produces the actual food or drink product. They may also be the *Packer Filler:* The company responsible for packaging the product.

Packaging Manufacturer: Company responsible for manufacturing the packaging.

Logistics Provider: Company providing distribution services to those in the packaging supply chain.

Retailer: The final link in the supply chain before the consumer.

Rotation: The number of complete cycles of consumer use and refilling. This is understood to differ from 'trip' which refers to the number of times a product is distributed from the manufacturer to the consumer.

4.1.2 Reuse Systems

The typical retail supply chain from production to supermarket shelves comprises of the following components:

Packaging Manufacturer
Product Manufacturer
Packer/filler
Logistics Provider
Retailer
Customer

Some of the above roles, for example logistic provider and retailer, may be undertaken by the same organisation.

The majority of retail goods in the UK are sold in packaging designed to be non-returnable. Accordingly, supply chains have developed for the flow of primary packaging in one direction. A 'reuse system' will require the flow of goods in the opposite direction to normal distribution activities. This is often referred to as reverse logistics. Broadly speaking, a reuse system will be one of two types:

1. The return of the packaging back to a product packer/filler to be reused again for the same, or similar, product. The consumer may be able to return the packaging via the original retail channel or a third party, e.g. such as a 'recycling depot'. The filler may be the original product packer/filler, or another manufacturer who can make use of the packaging. In some cases the packer/filler may contract a third party to carry out washing and cleaning services.
2. Refilling by the consumer at the original retail location. Consumers regularly purchase 'refills' e.g. air freshener refills, sugar for storage in glass jars at home, or biscuits to put in a biscuit tin. However, some of these examples create more waste as the packaging used to transport the product to the consumer's home is invariably thrown away. Less waste is generated if the consumer can refill the original packaging directly at the retail location.

4.1.3 Reuse in Western Countries

In western countries the most prevalent example of type (1) is the reuse of beverage containers. Depending on the country, other products have commonly been supplied in reusable packaging e.g. milk in the UK. There are also other examples of non-food products, such as washing powder, that operate refill systems. The reuse of beverage containers will be the main focus of this report .

Most researchers report a general trend towards the decline in the use of returnable packaging. In the United States, the market share for reusable soft drinks has been reported to decline from 100 % in 1947 to 1 % in 2000 and in Canada it has fallen from 47 % in 1985 to less than 5 % in 1997 (ILSR; 2002). In a study of reuse of primary packaging in Europe Golding (1998) reports that returnable containers were gradually eliminated from retailers' listings from the 1980s onwards. However, many reuse systems have survived across Europe and the following trends can be identified:

1. Countries like the UK, France and Ireland, in which reuse systems have almost disappeared from the market and only cover market shares of under 5%.
2. Countries like Belgium, Greece, Portugal, Italy and Spain, where reuse has disappeared in some product areas. In other branches reuse systems still hold steady, mainly for carbonised beverages or wine.
3. Countries like Finland, Germany, Sweden, Austria, Denmark and the Netherlands, where reuse exists for all beverages and all retail channels. Alongside of the reuse systems, non-returnable packaging also exists to a varying extent, anywhere from 10-50%. Non-returnable packaging is growing steadily where there is no strict legislation.

It is noticeable that those countries in (3) have adopted waste management policies which directly favour reusable containers for certain types of products.

4.2 Europe

4.2.1 Overview

The total quantity of packaging put on the market in the EU amounts to some 58 million tonnes. Consumption according to member states ranges between 74.43 kg/cap in Greece and 189.2 kg/cap in France, the EU-15 average amounting to 155.2 kg/cap (European Commission, 2001).

The most important piece of legislation regarding packaging in the EU is the Directive on Packaging and Packaging Waste (94/62/EC). The Directive aims at harmonising national packaging legislation with the twin objectives of a) preventing and reducing the environmental impact caused by packaging and packaging waste, and b) ensuring the functioning of an internal market so as to avoid obstacles to trade, as well as the distortion of, or restrictions to, competition. Member states were given flexibility in transposing the Directive into national legislation and a number of distinct systems have developed.

Although the Directive (94/62/EC) sets out quantitative targets for recovery and recycling of packaging no objective is set for reuse. According to Article 5, "member states may encourage reuse systems of packaging waste, which can be used in an environmentally sound manner, in conformity with the Treaty". Approaches to reuse vary across the EU. Some states have set targets, or taken other measures to encourage reuse, which have mainly been aimed at beverage packaging. In many instances these are intended to protect and support existing systems. Some of these policies were in place before the introduction of the Packaging Directive. Table 1 summarises the different measures taken in the EU.

Table 1 Different Reuse Measures in the EU [1]

Country	Measure
Germany	• National target for reusable packaging to comprise 72% of all packaging for beer, mineral water, carbonated soft drinks, fruit juices and wine. • Mandatory deposits introduced on non-returnable packaging if target not reached.
Finland	• Levy on non-returnable containers. • Reuse quota for beverages.
Portugal	• Product-specific quotas for packaging of beverages in returnable containers.
Belgium	• Levy on non-returnable containers
Denmark	• Recently repealed ban on beverages sold in cans. • Deposit system on all beverage containers.
Netherlands	• Voluntary agreements with industry not to replace existing reuse systems.
Austria	• Reuse quotas for beverage packaging

[1] Adapted from European Commission (2001), Golding (1998), and ILSR (2002)

Outright bans on non-returnable packaging could possibly be ruled out by European law on the basis that such a ban would be an intervention in the internal market. Denmark recently repealed a ban on non-returnable beverage packaging that was the subject of a pending lawsuit by the European Commission. Any attempts in the future are likely to bring a similar action as well as strong opposition from the packaging industry.

In addition to those measures given above, a number of complementary regulations exist in each country that will have direct or indirect effects on packaging and packaging waste, e.g. a ban on the landfilling of collected packaging waste in Italy and the UK's landfill tax (European Commission; 2001).

The following sections detail the differing approach taken to reuse in two European countries, Germany and the UK, and highlight case studies in each of these countries.

4.2.2 Germany

The regulation of packaging has been the topic of much debate in Germany for over the past 20 years. The Packaging Ordinance in 1991 established the following.

The 'Duales System': The Ordinance places a legal obligation on retailers and manufacturers of packaging to recover and recycle all forms of packaging. They can be exempted from their individual obligations if they join a compliance scheme. The 'Duales System' recovers packaging from consumers via kerbside collection and bring-sites and is funded by license fees for the use of the 'green dot' on packaging received from manufacturers and retailers. This system operates in parallel with municipal waste collections (Duales System Deutschland AG, 2002)

Reuse Quota: A target for reusable packaging to comprise of 72% of all beer, mineral water, carbonated soft drinks, fruit juices and wine. If this quota is not achieved two years in a row, the government can enforce the introduction of deposit-return systems on the manufacturers/retailers, who thus forfeit their option to be a member of the Duales-System.

In 1997 the quota was not achieved for the first time because of the increasing prevalence of beer cans and of non-returnable mineral water bottles. In 1998 the quota was again not met and this sparked much debate over how the Ordinance should be applied. A variation on the Ordinance was proposed in 2000, whereby wine was excepted along with those beverages where it could be demonstrated that it would be 'ecologically disadvantageous' to package in reusable containers. This was to be confirmed by an extensive Life Cycle Analysis (LCA) (ILSR, 2002). The introduction of deposits was challenged in court by German retailers (Environment Daily, 2002) and was subject to an infringement action by the European Commission (European Commission, 2001). However, the compulsory deposits did come into force on 1st January 2003 for beer, mineral water and carbonated soft drinks (Federal Environment Agency, 2003).

The compulsory deposit on non-returnable packaging is as follows:

- 25 Euro Cents on packing up to 1.5 litres; and
- 50 Cents for over 1.5 litres.

This is higher than the deposits that existed on non-returnable containers: typically 8 cents for a bottle of beer and 15 cents on mineral water bottle (both >1.5 litres).

The deposit is charged on all members of the supply chain: fillers and importers as first distributors, wholesalers and retailers.

Retailers have to accept the return of packaging if they stock that type of drink in non-returnable packaging. Shops with a small area (below 200 m^2) only have to take back non-returnable packaging from the brands they stock. Along with distributors and manufacturers, the retailers are then responsible for organising recovery and recycling. The German government envisages that retailers will invest in automated deposit return machines for their stores. The Federal Environment Ministry estimated that around 80,000 machines will be required at an average cost of 12,500 Euros each (Federal Environment Agency, 2003). This equates to an investment of about 1 billion Euros to be borne by retailers. Savings in administration of the scheme will be partly offset by savings from the license fee for the Duales System and revenue from the sale of recyclables. The German Government estimate the additional net costs to be around 135 million Euros/ annum; less than 1 Euro cent per item of packaging.

The packaging ordinance is principally designed to protect those brands that have already invested in a reuse system. It is not yet clear if it will actually encourage an increase in reusable packaging.

Case Study – The 'Mehrwegsystem' for mineral water

A good example of an existing reuse system in German is the 'Mehrwegsystem' (reuse system) that operates for mineral water. This is a good demonstration of one important type of logistics system to return packaging, **the 'pool system'**.

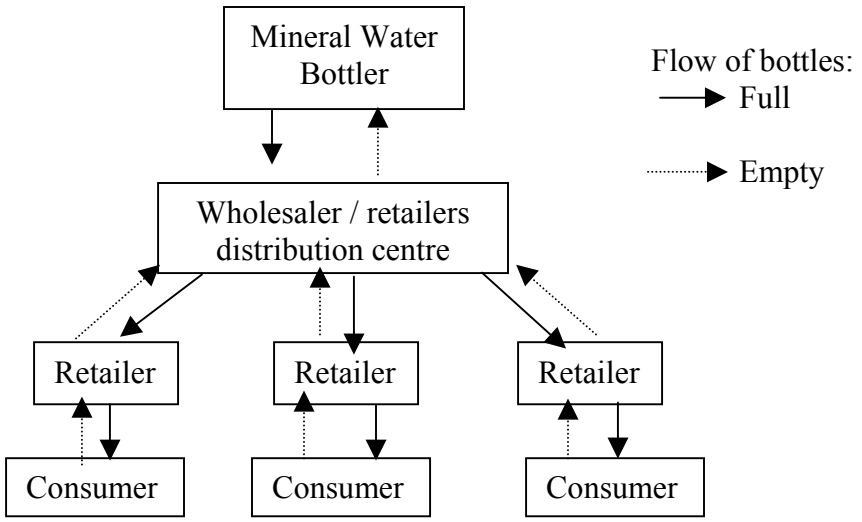
The market for bottled water has grown considerably over the past decade and has now reached a value of €1 billion. Germany is the largest market representing around a quarter of all sales (Datamonitor, 2003). From 1983 – 1994 consumption of mineral water doubled in Germany to 8.4 billion litres, this amounts to an average consumption of 93.4 litres/capita/year.

In a pool system, a number of fillers of the same type of product will co-operate in the management of a reuse system. The pool will rely on the use of a standard container and large pools will be operated by a management organisation. The system in Germany is managed by Genossenschaft Deutscher Brunnen (GDB). Each mineral water bottling company will have a contract with the GDB to receive a supply of standard bottles. The GDB will be responsible for:

- Setting standards for new bottles which are brought into the pool, handling of packaging within the filling lines and distribution, and the selection of damaged packaging.
- Determination of the number of new bottles required.
- Publicity requirements for the pool (see http://www.gdb.de/).

Figure 1 shows a schematic of how the pool system operates.

Figure 1 Pool System



Customers can return their bottles to any retailer who sells any of the brands of water in the pool. Redistribution is then back through the supply chain. A deposit system will exist between each of the players in the pool.

There are a total of 1.72 billion bottles in circulation in the GDB pool, the majority of these are a standard glass bottle, the "Perlenflasche". The design of these bottles has remained the same since the 1960's and is considered to be an example of a 'classic' consumer item.

There are also 300 million PET bottles in the system. The GDB estimate that the glass bottles are reused 40 to 50 times, whilst the PET bottles 15 to 25 times. The bottles are also transported in standard crates, of which there are about 168 million (GDB, 2003).

A pool system of this type has the following advantages:
- The costs of running the pools and investing in new packaging are shared between a number of companies.
- The co-operation of a number of companies alleviates any market disadvantage that a company may suffer if it introduced its own reusable packaging.
- Return rates are increased as the consumer can return the bottles back to any retailer who stocks one of the pool's brands.

As a result, pool systems are more attractive to small to medium sized companies.

4.2.3 United Kingdom

Annually the UK produces in the region of 9.2 million tonnes of waste packaging per year, this equates to approximately 156 kg/capita/annum. A breakdown of packaging flowing into the UK waste stream is show in Table 2.

Table 2 Breakdown of Packaging flowing into the UK Waste Stream in 2000 (SEPA, 2002)

Material	Tonnage
Paper	3,855,000
Glass	2,155,000
Plastic	1,600,000
Steel	750,000
Wood	670,000
Aluminium	110,000
Other	40,000
Total	**9,180,000**

For some product types, such as milk, reuse systems were once commonplace in the UK. Between 1975 and 1998 the doorstep milk delivery market dropped from 75% to 25%. In 10 years, from 1977 to 1987, reusable soft drink containers declined from 60% to 3% of the UK market (Golding, 1998).

Until the end of the 1960s the bulk of packaged beer was sold in returnable glass bottles. In 1969, for example, when 29% of all beer was packaged, 93% of this comprised of returnable bottles (EIU Ltd, 1995). However, the growth in off-trade sales, and especially the rise in sales of alcohol in supermarkets, provided a catalyst for the introduction of non-returnable packaging. The balance began to shift quickly with the surge in off-trade beer sales and in 1980 - for the first time - non-returnable packaging overtook returnable packaging. By 1999, returnable bottles made up just 4% of the packaged beers sales and were almost entirely restricted to on-trade sales (EIU Ltd 2000a).

As with the rest of Europe, the UK retail industry is now dominated by large supermarkets with the top five retailers accounting for almost 50% of the grocery market. Another key factor that has driven the food retail industry over the last 20 years has been the development of retailers' own brands. Own brand products now account for 36% of the total sales in multiple supermarket chains. For some companies, such as Marks & Spencer, it accounts for almost 100% of their sales. This means that the retailer, rather than the packer filler, is the brand owner and automatically the specifier of the supplier, the products, its packaging and design, and sometimes even its production process.

4.2.4 Policy and Legislation

The EC Packaging Directive is transposed into UK law by the Producer Responsibility Obligations (Packaging Waste) Regulations 1997. The Regulations implement the recovery and recycling targets set out in the EC Directive. Responsibility for meeting these targets is shared between each sector in the retail chain (Table 3).

Table 3 Allocation of Responsibility under UK Packaging Regulations

Sector	Share of Responsibility (percentage of overall recovery or recycling target)
Raw materials manufacturer	6
Converting operation	9
Packer/filler	37
Retailer (Seller)	48

Only those companies with a turnover of more than £2 million a year and /or handle more than 50 tonnes of packaging a year have to comply. Since introduction of the regulations the targets have been as follows:

1998 - 38% recovery, 7% recycling
1999 - 43% recovery, 10% recycling
2000 - 45% recovery, 13% recycling
2001 - 56% recovery, 18% recycling
2002 - 59% recovery, 19% recycling

The UK narrowly failed to meet the Directives recovery target of at least 50% but did meet the recycling target and material-specific recycling targets for all materials including plastic. The UK achieved 48% recovery with a shortfall against the 50% target of just 195,000 tonnes.

In line with the Directive's requirements that recovery and recycling targets should be reviewed every five years the Commission published proposals in 2001 for the targets up to 2006. The proposals would increase overall recycling target to 55% and the overall recovery target to 60%. These proposals are still to be reviewed at European level.

Companies have to demonstrate their compliance by obtaining Packaging Waste Recovery Notes (PRNs) from accredited UK reprocessors. The reprocesses will sell their PRNS to obliged companies or their representatives. Their value, and the cost to industry, is dependent on supply and demand, which is largely dictated by the difference between target (overall and for individual materials) and existing packaging recycling/recovery activity. (Select Committee, 2002)

Reuse is not specifically mentioned in the regulations, but after its first rotation, packaging will not attract further obligation. The regulations also do not set any targets for recovery of the different types of packaging i.e. primary, secondary or tertiary. Unlike other EU countries, such as Germany, the regulations do not place any explicit responsibility on industry for collection of packaging from the domestic waste stream.

The result has been that most of the major retailers meet a substantial amount of their obligation through recovering transit packaging from their stores back through their distribution centres for baling and onward distribution to recycling plants. Other initiatives have also been taken to minimise the transit packaging that reaches the stores in the first place. With non-food products, transit packaging is removed and stores receive merchandise "ready for display". In food distribution, re-useable plastic trays have become standard for produce and perishable products (Fernie; 2001). By contrast, smaller retailers do not enjoy the same benefits of transit packaging recovery. It is sometimes impracticable to recover transit packaging from small stores. A further problem is that convenience stores stock more "packaged" goods than the major retailer and thus have less of an opportunity to use plastic trays in their business (Fernie & Hart; 2001).

There are also other complementary legislation and policy targets that will have a direct or indirect effect on packaging waste.

The European Landfill Directive (Council Directive 1999/31/EC) requires a progressive reduction in the landfilling of Biodegradable Municipal Waste (BMW). This will require the UK to reduce the amount of BMW going to landfill to 35% of 1995 levels by 2016 or 2020.

A reduction in the growth of household waste is recognised as a key part of meeting UK government and EU landfill reduction targets. The National Waste Strategy for Scotland has set a target of zero growth in municipal waste by 2010 (SEPA, 2003). A number of measures have been identified for tackling waste at source, including the promotion of reuse and joint working with local retailers and manufacturers to promote responsible product design. In addition, the National Waste Strategy has also identified targets for increasing recycling and composting of municipal waste to 25 % of arisings by 2006.

A report by the Cabinet Strategy Unit report, '*Waste not, Want not'* has identified four key investment measures to bring about a 1% per annum reduction in the rate of growth in household waste (Cabinet Strategy Unit, 2002).

1. An extension of home composting participation.
2. Greater use of re-usable nappies
3. A retailer initiative focussed on the top 5 supermarkets.
4. Increased R&D on waste minimisation through better product development and design.

The Strategy has also set a target recycling or composting 35% of household waste by 2010, rising to 45% by 2020.

The Landfill Tax was introduced in 1996 as a fiscal measure to divert waste from landfill. The current level of landfill tax is £14 per tonne for active waste and £2 per tonne for inert waste. This will rise to £15 in 2004-5, and then increase by £3 per annum to a medium to long-term rate of £35 per tonne (HM Treasury; 2003).

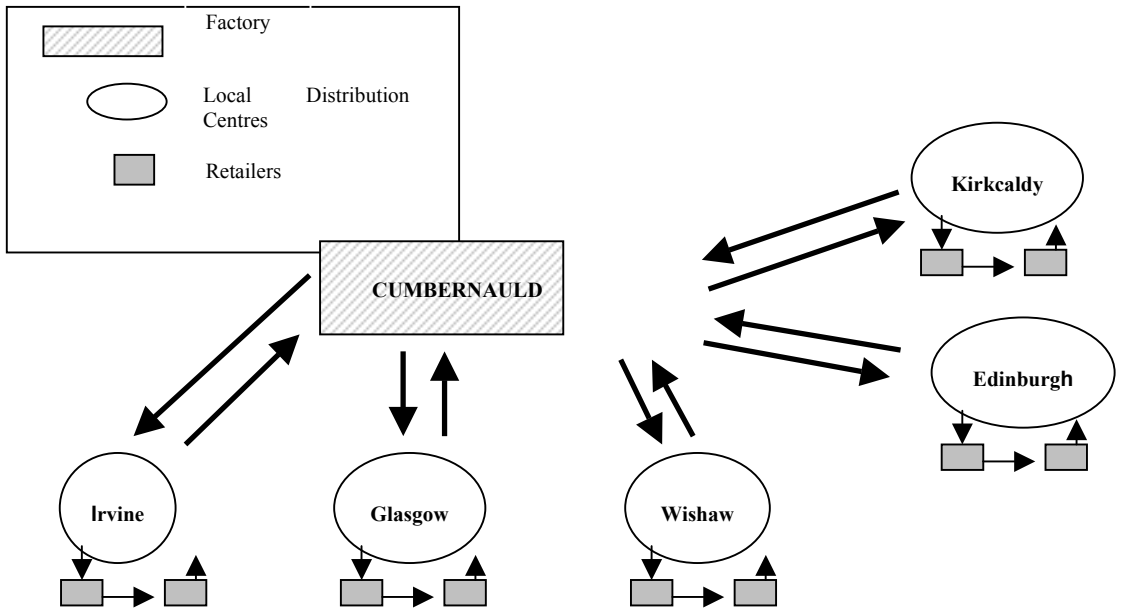
4.2.5 Case Study - Barrs Irn Bru

One of the few remaining examples of primary packaging reuse in the UK is the use of a returnable glass bottle in the Glasgow area for IRN-BRU. The drink is manufactured by AG Barrs in Glasgow and is the leading brand in the flavoured carbonated drinks market with a market share of 10% as well as the top carbonated selling drink in Scotland. The drink is mainly sold in cans and PET bottles. However, the traditional method of sale, a returnable 750ml glass bottle and crate system, is still used for sale to local retailers. Two reasons for the maintenance of this system are given by the manufacturer:

1. Customers have an intrinsic preference for the 'better taste' of IRN-BRU when it is supplied in a glass bottle.
2. High bottle return rates ensure that the system is economically viable.

The system is a good example of a **'closed-loop'** reuse system. A schematic of the reuse system is shown in Figure 2. Return from the shop is via one of six distribution centres and then back to the Barrs factory for cleaning and refilling. A 20 pence deposit system results in an impressive return rate of approximately 85%. The returnable bottles move to and from shops in reusable plastic crates. At the manufacturing plant in Glasgow they go through a series of several washes at various temperatures. A new returnable glass bottle line, installed in 1996, has a capacity of 24,000 bottles / hour and incorporates the latest energy saving technology. The bottles typically undergo 10 rotations. Unfortunately the popularity of the 750 ml bottle is slowly declining. The increase of supermarket shopping has seen a corresponding increase in demand for 2 litre and 500 ml plastic bottles favoured by the large multiple retailers (Golding, 1998). Currently Barrs sell around 4 million 750 ml glass bottles of IRN-BRU a year.

Figure 2 – Closed Loop System for Barrs Soft Drinks 750ml bottle



4.3 Canada

Canada is divided up into ten provinces which run relatively autonomous governments much like state governments. Each province has the legal responsibility for management of waste in their provinces and can set legislation accordingly. Every province in Canada has some form of policy or regulation with regard to beverage container waste management. While a variety of approaches are employed, a common feature is the emphasis on 'producer responsibility'. This is referred to by the federal government as *Extended Producer Responsibility* or S*tewardship* (Environment Canada; 2000).

It is interesting to compare the success and failure of the varying approaches across Canada to encouraging reuse of primary packaging. This report will compare three of Canada's provinces and the detailed reuse system employed nationwide by the beer industry.

4.3.1 The Canadian Beer Industry

The Canadian beer industry maintains a highly effective closed-loop return system for its refillable bottles. The beer industry in Canada generates more than $4.4 billion dollars a year with over 17,000,000 hectolitres being sold in Canada each year (Brewers Association of Canada; 2001). In comparison to the UK, there are fewer retail channels for alcohol. Most provinces operate government owned retail liquor stores that sell spirits, wine and beer. In some provinces, certain wine and beer sales are allowed outside the government channel. However, such sales are strictly limited. Brewers in Canada act as producers, distributors and brand-owners.

Standardisation of primary packaging is an important factor in ensuring the success of the system. Over 70% of beer in Canada is sold in glass bottles, the majority of which are Industry Standard Bottles (ISB) (The Brewers Association of Canada; 2001). Although the industry moved voluntarily to this system in 1992 (Environment Canada; 2003) it supported regulations in each province which place mandatory deposits on beer bottles.

The collection mechanism will vary from province to province. Return will either be to a retail location or recycling depot (see next section). In some instances, the brewers will collect the bottles from the retail location, or distribution centre, upon delivery of stock. In some states the liquor store organisation will manage the return of retail, distribution and return system for brewers (see example on 'The Beer Store'). In some cases the customer will only receive half of the deposit, the remaining money being used to fund the system. Non-refillable imported bottles, which account for 7% of sales (Environment Canada; 2003), or cans will also be covered by provincial deposit regulations and will be taken back via the same systems and recycled.

The Brewers Association of Canada represents all brewing companies in Canada and supports the reuse system in Canada. According to the Brewers Association, the overall return rates of beer bottles is an impressive 97.1%, return rates in some provinces are as high as 99.8% (The Brewers Association of Canada; 2001). The ISB typically undergo 15 to 20 rotations.

Consumers are now very familiar with the ISB, known as 'long-necks', and this has apparently influenced the industry's continued support of the system (ILSR, 2002).

4.3.2 The Beer Store - Ontario

The Beer Store is owned by Ontario's three biggest brewers – Labbatt, Molson and Sleeman. They provide retail and distribution services to 25 Ontario brewers, and 35 Canadian and foreign brewers. They own a chain of 436 'Beer Stores' and also supply 600 government owned liquor stores and 17,000 licensed bars, restaurants and hotels. The system is open to any brewer wishing to use it, according to the Beer Store "*no brewer is refused access, nor is any legally-approved brand refused entry"*. The system operates with common rules and a service fee mechanism based on volume.
The Beer Store system achieves a return rate of 99% on its bottles which are returned via its stores. Customers can also return cans, cartons and plastic shrink-wrap to the stores. Return of bottles back to brewers is done via Beer Store's distribution centres. Brewers are allowed to use non-ISB, however they have to pay an extra handling fee. According to The Beer Store, they divert over 500,000 tonnes of waste from landfill sites each year, this saves Ontario Municipalities over $60 million (£25 million)
(all information The Beer Store; 2003).

4.3.3 Non-Liquor Containers

Nova Scotia lies on the east coast of Canada and has a population of about 1 million. In 1995 Nova Scotia released its *Solid Waste-Resource Management Strategy* which set out a plan to divert 50% of the waste going to landfill by 2000 (Nova Scotia Department of the Environment and Labour, 1995). Resulting legislation has imposed a deposit system on all beverage containers (except those containing milk or milk products) as follows:

Non Alcoholic	**Alcoholic**	
	≤ 500 ml	> 500 ml
10 cent deposit	10 cent deposit	20 cent deposit
5 cent return	5 cent return	10 cent return

Deposits applied to reusable bottles are completely refundable.

A not-for-profit organisation, the Resource Recovery Fund Board (RRFB), was established to administer the programme.

Consumers can return beverage containers, and other recyclables such as paper and card, to any one the 88 'Enviro-Depots' throughout the province. The depots are privately run businesses that are typically run by the owners of other small businesses, such as petrol stations, scrap yards etc.

The deposit system operates as follows:

- **Distributors:** required to submit monthly reports of sales to RRFB and pay deposits based on these sales.
- **Retailers:** responsible for collecting deposits from customers and remitting these to the distributor.
- **Enviro-Depots:** Refund customers half the deposit, who in turn receive this, plus a handling charge of 3 cents per unit, from the RRFB.

Costs of the deposit system is distributed as follows:

- **RRFB:** Very little of the excess deposit (2 cents per unit) is required to administer the system and the revenue generated from unredeemed deposits more than offsets the systems costs (Environment Canada; 2003). The system made a surplus in 2002 of over $9 million (£3.75 million) and this has been channelled into the provinces collection programs and other landfill diversion programs. This is equivalent to a net cost per container of $0.022 (£0.01) and net surplus per container of $0.003.
- **Distributors:** Beverage distributors incur costs of producing monthly reports to the RRFB. It is assumed that this is passed onto the producers.
- **Retailers:** Will incur administration costs in returning deposit back to distributors
- **Customers:** Apparently, there is no evidence that the shelf price of beverages sold in Nova Scotia has been affected by the costs of the programme (Environment Canada; 2003). The cost to the taxpayer is reduced through subsidising kerbside collections and reduction in landfill costs.

Although the system has facilitated a return rate of 83%, with the billionth bottle being collected in 2001, its success in encouraging reuse seems to have been limited (RRFB; 2002). Besides beer bottles, most of the beverage containers are designed as non-returnable packaging and are destined for recycling after collection by the Enviro-Depots. The Canadian market share for non-alcoholic drinks in refillable bottles declined from 47% in 1985 to less than 5% in 1997 (ILSR; 2002).

Prince Edward Island

Prince Edward Island lies off the east coast of Canada and has a population of about 140,000. The province has taken a unique approach in Canada by bringing into force regulations that require all flavoured carbonated beverages and beer to be sold in refillable glass containers. These regulations were originally enacted in the late 1970s and early 1980s in response to concerns about litter created by drinks cans.

The regulations have also put in place a deposit system. However, unlike Nova Scotia, the producer is responsible for management of the system. All retailers are obliged to accept return bottles from the customer and refund a deposit. Stores may keep a minimum portion of the deposit to compensate for handling and storage, but in reality most return the full amount. The producers may keep unredeemed deposits to compensate them for running the system.

The system appears to work well with an overall return rate of 98% (Environment Canada; 2003). It may also have benefits for the local economy as it distorts the market in

favour of local producers. However, there has been aggressive lobbying from major drinks manufacturers, such as Coca-Cola, and some residents have questioned the need for the ban because of the success of recycling programs in other provinces (Institute of Self Reliance; 2002).

Manitoba

Manitoba has regulations to encourage the use of refillable containers and has adopted an interesting approach to facilitating "producer responsibility". Manitoba implemented its 'Multi Material System' in 1995 with the creation of the Manitoba Product Stewardship Corporation (MPSC) (Environment Canada; 2003). The MPSC has the power to collect a 2 cent levy on all non-milk, non-deposit beverage containers from the brand-owner, or the first importer into the province. This levy is then used to fund 80% of the cost of municipal kerb-side collection recycling programmes.

The 2 cent levy is passed onto the consumer and shown separately on the their till receipts. MMSC claim that the system does not cost the consumer any more than the deposit system in other provinces. In addition, the system pays for the collection of other recyclables, such as paper, card, cans, and plastics (MPSC; 2002).

At present the system achieves a diversion rate of 50% for the materials it collects - equivalent to almost 44,000 tonnes. The MPSC claims that a beverage container deposit system would result in the recycling of only 14,500 tonnes (MSPC; 2002).

However, the Container Recycling Institute (CRI) points out that the system only results in a return rate of beverage containers of 35% (Institute of Self Reliance; 2002). The system also ignores the potential Life Cycle benefits of reuse rather than recycling.

4.4 Conclusions

A review of the different reuse systems and regulatory approaches reviewed in this study has identified a number of optimum conditions where reuse system operate most effectively.

Logistics

- Reuse schemes seem to work most efficiently where there are a limited number of retail channels and short supply chains. They work particularly well for local or regional products.
- Pools systems have benefits for small to medium size business wishing to implement reuse.
- Closed loop system can work well in situations where the producer is situated close to the points of retail, thus reducing transportation distance.

Marketing/Customer Behaviour

- The use of reusable packaging is viewed by the consumer to add value to the product and encourages loyalty to the product. Reuse systems operate most effectively when there is consumer support and recognition for the use of reusable packaging.
- Regional or local products attract higher return rates.

Legislation

- The schemes which receive the broadest industry support have been set up 'voluntarily' i.e. without the influence of strict regulation. Bans of certain types of packaging invoke strong opposition from packaging and retail industries.
- Maximum return rates are achieved where a deposit system exists.

Packaging

3. The use of standardised packaging has the potential to reduce costs of a reuse system for retailers, or others responsible for collection, and producers.
4. Glass and PET are the most common materials used in reusable packaging.

5 Pilot Scheme

5.1 Introduction

At the outset of the project it was envisaged that the 'pilot project' would take the form of an actual demonstration of a new reuse scheme in the Edinburgh area. This would have been based around one of the following:

1. A new packaging design that could be piloted by a major retailer.
2. Radio Frequency tagging to measure the number of times packaging is reused.
3. Education and Awareness raising activities amongst consumers.
4. Local Production and Distribution.

Current reluctance amongst the retail sector has meant the project team struggled to establish a project in Option (1). The lack of existing high volume reuse systems in the UK at present means that the benefits from (2), (3) and (4) are limited.

From the research done to date by the project team it is obvious that a paradigm shift would be required in existing attitudes/behaviour before reuse schemes can be initiated on a large scale in the UK. Through the Forum a number of obstacles to widespread reuse have been identified by those in the retail supply chain. The reluctance of packer/fillers and retailers to introduce widespread reuse schemes is due to a number of reasons identified through discussion with stakeholders:

- The logistical complexities of organising a multi-directional chain.
- The relatively cheap cost of virgin packaging.
- Health & Safety obligations.
- Existing UK Packaging regulations.
- Consumer behaviour.

However, from the categorisation study it is evident that large reuse schemes operate successfully in both Europe and North America. Could such a scheme become common place in the UK? Are the above-identified obstacles insurmountable?

The pilot study consists of a desk-based study that examined the feasibility of increasing the utilisation of reusable packaging in the UK. This identified the key areas for further development and serves as a basis for future funding proposals that may be bought forward by the project partners.

5.2 Scenario Development and Evaluation

The approach of the project team has been to formulate a set of four future scenarios for reuse schemes in the UK. These have been developed based on the optimum conditions identified in the categorisation study. The four scenarios represent increasing levels of complexity, Scenario 1 being considered the simplest to implement whilst diverting the least amount of waste from landfill, through to Scenario 4 which will be the most complex but results in diverting a greater amount of waste. The four scenarios are as follows:

Scenario 1 Local Brewer Closed Loop System
Scenario 2 Soft Drinks Closed Loop System
Scenario 3 Large Brewer Off-trade Sales
Scenario 4 Mineral Water Pool System

The products used in the Scenarios are hypothetical. However, they have been based on actual market statistics and data, and mirror the characteristics of many existing products. As per the EEP joint funding application, Scenarios 1 and 4 are set in a Edinburgh/Scottish context.

The approach to evaluation of the different Scenarios has been two-fold. Firstly, the scenarios have each been assessed against a set of criteria as follows.

6 Scenario Evaluation

6.1 Reduction in Solid Waste

In terms of waste policy, the primary motivating factor for introducting returnable packaging will be the potential reduction in the amount of solid waste that has to be dealt with further down the waste hierarchy. For each case study, estimates have been made of the total savings in solid waste as a result of the introduction of the scheme. Returnable packaging will weigh more than non-returnable as it will have to withstand a number of rotations. Weights of packaging in this report have been derived from observations by the project team of existing packaging. However, it should be noted that the weight on packaging will depend on other factors besides the intended packaging system e.g. bottles may be heavier to satisfy branding and marketing functions. Calculations of solid waste produced for each scenario are shown in Appendix 1.

6.2 Overall Environmental Benefit/Disbenefit

It is vital that environmental benefits arising from waste reduction are not outweighed by the impact of other activities in a reuse system. The main activities of concern are:

- Transport of full and empty packaging: heavier packaging decrease fuel efficiency and more complex supply chains may increase overall vehicle mileage. This increases both fossil fuel consumption and traffic levels in already congested urban areas.
- Washing and cleaning of packaging: these processes require both energy and water.
- Use of raw materials in packaging manufacture: packing for reuse takes more primary resources per unit of packaging produced, as the packaging must withstand a given number of reuses.

A 'cradle-to-grave' approach is required to assess the environmental impact of a new reuse system against the existing disposal route through the household waste stream.

Life Cycle Analysis (LCA) is a standardised methodology, IS14040, allowing practitioners to trace back to the environment all of the resources consumed and all of the emissions to air, water and land at each stage in the manufacture, use and disposal of products. These exchanges with the environment are then related to potential environmental impacts such as global warming, resource depletion and ozone depletion. An analysis that includes all the aspects detailed in IS14040: goal and scope; an inventory of all inputs and outputs; all life-cycle stages; an impact assessment; interpretation analysis; detailed sensitivity analysis; and peer review is called a 'full LCA'. The complexity of a full LCA requires that it is extremely resource intensive and time consuming. In addition, analysis would have to be effectively carried out for both the status quo and the new system. As such, a full LCA analysis for each scenario is not possible in this project. Therefore, this study will apply Life Cycle Concepts (LCC) in a qualitative manner to identify the principal impacts of concern in each scenario.

For each scenario the principal environmental impacts for each of the major activities in the supply chain have been identified. The degree of increase or decrease for each of these impacts has then been estimated. Table 4 below provides a model of the qualitative assessment used for each scenario.

At some point in a reuse system there will be an environmental 'break-even' point, whereby the number of rotations decreases and/or the transportation distance increases to point where the overall environmental impact is the same as conventional disposal routes.

A number of LCAs have already been carried out for reuse systems. These have been performed by either:

- governments to inform waste policy and legislation decisions (as in studies done by the Danish and Germany environment regulators); or
- packaging and food production companies; or
- independent environmental bodies.

Where relevant the results of these LCAs will be referred to in the assessment of the scenarios. However, even though they may study similar reuse systems, the results of these LCAs cannot be directly transferred scenarios in this report. There are a large number of variables in each reuse system which could alter its environmental impact, such as distribution distances, modes of transport, return rates, a region's waste management infrastructure, electricity production (fossil or renewable), and availability of raw materials for bottle manufacturers.

Table 4 The Model Qualitative Impact Assessment for Each Scenario

	Increasing Impact ←				No Change	Decreasing Impact →			
	100% Change	75% change	50% change	25% change	0 – 25%	25% Change	50% change	75% change	100% change
Manufacture of Bottles									
Energy Demand									
Raw Materials Usage									
Distribution									
Vehicle Mileage									
Fuel Usage									
Return of Bottles									
Vehicle Mileage									
Fuel Usage									
Washing and Cleaning									
Energy Demand									
Water Demand									
Waste Management									
Waste Arisings									

A study has been carried out on behalf of the Danish Environmental Protection Agency (1998) which compares the environmental impacts for different packaging systems for carbonated drinks. The following systems were compared:

- Refillable vs. disposable glass bottles
- Refillable glass vs aluminium
- Aluminium vs Steel
- Refillable vs. disposable PET bottles.

Although this study provides useful guidance it has been developed for specific situations and their results are not directly transferable.

For example the Danish study has been prepared for the following conditions that would not directly transfer to the UK:

- A very high recycling rate of non-returnable packaging; and
- Transport distances relating to the Danish supply chain; and
- A different electricity generation portfolio to the UK.

6.2.1 Required Logistical System

For each scenario the required system for distributing/returning the packaging will be detailed along with discussion on the degree of adaptation that might be required to be made to existing supply chains.

6.2.2 Consumer Acceptance and Behaviour

The effective operation of a reuse system relies upon consumers returning packaging. In addition, the use of reusable packaging may affect the appearance and subsequent marketing of products. For each scenario an assessment of consumer behaviour has been made using existing research and experience. This is accompanied by recommendations for public awareness raising and marketing strategies.

The economic implications will be considered separately for each of the major players in the supply chain.

6.2.3 Economic implications

The evaluation of each scenario takes account of the financial implications for:

- Packaging Producers;
- Packers / Fillers;
- Retailers

6.3 4 Reuse Scenarios

6.3.1 Scenario 1 Local Brewer Closed Loop System

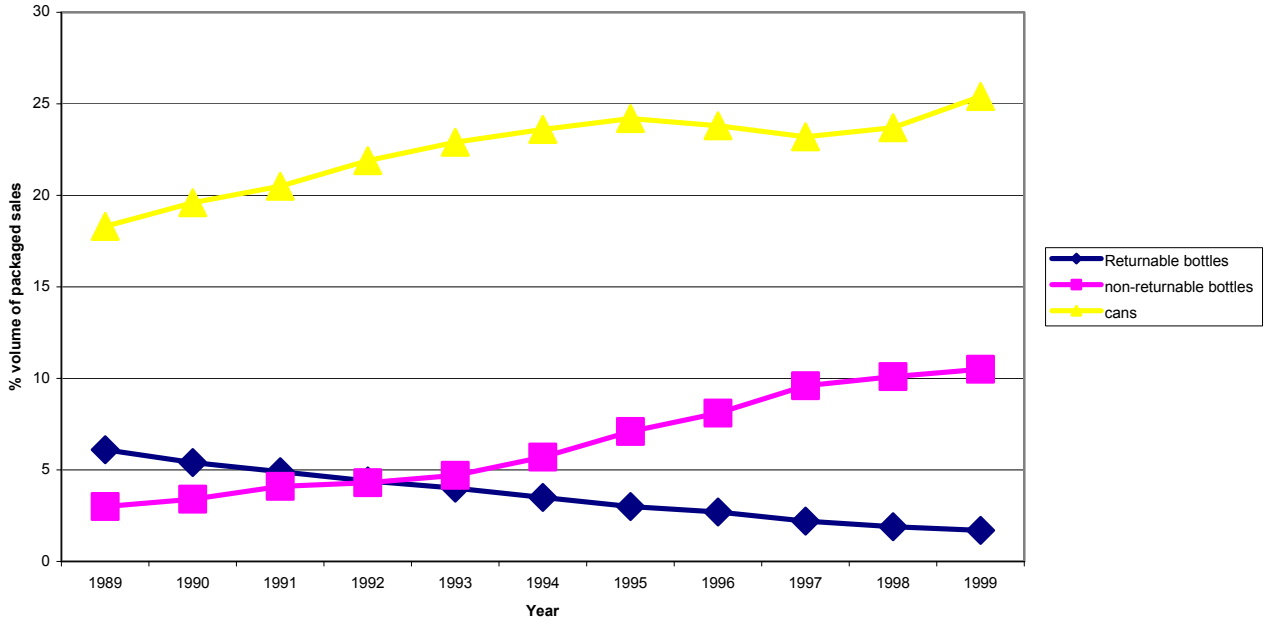
Background: About 36 million barrels of beer are brewed in the UK each year with a total market value of around £16 billion. Although there is a very large number of brands in the UK beer market, the majority of beer is brewed by four large companies: Scottish

& Newcastle; Carlsberg-Tetley; Corrs; and Interbrew. Between them they about brew about 85% of the market volume (EIU, 2000). There are also approximately 50 regional and local brewers and a large number of micro-brewers. Regional brewers are defined as those producing between 30 million - 200 million litres per annum. The Edinburgh area has two independent regional brewers: Caledonian and Belhaven. There are also breweries owned by Scottish Newcastle and Carlsberg-Tetley.

The Categorisation Study identified that short supply chains, limited numbers of retail channels, and local identification with a product, as all being conditions where reuse schemes work best. Therefore this scenario will use the example of a regional brewer utilising a reusable bottle scheme through their own estate of pubs.

Although the scenario is set out for a hypothetical brewer its characteristics are based on the type of brewer found in the Edinburgh area. Returnable bottles were once very common in pubs, working well where outlets purchased most of their supplies from one or two sources, and where collection and sorting of bottles was a fairly straightforward task. However, the subsequent growth in the off-trade market, notably the supermarket chains, provided the catalyst for a shift towards non-returnable packaging in an array of cans, PET bottles and glass bottles. Figure 3 shows the decline in the use of returnable packaging over the 1990s.Over the same period the overall sale of packaged beer rose from 27% – 37% (Retail Intelligence; 2000a)

Figure 3: Share of Packaged Beers Sales by Packaging Type (adapted from Retail Intelligence; 2000a)



Even in pubs, the role of returnable bottles is very much reduced. A few reuse schemes remain such as Newcastle Breweries' 'Newcastle Brown Ale'.

Packaging & Product: Pubs, or 'on-trade', sales account for about 70% of the beer volume sold in the UK. Although the majority of beer sold in pubs is draught beer, approximately 7% is packaged and this accounts for about 20% of the total packaged market (EIU; 1995). The off-trade market is dominated by cans. However on-trade packaged beer is sold in glass bottles which conveys an image of quality much more successfully than other types of packaging. Glass is also very versatile in offering huge varieties of shapes and designs, enabling one brand visually to differentiate itself from others. As such, glass bottles are ideally suited for premium packaged products with a strong identity. This is the typical brand characteristic of beer produced by smaller breweries.

The scenario will assume that the brewery will utilise refillable glass bottles for its on-trade packaged beer. Assuming the brewery has an output of 12,000,000 litres / year, 8,200,000 of which (70%) it sells through its estate of 150 pubs, around 575,000 / year (7% of the total on-trade) will be sold in 500ml glass bottles. The brewery produces both ale and lager. This equates to 1.1 million bottles of beer per year.

Retail Outlets: 150 pubs which make up the brewery's estate. The assumption made is that all of these are within a radius of about 75 miles of the brewery.

6.3.2 Scenario 2 Soft Drinks Closed Loop System

Background: This scenario expands on the 'IRN-BRU' case study. The aim was to examine the feasibility of operating a reuse system through the major supermarkets. The drinks market is dominated by two suppliers – Coca-Cola and Britvic – who supply a large number of brands. The remainder of the market is made of a number of smaller companies who each have no more than 3% of the market value (Retail Intelligence; 2000). Although most of brands produced by these companies are marketed nationwide some do have strong regional markets. This was one of the optimum characteristics identified in the Categorisation Study. The manufacturer is assumed to be located in the central belt of Scotland.

Packaging and Product: Three different brands will be packaged in three sizes of bottle manufactured from PET: 500ml, 1 litre, and 2 litre. PET is usually favoured over glass by retailers and it is significantly lighter than glass and impact resistant. It also has the advantages of being clear (unlike HDPE), resistant to light degradation and can be used for still or carbonated drinks. All three brands will be flavoured carbonates. These types of drinks account for 30% of the overall carbonate market of 5,070 million litres (Retail Intelligence, 2000b). In this scenario, Brand 1 is assumed to be the market leader in flavoured carbonates with 10% of the market share; equivalent to 150 million litre. Brand 2 has a 2% share with 30 million litres. Brand 3 a 3% share with 45 million litres. All Brands are sold nationwide but Brand 1 has a strong market in Scotland. Data has been obtained for the total market share (in terms of volume) of 500ml, 1litre, 1.5 litre and 2 litre PET bottles. This has been used to estimate the sales volume in the different sizes of bottle for each brand and thus the number of bottles sold (Table 5).

Table 5: Sales of Brands 1, 2 & 3 by packaging type

	Number of Units Sold			
	2 litre	**1.5 litre**	**1**	**0.5**
Brand 1	30,195	24,400	18,300	91,500
Brand 2	5,940	4,800	3,600	18,000
Brand 3	8,910	7,200	5,400	27,000

Retail Outlets: All the brands will be sold through both large and small retailers. However, the scenario will focus on return of bottles back through the major grocery retailers.

6.3.3 Scenario 3 Large Brewer Off-trade Sales

Background: This builds on the Scenario 1 by examining the impact of a large brewer implementing a reuse system in the off-trade market. Two large brewers, Scottish & Newcastle and Carlsberg-Tetley, have breweries in Edinburgh. In this scenario, it is assumed that the brewer produces around 1826 million litres a year and has a market share in the off-trade of about 25%.

Packaging & Products: The reuse system will encompass the brewer's two best selling brands, which between them have a market share of about 3% (Brand 1) and 5% (Brand 2) of the off trade market. They are both 'premium' products so the packaging is 500ml glass bottles instead of PET. From existing market information it is assumed that glass bottles will account for 12% of the volume of sales (the remaining being in cans).

Retail Outlets: This scenario will focus on the issues of sales through smaller stores. The bottles will be sold through 'multiple specialists' ('off-licenses'). These outlets will be throughout the UK.

6.3.4 Scenario 4 Mineral Water Pool System

Background: The total market for mineral water is 1,3000 million litres per year. Despite rationalisation of the past decade there are still a large number of brands with very little product differentiation. It is not uncommon to see 25 – 30 different brands on sale in large supermarkets. As a result the market is characterised by intense competition. A large proportion of UK brands are bottled in Scotland. Although the two market leaders originate in Scotland, Highland Spring (4.8% of the market) and Strathmore (5.4%), there are also a number of smaller bottlers. There are over 35 registered sources of bottled water in Scotland (Zenith International, 2003).

The aim of this scenario is to examine the possibility of the all the Scottish companies forming a pool system of standardised bottles. The return system would only operate for Scottish retailers and so this may cause problems with 'rogue' bottles from south of the border. However, it would:

- Result in shorter supply chains.
- Promote the 'Scottish Identity' of the brands.

- Fit local policy. For example, the Edinburgh Sustainable Development Partnership' are currently developing 'Edinburgh Standards' for waste management. These standards would be part of an aspirational framework for developing sustainable development in Scotland with businesses and communities being encouraged to sign up to the Standards.

It is assumed the total market share of Scottish bottled water will be 23%.

Packaging & Product: The pool will be for still water, bottled in 2 litre and 0.5 PET litre bottles. The total volume sold in 2 litre bottles will 9.3 million litres/year, and 3.5 million / year in 0.5 litre bottles (Appendix 1)

Retail Outlets: Both large supermarkets and smaller retailers.

6.4 Evaluation of Scenario 1

6.4.1 Reduction in Solid Waste

Table 6 outlines the assumptions made in calculating the amount of waste diverted.

Table 6: Assumptions made in calculating reduction in solid waste

Parameter	Value
Weight of refillable bottle	0.480 kg
Weight of non-returnable bottle	0.220 kg
Return Rate	90%
Number of bottles required per year	1.1 million
Number of Rotations	15

The reuse system will result in 24 tonnes/year of waste from the pubs (for recycling or disposal in the commercial waste stream) and 29 tonnes/year of bottles will have completed 15 rotations. It is assumed the brewery would recycle the latter. The non-returnable system would result in 251 tonnes / year arising from consumers. This equates to a saving of 198 tonnes/year.

If all small breweries in Scotland adopted a returnable system the total waste saving is estimated at 7000 tonnes/year. The total commercial waste collected by Scottish Local Authorities is about 500,000 tonnes/year (SEPA; 2003). Total waste going to landfill in Scotland is about 10 million tonnes. Compared to these figures the potential waste reduction is small. However, the following should be considered:

- It would constitute a large drop in the amount of waste produced per pub; and
- The total glass recycled in Scotland in 1999 was 112,296 tonnes and
- The total glass collected by Scottish local authorities for recycling was 32,266 tonnes.

6.4.2 Scenario 1 Overall Environmental Benefit/Disbenefit

	Increasing Impact ←				No Change	Decreasing Impact →			
Manufacture of Bottles									
Energy Demand								X	
Raw Materials Usage								X	
Distribution									
Vehicle Mileage					X				
Fuel Usage				X					
Return of Bottles									
Vehicle Mileage					X				
Fuel Usage				X					
Washing and Cleaning									
Energy Demand				X					
Water Demand				X					
Waste Management									
Waste Arisings								X	

Manufacture of Bottles:

- Amount of raw material is reduced by up to 78%.
- The refillable glass bottles will require more glass per bottle. However, the Danish study (Danish Environmental Protection Agency; 1998a) reported that the additional energy required to produce heavier bottles is minimal.

Distribution and Return of Bottles

- Where possible delivery lorries should be able to collect bottles.
- Bottles are significantly heavier and therefore there will be an increase in fuel usage. However, the distances travelled are expected to be relatively short with all the pubs being within 75 miles of the brewery.

Washing and Cleaning

- The washing and cleaning process will require energy and water. However, the energy demand may only be 15% of that required to produce a new bottle (Danish Environmental Protection Agency; 1998).

Waste Management

- Waste arisings are reduced by 78 %.

The Danish Environmental Protection Agency (1998) study found the energy demand, potential global warming, acidification, nitrification and photochemical ozone formation, were all significantly lower for a refillable glass bottle than for non-returnable bottles. This is due to the fact that the recycling of glass demands more energy than washing and filling of refillable bottles.

The European Commission commissioned a study to evaluate the cost/benefit analysis for the reuse and recycling of different packaging materials (RDC-Environment & PIRA International; 2003). This analysis applies monetary values to environmental impacts and therefore includes an LCA of various packaging systems. A comparison of refillable vs. non-returnable glass bottles found that the 'break-even distance' for glass bottles reused 20 times was about 1250 miles. This was for an assumed recycling rate of non-returnables of 42%, the current average British rate being about 35%.

6.4.3 Consumer Acceptance and Behaviour

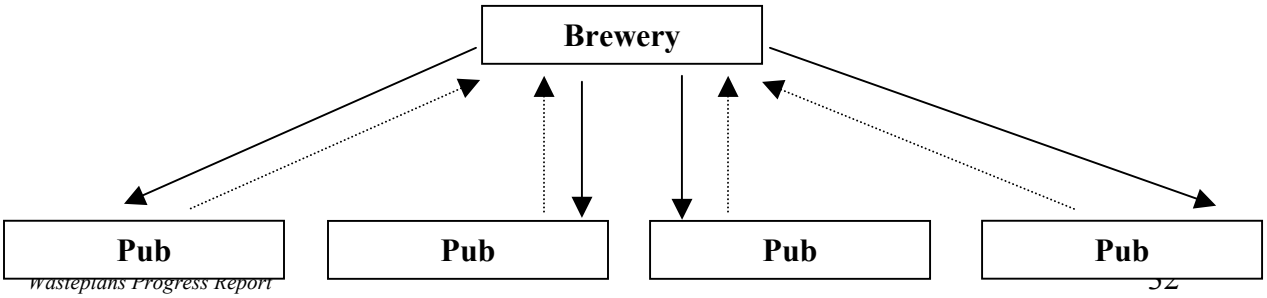
Returning Bottles

- The public attitude to waste is almost negated in this scenario as the consumer is unlikely to be aware that by leaving their bottle in the bar will facilitate its reuse. Return rates are likely to be high. In similar systems in Canada a return rate of over 99% is achieved.

Appearance and Marketing Issues

- As this is a closed loop system (i.e. it does share standard bottles with other producers) the packaging can still reflect the uniqueness of the brand.
- After a number of reuses the bottle is likely to have a 'scratched' or 'scuffed appearance'. In the minds of some consumers this may detract from the quality of the beer. Consumers tend to 'drink with their eyes' and there have been several studies which prove that the appearance of the beer can influence the perception of its flavour (Smythe *et al.* , 2002). However, the Canadian experience has found that consumers have come to prefer drinking from reusable bottles. If marketed correctly the appearance of the bottle could be used to enhance the beers' 'traditional' and 'local' attributes.

Figure 4 Closed Loop System for Scenario 1



6.4.4 Required Logistical System

- The reuse system will be in the form of a closed loop system. The efficiency of return will be maximised by utilising space in lorries returning from deliveries.
- It is assumed that the brewery will have sufficient floor space to install a bottle washing plant.
- The pubs will require some storage space for bottles. Available space will be maximised as the bottles will be supplied in stackable crates. If bottles from different breweries are also used in the pub then staff at the pub will have to undertake some sorting of bottles.
- A deposit system is unlikely to be required as the pubs will have close ties with the breweries and it will therefore be in their interest to maximise return rates.

6.4.5 Economic Implications for Packaging Manufacturers

- It is assumed that a glass bottle manufacturer would already have the required design knowledge to produce a glass bottle and therefore the required R&D investment would be small.
- Any changes to existing manufacturing equipment are expected to be small.
- Although there will be a reduction in the volume of sales, this is likely to be offset by the production of product with higher value, Golding (1998) reports that returnable glass bottles are approximately twice the price of non-returnable packaging.

6.4.6 Economic Implications for Product Manufacturer

- The brewery will have to invest in a supply of bottles and bottle washing facilities.
- The supply of bottles will need to take into account seasonal fluctuations in the sale of beer.
- The washing plant will require: bottle handling equipment; a bottle washer; bottle inspection equipment; and possibly wastewater treatment equipment. This plant amounts to a significant investment. According to Golding (1998) overall investment costs for reuse packaging systems are 1.5 - 5 times greater than for non-returnable packaging systems.
- The returnable glass bottle is likely to be in the region of twice the weight of a non-returnable bottle. This will increase fuel costs although the mileage of the distribution fleet should not increase significantly.
- Although the cost for a returnable glass bottle is approximately twice as expensive as a non-returnable bottle, in this scenario high return rates (90%) are expected and the rotations rate will is 15. Therefore packaging purchasing costs will be reduced by approximately 85%, which is of significant benefit to the product manufacturer.
- The returnable system will reduce the company's glass recycling obligation by 32 tonnes. Assuming a current PRN value of about £10, this would only amount to a relatively small saving.

- Investment in the plant by the brewery will be subject to the following risks:
    i) System efficiency dropping due to low return rates.
    ii) The appearance of bottles resulting in a drop in sales.
- Before investing in a reuse system the brewery would be advised to undertake a survey of all its pubs to assess storage space and also consumer research into the effect of reused bottles on sales.
- PIRA and RDC (2003) report that the internal costs (costs to both packaging producers, product manufacturers and retailers) are always lower for non-returnable systems.

6.4.7 Economic Implications for the Retailer

- Assuming there is no drop in sales and sufficient storage space is available the economic implications for the retailer are assumed to be small.

6.5 Evaluation of Scenario 2

6.5.1 Reduction in Solid Waste

Table 7 outlines the assumptions made in calculating the amount of waste diverted.

Table 7: Assumptions made in calculating reduction in solid waste

Parameter	Value
Weight of refillable PET bottles 500ml 1 litre 2 litre	 0.053 kg 0.060 kg 0.100 kg
Weight of non-returnable bottles 500ml 1 litre 2 litre	 0.025 kg 0.030 kg 0.050 kg
Return Rate	85%
Number of Rotations	10

Calculations for the reduction in waste produced are shown in Appendix 1. The amounts for each brand are as follows:

Brand 1 – 1468 tonnes/year
Brand 2 - 297 tonnes/year
Brand 3 – 475 tonnes/year
Total: 2,240 tonnes/year

This amounts to a 45% reduction in solid waste.

Total household waste produced in the UK each year is 28 million tonnes (Cabinet Strategy Unit; 2002). PET bottles constitute about 1.34% of this waste or 370,000 tonnes (ReMaDe Scotland; 2002). This only amounts to 0.1% of the total UK waste stream.

The point often made is, "is it worth it?".

Although plastic bottles make up only 1.34% of household waste they take up significantly more volume. WRAP (2002) has calculated that plastic bottles comprise 12% of volume of waste collection vehicles and 4% of the volume of landfilled domestic waste. This adds extra costs to both collection and disposal and is particularly relevant in those parts of the country with limited landfill capacity and/or high landfill charges. The potential 2,240 tonnes/year of waste saved by this scenario would amount to 6,000 m^3 of landfill capacity. The additional costs of disposing of plastic bottles in the domestic waste stream is estimated to be about £174/tonne. If 85% of all plastic PET bottles could be reused, this would amount to a saving of about £54 million pounds. The amount of solid waste in this scenario would save about £300,000

The reduction in recycling obligation for the producer would be 157 tonnes. For the supermarkets it would be 203 tonnes. PRN price for plastic is currently about £10, therefore the potential savings are small.

Manufacture of Bottles:

- Amount of raw material required is reduced by approximately 45%.
- Unlike glass, the energy required to produce plastic bottles will be directly related to the amount of plastic used. However, less bottles are required and the overall energy saving will be in the same order of magnitude as for raw material savings.

Distribution and Return of Bottles

- The reverse logistics supply chain is discussed in detail below. Assuming that the lorries delivering stock to either distribution centres or supermarkets can accommodate empty bottles, then the increase in vehicle mileage should not be great. However, supermarket supply chains can be large and complex and the reuse system could result in additional journeys.
- Bottles are heavier and therefore there will be an increase in fuel usage.

Washing and Cleaning:

- The washing and cleaning process will require energy and water. However, the energy demand may only be 10% of that required to produce a new bottle (Danish EPA; 1998).

Waste Management

- Waste arisings are reduced by 65%.
- Experience from Canada has shown that where a deposit system exists the amount of litter in public places drops.

6.5.2 Scenario 2, Overall Environmental Benefit/Disbenefit

	Increasing Impact ←				No Change	Decreasing Impact →			
Manufacture of Bottles									
Energy Demand							X		
Raw Materials Usage							X		
Distribution									
Vehicle Mileage					X				
Fuel Usage				X					
Return of Bottles									
Vehicle Mileage				X					
Fuel Usage				X					
Washing and Cleaning									
Energy Demand					X				
Water Demand				X					
Waste Management									
Waste Arisings								X	

The Danish EPA (1998) study found the energy demand, potential global warming, acidification, nutrification and photochemical ozone formation, were all significantly lower for a returnable PET bottle than for non-returnable bottles.

6.5.3 Consumer Acceptance and Behaviour

Appearance and Marketing Issues

- As this is a closed loop system (i.e. it does share standard bottles with other producers) the packaging can still reflect the uniqueness of the brand, for example through shape or texture.
- After a number of reuses the bottle is likely to have a 'scratched' or 'scuffed' appearance. In the minds of some consumers this may detract from the quality of the drink. Consumer research would be required before investing in a reuse scheme.

6.5.4 Required Logistical System

In their distribution from the manufacturers (or farm) to shop, most products pass through one intervening storage or transhipment point. This point can be a retail distribution

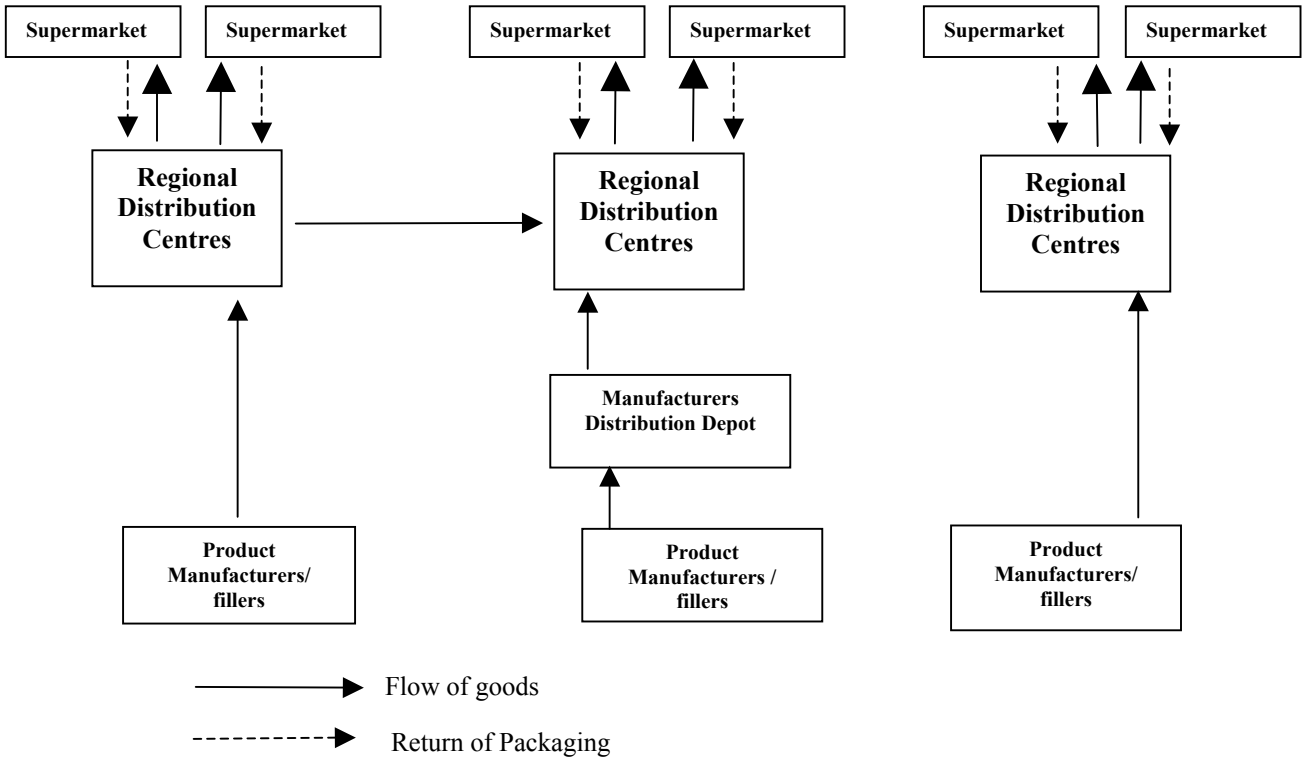
centre, wholesale warehouse or manufacturer's distribution depot. The term 'primary distribution' is used to describe the movement from factory to distribution centre/depot. The subsequent delivery to shops is called 'secondary distribution'.

Changes in the retail logistics in recent years will have an important impact on the viability of the return of goods through supermarkets. The following trends were identified under the UK Technology Foresight Programme by researchers at Heriot Watt University (McKinnon; 1996).

- ***Increase in Retailers' Control over Secondary Distribution***. The majority of goods in UK stores are now channelled through retailers' own Distribution Centres (DC). The DC will receive bulk loads from a supplier, act as a central stockholding point and consolidate loads for direct delivery to retail outlets. Unlike wholesalers, who will supply a number of different retailers, a retailers' DC will normally supply its own branch stores. This requires less stock to be held at the stores and thus allows the retailers to make more efficient use of expensive retail space for displaying goods. It also reduces the number of deliveries a supermarket receives a day and 'backdoor congestion'.
- ***Rationalisation of primary distribution:*** It has become common for retailers' vehicles on the return journey from shops to collect goods from suppliers' premises for delivery to the DC. Until recently, a manufacturer selling its products through a supermarket chain would be required to distribute the products to all the retailers' DCs. Some retailers are now asking suppliers to concentrate their deliveries on one, or a few, DCs, leaving them to cross-ship a proportion of supplies to other DCs.
- ***Reverse Logistics*.** As a result of UK packaging regulations it has been in the retailers' interest to recover as much secondary packaging as possible. This can go a long way to meeting their overall compliance and reduce the costs of joining compliance schemes or buying PRNS. Fernie (2001) showed that over 0.5 million tonnes a year is recovered by the leading supermarkets. The recovery of this packaging requires 'reverse logistics' operations by utilising empty space in lorries returning from stores to convey waste packaging back to the DC for consolidation. Supermarkets are also now making substantial use of reusable trays for fresh produce and these are then returned back to suppliers though the DCs.

Figure 5 shows a schematic of the retail supply chain. Bottles returned to supermarkets would need to flow in the opposite directions to goods through this supply chain. Storage space would be required at both stores and DCs with manufacturers collecting empty bottles on delivery of goods to DCs. The supply chain will be further lengthened where if the drinks manufacture has intermediate depots.

Figure 5 – Retail Supply Chain



The above changes have allowed retailers to increase vehicle utilisation and reduce the number of deliveries to stores which are often in dense urban areas. These changes have therefore increased operating efficiency and brought about environmental benefits. But what would be the effect of implementing a nationwide reuse scheme?

- The creation of longer supply chains makes the return flow of goods more complicated.
- Retailers would be reluctant to relinquish space at stores for returned bottles.
- If additional vehicle movements were required this would reduce operating efficiency and impact on the environment.

However…

- Retailer logistics providers are now very accustomed to returning transit and secondary packaging from stores.
- Retailers are likely to be receptive to initiatives which reduce their environmental compliance costs.

A survey of transport efficiency in the UK Food Supply Chain has been carried out by the Logistics Research Centre at Heriot-Watt University (McKinnon; 2002). This study monitored the activities of approximately 2,300 vehicles carrying food products over a two day period. It found that out of the total vehicle-kms travelled in secondary

distribution, an average of 23% of were run empty. This indicates a certain capacity for transporting backloads, such as returned bottles, back from stores. However, it is possible that retailers would prefer to use this capacity for supplier collections.

The use of a deposit on bottles will enhance the return rate of bottles. Deposits will be exchanged between the filler, retailer and consumer. This system will require an administrative system that will need to be linked to logistical and stock control systems. The deposit value will need to reflect the cost of new packaging, extra costs of handling and administration, and likely consumer behaviour and acceptance.

6.5.5 Economic Implications for Packaging Manufacturers

- It is assumed that a glass bottle manufacturer would already have required design knowledge to produce a glass bottle and therefore the required R&D investment would be small.
- Any changes to existing manufacturing equipment are expected to be small.
- Although there will be a reduction in the volume of sales, this is likely to be offset by the production of product a with increased value. Golding (1998) reports that returnable glass bottles are about twice the price of non-returnable packaging.

6.5.6 Economic Implications for Product Manufacturer

- The drinks manufacturer would need to invest in the required bottle handling and washing plant, and the supply of bottles would need to take into account seasonal fluctuations in the sale of drink.
- The cost for a returnable PET bottle will be approximately twice as expensive as a non-returnable bottle. For this scenario, high return rates of 85% are anticipated and the Rotations rate is 10. Therefore, after the initial investment in bottles, packaging purchasing cost will be about half that for the non-returnable system.
- The use of returnable bottles would reduce the cost of compliance with the Producer Responsibility Regulations.
- Investment in the plant by the brewery will be subject to the following risks:
  i) System efficiency dropping due to low return rates;
  ii) The appearance of bottles resulting in a drop in sales;
  iii) reluctance from supermarkets to stock their product (see criterion 7).
- In some countries, for example Canada, the packaging manufacturer will pay the supermarket a handling fee for returning bottles.
- The packaging manufacturer will also incur costs through the operation of the deposit administration system.
- Some of these costs could be offset by income from un-redeemed deposits.
- PIRA and RDC (2003) report that the internal costs for PET bottles are always lower for non-returnable systems.

6.5.7 Economic Implications for the Retailer

As the major supermarkets dominate the grocery market they will have the greatest influence over the packaging system decisions. The drinks manufacturers will not want to adversely affect their relationship with the supermarkets. The reuse system would result in the following costs for the supermarket:

1. Increased logistical costs.
2. Loss of retail space due to storage of bottles.
3. Increased manpower in handling of bottles.
4. Increased administration costs in managing deposit system.

Costs for 2, 3 and 4 could be reduced through the use of Reverse Vending Machines (RVMs). RVMs are designed to collect and identify empty beverage containers and refund the appropriate deposit. The machines will typically be able to recognise the bottle by scanning the bar codes and undertake a degree of sorting. Incorrect bottles can be rejected. Deposit return is typically via a redeemable receipt, however the system could be linked to supermarket loyalty cards. Large volume RVMs will require 'backroom' storage behind the machines. RVMs can have a built-in modem which could be linked to the supermarkets logistical systems and deposit administration systems. However, RVMs would require an upfront investment by the supermarkets. An average cost for an RVM is about £10,000.

Administration costs may be shared with the manufacturer and/or potentially offset by income from un-redeemed deposits.

As with the manufacturers, supermarkets will be able to benefit from reduced packaging compliance costs.

6.6 Evaluation of Scenario 3

6.6.1 Reduction in Solid Waste

Table 8 outlines the assumptions made in calculating the amount of waste diverted.

Table 8 Assumptions made in calculating reduction in solid waste

Parameter	Value
Weight of refillable bottle	0.425 kg
Weight of non-returnable bottle	0.220 kg
Return Rate	85%
Number of bottles required per year	11 million
Number of Rotations	10

The reuse system would reduce solid waste by 3633 tonnes/year; a 77% reduction. The packaging obligation for the manufacturer would be reduced from 330 to 75 tonnes per year.

6.6.2 Scenario 3, Overall Environmental Benefit/disbenefit

	Increasing Impact ←				No Change	Decreasing Impact →			
Manufacture of Bottles									
Energy Demand								X	
Raw Materials Usage								X	
Distribution									
Vehicle Mileage					X				
Fuel Usage				X					
Return of Bottles									
Vehicle Mileage				X					
Fuel Usage				X					
Washing and Cleaning									
Energy Demand					X				
Water Demand				X					
Waste Management									
Waste Arisings								X	

Manufacture of Bottles:

- Amount of raw material is reduced by up to 77%.
- The refillable glass bottles contain more glass. However, the Danish Study (1998a) reported that the energy required to produce heavier bottles is minimal.

Distribution and Return of Bottles:

- Chains of multiple specialist will consolidate stock at distribution centres. Hence the logistical problems and impact will be similar to Scenario 2.
- Bottles are significantly heavier and therefore there will be an increase in fuel usage.

Washing and Cleaning:

- The washing and cleaning process will require energy and water. However, the energy demand may only be 15% of that required to produce a new bottle (Danish EPA, 1998).

Waste Management:

- Waste arisings are reduced by over 77%.

6.6.3 Consumer Acceptance and Behaviour

Returning Bottles:

- Consumers could become confused over which beer bottles are returnable and which locations they can return them to.

Appearance and Marketing Issues

- As for Scenario 2.

6.6.4 Required Logistical System

The logistical issues are the same as for Scenario 2 with the following considerations:

- Storage of bottles is likely to be a problem for smaller stores. This may be compounded by less frequent deliveries.
- Very small stores, like 'cornershops', will often collect produce themselves from the wholesaler. Consumers may buy bottles from one shop (for example which is further away but cheaper) but return them to another (which is closer to their home). Smaller stores may therefore not be able to cope with the number of returns.

6.6.5 Economic Implications for Packaging Manufacturers

- As for Scenario 1.

6.6.6 Economic Implications for Product Manufacturer

- The brewery will have to invest in a supply of bottles and bottle washing facilities.
- The supply of bottles will need to take into account seasonal fluctuations in the sale of beer.
- The washing plant will require: bottle handling equipment; a bottle washer; bottle inspection equipment; and possibly a wastewater treatment plant.
- The returnable glass bottle is likely to be twice the weight of a non-returnable bottle. This will increase fuel costs although the mileage of the distribution fleet should not increase significantly.
- However, there are large potential savings for implementing a reuse system and in scenario 3 packaging costs will be reduced by about 87%. This results from the high return rates off-setting the costs of production.

6.6.7 Economic Implications for the Retailer

The reuse system could result in the following costs for the retailers:

1. Increased logistical costs.
2. Loss of retail space to storage of bottles.
3. Increased manpower in handling of bottles.
4. Increased administration costs in managing deposit system.

6.7 Evaluation of Scenario 4

6.7.1 Reduction in Solid Waste

Table 9 outlines the assumptions made in calculating the amount of waste diverted.

Table 9 Assumptions made in calculating reduction in solid waste

Parameter	Value
Weight of refillable bottle 2 litre 0.5 litre	 0.1 kg 0.053 kg
Weight of non-returnable bottle 2 litre 0.5 litre	 0.050 0.025
Return Rate	85%
Number of bottles required per year	11.5 million
Number of Rotations	10

The reuse system would result in a reduction in solid waste from 260 to 191 tonnes. This amounts to a reduction of only 25%.

Manufacture of Bottles:

- Raw material use would be reduced by 25%. Assume corresponding drop in energy use.

Distribution and Return of Bottles:

- Operation of the system in Scotland should reduce impact of these activities.

Washing and Cleaning:

- The smaller companies in the pool may want to contract their bottle washing to a management company or one of the larger bottlers in the pool. The use of larger plant would increase water and energy efficiency.

Waste Management:

- Waste arisings are only reduced by 25%

6.7.2 Consumer Acceptance and Behaviour

- Consumers may get confused over which brands they can/cannot return. A marketing strategy would be required by the pool.
- The use of a standard bottle could cause brand differentiation problems. The pool system could result in consumers having a greater loyalty to Scottish brands.
- The use of a deposit system would increase return rates.

6.7.3 Scenario 4, Overall Environmental Benefit/disbenefit

	Increasing Impact ←				No Change	Decreasing Impact →			
Manufacture of Bottles									
Energy Demand						X			
Raw Materials Usage						X			
Distribution									
Vehicle Mileage					X				
Fuel Usage				X					
Return of Bottles									
Vehicle Mileage				X					
Fuel Usage				X					
Washing and Cleaning									
Energy Demand					X				
Water Demand				X					
Waste Management									
Waste Arisings						X			

6.7.4 Required Logistical System

- The pool will require management by a central organisation. This would need to:
  - i) Monitor returns;
  - ii) Calculate the amount of new packaging required;
  - iii) Collect fees from members based on packaging requirements;
  - iv) Administer deposit system.
- The logistical issues in returning packaging through the supply chain would be similar to Scenario 2. However, the use of standardised bottles and crates would reduce sorting and handling problems.

6.7.5 Economic Implications for Packaging Manufacturer

- Same as for Scenario 2.

6.7.6 Economic Implications for Product Manufacturer

- The costs of running a reuse system and investing in packaging are shared between the pool members. Large pools will be able to negotiate better unit prices for packaging. Administration costs of the deposit system are also shared.
- Smaller companies in the pool could out-source washing and cleaning to an external service provider. This would reduce capital costs and financial risk.
- Concerns over loss of brand listing would be reduced if a number of companies joined the pool.
- Brand owners would have concerns about loss of brand identity as a result of standardised bottles.

7 Backcasting

Backcasting gives the opportunity to ask "based on where we are today, and were we want to be in the future, what needs to change to ensure that a successful transition is made from the today's world to the desired future situation?" Backcasting, in its most general sense can be applied to any number of situations. The aim of applying backcasting in this project is to identify which steps would be required for an increase in the reuse of packaging as identified in the Scenarios in the previous sections.

Within this project the following factors formed the focus of the backcasting effort: the views of key players in the industry; economic and environmental assessment tools; consumer behaviour; and the adaptation of the supply chain.

7.1 Views of Key Players in the Industry

Structured interviews were carried out with Forum's core members to obtain their view on various reuse scenarios. These were carried out either face to face or via telephone. An interview was also carried out with an employee of a company, Scottish Courage, who had not been involved in the Forum to date. The following is a summary of the main points made during these interviews:

7.1.1 Industry Council for Packaging and the Environment (INCPEN)

An interview was carried out with Jane Bickerstaffe. INCPEN was established 22 years ago as a forum for all industrial sectors of the packaging chain. Members include raw materials suppliers, packaging manufacturers, converters, packer/filler and retailers. They have over 60 members.

Waste Hierarchy:

- INCPEN noted that only 3-4% of the weight of waste in landfill is domestic.
- This raises questions about how much the consumer market can shift the waste burden through a reuse model.

- Raised question of whether the waste hierarchy is a single-direction hierarchy. Also the extent to which consumers are aware of the waste hierarchy and their understanding of the difference between reuse and recycling.

Legislation:
- Current packaging regulations have skewed the market and generally not performed well.
- INCPEN has a code of practice for packaging production which is their preferred approach, rather than legislation.

Life Cycle Analysis:
- Research by INCPEN members has shown that:
    - Energy costs for returnables is twice that for an equivalent one–way package;
    - Water use is five times greater;
    - Transports cost are double.
- Energy use for packaging is only 11% of the total energy used by the whole food supply system. Packaging serves to protect food and prevent wastage so therefore reduces overall energy consumption.

Logistics:
- The one trip system is the result of competitive market conditions.
- INCPEN members are highly flexible and could adapt to a reusable system if the conditions were right.
- INCPEN members are aware of lots of examples where conditions are right for reuse, especially for business to business transactions.

7.1.2 Scottish Courage

An interview was carried out with Pete Evans who is currently involved in market research at Scottish Courage. Scottish Courage are one of the top four brewers in the UK.

Market Factors:
- Approach to new products is very much market led i.e. the large corporate customers have a significant amount of input into the development of new product lines.
- Regionalisation of brands is important to Scottish Courage, but they do create niche markets that are more expensive to service than national brands.

Economic & Financial incentives:
- Pricing;
- Tax regimes and benefits;
- Collaboration with other market leaders to share commercial costs.

Consumer Acceptance and Behaviour:

- "Consumers tend to drink with their eyes" – which raises the question, what would a returnable glass bottle look like?
- Customer confusion over waste hierarchy i.e. would they send bottles for recycling rather than reuse (this could be a very costly problem to the industry).

Logistics:

- Changing to a reuse system would require a major product overhaul.
- Cask reuse is standard in the on-trade. However, it does cause problems in terms of storage, Health & Safety and visual appearance of pub.

7.1.3 Wincanton Logistics

Wincanton Logistics are a logistical service supplier. Interview was held with John McKeown who is a manager at their Distribution Centre in Dunfermline. This location provides stock distribution to Somerfield stores in Scotland. The main topic of the interview was the logistical implications of reuse systems.

- Wincanton already backhaul 250 tonnes/week of secondary and transit packaging.
- Despite optimisation efforts by industry, vehicles are returning from stores with extra capacity.
- Most stores are visited once a day.
- Keeping stock levels low at the stores is the retailers main concern. Smaller multiples, such as the Co-op and Spar, would have the least available storage space for returned bottles.
- Using empty lorries to collect from suppliers is becoming more common.
- Contracts between service providers and supermarkets aim to incentivise the service provider to carry out their operations in the most efficient manner possible.

7.1.4 United Glass

Unitied Glass is the UK's leading manufacturer of glass packaging. It has two glass bottle manufacturing plants at Alloa in Scotland and Harlow in Essex. John Forsyth is in charge of recycling operations at their Alloa plant in Scotland.

- If requested by client they could produce a reusable bottle. They already provide this service to AG Barrs.
- United Glass use a significant amount of recycled glass in their products.

7.1.5 Summary of Views from Industry

The retailer is critical to any reuse scheme that involves the consumer. Unfortunately, despite the efforts of the project team, it was not possible to get a major retailer to participate in this project.

Views from industry show that there are a number of concerns over reuse models for a range of reasons:

- Long supply chains and nationally distributed products create logistical problems for reuse;
- Concerns that consumers do not understand the waste hierarchy and therefore may confuse reuse and recycling;
- Life cycle costs for reuse models are uncertain or unfavourable, set against single-use packaging;
- Although theoretically there is capacity for reuse within the transport of product / packaging between packers and retailers and on the return journey (backhaulage), there is often little space available within stores to support collection points;
- There is sufficient technology to support reuse systems – from packaging manufacture to washing and refilling.
- The financial / economic / legislative incentives for reuse don't at present stimulate significant reuse activity, or are actively moving the supply chain away from reuse models, particularly for consumer products.

The backcasting exercise with key players within the industry identified these factors as the areas where major change would be needed if reuse models were to become more prevalent.

7.2 Consumer Acceptance and Behaviour

To corroborate the views of the Industry, a recent report by the Scottish Waste Awareness Group (SWAG) has found similar cause for concern over reuse models that involve the consumer.

SWAG identified that the majority of people in Scotland currently readily understood the concept of reuse, however very few understood the concept of the waste hierarchy (SWAG; 2002). In addition, the number of people actively participating in reuse scheme, apart from the reuse of plastics bags, was minimal. The success of large-scale reuse schemes would rely on people understanding why a particular item of packaging should be returned and not thrown away or recycled. This is especially important considering the likely increase over the next few years of the use of kerbside collection of recyclables to meet UK and EU recycling policy.

SWAG identified the following education measures to increase reuse:

- Inform people as to what they can reuse.
- Inform people as to how to reuse.
- Inform people what choices of reuse are available in their local area, and at national level and to link this to the provision of infrastructure.
- Inform people why reuse is a worthwhile practice. This might include:
    i) increasing awareness of waste as a resource to start to shift thinking from 'waste' to 'resource' use;
    ii) increasing awareness of the importance of conserving virgin materials;
    iii) promote resource friendly procurement to householders.

The Belgium environmental organisation Espace Environment recently undertook a 2 year part European funded project to promote waste minimisation in four local authority areas in Belgium. The project's partners included local authorities, supermarkets and local community groups. One of the waste minimisation measures promoted by the project was the reuse of refillable containers. The promotional tools used included: information leaflets; educational courses; local meeting and displays. The use of display cabinets at local events and in public places provided examples of those items that had less or reusable packaging (see Figure 6).

Figure 6 Display showing example of packaging which reduce waste (Courtesy of Jean-Marie Savino, Espace Environment, Belgium)

Over the course of the project, local supermarkets saw a 20% increase in the sale of returnable bottles and an almost identical drop in the sale of non-returnable bottles. Evaluation of the project concluded that communication tools, such as the display cabinets, were not sufficient alone for promoting waste minimisation and that corresponding public participation actions, such as the involvement of community groups, was also required.

7.3 Life Cycle Analysis

The overall environmental impact of a reuse system will depend on a number of variables and is very context specific. However, full LCAs are resource intensive and costly, especially for smaller companies. In addition, are the results readily understandable, especially to the general public? Terms such as 'nitrification' and 'ozone depletion' do not have an immediate association with packaging. Some argue that the use of LCAs for packaging is not yet fully developed and more scientific research is required.

How could LCAs for packaging be made more understandable and less costly?

There is LCA software on the market which is specifically targeted at packaging. For example, PIRA International's software PEMS & Ecopacker (http://www.piranet.com/). It has not been able to evaluate these programmes as part of this project. However, they are still likely to required skilled personnel to operate, a resource which many small producers will not have.

Another option would be to use less complex LCAs, sometimes referred to as 'streamlined' LCAs. These relate environmental impacts to one variable, such as energy use and may be quicker and easier to understand. Further evaluation and development of LCA tools could be the topic of future research.

7.4 Policy and Legislation

It is not the purpose of this research to investigate the reasons why disposal and recycling have emerged as the dominant activities as opposed to reuse systems, but rather to consider where opportunities exist for reuse models for consumer items, within the overall waste management picture.

The waste hierarchy places reuse higher up the chain than recycling or disposal. This raises the critical question of whether reuse should be promoted as a policy aim in its own right, rather than being selected as the most environmentally desirable and economically feasible option. In the course of this project, INCPEN and others interviewed expressed concerns that reuse did not always provide the most cost-effective or environmentally desirable solution to waste management problems experienced by businesses. In addition, LCA is still producing contradictory evidence concerning whole life costs of reuse systems.

The characterisation study confirmed that incentives, rather than prescriptive legislation, have achieved better results for reuse models. This view was also confirmed by INCPEN. For example, prescriptive approaches such as bans on certain packaging, quotas and compulsory deposit systems are not favoured by industry.

The EU has proposed increases in recovery and recycling in packaging regulations. There is no sign yet that they will introduce targets for reuse, but it is becoming an increasingly

important issue at euro level. In addition, Germany has recently introduced a compulsory deposits system. As recovery and recycling targets increase, retailers will have more and more difficulty in meeting targets by just recycling their transit and secondary packaging. Consequently they will need to concentrate more on primary packaging which could lead to investment in reuse packaging.

In recent years there has been a significant shift to one-trip systems (followed by the intent to recycle, although this is largely in the hands of consumers and outwith the control of business). The emergence of one-trip systems has come about for a number of reasons, including:

- Drive for efficiency and profits in retail supply chain;
- Difficulty of implementing reverse logistics systems for nationally distributed products with long supply chains;
- Health and Safety concerns;
- Existing UK Packaging regulations;
- Consumer behaviour;
- The emergence of recycling as the most prevalent activity in the waste hierarchy after disposal.

Accepting the current emphasis on disposal and recycling, and the fact that businesses are increasingly finding that one-trip systems work best and may even be the most environmentally desirable, it is difficult to imagine where reuse models may fit in, or indeed, where the policy support and legislative drivers may come from in future. With increasingly stringent EU legislation, there may be more impetus upon businesses to consider reuse models, but as noted above, top-down and prescriptive measures have been least successful in the implementation of reuse models.

After careful consideration of the complex policy and legislative issues, the project team concluded that reuse models might have the greatest role to play when combined with other emerging policy areas, for instance proposals for sustainable production and consumption patterns and for sustainable farming methods.

For example, to reduce the impact of additional transport and shorten supply chains, reuse schemes could be linked with recent initiatives to encourage consumers to buy locally produced foods and products. The Government's recent report '*The Strategy for Sustainable Farming & Food'* (DEFRA; 2002) emphasised the importance of adding value to food products by promoting locally produced foods. In addition, there has been a recent announcement by DEFRA proposing a strategy for sustainable production and consumption, and there is also concern over "food miles", the distance travelled between producer and consumer. Some supermarkets such as ASDA, have already taken the lead in this area and make specific effort to market locally produced produce.

Reuse models have most potential to add-value to small and medium-sized businesses, offering specialist items to local or regional markets. Farmers and local producers typically fall into the small and medium-sized businesses category, and increasingly people are sourcing locally produced items.

Where supply chains are short, businesses get the financial benefits of reuse systems that control packaging costs and take advantage of local logistical and distribution systems. For instance, scenarios 2 and 4 show how local producers can benefit from either closed-loop or pool systems for return logistics and has already been noted, these are easier to establish where supply chains are short.

The greatest chance for success of reuse models occurs when the consumer is aware of the reuse model and perceives that reuse of the packaging adds to the character and uniqueness of the product. Building local brand awareness will avoid confusion in the minds of consumers as to whether they should recycle or reuse.

Introducing a waste management dimension to the emerging policy areas of sustainable food production, sustainable production and consumption patterns, and reduction in food miles makes these policies more viable.

With these emerging polices in mind, policy and legislation in the future needs to operate in such a way that allows smaller producers to reap the financial benefits of reuse models for packaging, as well as making a contribution to local waste management priorities. For instance, small to medium-sized businesses need to be able to make investment decisions for plant and equipment and logistics systems that allows for reuse packaging systems. Financial incentives need to support investment in:

- Washing equipment and support for stringent Health & Safety standards;
- Local logistics networks and pool systems to create economies of scale that generate financial benefits for local producers.

8 Conclusions and the Potential for Reuse Models

A number of conclusions in the study so far point to reasons why reuse models are increasingly difficult to implement. This raises the question, "is there potential for reuse models?". Taking the results overall, it is possible to outline where reuse models would have the most benefit and make a significant contribution to waste minimisation and to good business practice. The optimal conditions for reuse models are as follows:

Logistics

- Reuse schemes seem to work most efficiently when there is a limited number of retail channels and short supply chains. They work particularly well for local or regional products.
- Pools systems have benefits for small to medium-sized businesses wishing to implement reuse.
- Closed loop system can work well in situations where the producer is situated close to the points of retail, thus reducing transportation distance.

Marketing/Customer Behaviour

- Reuse systems operate most effectively when there is consumer support and recognition for the use of reusable packaging. The use of reusable packaging is viewed by the consumer to add value to the product and encourages loyalty to the product.
- Regional or local products attract higher return rates.

Legislation

- The schemes which receive the broadest industry support have been set up 'voluntarily' i.e. without the influence of strict regulation. Bans of certain types of packaging invoke strong opposition from packaging and retail industries.
- Maximum return rates are achieved where a deposit system exists.

Packaging

5. The use of standardised packaging has the potential to reduce costs of a reuse system for retailers, or others responsible for collection, and producers.
6. Glass and PET are the most common materials used in reusable packaging.

A more general set of conclusions for the project are as follows:

1. Reuse models work least well for nationally distributed products with long and complex supply chains and where consumers have the opportunity to confuse reuse with recycling.
2. In the consumer market, reuse models have most potential to add value to small to medium-sized businesses, offering more specialist items to local/regional markets, where supply chains are short and businesses get the financial benefits of reuse systems that control packaging costs and take advantage of local logistical and distribution systems.
3. The greatest chance for success of reuse models occurs when the consumer is aware of the reuse model and perceives that reuse of the packaging adds to the character/ uniqueness of the product.
4. Aligning packaging reuse models with other emerging policy areas e.g. sustainable farming and food production, food miles, sustainable production and consumption patterns, provides both good business practice and the waste management dimension to these policies.
5. Financial incentives to support reuse schemes would be most beneficial when directed to allow smaller producers to reap the financial benefits of reuse models e.g. financial incentives for washing equipment, local logistics networks and pool systems to create economies of scale that generate financial benefits for local producers.
6. Taking this scoping study forward, there is clearly the need to develop a REUSE AUDIT methodology that will allow packaging reuse models to be developed by small to medium-sized businesses offering locally produced products to local/ regional markets. With a shift towards local production patterns in the future, this new approach would offer business advantages and make a significant contribution to local waste management priorities.

The major conclusion of this study is that reuse models work least well for nationally distributed products with long and complex supply chains and where consumers have the opportunity to confuse reuse with recycling. However, reuse models have most potential to add value to small and medium-sized businesses, offering more specialist items to local or regional markets, where supply chains are short and businesses get the financial benefits of reuse systems that control packaging costs and take advantage of local logistical and distribution systems. The greatest chance for success of reuse models occurs when the consumer is aware of the reuse model and perceives that reuse of the packaging adds to the character and uniqueness of the product.

9 Proposal for Future Work

Building on the conclusion that reuse models make the optimal contribution to waste management priorities and to businesses where supply chains are short, products are distributed within a local/regional area and consumers perceive the reuse of packaging as a characteristic of the product, it is proposed to develop this scoping study to create a **REUSE AUDIT methodology**.

A reuse audit would focus upon getting reuse packaging models established for small to medium-sized companies selling products into local/regional markets. The reuse audit would investigate optimal return rates for packaging to make it financially viable, consumer preference, the distribution and reverse logistics, space within retail outlets and consumer behaviour. Unlike a waste minimisation audit, a reuse audit could be done for a number of companies offering similar products within a local/regional catchment, so that the opportunity for pool collection and reverse logistics systems could be investigated.

Once developed, a reuse audit would be a technique used by companies to investigate reuse opportunities, or by groups of companies looking to establish pool collection systems. A reuse audit would link to local waste management priorities and ultimately the National Waste Plan.

It might be tempting to assume that reuse models could not make a major contribution to waste management priorities as the volume and weight of waste would not be significant. However, as there is increasing interest and support for local production and consumption patterns to become re-established, local markets will become increasingly important in terms of waste management. Aligning reuse models with other policy areas e.g. food miles, sustainable farming and food, sustainable production and consumption patterns, provides the waste management dimension to these emerging policy areas. In addition, this approach gives small producers the chance to differentiate themselves from big-brand products.

SISTech has had preliminary discussions with the Scottish Environment Protection Agency (SEPA) to link the proposal to develop a reuse audit methodology with a waste minimisation project.

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11 Appendix 1 - Scenario Calculations