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Bin-tax

Diftar

Pay-as-you-throw (PAYT)

Refuse charging

Pollutor pays

Unit-based waste collection charges

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This study is based upon work initially carried out by the author elsewhere, with the assistance of operators from IVAGO.

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BACKGROUND

IVAGO is a company set up 1 January 1995 with 50:50 share ownership split between the city of Ghent (and a smaller community, Destelbergen) and the 3 private partners Indaver (Vlar), Watco and Seghers Better Technology.

The two areas – Ghent and Destelbergen – cover a range of different types of dwellings and housing density. For example, the city of Ghent, with 224,000 residents, is spread over an area of 7,000 ha and is subdivided into 3 area types:

- Central area, including all apartment buildings up to 10 individual apartments (136,091 residents).
- Large apartment buildings with more than 10 individual flats (24,834 residents or 17,880 families).
- Rural areas (88,409 residents or 34,768 families)

This provides context for the design of the services and the associated charging scheme (as will become clear below).

The context for IVAGO's work is provided, to a significant degree, by OVAM (the Flemish Environmental Agency). OVAM issued a Plan of Execution for Household Waste for the period 1997-2001. This plan became the backbone of the waste strategy for the region of Flanders and included the following targets:

1. Prevention: the objective for 2001 was 6% of total household waste collected in 1995;
2. Increase recycling / reuse from 34 % in 1995 up to 52 % in 2001.
3. Increase the rate of source separation from 22 % in 1995 to 45 % in 2001. This means that the total amount of household waste separately collected had to increase from 70 kg to 120 kg per resident.
4. Residual waste per inhabitant was to decrease from 325 kg in 1995 down to 255 kg in 1998 and 240 kg in 2001.

Residual waste is termed 'refuse waste' in Flanders and is defined as the total of:

- collected refuse waste door-to-door
- bulky household waste (furniture, metal scrap, refrigerators, TV's, plastics,...)
- community waste (street cleansings, public waste bins, ...)

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PRE-SCHEME SITUATION

To cover environmental expenses most cities and communities had operated a system of fixed charges per household, or a system of indirect taxes related to householder income. The city of Ghent had no environmental or household tax rate as such.

This meant that the total cost of waste management for the city of Ghent had to be covered by general revenues the city derived from all other tax systems. IVAGO was receiving, and still receives, a monthly contribution from the city to cover its costs. However, this budget was frozen in 1995, and in 2003, the total amount received in was actually reduced by €1.1 million to €25.9 million, despite inflation, salary increases and so forth. Hence, the service was, until the introduction of the DVR scheme, free at the point of collection for householders.

Between 1994 and July 1998 (the start of the DVR charging scheme, or Diftar system in Flemish) a variety of systems were introduced, step by step, in order to pave the way for the DVR charging scheme's introduction.

1. The old "bucket" style receptacle was replaced by a 60 litre plastic bag for residual waste;
2. From 1996 PMD (plastic bottles, metal and drink packages) were collected in a transparent blue sack, once every month;
3. In the rural areas, from 1996, collection of organic solid waste, once a fortnight, was started. Initially, a special fee was charged to the resident, but this was discontinued;
4. Glass was traditionally collected door-to-door (for more than 20 years free of charge);
5. The residual waste fraction was collected fortnightly. The residents paid 8 BEF (€0.2) per sack.

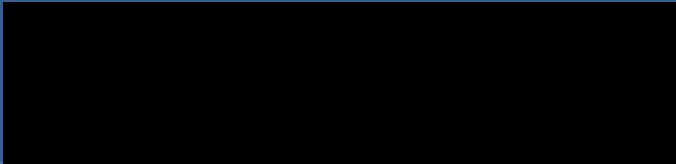
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RATIONALE FOR SCHEME INTRODUCTION

The city of Ghent was the first city in Flanders to introduce (as of mid 1998) a system which made a direct link between the amount of waste generated by a family and the money they had to pay for it. The principle rationale for this was to make 'polluters pay'.

The aims of the system – which went beyond the targets set by OVAM – were as follows:

1. Reduce the amount of waste produced and maximise recycling and reuse of waste materials where practical;
2. Reduce total refuse waste from 325 kg per resident in 1995 to 165 kg in 2000;

- 
3. Increase selectivity from 31 % to 50 % by year 2000;
 4. Control the impurities on selective fractions to agreed levels. For example, for the packaging fraction (called 'PMD waste' – plastics, metals and drinks cartons): less than 20 % impurities);¹
 5. Keep the total quantity of household waste below 500 kg per resident per year;
 6. Increase the number of household waste sites (civic amenity sites) so there is a maximum coverage of the territory (in principle one site for each 25,000 residents);
 7. Reduce the financial contribution of the city of Ghent by €7.5 million (or 30%); and
 8. Create awareness of the costs of waste management through direct charging of residents according to the costs of collection and waste treatment of different materials.

The City decided that a number of other factors needed to be considered. Those identified by the City as important were as follows:

- that because, by charging residents for their waste, incentives for evasion would be created, illegal behaviour such fly-tipping should be severely punished. This would require new measures to be put in place;
- that social corrections (for poorer households) would have to be possible in the system;
- that there would need to be equality of treatment, in the costs of the service, between the residents of the rural area and the residents of the city centre;
- that only a proportion of the costs for refuse, organic solid waste and packaging fraction would be recovered through the charging system;
- that the charge would be set be as low as possible, consistent with achieving the objectives set by the municipality;
- that there should be a difference in the charging rate between that for refuse and that for organic solid waste which would be sufficient to stimulate separation, but not so high as to compromise the quality of the organic waste collected. If the price difference was too high, it was suggested that there would be a risk that too much refuse would find its way into the organic waste bin;
- that an appropriate solution for apartments should be found by which each resident would become individually responsible, as well as financially responsible, in relation to the prevention of waste and the behaviour towards source separation. In each apartment where waste chutes existed, these would need to be firmly closed;
- that complaints and abuses should be minimised;
- that all existing services (including the frequency of collecting waste) should be maintained, especially in an initial stage;
- that the legality of the charging model would need to be established. The way IVAGO is structured, it is not allowed to invoice the residents directly because of the complexity of fiscal and juridical laws. The city itself would have to collect the money via a 'retribution' system approved by the council; and
- that progressive extension should be made possible.

It was agreed that the project would be introduced on 1/7/98.

1. PMD is the term for plastic and metal drinks containers in Flanders.

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CHARGING SYSTEM USED

As previously mentioned, for the purpose of the provision of waste services, Ghent and Destelbergen are divided into three areas, the central area, apartment buildings and the rural areas. The designation determines the type of receptacle to be used by the residents, i.e. whether they use a sack or a waste bin. The residents cannot choose whether they use sacks or bins – this decision is made for them as the whole door-to-door collection system is designed to match the type of receptacle used.

The central area uses only sacks for refuse and biodegradable sacks for organic waste. At large buildings, residents are asked to use the sacks and then put them in a large trolley bin. The rural area has only wheeled bins, one for residual waste and one for organic waste. All the bins are equipped with an intelliGhent “chip”. All areas make use of the same transparent blue sack for packaging materials.

Table 1 on page 6 shows the different tariffs applied for bins and sacks in rural and urban areas. The charges can only be collected by the treasury department of the city of Ghent. All rates have to be approved beforehand by the council. IVAGO is responsible for the technical specifications (sacks, bins) but it is the city of Ghent who purchases the containers from different suppliers. IVAGO also takes care of the distribution of sacks and waste bins.

The residents in the centre of Ghent buy – from one of the 350 distribution centres (shops, etc.) - the relevant waste sack. Waste sacks, packed in rolls of 10 or 25, are purchased at a fixed rate (no discounts are granted). The storekeeper receives a small fraction of the sales price (1 to 2 %). The service he/she is offering will enable the storekeeper to attract people who will buy other goods as well.

The residents in the rural area are obliged to use containers and pay in advance in accordance with the size of the container for 18 ‘emptyings’. Waste bins, one for residual waste and one for ‘meat-excluded’ organic waste (i.e. kitchen and garden waste), are supplied free of charge to each resident in the rural area of Ghent. The bin has a unique intelliGhent chip which registers each individual emptying of the bin. It is automatically read by a reading device mounted, at the back, on the loading system of the truck. Data (customer name, address, type & size of container) are registered in the chip and fed to the RAM-disk on the on-board computer in the truck. At the end of the day the driver presents the RAM-disk to the central computer system at IVAGO. Data are sent by modem to an outside service company who processes the data. A new request for payment is issued automatically when the ‘credit’ remaining has reached a specific level (6 emptyings). The system is fully automatic and does not allow human interference. The waste bin cannot be emptied if the resident has not paid in advance (since the chip on the bin is read as it is loaded on the vehicle, and the bin lift will not function if the householder has used up all credit) so there are no bad debtors in the system.

Of the total costs for collection and processing / treatment / disposal, approximately 20% are met by the charges paid for sacks and emptyings of bins.

Table 1. Structure of charging system applied in Ghent

| Type of waste | Recipient | Volume | Price in € |
|---------------------------|--------------------|------------------|------------------|
| Refuse waste | Sack | 15 l | €0.37 per sack |
| | | 30 l | €0.62 per sack |
| | | 60 l | €1.24 per sack |
| | Waste bin | 40 l | €0.87 per pickup |
| | | 60 l | €1.24 per pickup |
| | | 120 l | €2.48 per pickup |
| 240 l | | €4.96 per pickup | |
| Biowaste | Biodegradable Sack | 15 l | €0.25 per sack |
| | | 30 l | €0.50 per sack |
| | Waste bin | 40 l | €0.62 per pickup |
| | | 60 l | €0.99 per pickup |
| | | 120 l | €1.98 per pickup |
| | | 240 l | €3.97 per pickup |
| Non-glass packaging (PMD) | Blue sack | 60 l | €0.12 per sack |
| Paper/cardboard | - | - | No charge |
| Glass | - | - | No charge |

Note: Where bins are concerned, the price is 'per emptying' of the bin. Residents choose the frequency with which they 'set out' their bin for collection. Each pick up is registered on the intelliGhent chip.

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EFFECTS OF SCHEME AND SERVICE CHANGES

Table 2 and Table 3 show the evolution of waste arisings and their destination in Gent. One notes, from the Tables, the continuing rise in source separation rates. Also of note is the way in which the separate collection of organic waste (OSW), collected on a door-to-door basis, has dropped slightly (following the (re-)introduction of a charge for its collection). At the same time, garden waste collections (at the container-park s) have continued to increase. This suggests that because the network of sites is relatively dense in the area, householders have been incentivised by the charging scheme to carry a growing proportion of their waste to the sites. Lastly, and significantly, there has been a major increase in the quantity of waste flowing through the well-organised container-park s, which selectively collect a very large number of waste fractions. This incurs some cost on the part of the householders themselves.

Table 2. Effects on waste production in Ghent
Tonnes, unless otherwise indicated

| | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|----------------|----------------|----------------|----------------|----------------|
| Total refuse (1) | | | | | |
| Door-to-door | 68,967 | 58,220 | 49,396 | 35,824 | 31,426 |
| Bulky waste | 4,466 | 10,846 | 10,468 | 10,874 | 8,663 |
| Street cleansings | 1,252 | 1,500 | 1,600 | 1,651 | 2,271 |
| TOTAL | 74,685 | 70,566 | 61,464 | 48,349 | 42,360 |
| Kg per resident | | | | | |
| Door-to-door | 300 | 253 | 219 | 160 | 140 |
| Bulky waste | 19 | 40 | 46 | 49 | 39 |
| Street cleansings | 6 | 7 | 7 | 7 | 10 |
| TOTAL | 325 | 300 | 272 | 216 | 189 |
| Separately collected (2) | | | | | |
| Tonnes | 30,954 | 36,764 | 47,598 | 58,701 | 66,941 |
| Kg per resident | 135 | 160 | 211 | 261 | 299 |
| Percentage % | 31 | 35 | 44 | 55 | 61 |
| Total household waste (1+2) (Tonnes) | 105,639 | 105,830 | 107,463 | 107,050 | 109,301 |
| Kg per resident | 460 | 460 | 475 | 477 | 487 |

Table 3. Selectively collected waste fractions in Ghent
Tonnes

| | 1995 | 1996 | 1997 | 1998 | 1999 |
|-----------------------------|---------------|---------------|---------------|---------------|---------------|
| Demolition waste | 6,928 | 11,843 | 11,008 | 13,215 | 14,992 |
| Paper/hardboard | 9,564 | 9,140 | 10,613 | 13,374 | 15,583 |
| OSW | - | 1,639 | 11,666 | 11,047 | 9,186 |
| Garden green waste | 7,208 | 5,539 | 4,759 | 6,484 | 8,372 |
| Glass | 5,948 | 5,833 | 5,585 | 6,397 | 6,672 |
| Metal | 978 | 2,271 | 2,264 | 2,457 | 2,731 |
| Electric & Electronics | 12 | 20 | 200 | 304 | 373 |
| PMD | 108 | 156 | 277 | 2,828 | 3,707 |
| Wood | - | - | - | 1,218 | 3,652 |
| SDW (small dangerous waste) | 155 | 204 | 294 | 367 | 435 |
| Others | 53 | 119 | 934 | 1,012 | 1,237 |
| TOTAL | 31,007 | 36,883 | 47,598 | 58,701 | 66,941 |

The effects of the scheme have been significant, though it is difficult to dissociate these from the other changes in the collection scheme being implemented on an ongoing basis. However, discussions with those responsible for the service suggest they believe that the charging system is an important component of the overall service. The fact that it is difficult to estimate the effects of the charging scheme in isolation merely reaffirms the view that charging ought to be considered alongside the provision of carefully designed services.

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ILLEGAL DUMPING

Before introducing the system, no adequate reporting system was in place for illegal tipping. Today an estimated maximum of 0.5% of total household waste is thought to be illegally tipped. According to IVAGO, the major problems occur around, and in, large buildings, and in some areas with low income residents. There is no easy way of characterizing the type of person who is the "fly tipper". Our own visits to the scheme suggest that at apartment blocks, there is also a significant amount of waste leakage, with refuse being disposed in sacks for PMD waste. This varies significantly across apartment blocks, a key variable being the supervision of the apartment block attendant. Where the attendant takes a positive interest in the scheme, the trolley bins are clean, and the material is far less contaminated than in the case where the communal area is left to deteriorate, attracting increasing quantities of dumped materials.

It is also thought to be unavoidable that some commercial waste will be found in the household waste stream. As a rule, in Gent, small companies may present up to 3 bags. IVAGO also collects commercial waste (similar to household waste) on a contractual base (about 4,000 customers). Problems persist due to some (small amounts of) 'black market' money (and other 'benefits in kind') for the waste collectors themselves.

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PRIVATE COSTS

It is not straightforward to compare costs before and after the start of the system. There were too many changes in logistics and service levels which took place alongside the charging system. As stated before, the residents only pay directly 20% of the total cost for the collection and treatment of all waste fractions. The residents pay on an account number of the city of Gent. IVAGO receives a monthly contribution from the city to cover all costs.

To compare costs, one must also consider the service on offer. Politicians want to increase service performance continuously, but this can have a significant impact on cost. For example, if IVAGO was to collect organic solid waste every week (instead of every fortnight), it is estimated that this would cost an additional €1 million annually (investment in extra lorries, staff, etc.).

If one compares the period before 1998 and the period after, one sees a continuation of the improvements made in separate collection (see Figure 1), a continuous increase in waste delivered to bring sites, and – in the year 1998 – a slight constraint on overall growth of waste arisings (though this is barely discernible, and could not be assumed to be statistically significant) (again, see Figure 1).

If one attributed the changes between 1997 and 1999 entirely to the charging system, one finds the changes as in Table 4. These are figures from IVAGO, adjusted for calculations of changes.

Figure 1. Evolution of system performance in IVAGO area

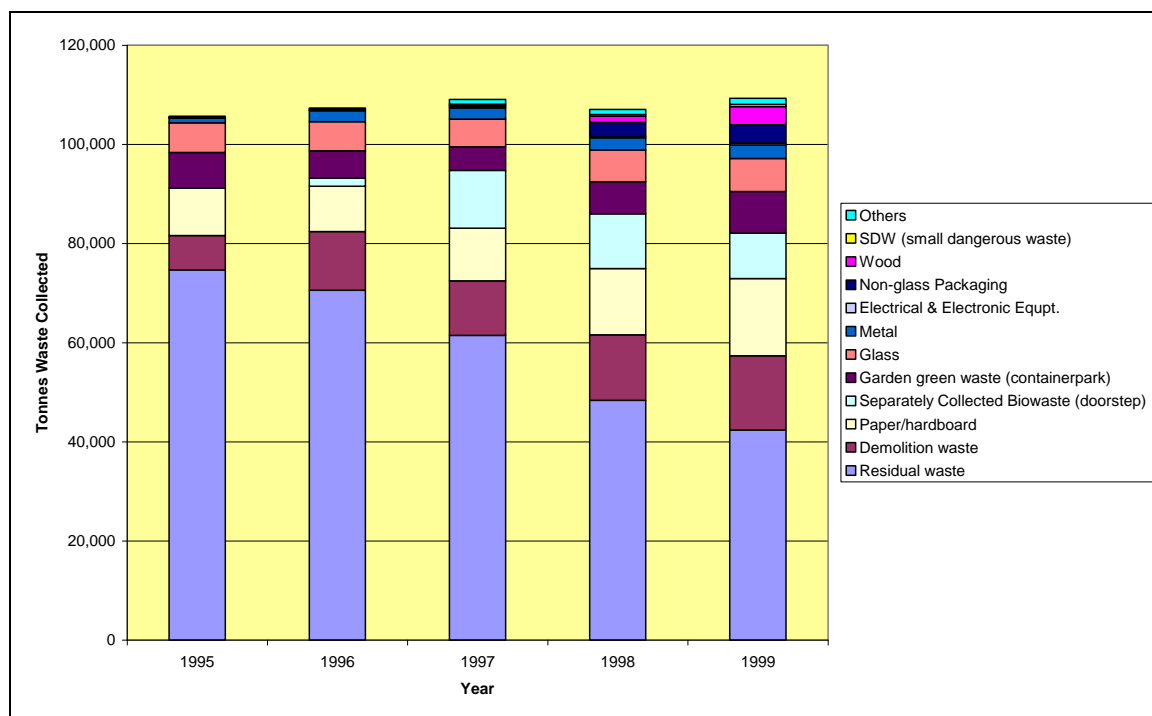


Table 4. Changes in material flows, Ghent
1997-1999

| Material | Change in Quantity (tonnes, 1999-1997) |
|--------------------------------|---|
| Residual waste | -19,104 |
| Separately Collected Fractions | |
| Demolition waste | 3,984 |
| Paper/cardboard | 4,970 |
| OSW | -2,480 |
| Garden green waste | 3,613 |
| Glass | 1,087 |
| Metal | 467 |
| Electric & Electronics | 173 |
| PMD | 3,430 |
| Wood | 3,652 |
| Household hazardous waste | 141 |
| Others | 303 |
| Total Waste | 1,838 |

Table 5. Total costs, savings and revenues of the DIFTAR system in Ghent
Annual figures

| | € per annum | € per household per annum, approx |
|---|---------------------|-----------------------------------|
| ADDITIONAL COSTS | | |
| <i>Operation of DVR system (third party)</i> | € 700,000 | € 6.09 |
| <i>Additional in-house administration and follow up of container changes (4 people)</i> | € 150,000 | € 1.30 |
| <i>Depreciation on containers</i> | € 350,000 | € 3.04 |
| <i>Clean up from illegal evasion of the charge system</i> | € 300,000 | € 2.61 |
| CHANGE IN COSTS OF TREATMENT | | |
| <i>Reduction of 19,104 tonnes residual waste</i> | -€ 2,300,000 | -€ 20.00 |
| <i>Reduction of 2,400 tonnes organic waste</i> | -€ 200,000 | -€ 1.74 |
| <i>Increase of 3,613 tonnes garden waste</i> | € 108,390 | € 0.94 |
| LOGISTICS SAVINGS | | |
| <i>Fewer staff and trucks (changes in set-out frequency)</i> | -€ 600,000 | -€ 5.22 |
| TOTAL IMPLEMENTATION COSTS | € 1,500,000 | € 13.04 |
| IMPLEMENTATION COSTS NET OF LOGISTICS SAVINGS | € 900,000 | € 7.82 |
| CHANGES IN TREATMENT COSTS | -€ 2,391,610 | -€ 19.80 |
| TOTAL COSTS NET OF SAVINGS = 1 | -€ 1,491,610 | -€ 12.97 |
| INCOME FOR TREASURY FROM CHARGES = 2 | € 5,400,000 | € 46.96 |
| NET EFFECT ON REVENUES = (2-1) | € 6,891,610 | € 59.93 |

Table 5 shows that system net cost reductions are of the order €13 per household. This is strongly dependent upon one's view as to whether the changes over this period are attributable solely to the charging system, or whether the benefits derive also from system changes which are independent of charging. If one assumes that 50% of the change in treatment costs is due to the DVR system, but all of the costs and logistical savings are attributable to the charging system, the savings net of costs fall to €2.08 per household. If one attributes only 25% of the change in treatment costs to the scheme, then net costs of €2.87 apply. The revenues from the charging system augment the net savings, such that the net effect of the system, in the context of the budgetary situation, has been to increase the budget available for other activities by almost €7 million. This is not relevant for the assessment of costs and benefits, and simply represents a change in the distribution of costs.

Table 4 does not show the additional costs which might be attributed to increased outlays on the recycling collections, though it is worth noting here that in Flanders, to the extent that collections increase, the payments made by the organization in charge of compliance with the Packaging Directive makes payments to municipalities on the basis of materials collected. Similarly, Producer Responsibility-type mechanisms applied to other materials (the BEBAT scheme for batteries, for instance) can enable local authorities to generate revenue streams from materials collected separately at container-park s.

If these costs were included, it might be the case that the increase in the collection of packaging would actually indicate that the cost savings are not as great as they are shown here. Certainly, in the UK, where changes from fortnightly collections to weekly ones occasion an increase in capture of materials, costs for such a change tend to be of the order €5-6 per household per annum. Consequently, inclusion of these figures may make the picture regarding costs somewhat less positive than it has been presented here. This is especially true since the PMD fraction consists principally of low density packaging materials. Even if these are assigned a relatively high cost of around €300/tonne for collection, then the additional cost for the whole system would still remain negative since the per household cost of this increased collection would be of the order €10 per household.

EXTERNAL COSTS AND BENEFITS

If one uses the same material flows as those discussed in Table 4 on page 9, the external costs are as calculated in Table 6. We have calculated these assuming that the scheme is responsible for all the change, for 50% of the change, and for 25% of the change.

Table 6. External benefits and costs of the scheme in Ghent

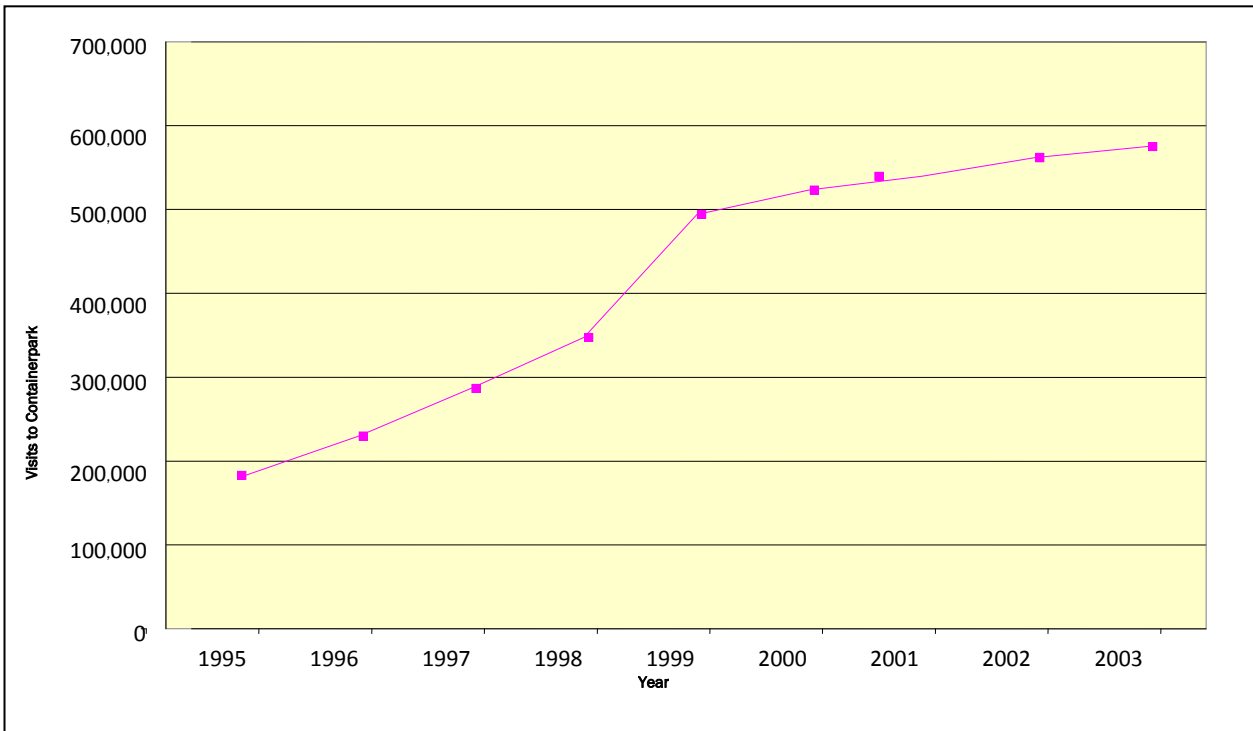
| Waste Stream | Tonnage Change | External Benefit (low damage costs) | External Benefit (high damage costs) |
|--|----------------|-------------------------------------|--------------------------------------|
| Residual Waste | -19,104 | € 619,944 | € 1,199,168 |
| Paper and Card | 4,970 | € 227,920 | € 468,045 |
| Glass | 1,087 | € 12,357 | € 48,643 |
| Steel | 1,925 | € 104,047 | € 189,248 |
| Aluminium | 257 | € 159,567 | € 428,537 |
| Plastics | 1,715 | € 79,729 | € 141,990 |
| Inerts | 3,984 | € 11,554 | € 11,554 |
| Compostables | 1,133 | -€ 15,673 | -€ 58,333 |
| Total External Benefits | | € 1,199,445 | € 2,428,851 |
| External Benefit per Household Assuming 100% effect | | € 10.43 | € 21.12 |
| <i>Assuming 50% effect attributable:</i> | | € 5.21 | € 10.56 |
| <i>Assuming 25% effect attributable:</i> | | € 2.61 | € 5.28 |

In this case, there are no benefits attributable to recycling of wood, or to recycling of other items such as waste electrical and electronic equipment.² On the other hand, no disbenefits have been attributed to the waste which is illegally disposed of. This is believed to be low in quantity (around 0.5% of total, or around 500 tonnes per annum), and the costs to IVAGO of dealing with this are accounted for in the private costs.

In addition, some additional time is spent by households in terms of visits to the container-park. Figure 2 suggests that here has been an increase over time in the number of visits made to container-parks. It is not entirely clear the degree to which this has been motivated by the charging system itself. However, following the introduction of the DVR scheme, in July 1998, there does appear to have been an upward shift against the background of an upward trend. In 1999, one can estimate that the increase in visits over and above the background trend was around 100,000 visits, or marginally less than one visit per household.

2. These are potentially significant. A recent US EPA study suggests that the savings in terms of greenhouse gases alone amount to 2.71 tonnes of CO₂ equivalent (see USEPA (2003)).

Figure 2. Change in number of visits to container-park over time in Ghent



Using the same assumptions as in the case of Torelles de Llobregat (each journey to and from the site takes 40 minutes, 30% of time attributable directly to the activity, value of time foregone €8-10 per hour), then including this as a cost, without any counterpart benefit, would increase the costs of the system by €1.77 – €2.22 per household. These costs – much lower than for Torelles de Llobregat – illustrate the significance of widening the scope of materials collected for recycling / composting through convenient kerbside recycling systems.

The net benefits depend upon the degree to which one assumes the charging scheme is responsible for the changes concerned. Attributing all the change to the charging scheme seems unrealistic and would lead to benefits far greater than in the other schemes examined even though the effect on waste prevention is barely existent in this case. Even where 25% of the effects on the change from 1997-1999 are attributed to the scheme, however, net benefits lie between €3 and €5 per household.

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SUMMARY COSTS AND BENEFITS

The potential permutations of costs and benefits are shown in Table 7 below.

Table 7. Balance of costs and benefits of DVR scheme, Ghent

| | 25% effect | | 50% effect | | 100% effect | |
|--|------------------|-------------------|------------------|-------------------|------------------|-------------------|
| | Low Damage Costs | High Damage Costs | Low Damage Costs | High Damage Costs | Low Damage Costs | High Damage Costs |
| Private Costs | € 2.87 | € 2.87 | - € 2.08 | - € 2.08 | - € 12.97 | - € 12.97 |
| External Costs, Time Excluded | - € 2.61 | - € 5.28 | - € 5.21 | - € 10.56 | - € 10.43 | - € 21.12 |
| External Costs, Time Included | - € 0.84 | - € 3.06 | - € 3.44 | - € 8.34 | - € 8.66 | - € 18.90 |
| Balance of Costs and Benefits Per Household, Time Excluded | € 0.26 | - € 2.41 | - € 7.29 | - € 12.64 | - € 23.40 | - € 34.09 |
| Balance of Costs and Benefits Per Household, Time Included | € 2.03 | - € 0.19 | - € 5.52 | - € 10.42 | - € 21.63 | - € 31.87 |

As with the case of Torelles de Llobregat, there are few permutations where the system imposes net social costs. These are where a) a relatively small effect is attributed to the DVR scheme, and b) where the damage costs used are low (so benefits of avoided disposal and recycling are smaller). Again as in the Torelles de Llobregat, the situation appears slightly worse where the costs of time are taken into account. However, in the case of Gent, including these has a smaller effect, and even in the worst case, the net social costs are of the order €2.00 per household.

If, on the other hand, the DVR scheme is attributed with a more significant proportion of the change occurring between 1997 and 1999, then benefits may be as high as around €10 per household (50% effect attributable) rising to €21-34 if all the change occurring in the period is attributed to the DVR scheme.

On balance, therefore, and based upon the effects of DVR schemes in similar situations elsewhere, it seems likely that the DVR charging scheme will have contributed to the generation of net social benefits. Indeed, perhaps the more important observation is that, as part of a package, the DVR scheme contributed (however significantly) to the generation of net social benefits of the order €20-30 per household.

REFERENCES

Eunomia (2003), *Waste Collection: To Charge or Not to Charge?* A Final report to IWM (EB),
<http://www.eunomia.co.uk/Charging%20report.pdf>.

USEPA (2003) *Background Document for Life-Cycle Greenhouse Gas Emission Factors for Carpet and Personal Computers*, EPA530-R-03-018 November 21, 2003



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