Papur Datgan
Sbwriel Caniau a Photeli

Can and Bottle Litter
Position Paper

CADWCH GYMRU'N DACLUS | KEEP WALES TIDY

"As a tourist-oriented state whose major attraction is its natural beauty, we are very aware of the contribution of the deposit system in keeping our roadsides clean... The deposit law has had a positive effect in fostering over 1,600 jobs with annual wages of $22.8 million at local redemption centres throughout the state"

Angus King, Former Governor of Maine[1]

Field with stream, Yr As Fawr, Vale of Glamorgan. Photo: S. Booth

"Society is telling us in unmistakeable terms that we share equally with the public, the responsibility for package retrieval and disposal... This industry has spent hundreds of millions of dollars... in the attempt to dispute, deflect, or evade that message. It is interesting to speculate on the state of our public image, and our political fortunes had that same sum been devoted to disposal or retrieval technology".

Dwight Reed, Former President of the National Soft Drink Association[2]

Executive Summary

Keep Wales Tidy has examined the issues surrounding can and bottle litter, and has reached the conclusion that the best means of addressing this problem, while conferring minimal costs onto taxpayers, retailers and government, is to apply deposits to drinks containers.

Our policy statement is "the competent legislative authority should introduce legislation for Wales that mandates refundable deposits on plastic, glass, and metal drinks containers in order to reduce the defacement caused by these items to the Welsh landscape". The deposit value is a decision for policymakers.

Drinks containers are one of the most ubiquitous groups of litter items in Wales, comprising 16% of litter by weight, and they do not degrade easily.

As a measure to reduce drinks container litter, deposits are extremely effective - in fact, they are fifteen times as cost-effective as paying people to pick up litter. By placing a value on items currently viewed as 'rubbish' they give a financial incentive to people to dispose of their used containers appropriately, and they reward those who help keep the streets of Wales clean. Instead of local authorities and taxpayers footing the bill for clearing up - as at present - deposits place the financial burden where it belongs, on manufacturers and consumers.

Unredeemed deposits (those that the consumer chooses not to collect) could be used to fund waste management and recycling initiatives Wales-wide, an important ancillary benefit that is beyond the scope of this document, but which is practised extensively in other jurisdictions.

Other benefits of a mandatory deposit system include:

- Vastly improved recycling: deposit laws create a collection infrastructure that recycles drinks containers at a higher rate than all other collection programmes combined.
- Reducing greenhouse gas emissions and energy consumption: production of drinks containers from recycled material requires far less energy than that needed for their production from virgin materials, and causes a concomitant reduction in greenhouse gas emissions.
- Creating jobs and providing new business opportunities: deposit laws create jobs, because people are needed to collect and process bottles and cans. These jobs would be spread throughout Wales. Additionally, businesses profit from the sale of recycled scrap, and can also invest deposits paid by consumers in operations to provide short-term gain.
- Reducing resource use and landfill: increased recycling of materials means less mining, drilling, or dredging for raw materials. Deposit systems are also extremely effective at diverting drinks containers from landfill; in Wales, landfill costs of £4.5 million would be saved by local authorities annually.
- The costs of the system are borne by those who benefit from the sale of the containers, not by taxpayers or government.
- Charities and people on low income can generate money from collecting littered drinks containers.
- Deposits are proven to be exceptionally effective at reducing injuries, by removing glass bottles from the general litter stream.

There are also some disadvantages with introducing deposit legislation:

- Industry will resist the introduction of deposit legislation in Wales, as it does in every jurisdiction worldwide. It will claim that its costs are excessive.
- Possible increased fuel costs for consumers, from additional trips made to return deposits.
- Fraudulent redemption puts additional costs on deposit systems, although modern systems are becoming increasingly difficult to defraud.
- Current recycling systems may find that revenue is lost, although collection costs will actually reduce.

Overall, the overwhelming popularity of deposit legislation wherever it operates suggests that the social benefits outweigh system costs by a considerable margin.

Keep Wales Tidy urges the competent authority to consider the necessary legislation as a litter abatement measure with substantial side benefits.

"I am embarrassed and appalled to see my bottled water products discarded on the side of the road. I feel a personal sense of responsibility about it. I hardly ever see discarded soda products [which are subject to a deposit] as litter. The so-called 'Bigger Better Bottle Bill' needs to be passed"

Andrew Swanander, Owner, Mountaintown Spring Water[3]

This document is Keep Wales Tidy's policy response to the problem of drinks cans and bottles littering Wales.

1. Introduction

Drinks containers are a particularly common feature of the Welsh landscape. Once their contents are drunk, many people dispose of bottles and cans incorrectly: they then become litter.

Following a review of available information, Keep Wales Tidy has determined that the best way to reduce can and bottle litter, while minimising the operational and administrative burden on government, and the financial burden on taxpayers, is to pursue a policy of deposits on drinks containers.

Deposits would shift the litter, disposal and recycling costs associated with empty containers from government and taxpayers to producers and consumers. Taxpayers subsidise the use of single-use beverage containers, because they pay for clearing litter, operating kerbside recycling schemes, and for landfilling municipal waste. It is a key element of sustainable development, a constitutional responsibility of the Welsh Assembly Government, to adhere to the polluter pays or user pays principle. Moreover, it is time we considered the disposal of an item as part of the cost of purchase rather than as an afterthought.

2. The Problem

The principal problem of drinks containers is their overall abundance in litter. Keep Wales Tidy has conducted surveys of street can and bottle litter right across Wales[4]. Out of a total of 660 streets surveyed, 26.8% suffered from can and bottle litter. Litter survey methodology uses transects of 50m length, and because most streets are longer than 50m, these statistics understate the actual prevalence of can and bottle litter. The picture is even worse for 'functional sites' (grass verges, playgrounds, promenades etc.); of the 68 such sites surveyed, 60.3% were blighted by these forms of litter.

A survey* in 2004, funded by the packaging industry (INCPEN), determined that 22% of streets in England are littered by soft drinks cans, and 8% by 'soft plastic bottles'[5]. In terms of the presence of cans and bottles as a proportion of litter items, the same study found a prevalence of 2% (85% of litter items were cigarette ends). Drinks-related litter was the third most common form of litter (behind cigarette ends and sweet wrappers).

The importance of larger litter items is described by Stein and Syrek thus: "litter is usually considered to be first and foremost a visual form of pollution where the larger items are more visible to pedestrians and doubly so to motorists. However, the primary problem with including the small items [in research methodology] is they bias the results towards the less visible components of litter"[6].

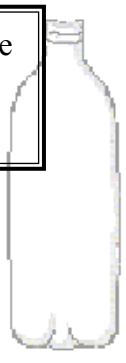
In volume, area, or mass terms, drinks containers assume much greater significance, because:

- even crushed, a bottle or can will be considerably more voluminous and visible than most smoking paraphernalia or sweet wrappers
- an average 500ml PET drinks container weighs 26g, and 330ml aluminium cans weigh around 16g[7]. This is considerably more than a cigarette end (approximately ½g), and most empty sweet wrappers. Using data from AEA technology[8], Keep Wales Tidy has calculated that drinks cans and bottles constitute approximately 16% of litter by weight in Wales (Annex 1).

In the 2004 Marine Conservation Society Beachwatch survey[9], drinks-related litter comprised 12.1% of all litter items found on Welsh beaches. Plastic drinks bottles were the 3rd most common item of litter found on Welsh beaches, forming 8.6% of all items; only plastic pieces (1-50cm) and plastic rope/cord/net (<50cm) were more abundant. There was an average of 227 plastic bottles per kilometre of Welsh coastline surveyed. Metal drinks cans constituted 2% of all litter items, with 48 per kilometre.

> "Even in the remotest parts of the planet, we see garbage, plastic bottles..."
> Iain Kerr, Captain of *The Odyssey*[10]

Soft drinks consumption in the UK is increasing



* For this analysis, we have excluded 'chewing gum stains'. No official document exists in the UK that defines these as litter, nor are they classed as litter in legislation in any constituent country of the UK.

rapidly; growth in 2003 was 11% in value, and 7% in volume[11], and impulse buying of 500ml PET containers increased by 25% over the two years 2003-2004[11]. The littering problem is likely to have become worse over recent years as a result, and the prognosis for the future holds little prospect for improvement in the absence of state intervention. This is backed up by evidence from the Marine Conservation Society, which indicates that plastic bottles were more than twice as common on Welsh beaches in 2004 as they had been in any of the previous five years[9].

Unsightly litter is a threat to Wales' image as a pristine holiday destination. By reducing the presence of cans and bottles on Wales' roads, verges, fields and beaches, we can encourage the return of visitors who support our biggest industry.

Since cans and bottles are some of the most common forms of litter, they are also significant contributors to the annual Welsh bill of £37 million[12] (excluding landfill costs) for street cleansing.

The second problem with cans and bottles is that they do not readily biodegrade, which means that when they are disposed of inappropriately, they stay littering the environment for a long time:

- Plastic is estimated to persist for hundreds of years in the environment[13], although the relative novelty of plastics in the environment means that it is not clear precisely how long plastic bottles persist. A further problem is that plastic is buoyant, and plastic bottles with their tops on especially so; once they reach waterways they will stay in circulation until they degrade, which could take several decades or more. Data collected by the Marine Conservation Society[9] indicates that nearly half of all the litter items on Wales' beaches in 2004 were plastic.

- Glass takes a very long time to break down, estimated as anything from one thousand to one million years. Another problem with glass bottles is that if they become smashed, the shards of glass are a health hazard, and it is significantly more difficult to clear up the remnants of a smashed glass bottle than the bottle itself.

- Aluminium cans are often quoted as taking from 80-100 years to break down.

The problem, therefore, is that we have a set of items that form a disproportionately high fraction of litter and that do not readily degrade.

3. Options for Improvement

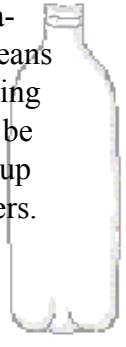
Several options have been put forward to reduce the litter problem associated with improper disposal of drinks bottles and cans. Among these are anti-litter messages, increased enforcement of litter laws, anti-litter taxes, increasing the use of refillable containers, specifying a minimum level of reuse or recycling of bottles and cans, and the development of container deposit systems.

In 1979, a US Cabinet-level panel studied deposit legislation and the litter tax. After two years of research, the panel concluded that the litter tax was "not an effective substitute for a beverage container deposit system."[14]. An example of an anti-litter tax comes from New Jersey, USA, where a tax has been applied for several years on 15 categories of 'litter-generating products'. Despite millions of dollars of litter tax money spent on litter clean-ups, overall litter in New Jersey is close to the national average and urban street litter is 41% higher than the national average[15].

Many local authorities in Wales now have dedicated enforcement officers whose work includes issuing Fixed Penalty Notices for littering, but it is not easy to catch someone in the act of littering[16], and the scale of the littering problem means that enforcement efforts are likely to have an effect on just a small proportion of the people who litter.

It would be possible to specify a minimum level of reuse or recycling for industry, but Keep Wales Tidy suggests that mandatory deposits are a more effective means of reducing the litter effect of can and bottle waste, because they also provide an incentive for collecting these materials.

Projecting anti-litter messages is an activity with which Keep Wales Tidy is consistently involved, and while it is important to maintain a focus on education and enforcement, there are other effective means to reduce the litter burden on society. By specifying that all drinks containers of a certain type should be subject to a deposit, industry and consumers end up solving the problem, not government and taxpayers.



4. Why Deposits?

Deposits on beverage containers are not a new idea. The beverage industry knows what works to recover containers because they invented the deposit system for refillable glass bottles, and they operate the system in the 11 states of the USA where they are required to do so. A deposit return system would target a category of packaging - more than $^{1}/_{2}$ billion drinks containers annually - that is not addressed by existing policies other than through traditional command and control style regulations[11].

> "Container Deposit Legislation addresses serious ongoing litter problems and ensures the producers of beverages and packaging take full responsibility for their products".
>
> Former President of the Australian Local Government Association, Councillor John Ross[17]

The changes that have taken place in the beverage industry are a reflection of our mobile, affluent, throwaway society. The gradual demise of refillable beer and soft drink bottles in the fifties and sixties was driven by the rise in one-way, no-deposit cans and bottles. The trend is toward more single-serving, throwaway packaging, with more drinks consumed away from home, and away from kerbside recycling programs.

A deposit-refund system combines a chargeable deposit on a commodity with a refundable credit upon the execution of a desired action. The programme costs are shifted from government and taxpayers to those who benefit from the sale of the product: the producer and/or the consumer. Because 70% or more of the deposit containers are returned, taxpayers pay less for disposal, less for picking up litter, and less for kerbside recycling[14]. For government, deposit-refund systems are considered to be one of the least costly of waste management policies, in addition to resulting in high recovery rates, as they give consumers the necessary incentive to find appropriate disposal avenues[18, 19].

Deposit systems are extremely cost-effective at removing cans and bottles from the litter stream. Keep Wales Tidy has analysed some research (Annex 2) that demonstrates that deposits are fifteen times as cost-effective in removing cans and bottles from litter as paying people to pick up litter. Since it is almost exclusively local authorities in Wales that pay people to pick up litter, council taxpayers will derive particular benefit from the greater efficiency of drinks litter removal. This more efficient method would be funded by the consumer and the producer.

Many other jurisdictions worldwide successfully operate deposit systems, including Austria, Belgium, Canada, Denmark, Finland, Germany, Iceland, Israel, the Netherlands, Norway, Portugal, Sweden, South Australia, Sri Lanka, Switzerland, and eleven states in the USA. Even Kiribati (population 103,000) is in the process of developing a deposit system[20].

Refundable deposits currently achieve recycling rates ranging from 70-95% in the US states where they operate, they make producers and consumers responsible for drinks containers, they virtually eliminate drinks container litter, and they dramatically reduce the number of containers that are made from virgin materials[21].

> "States that rely on small refundable deposits get consistently high recycling rates and substantial reductions in beverage container litter - all at no cost to taxpayers".
>
> Pat Franklin, Executive Director, Container Recycling Institute[22]

Wherever they operate, deposits are popular with the public. In the USA, poll after poll indicates that people support paying small, refundable deposits on beverage containers to reduce litter, waste, and pollution, save energy and resources, and create new jobs and businesses[21]. Strong public support was one of the key factors in the introduction of deposit legislation in Oregon; four years after implementation, 90% of the population were still in favour of the law[23]. That level of support has continued; the Bottle Bill is one of the most popular pieces of legislation ever passed in the state[23]. A telephone survey conducted by the South Australia Environment Protection Authority in 1993 revealed that 95% of people supported the state's refundable deposit on drinks containers[24]. As a litter abatement measure, a deposit system received the approval of 89% of Dutch consumers[25]. The popularity of deposit systems is partly due to the fact that they empower and encourage individuals to do the right thing, giving them the opportunity to contribute positively to society and the environment[26].

Returnable deposits on bottles and other packaging was found to be "among the most popular [environmental policy] measures" in research conducted by the Welsh Consumer Council[27]. People across Wales are starting to understand that what each of us does today affects all of us in the future, and the future is not ours to waste. A deposit scheme epitomises values that many people in Wales hold dear: a cleaner environment, thriftiness, and wise use of resources.

5. Evidence for Litter Reduction

> "Picking up pieces of litter is possibly the most expensive method of solid waste management"
> City of Tacoma Solid Waste Management[28]

Deposit laws have been enacted in numerous jurisdictions worldwide. With the 1970 Litter Act, British Colombia became the first jurisdiction in North America to establish a mandatory deposit refund system for soft drink and beer containers, as a litter control initiative[29].

In the USA, 11 out of the 50 states have deposit laws:

- The 1983 deposit law reduced beverage container litter in New York by 70-80%[30]. A litter study in New York in 1984 found a 68.5% reduction in drinks container litter compared with neighbouring Pennsylvania, which does not have a deposit law[31]. In 2002, New York City Councilman G. Oliver Koppell said "The bottle bill is recognised as the single most effective law in our State's history at diminishing litter along our roadways and in our public spaces, and in encouraging recycling"[32].

- A separation study of litter collected from four sites in Massachusetts revealed that four times as many containers without a deposit ended up littering the waterways as containers with a deposit[33]. Since three-quarters of all containers sold in Massachusetts carry deposits, the likelihood of an individual non-deposit container ending up in the waterway is twelve times greater than a deposit-bearing container.

- Before passage of Oregon's Bottle Bill in 1971, drinks containers made up as much as 40% of roadside litter. By 1973, after passage of the law, this proportion was only 10.8%, and by 1979 it was down to 6%[23]. A study of drinks container litter in Oregon in 1977 found an 87.9% reduction in litter compared with neighbouring California in 1974, which at that time did not have a container deposit law[31]. The litter reduction effect continues to this day, and it is claimed that the legislation created a broader anti-litter ethic that has led to reductions in other types of litter[23].

> "It was the community sense of environmental responsibility that led us to... pass a returnable bottle bill which has made littering tantamount to betraying your roots as an Oregonian".
> Former Oregon Governor John Kitzhaber[34]

- In 1993, a study concluded that drinks container litter had decreased in California by 63.9% since 1986 – the year that the deposit law was introduced[31].

- One year after the deposit law went into effect, the Iowa Department of Transportation[35] reported a 77% reduction in bottle and can litter and a 38% overall reduction in roadside litter in the state.

- In Michigan, the deposit law enjoys widespread public support, and the high refund value (10¢) reduced beverage container litter by 84% and total litter by 41%[36]. Syrek notes that drinks container litter reduced by 91.5% in 1979, the first year of Michigan's deposit law[31].

> "Michigan's 26-year-old bottle return law has worked so well to reduce litter and reuse resources, it's hard to believe we're only one of 10 states to have one".
> Editorial, Detroit Free Press, 24 June 2002[37]

- A study by the Maine Department of Transportation found that, after the deposit law, total litter declined by 10% and container litter declined by 56%[38]. Since completion of the study, the redemption rate has risen, so it is likely that container litter has decreased further. Bottle and can litter on Maine's shorelines decreased by 30% the year after Maine's bottle bill was expanded[39].

- The Vermont Highway Department recorded a

76.1% reduction in container litter following the state's 1972 deposit law[40].

- The Center for Marine Conservation[41] showed that, on average, drinks container debris represents 19% of beach litter in non-deposit law states in the USA, against 7% in states with deposit laws.

Table 1. The Effectiveness of Deposit Laws in Reducing Container Litter and Overall Litter

State	Reduction in Drinks Container Litter (%)	Reduction in Total Litter (%)
Iowa	77[35]	38[35]
Maine	69-77[42]	35-56[42]
Michigan	80[36]	38[36]
New York	70-80[30]	30[43]
Oregon	83[44]	47[44]
Vermont	76[45]	35[45]

The effects of deposit systems on litter reduction in the USA are well documented through pre and post bottle bill surveys. When outliers to litter statistics are removed, beverage container litter reductions have consistently been between 70 and 84%, and total litter has been reduced between 34 and 47%[14]. Syrek's work confirms that drinks container litter has been reduced by an average of 80.8% in states with deposit legislation[31].

In Germany, introduction of deposit legislation has been claimed to have put an end to the 'throwaway' mentality[46], and, it is hoped, will put an end to bottle and can litter in public places.

In South Australia, two-thirds of littered drinks containers are those that are not subject to Container Deposit Legislation[47]. The same legislation was found by the Environment Protection Authority[24] to be "contributing significantly to the Government's overall litter reduction objectives" through a "substantial reduction of containers into [the] litter stream". The reduced littering also provides an economic benefit associated with reduced landfill and litter collection costs of local government[24]. Bergsma et al.[25] conducted a study into methods of preventing and combating litter in general, and can and bottle litter in particular. The group found that a deposit for the can and bottle component would be effective in combating litter from these products. A deposit of 20¢ was calculated to lead to an 84% reduction in the quantity of can and bottle litter.

The refundable deposit provides a financial disincentive to litter. If the consumer chooses to toss the can or bottle, someone else may pick it up and redeem the deposit. In Denmark, consumers "often go out of their way to pick up carelessly discarded bottles and cans, knowing that they will be rewarded with a refund on returning the packaging to a registered sales location"[48]. Bottle bills are considered to be more effective than other reward anti-littering campaigns because they are long term and cost effective[49].

There is no jurisdiction in the world that has seen an increase in drinks container litter following introduction of deposit legislation. However, many of those jurisdictions have seen a very substantial decrease in such litter.

Time and again, government-funded or independent surveys have demonstrated the same finding: deposit systems are an effective means of reducing can and bottle litter.

> "Oregon's historic bottle bill inspired the country to go into the container recycling business. More importantly, it has saved energy and natural resources and reduced litter in our parks and on our roads".
>
> Former Oregon Governor John Kitzhaber[50]

6. Other Benefits

There are other benefits associated with the development of deposits, quite apart from the impressive litter reduction effects.

> "The majority [of respondents] felt that the messages relating to recycling and increased employment and to supporting local small businesses were the strongest ones".
> Welsh Consumer Council[27]

A: Increasing Recycling

Drinks manufacturers and their representatives worldwide support recycling of their containers. "BSDA [British Soft Drinks Association] strongly supports the need for comprehensive kerbside collection schemes across the UK that addresses all waste streams"[51]. It is the taxpayer, of course, who pays for kerbside recycling. The UK's record on recycling is poor, with ex-Environment Minister Michael Meacher having described it as "frankly pathetic" during his tenure (1997-2003). Of the EU-15 countries, only Portugal and Greece have worse records for recycling of municipal waste than the UK[52], although performance is improving.

86% of the 2.4 million tonnes of glass packaging in the UK is estimated to be used for beverages[11]; currently, the UK recycles only 30% of its glass bottles and jars[53]. In 2003, 500 million plastic bottles were recycled in the UK[54], out of 14,946 million produced[55]; a recycling rate of 3.3%. Just 34% of the UK's aluminium[56] and steel[11] cans are recycled.

> "Compared to the average German and Danish consumer, UK consumers appear to consume between 565,000 and 655,000 tonnes more glass, plastic and cans each year. A suitably designed deposit return system could address some of these shortcomings without undermining the mix of policies that to date have proven successful".
> Oakdene Hollins[11]

Deposit laws create a collection infrastructure that recycles beverage containers at a higher rate than all other collection programs combined[22]. Those 10 US states with deposits from which information is currently available (Hawai'i started its deposit system in 2005), recycle more bottles and cans than all the other 40 states together[32]. In 1990, the 10 deposit states accounted for more than 80% of the USA's glass recycling[57].

States with deposit laws have an overall recovery rate of 71.6%, compared to 27.9% in non-deposit states[58]. Michigan, with its 10¢ deposit, reports the highest recycling rates in the USA under its beverage container deposit law, with annual recycling rates in the range of 95 to 98 percent.

> "Since the Returnable Container Act went into effect in 1983, over 59 billion containers weighing about 4.4 million tons have been recycled".
> New York State Department of Environmental Conservation[59]

A report by a group of US environmental organisations and businesses, including Coca-Cola, found that states with deposit laws recycle an average of 490 beverage containers per capita, at a cost of 1.53 cents per container, while non-deposit states recycle an average of 191 per capita at a cost of 1.25 cents per container[58]. This lower cost reflects, in large part, the relative cheapness of landfilling as a waste management option.

In Oregon, the effect of the deposit law on waste reduction and resource conservation is said to be its most remarkable feature. Since 1973, between 83% (2002) and 94% (1973) of deposit-bearing drinks containers have been returned[23]. The success of the deposit legislation was important in laying the foundation for other recycling programs[23]: Oregon's recycling programs, including the Bottle Bill, resulted in a statewide municipal solid waste recovery rate of 43% in 2002[23].

A British Government study commissioned in 1992 by the Department of Trade and Industry and what was then the Department of the Environment, concluded that up to 95% of containers could be recycled if a deposit-refund system was implemented in the UK[60]. After deposit legislation was passed in New York, recycling rates increased dramatically: from 18% to 82% for aluminium cans; from 5% to 79% for one-way glass bottles; and from 1% to 57% for PET[61]. In Denmark, where deposits operate, 98% of refillable containers, and 80% of one-way drinks containers were returned in 2004[62].

"Since the Returnable Container Act went into effect in 1983, over 59 billion containers weighing about 4.4 million tons have been recycled".
New York State Department of Environmental Conservation[59]

Bergsma et al.[25] found that introducing a deposit in the Netherlands would result in an almost total shift of the can and bottle component from the waste disposal system, enabling the recycling percentage for PET bottles to rise from 0% to 80-90%, and for cans from 70% to 95%. The voluntary, industry-led deposit system in Sweden has resulted in a nationwide aluminium can recycling rate of 86% in 2000, and has ensured that the program is financed by beverage producers and consumers rather than taxpayers[63].

Recovery rates for glass bottles are up to 40% higher in South Australia as a result of Container Deposit Legislation[24]. In every province of Canada, refillable beer containers are returned through a 10-cent deposit-return system that has resulted in average return rates of over 97% across the country[29]. Bottle return averaged 97.31% over a 13-year period to 2003 in Michigan[64].

As much as 90% of the 600,000 tonnes of bottles used in licensed premises in the UK is currently landfilled[65].

A glass bottle deposit scheme is a better way of recycling glass than most other schemes, because generally the bottles only need to be re-washed. The system of using bottle banks means that the glass gets broken and must be melted down again. Also, the glass collected in bottle banks and at kerbside is generally mixed (colour) glass, and the markets for mixed glass are fewer than those for segregated glass. The quality of deposit-bearing recyclate is consistently better than its non deposit-bearing counterpart[14, 58, 66].

Deposits would provide a recycling opportunity for the hundreds of thousands of people in Wales whose kerbside recycling does not include plastic bottles (PET), aluminium, or glass. Deposits would also encourage recycling away from home, and in public places where recycling is not available.

B: Reducing Greenhouse Gas Emissions and Energy Consumption

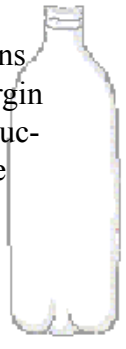
The Environment Protection Authority[24] determined a 'possibly significant' reduction in greenhouse gas emissions due to Container Deposit Legislation in South Australia, principally from reduced power plant emissions. As a result of their deposit law, people in the state of New York have reduced greenhouse gas emissions by 4 million tons, and saved the energy equivalent of 25 million barrels of oil - enough energy to provide electricity to every home in New York City for one year[39].

Greenhouse gases that contribute to climate change are also produced during virgin aluminium manufacturing. Other air pollutants contribute to smog, acid rain, and fluoride deposition[32]. The production of recycled aluminium generates just 5% of the amount of pollutants generated by virgin production[67].

The production of aluminium cans from virgin material is highly energy-intensive. Primary smelting of aluminium uses around 14kWh per kg of aluminium, whereas secondary smelting uses around 5% of this figure[68], while also eliminating the need for 6kg of bauxite and 4kg of 'chemical products'[69]. Likewise, more energy is used in making virgin PET and glass than from recycled stock; recycled glass is easier to melt than the raw materials, and therefore requires less energy[70]. Producing steel from recycled material saves 75% of the energy needed to make the product from virgin material[71].

At a time when we are experiencing serial increases in the price of electricity, the people of Wales continue to squander one of the most energy-intensive consumer products on the market: single-serving, single-use aluminium beverage cans. The energy needed to replace the UK's annual wastage of aluminium cans from virgin materials would fulfil the electricity needs of more than 178,000 Welsh households[68, 72] (Annex 3). Increasing the national recycling rate for drinks containers to 80% would save energy and resources worth millions of pounds annually.

Every tonne of steel recycled reduces air emissions by 86%[73]. Each tonne of glass produced from virgin materials releases 185kg of 'process' CO_2[70]; production from cullet (recycled glass) does not produce any 'process' CO_2.



"When one takes into account the environmental and energy impacts of extracting raw materials to replace wasted cans, the aluminium can is arguably the most environmentally destructive form of consumer product packaging on the market... Ironically, the increase in aluminium can waste comes at a time when parts of our nation face skyrocketing electricity costs"

Jenny Gitlitz, Research Director, Container Recycling Institute[74]

Recycling one plastic bottle saves enough energy to power a 60W light bulb for 6 hours[75]; the energy required to recycle plastic bottles is eight times less than that required to create them from virgin material[76].

C: Creating Jobs and Providing New Business Opportunities

Deposit laws create jobs, because people are needed to collect and process bottles and cans[77]. In the US states with deposit laws, net job gains have varied from 348 in Oregon to 4,648 in Michigan[14]. No US state has recorded a net job loss as a result of deposit legislation. A report for the Arizona Department of Commerce estimates that 4.1 new jobs in recyclables processing and recycled-content manufacturing are created for every 1,000 additional tons recovered, regardless of the type of recycled material[78]. Converting to metric units, 4.5 new jobs would be expected to be created per 1,000 tonnes recovered.

"The development and operation of a beverage container recycling infrastructure creates a significant number of jobs and has been shown to improve... competitiveness".

Businesses and Environmentalists Allied for Recycling[58]

In South Australia (population 1.5 million), Container Deposit Legislation is estimated to have provided a net gain in jobs of 1,674, both full- and part-time[24]. The legislation has also been particularly effective at "redistributing employment opportunities in favour of regional locations due to the number of collection depots located throughout the State". An independent review in New South Wales, commissioned by the State Government, recommended the introduction of deposits on drinks containers[79]. Dr. White's report found that the net benefit to New South Wales of Container Deposit Legislation would be in the order of $AUS70 million to 100 million a year and provide an additional 1,000 to 1,500 full time jobs[79].

"The potential for creating jobs from resources previously considered waste should be enough in its own right to implement serious resource recover measures. We can't expect industry to do this without regulation because job creation is not its mandate. This belongs to Government, which must provide the vision, leadership, and legislation".

Envision New Zealand[26]

Deposit laws have also been proven to be business revenue generators in the USA. Businesses profit from the sale of recycled scrap material in the enhanced recycling industry facilitated by deposit legislation. They can also profit by investing the deposit money they receive upfront from dealers in short-term gains operations, collecting interest or other revenue on it before paying it out to the State when deposits are claimed by consumers[77]. Those agencies that collect deposit containers placed for kerbside recycling also gain from people foregoing their container deposits[24].

D: Reducing Resource Use and Landfill

The reduction in resource use from recycling drinks containers is striking. If we double the recycling rate for, say, aluminium cans, then we halve the amount of bauxite that needs to be mined for their production. The Environment Protection Authority in South Australia found a reduction of 16,000 tonnes per annum in raw material for glass production as a result of Container Deposit Legislation[24]. Since the biggest material component of glass is sand, reducing the demand for virgin glass will reduce the amount of sand dredged or otherwise harvested in Wales.

For every tonne of steel cans recycled, 1.5 tonnes of iron ore, half a tonne of coal, and 40% of the water used in the production of virgin material are saved[71].

At the end point of a container's life cycle, for every can or bottle that enters the recycling waste stream, it is one item less that will not enter the general waste stream, with an ultimate destination of land-

fill.

> "The impacts of recycling trucks and processing facilities, which to be sure do exist, are insignificant compared with the pollution prevention and resource conservation reductions that result from making products out of recycled rather than virgin raw materials".
>
> City of Tacoma Solid Waste Management[28]

The US General Accounting Office calculated that states with deposit legislation were diverting 3-4% of their solid waste from landfill[57].

- Since passage of the bottle bill in New York in 1983, more than 75 billion bottles and cans have been diverted from the waste stream, virtually all of which have been recycled[39]. Returned deposit containers in New York accounted for 5% of the total waste diverted from landfill in the financial year 1995/96[80].

- The Connecticut Department of Environmetnal Protection credited deposit legislation with a 5-6% reduction in overall solid waste in 1980-1981[81].

- 5% of Iowa's diversion from landfill in 1995 was a result of deposit legislation[82].

- Maine's Waste Management Agency estimated in 1993 that approximately 14% of the total diversion from landfill was a result of the deposit law[83].

- Massachusetts Department of Environmental Protection credits deposit legislation with 16% of landfill diversion in 1995[84].

- In 1990, the Michigan Department of Natural Resources concluded that the deposit law was reducing the solid waste stream by 6-8%[85].

- Vermont's Department of Environmental Conservation notes that 6% of waste diverted from landfill was from deposit-bearing containers[86].

42% of South Australia's diversion from landfill in 1998 was accounted for by recycling drinks containers subject to deposits[87].

87,000 tonnes of aluminium cans are used in the UK each year, 66% of which are landfilled[56]. That's nearly five and a half billion cans, with more than three and a half billion wasted annually – 60 for every person in the UK. In 2002, baled aluminium cans had a value of £730 per tonne[68] - £42 million worth of aluminium is being landfilled each year.

> "... It has helped to extend the life of many landfills through diversion of containers from the waste stream..."
>
> Howard Dean, Former Vermont Governor and Presidential Candidate[88]

9 billion steel cans are likewise being landfilled annually[69]. Oakdene Hollins[11] estimate that 4.1 billion steel cans are used for beverages, with a likely recycling rate similar to that for aluminium (34%). For every tonne of steel packaging recycled, 258kg of additional solid waste is diverted from landfill as a result of the reduction in virgin production by-products[73, 89].

Deposits would divert approximately 720,000 tonnes of glass from household waste in the UK, reducing the total household waste by 2.7%[11]. This is in addition to the 800,000 tonnes already collected by local authorities.

In 1998, drinks containers represented 8-10% of landfill waste in the UK[60]. Landfill sites are scarce and filling up fast, and new sites are often unpopular[60]. Given the reduction in landfill that would occur in the United Kingdom if most bottles and cans were recycled, it was estimated in 1998 that, UK-wide, about £50 million of taxpayers' money could be saved each year on landfill and transport costs[60]. That sum would be substantially greater today on account of the increasing cost of landfilling. Reducing the volume of material being sent to landfill also reduces the need for more sites, improving people's quality of life.

Keep Wales Tidy estimates that drinks containers comprise approximately 6.9% of municipal waste arisings in Wales (Annex 4). In 2004/05, the total amount of municipal waste arising in Wales was 1.94 million tonnes[90]; a deposit system collecting 70% of drinks containers by weight would reduce Wales' landfill waste by some 93,000 tonnes. At a landfill tax of £21 per tonne from April 2006, and landfill gate fees of between £25 and £30 per tonne[91], we estimate the savings to Welsh local authorities as a result of deposits to be £4,502,910 in the year 2006/07.

E: Societal Benefits with Minimal Costs

The costs of disposal of used drinks containers are shifted from government and taxpayers to those who benefit from the sale of the product: the producer and/or the consumer. Non-return of deposit-bearing containers represents an additional transfer of income from the non-claiming consumer to whichever body claims the unredeemed deposit. In Massachusetts, between 1990 and 1996, $62.5 million of unclaimed deposits went to fund environmental programmes including municipal recycling[92].

> "... It [the Returnable Container Act (RCA)] has internalised the cost of solid waste management for beverage containers covered by the RCA... Therefore the taxpayer does not have to subsidise the disposal of empty beverage containers"
>
> New York Governor George Pataki[93]

Retailers in South Australia identified costs to be "of no significance" in complying with Container Deposit Legislation[24]. In Germany, the Federal Environment Ministry and the Federal Economic Ministry estimate that the prices for drinks in one-way packaging would increase by less than 1 cent per packaging even if all additional costs for the setting up and operation of deposit/return systems are apportioned to consumers[46]. A deposit return system is an effective means of correcting the external costs associated with disposal of the containers to landfill[94, 95].

> "Corporations share with their consumers the responsibility for the impacts of their products and packaging on the global environment... and refundable deposits put the responsibility where it belongs"
>
> Pat Franklin, Executive Director, Container Recycling Institute[21]

Gathering unredeemed cans and bottles can be a source of income. Voluntary groups, charities, and people on low incomes have ready access to an easy source of fund-raising[60]. In Maine, USA, Anderson reported on the benefits of incentivising public collection of bottle and can litter to obtain refunds[96].

If a low-value deposit was introduced in the UK, Oakdene Hollins calculated that between £78 million and £126 million would be available for the use of voluntary, and youth groups, from collection of littered deposit-bearing containers, based on a redemption rate of 70%[11].

> "By embedding greater value in the container, those who choose to discard a deposit-bearing container are effectively allowing others to redeem the value by picking the litter from the street or non-recycling waste container"
>
> Oakdene Hollins[11]

Farming organisations are some of the biggest supporters of deposit legislation in the USA because litter on farms accounts for damage costing, on average, $938 per farm per year[77]. Deposit laws decrease litter and reduce this costly damage.

> "Can and bottle litter is a serious problem for our members, especially for those who have land near towns, villages, and roads".
>
> Dafydd Jarrett, Policy Officer, National Farmers' Union Cymru[97]

The problems are largely related to feed contamination, equipment damage and livestock deaths or lameness[97, 98]. Any sort of metal in particular is very dangerous for cattle, especially if it is taken in with the harvest and incorporated with feed[98]. Harvesting machinery is very sensitive to glass and metal, and severe damage can occur if litter becomes caught up in the mechanism[98]. In Wales, farmers suffer to varying degrees from this blight, depending largely on the farm's location and proximity to roads, footpaths, and other open land[97, 98].

> "Farmers who are participating in an agri-environmental scheme have an obligation to keep their land free of litter, and collecting cans and bottles obviously places an unnecessary burden on our members".
>
> Arwyn Owen, Director of Agricultural Policy, Farmers' Union of Wales[98]

F: Reducing Injuries

Following enactment of deposit legislation in Massachusetts, the incidence of glass-related sutured lacerations in the emergency ward of Children's Hospital, Boston, dropped by 60%[99]. By providing incentives for the return of empty containers, the policy was beneficial to urban children by reducing their exposure to broken glass in the environment[99].

> "City centres are littered with glass, particularly bottles, strewn everywhere. Anyone looking for a scrap has a weapon readily available"
> Professor Jon Shepherd, Vice-Dean, Cardiff University School of Dentistry[100]

Researchers from Cardiff University School of Dentistry conducted a comparison of bottle and glass attacks in Helsinki and Cardiff. Over the course of the year 2003, there were 133 bottle-related assaults in Cardiff, and just one in Helsinki[101]. The researchers reached the conclusion that it is the financial incentives (deposits) on bottles in Finland that lead to reduced availability of these weapons, because people clear the streets of glass bottles[101]. More than two-fifths of serious glass-related assaults carried out in the UK during 1996-98 involved the use of bottles[102]. The British Crime Survey has found that up to 12% of violent offences involve the use of glasses and bottles[103].

> "Deposits would be a terrific step forward in reducing bottle-related injuries"
> Professor Jon Shepherd, Vice-Dean, Cardiff University School of Dentistry[101]

7. Disadvantages

As with most new legislation, there are some disadvantages in developing a deposit law. Keep Wales Tidy has assessed these disadvantages and believes them to be minor in comparison to the benefits.

A: Increased Fuel and Opportunity Costs

There is some evidence that increased consumer costs of transport, time, and fuel result from the additional trips made to return deposit bottles[24]. If a consumer considers these costs to be overbearing, they can choose not to redeem their deposits.

B: Costs to Industry

Beverage fillers and distributors in South Australia argue that there is an impact on companies' ability to reinvest in other aspects of the businesses which would generate other benefits and employment, as a result of deposit legislation[24]. However, it is worth reasserting that all of the US states that have implemented deposits have recorded a net increase in employment as a result of deposit legislation, as has South Australia.

There will also be costs associated with collecting deposit-bearing containers from depots, but these costs are broadly equivalent to those incurred through collecting waste and recycled drinks containers. Instead of being borne by local authorities in Wales, these costs would be assumed by the industry.

Other costs include the printing of separate labels, and cost impacts of small volume runs. The net costs incurred by industry and consumers in South Australia are in the order of $AUS1,701,000 per annum, or $AUS1.14 per capita[24]. The Environment Protection Authority judges that the community's "very high acceptance level" of the deposit system shows that there is a net benefit to the South Australia population[24]. In Germany, the extra cost of deposits to industry, estimated at less than two pfennigs (½p) per container, was described by the Minister of Economy Werner Mueller as "economically bearable"[104].

There would also be substantial start-up capital costs for the industry. These would be for the purchase of operational equipment, for example, such as Reverse Vending Machines.

C: Collection Depot Costs

There is a case for considering jobs in collection and return depots as costs of the system, since they

would not otherwise occur. There are also costs associated with investment for buildings and equipment and the cost of providing space for sorting and handling operations.

D: Fraudulent Redemption

The fraudulent redemption rate in Michigan is estimated at 2.6%[105]. Michigan's 10¢ deposit is double that of most other deposit states, so a greater level of fraud would be expected. Nonetheless, this represents a cost to the system that needs to be minimised. In Wales, the risk of both petty and large-scale fraudulent redemption would have to be minimised through careful design; bar code reading is now the standard method of minimising the risk of fraud[106].

E: Loss of Market Revenue for Current Recycling Programmes

Revenue for deposit-bearing containers would largely be lost by current recycling programmes. It is very difficult to accurately project what the loss of market revenues would be, due to extensive gaps in knowledge. However, these costs would be dwarfed by the economic and environmental benefits enjoyed by society[28].

Deposits actually reduce collection costs by removing glass and plastic bottles from recycling collections – glass is heavy, and plastic has a low weight-to-volume ratio. Also, it is unfair to expect recycling to generate revenue when this expectation has never been made for landfilling. In any case, because there is no financial incentive to recycle, participation rates are much lower with kerbside programs than with deposit programmes.

8. Conclusions

Container deposits increase recycling rates, reduce environmental pollution and energy consumption, create jobs that are spread throughout the jurisdiction, and place the cost of recovery on those who produce and consume the beverages. Most importantly for Keep Wales Tidy, deposits are proven to substantially reduce drinks-related litter. There are costs associated with deposit legislation, but if the policy goals mentioned above are seen to be beneficial to the people of Wales, then container deposits are a proven way to achieve them. The fact that deposit legislation is so popular wherever it is in operation around the world, indicates that the public derives a net benefit from deposit laws.

> "If consumers are to be motivated to join in the drive towards sustainability, government must show the public that its intentions are serious, by putting added pressure on business and industry and by ensuring its own sustainability performance is unimpeachable".
> Welsh Consumer Council[27]

Keep Wales' policy on can and bottle litter is: "the competent legislative authority should introduce legislation for Wales that mandates refundable deposits on plastic, glass, and metal drinks containers in order to reduce the defacement caused by these items to the Welsh landscape".

The value of the deposit is a decision for policymakers. Keep Wales Tidy strongly recommends that the deposit is index-linked so as to maintain its value in line with inflation.

Seashore litter at Y Bae Pinc, Pen-y-Bont ar Ogwr, showing some of the 227 plastic bottles per kilometre of coastline in Wales. Photo: G. Clubb

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Annex 1 *Calculation of drinks container litter weight as a proportion of total litter*

We make some assumptions in this calculation that are based on extensive experience of conducting street cleanliness surveys across Wales. In all cases they are conservative estimates:

- 90% of 'dense plastic bottles' in litter are drinks containers
- 80% of 'packaging glass' in litter is drinks containers
- 45% of 'ferrous food and beverage cans' in litter are drinks containers
- 75% of 'non-ferrous food and beverage cans' in litter are drinks containers

The weight of these fractions in Welsh litter is described by AEA Technology (2003) - reference 8.

Drinks container fraction of litter, by weight, is therefore:

90% x 6.6% (plastic drinks bottles)	5.94%
80% x 8.1% (glass drinks bottles)	6.48%
45% x 3.2% ('ferrous' metal drinks cans)	1.44%
75% x 2.9% ('non-ferrous' metal drinks cans)	2.18%
	16.04%

Annex 2. *Calculation of cost-effectiveness of various types of litter reduction programmes*

Beverage manufacturers and other groups that oppose deposit legislation make much of an article by Stein and Syrek (2005 – reference 6), which gives the approximate cost of a different systems to remove one item of litter. These costs are noted in Table 1.

Table 1. Cost per item of litter removed for a variety of programmes in the USA

Type of Programme	Cost Per Item of Litter Removed (US$)
Drinks container deposits	4.24
Paid litter pick-up	1.29
Comprehensive litter control programme	0.23
Adopt-a-Highway	0.18
Paid targeted advertising	0.02

In the article, drinks related litter was the third most common form of litter at 14.4%. The study ignored pieces of litter smaller than 1 inch squared – if all items of litter were included, as they are in most litter methodology practised in the UK, this category of litter would have been fourth most common, at 7.0%.

Since deposit systems can only have an impact on drinks-related litter, it is fair to recalibrate the values in order to assess the cost-effectiveness of these programmes in removing one item of drinks-related litter. These costs are shown in Table 2.

Table 2. Cost per item of drinks-related litter removed for a variety of programmes in the USA

Type of Programme	Cost per Item of Drinks-Related Litter Removed (US$)	
	If drinks-related litter is 14.4%	If drinks-related litter is 7.0%
Drinks container deposits	4.24	4.24
Paid litter pick-up	8.96	18.43
Comprehensive litter control programme	1.60	3.29
Adopt-a-Highway	1.25	2.57
Paid targeted advertising	0.14	0.29

In the latest survey of its kind in the UK, EnCams (2004 – reference 5) determined that drinks-related litter comprises 3.1% of litter items in England. If we assume a similar proportion of litter in Wales, we get the findings shown in Table 3.

Table 3. *Cost per item of drinks-related litter removed with such litter comprising 3.1% of total litter*

Type of Programme	Cost Per Item of Litter Removed (US$)
Drinks container deposits	4.24
Paid litter pick-up	41.61
Comprehensive litter control programme	7.41
Adopt-a-Highway	5.80
Paid targeted advertising	0.65

It would be disingenuous to suppose that drinks container deposits would eliminate all types of drinks-related litter, since deposits only target bottles and cans, and other types of litter include bottle tops, straws, drinks cups, and soft cartons. Of the 699 items of drinks-related litter recovered in the EnCams study, 462 were containers that would be subject to the envisaged deposit. Because of the way the research was conducted in the USA, we can only deal with proportions of litter in order to inform our results, and we have to assume that the deposit system collects only bottles and cans, even though there would probably be a reduction in the littering of bottle tops. Thus, we can calculate the costs of different programmes in order to remove one deposit-bearing container from the litter stream (Table 4).

Table 4. *Cost per item of deposit-bearing litter removed with such litter comprising 2.0% of total litter*

Type of Programme	Cost Per Item of Litter Removed (US$)
Drinks container deposits	4.24
Paid litter pick-up	64.50
Comprehensive litter control programme	11.50
Adopt-a-Highway	9.00
Paid targeted advertising	1.00

Deposit systems do not claim to reduce all types of litter. They reduce littering of bottles and cans. Using data often quoted by the anti-deposit lobby, Keep Wales Tidy has demonstrated that drinks container deposits are more than fifteen times as cost-effective at removing cans and bottles from the litter stream as picking up litter. They are also more than twice as cost-effective as Adopt-a-Highway schemes, and only four times as expensive as paid targeted advertising, even though the actual effectiveness of deposit schemes in removing cans and bottles from the litter stream is much greater than targeted advertising can ever be.

It is worth pointing out that the costs of picking up litter are borne by the taxpayer – a means that is fifteen times less cost-effective at removing cans and bottles from the litter stream than deposits. The costs of deposit systems fall, instead, on those who benefit from them: the consumer and the producer.

Annex 3 *Calculation of energy wasted through not recycling aluminium cans*

66% of the 87,000 tonnes of aluminium cans used in the UK each year are wasted (Alupro, 2006 - reference 56), a total of 57,420 tonnes. Primary smelting of aluminium uses around 14kWh per kg of aluminium; secondary smelting uses 0.7kWh.

Total energy used to replace 57,420 tonnes from virgin material = 57420 x 14000 = 803,880,000kWh
less energy used to replace 57,420 tonnes from recycled material = 57420 x 700 = 40,194,000kWh
gives energy wasted in replacing landfilled aluminium cans from virgin materials = 763,686,000kWh

Average electricity consumption per household in Wales = 4278kWh (DTI, 2005 - reference 72).

Energy needed to replace the UK's annual wastage of aluminium cans from virgin materials is the electricity consumption of (763,686,000/4278) 178,515 Welsh households.

Annex 4 *Calculation of money saved by Welsh local authorities, through landfill costs alone, by deposit legislation*

The proportion of different waste categories in Municipal Solid Waste in Wales is detailed in AEA Technology (2003) - reference 8. We make assumptions that the following proportions of selected waste categories are the drinks container fraction (the figures for 'packaging glass' and 'ferrous food and beverage cans' are taken from Oakdene Hollins (2004) - reference 12):

- 80% of 'dense plastic bottles'
- 86% of 'packaging glass'
- 45% of 'ferrous food and beverage cans'
- 75% of 'non-ferrous food and beverage cans'

Corus (2006 - reference 74) and Dahlström et al. (2004 - reference 89) concur that for every tonne of steel packaging recycled, an additional 258kg of solid waste is diverted from landfill, so there are additional landfill reductions - not quantified here - that are enjoyed as a result of deposits.

Drinks container fraction of Municipal Solid Waste in Wales, by weight, is therefore:

80% x 1.7% (plastic drinks bottles)	1.360%
86% x 5.3% (glass drinks bottles)	4.558%
45% x 1.7% ('ferrous' metal drinks cans)	0.765%
75% x 0.3% ('non-ferrous' metal drinks cans)	0.225%
	6.908%

In 2004/05, the total amount of municipal waste arisings in Wales was 1.94 million tonnes (Statistical Directorate, 2005 - reference 90). We estimate the drinks fraction of this to be 134,015.2 tonnes. A deposit system collecting 70% of drinks containers by weight would reduce Wales' landfill waste by some 93,810 tonnes. Landfill tax will be £21 per tonne from April 2006, and landfill gate fees are between £25 and £30 per tonne in Wales (Mark Williams, 2006 - reference 91). A conservative estimate of the savings to Welsh local authorities as a result of deposits is £4,502,910 in the year 2006/07. This figure excludes all transportation and other overheads.