

High recycling rate in a wet–dry waste collection programme (Portugal)

Increases in recycling rates are dependent on public participation in the separation of each recyclable fraction. However, public participation varies according to the specific recycling system implemented and the level of acquired awareness. Individual participation in recycling programs increases not only through increased awareness but also with user-friendly program designs aimed at reducing distances between household and collection points (Garcês et al., 2002).

Over the past two decades, door-to-door wet–dry collection systems have been implemented in several cities in Europe and North America, demonstrating good results with increased public participation and recycling rates. Most wet–dry collection systems consist in a waste selection in two streams: one for “wet” materials such as organics (yard and food waste) and other soiled waste, namely contaminated packaging, diapers and napkins; and other for “dry” material that includes everything else that is clean and could be sorted for recycling or other destination (Otten, 2001). Reducing the number of recycling streams increases the amount of materials collected and decreases the associated net cost. However, it also tends to increase the amount of contaminants in recycling materials which reduces its value for the recycling industry.

Despite its ability to significantly increase recycling and composting, door-to-door wet–dry collection systems have not been implemented in Portugal. The few door-to-door selective collection systems running in Portugal are based on a three stream material-specific collection (paper/paperboard; glass; and plastic/metal packaging), calling for a source separation similar to the three colour container collection system placed in public areas (ecopoints), the most widely used recycling system in the country. This material-specific door-to-door collection system requires more highly motivated citizens as well as dedicated collection trips for each material, which represents additional costs to the geographically redundant door to door mixed wastes collection for landfill and incineration. In Portugal, in view of the fact that municipal solid waste management systems are mostly based on mixed collection for incineration or landfill, recycling depends on the voluntary efforts of citizens aware of the programme.

The pilot programme “It’s Easier to Recycle”

To assess the viability of a door-to-door wet–dry collection system in Portugal, we developed the pilot programme “It’s Easier to Recycle” in the rural small village of Fajã do Penedo on the island of Madeira (Portugal). Fajã do Penedo village is located in the Boaventura Parish of the São Vicente County in the north coast of Madeira, an island in the North Atlantic Ocean part of the Portuguese territory.

The pilot programme “It’s Easier to Recycle” consisted in a door-to-door municipal collection of separated solid waste: dry waste, in a white plastic bag; and wet waste, in a black plastic bag. The criterion for dry waste was: any dry and clean material that will not cause contamination to others and that could be subsequently sorted for recycling or other specific destination. The dry stream included packaging material, paper/paperboard, glass, wood, batteries, clothes, shoes, cork, small electric equipments, and many others. For the wet stream the criterion was: any wet and soiled material that could cause contamination to others, making impossible subsequent separation for recycling. The wet stream included food, yard wastes, kitchen waste, contaminated packaging, diapers, napkins and others. One key component of the system was that the “wet” and “dry” streams were equally convenient to households.

The programme was first publicised by means of a leaflet and a small poster, developed by the authors and printed using a colour printer. The leaflet included precise information about where each material should be placed in the wet–dry system. The advertising material was distributed door-to-door in the village together with an explanation on the programme objectives and on how the system should work. At least one member of each family was approached at home during visits. Each of the 40 families living in the centre of the village was personally invited to take part in the programme and 21 accepted, corresponding to a total of 50 inhabitants. Each of the 21 families comprised two or three family members with an average age of 47 years, the majority of which were retired or agricultural workers with primary levels of education.

The programme was carried out over a period of 120 days, from February to May 2007, with the two waste streams being collected in a pick-up truck twice a week, Mondays and Thursdays morning. Bags collected were transported to a nearby warehouse where wet and dry fractions were manually sorted for each material and weighed. Materials were manually sorted into the following categories: glass; paper/paperboard; plastic/metal; organics; and others. The “other” materials in the dry stream included batteries, clothes, shoes, small electric equipment, cork, wood and medical drugs; the “other” items in the wet stream included mostly diapers.

As a consequence of the pilot programme “It’s Easier to Recycle”, 1548 kg of municipal solid waste were collected, 1034 kg (66.8%) in the wet stream and 514 kg (33.2%) in the dry stream. Total waste production per capita was 0.258 kg a day, a value much smaller than in all the São Vicente County (0.885 kg per capita/day) or in total Madeira Island population (1.5 kg per capita/day) or even in Portugal mainland (1.2 kg per capita/day), but at least partly understandable since this programme only collected wastes from households in a rural area and did not include wastes from facilities such as restaurants, hotels and schools.

The organic proportion in waste generation was 43%, a value similar to Madeira Island (45%) and to Portugal (40%). All organics were collected in the wet stream (660.4 kg, 63% of wet stream), and paper/paperboard (6 kg in wet stream – 1% and 130 kg in dry stream – 25%), glass (15.7 kg in wet stream – 2% and 172 kg in dry stream – 34%), plastic/metal (6 kg in wet stream – 1% and 168.5 kg in dry stream – 33%) corresponds, altogether, to 32% (47% in Portugal and 45% in Madeira Island). The remaining 25% of total wastes produced fell into the “other” category, with a wet proportion of 33%.

Ninety four percent (94%) of total glass, plastic, metal and paper/paperboard produced in the households involved in the programme were recovered for recycling through sorting of the dry stream, a much better result than that achieved in Portugal (15%) and Madeira (21%). In our programme, paper/paperboard was recycled at a rate of 96% (13% in Portugal and 22% in Madeira Island), glass at 92% (43% in Portugal and 52% in Madeira Island) and metal and plastic at 97% (3.8% in Portugal and 3.5% in Madeira Island), values much higher than those obtained in the system implemented in Portugal or Madeira. From the dry stream, we also separated batteries, clothes, shoes, small electric equipment, cork, wood, medical drugs, and umbrellas, a total of 43.3 kg (8.4% of total production), which were forwarded for recycling or other appropriate final treatment.

This high proportion of material recovery represents a 30% recycling rate over total waste collected; this rate could be further increased through composting of the organic fraction from the wet stream. Not taking into account composting of the organic fraction, the total recycling rate reached on this pilot programme (30%) was much higher than national (7.2% in Portugal), regional (10% in

Table 1

Annual cost-benefit estimation for a wet–dry waste collection system in São Vicente compared to present day incineration and ecopoints system used in the county.

	Wet–dry (2001 tonnes a year)	Incineration and ecopoints (2001 tonnes a year)
<i>Costs</i>		
Advertising	15,000 € (21,450 USD)	3000 € (4290 USD)
Collection and transport	160,080 € (228,914 USD)	160,080 € (228,914 USD)
Manual sorting	130,000 € (185,900 USD)	0
Incineration	24,816 € (35,487 USD)	147,774 € (211,317 USD)
Composting	14,150 € (20,235 USD)	0
Sub-total	344,046 € (449,086 USD)	310,854 € (444,521 USD)
<i>Benefits</i>		
Paper/paperboard	70,621 € (100,988 USD)	9,055 € (12,945 USD)
Plastic/metal	192,780 € (275,675 USD)	8,327 € (11,908 USD)
Glass	9,422 € (13,473 USD)	7,905 € (11,304 USD)
Sub-total	272,823 € (390,137 USD)	25,287 € (36,160 USD)
Net cost	71,223 € (101,849 USD)	285,567 € (408,361 USD)
Net cost per ton	36 € (51 USD)	143 € (205 USD)

Madeira) or even local (10% in São Vicente County) levels achieved in 2007 and represents a recovery of 94% of total glass, plastic, metal and paper/paperboard produced in the households involved in the programme “It’s Easier to Recycle”.

We developed a cost-benefit estimate for a large scale implementation of this wet–dry programme in the São Vicente County in order to make a comparison with the waste management system currently enforced (Table 1).

Our expectation was that collection costs in wet–dry system should not exceed collection costs for the current refuse and recyclables program. Another consideration to the overall costs of the new system was the investment needed for the construction, maintenance and operation of a pre-sorting plant to manage the dry stream.

Despite its limitations, namely the short duration and the small number of families participating, the programme “It’s Easier to Recycle” has demonstrated that wet–dry waste collection has a high potential for increasing recycling. Our cost-benefit estimates also show that the wet–dry system is highly competitive against the currently implemented waste management system in São Vicente County. Despite similar expense totals for the two systems, the higher proceeds from the sale of recyclable commodities from the wet–dry system lead to a net cost (and net cost per tonne) for the wet–dry system of one-fourth the net costs for the bulk collection for incineration and ecopoints for recycling. In addition to environmental benefits, the difference of 107 euros per tonne means, alone, a benefit that amply justifies further investments in wet–dry municipal solid waste collection systems. The results from the “It’s Easier to Recycle” Programme, developed in a rural area with an aging population with low levels of schooling, has indicated how the wet–dry collection is a user-friendly system.

In regions such as Madeira, where a modern sorting plant for waste packaging already exists and could be easily adapted, a wet–dry collection system could be implemented with even lower costs than estimated for São Vicente, and achieve high rates of material recovery for recycling. Additionally, the Madeira Island municipal solid waste management system can also rely on an existing composting plant with a capacity to receive a large amount of the organics collected in a wet stream following the removal of waste packaging contaminants.

References

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