

**Recycling Components: as modified by John Furze from the recycling system in use at Hyldespaeldet Housing cooperative in Denmark.**

**Direct Re-cycling:**

- 1: Books and magazines.
- 2: Toys, bicycles etc.
- 3: Records, tapes, CD's etc.
- 4: Good – used clothes.
- 5: Carpentry-quality wood.

**Indirect Re-cycling:**

- 6: Cardboard and paper.
- 7: Special difficult paper with glued binding – telephone directories etc.
- 8a: Normal plastic material.
- 8b: Polystyrol/Flamingo – insulation material etc.

**Glass:**

- 9a: Re-cyclable standard bottles.
- 9b: Wine and spirits bottles.
- 9c: Other glass and pieces of broken glass and shards.
- 10: Aluminum.
- 11: Other metals.
- 12: Car tyres and rubber.
- 13: Rags and other textiles and old clothes.

**Organic:**

- 14: Organic kitchen waste and waste plant material => for composting.
- 15: Food waste for chickens.
- 16: Twigs and small wood branches.
- 17: Fuel wood.
- 18: Earth.

**Problem waste material:**

- 19: Redundant electronics.
- 20: Refrigerators and freezers etc.
- 21: Environmentally dangerous pollutants.
- 21a: Batteries.
- 21b: Material containing Mercury – thermometers etc.
- 21c: Poisonous wastes.
- 21d: Paint.
- 21e: Used motor oil.
- 21f: Medicinal material, needles etc.
- 21g: Other environmentally dangerous pollutants.

**Rest Products:**

- 22: Material that can be burnt.
- 23: Non-burnable material to be sent to the rubbish dump or tip.

This article is derived from **Total Recycling: Realistic Ways to Approach the Ideal**, a book by Daniel Knapp and Mary Lou Van Deventer, coming soon from the University of California Press. Their ideas are based upon lessons learned the hard way at Urban Ore, a precedent-setting recycling operation still growing vigorously in Berkeley, California. —JB

# How to Design Total Recycling Systems

By Daniel Knapp, Ph.D.  
& Mary Lou Van Deventer

**Total** recycling is a big vision — it means not wasting anything. It means a technological, economic, and cultural system built for convenient, effective reuse and recycling of anything we can no longer use. It means wasting and attitudes that permit waste are unacceptable. It has been considered presumptuous even to think of such a thing — until now. Now it is necessary.

But in a world of sound bites and attention spans shortened by television, big visions must be reduced to microbits to be seen at all. Which is okay, so long as the microbits expand on command. These principles are presented as microbits that could be expanded into a huge industry called total recycling:

- 1. Waste isn't waste until it's wasted.** Conventional disposal systems waste resources by mixing unlike things together, often in the name of efficiency. The first step in avoiding waste is avoiding mixing.
- 2. Recyclers handle discards, not wastes.** Discards can be recycled or wasted. We will always have discards, but we can deny people the option to waste them.
- 3. Recycling upgrades discards to resources** instead of downgrading them to garbage. Garbage represents a design failure in the disposal system. Recyclers sometimes waste things, but their ultimate goal is to waste nothing.
- 4. Recycling manages the supply of discards,** not the "solid waste stream." The term "waste management" should be reserved for the garbage disposal industry.
- 5. Recycling is a form of disposal.** Disposal by recycling is not destruction; it is orderly placement. Auction houses also dispose of things, as do estate sales. Only the garbage system disposes of things by destroying their value.
- 6. Disposal fees can power recycling** disposal just as they do garbage disposal. There are fees for disposal services rendered. Recyclers must be allowed and encouraged to compete with garbage interests for disposal fees. This will unlock the potential for recycling businesses to handle vast quantities of material and eventually to replace the garbage system.
- 7. All of what now becomes garbage** can be sorted into **twelve master categories** of recyclable materials.
- 8. A discard management system** in which recycling is the preferred disposal technology must begin with a **discard composition study**. Such a study analyzes today's discards to establish the proportion and volume of each of the twelve master categories of recyclables. Observational studies that sort and weigh are preferable to desktop studies that import data from other localities or use other esoteric methodologies.
- 9. Each locality should do its own composition study,** and results should be made public.
- 10. A comprehensive recycling system** provides

**opportunities to recycle all twelve** of the master discard categories. Recycling systems should not be called comprehensive until all twelve master categories are provided for.

- 11. Using the twelve master categories** provides a way to **estimate progress toward the goal** of total recycling. The steps are: (A) estimate the amount of each master category within the total supply of discards; (B) estimate the amount being recycled within each master category (include long-extant scrap industries); (C) add the discards wasted to the discards recycled; and (D) divide the discards recycled by the total discards. The resulting percentage will be the **recycling rate**.
- 12. Our culture will move toward total recycling in incremental steps,** not all at once.
- 13. Banning and preycling** (source reduction) are valid and useful tools for achieving the goal of total recycling. Some things will never be recyclable.
- 14. All closed landfills should be evaluated** for their suitability as sites for comprehensive recycling transfer stations. This is the largest single option for increasing discard disposal capacity for any community. It will also immediately reduce pressure on remaining landfill capacity.
- 15. Systematic research** should be conducted on the feasibility of **mining old landfills** to recover some resources, but more important, fill space.

## The Twelve Master Categories Of Recyclable Materials

**As** we mentioned, designing a comprehensive recycling system requires a discard composition study. To do the study, one must observe and record what is being tossed out. Categories become important at this stage, because watching the variety of things dumped at a landfill can be overwhelming.

To pull order out of the chaos, similar things must be grouped together. But the category list is crucial; a study will see only what its categories provide for. Inadequate categories will leave a lump of unidentified residue called "miscellaneous" or "garbage." The list has to be big enough to cover everything, and small enough to be useful.

Different sizes of lists are possible, depending on one's idea of what will ultimately happen to the discards. Composition studies for incinerators often have only two categories: burnable and nonburnable. A study for a garbage composting plant might use only four or five.

How many categories are best for a total recycling system? It turns out there are twelve. (The examples after the category names are intended to suggest expansion; they are not limits by any means.)

- 1. Reusable goods**, including intact or repairable home or industrial appliances; household goods; clothing; intact materials in demolition debris, such as lumber; building materials such as doors, windows, cabinets, and sinks; business supplies and equipment; lighting fixtures; and any manufactured item or naturally occurring object that can be repaired or used again as is.
- 2. Paper**, including newsprint; ledger paper; computer paper; corrugated cardboard; and mixed paper.
- 3. Metals**, both ferrous and nonferrous, including cans; parts from abandoned vehicles; plumbing; fences; metal doors and screens; tools; machinery; and any other discarded metal objects.
- 4. Glass**, including glass containers and window glass.
- 5. Textiles**, including nonreusable clothing; upholstery; and pieces of fabric.
- 6. Plastics**, including beverage containers; plastic

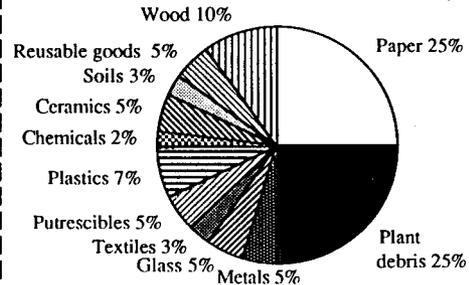
packaging; plastic cases of consumer goods such as telephones or electronic equipment; films; and tires.

- 7. Plant debris**, including leaves and cuttings; trimmings from trees, shrubs, and grass; whole plants; and sawdust.
- 8. Putrescibles**, including animal, fruit, and vegetable debris; cooked food; manures; offal; and sewage sludge.
- 9. Wood**, including unreusable lumber; tree rounds; and pallets.
- 10. Ceramics**, including rock; tile; china; brick; concrete; plaster; and asphalt.
- 11. Soils**, including excavation soils from barren or developed land; and excess soils from people's yards.
- 12. Chemicals**, including acids; bases; solvents; fuels; lubricating oils; and medicines.

## Estimated and Actual Percentages of Recyclables in the Total Discard Supply

**From** incomplete empirical studies and countless unsystematic real-world observations, we can build up a composite picture of the way the twelve master categories are probably related. This is a best guess and is not accurate for any specific locality, but it is still quite useful because it provides an overview showing that although discards viewed en masse are chaotic and psychically overwhelming, they are nevertheless finite and can be accounted for.

### Percentage of Recyclables in the Discards



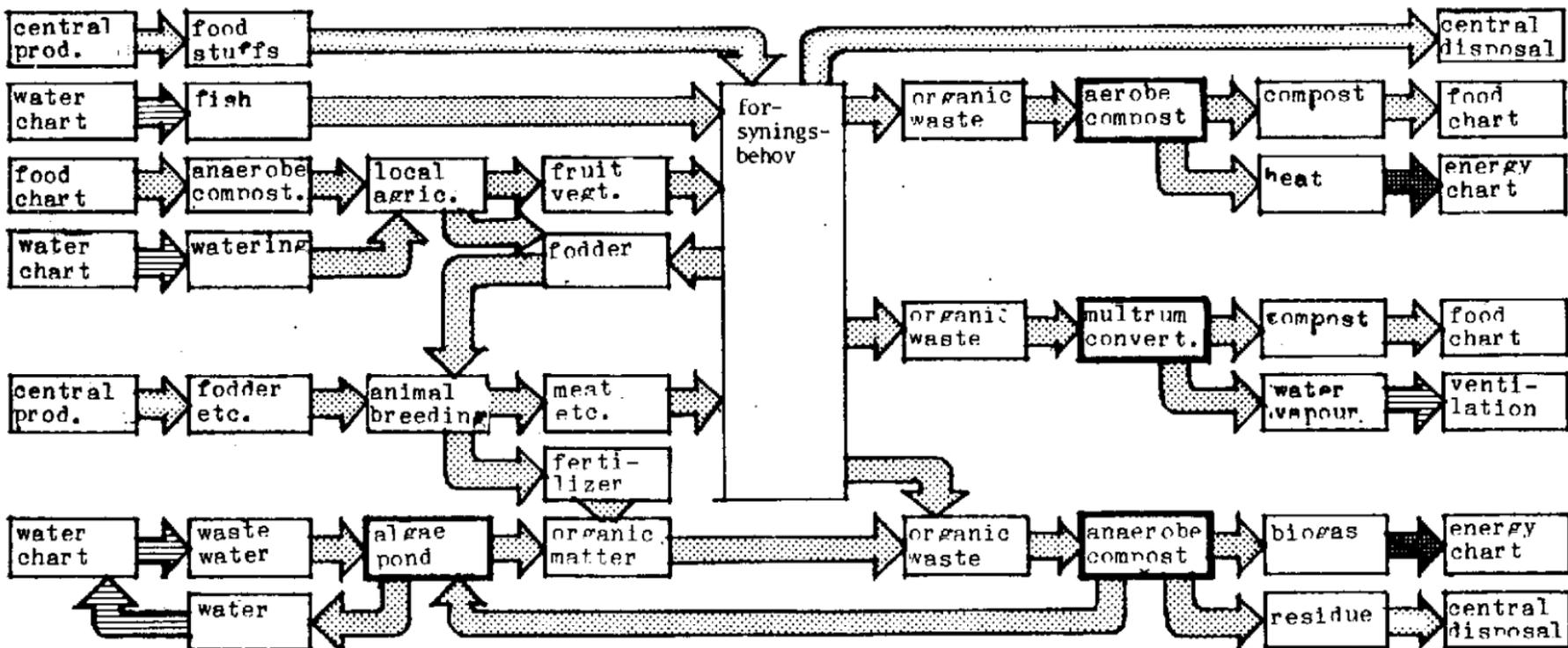
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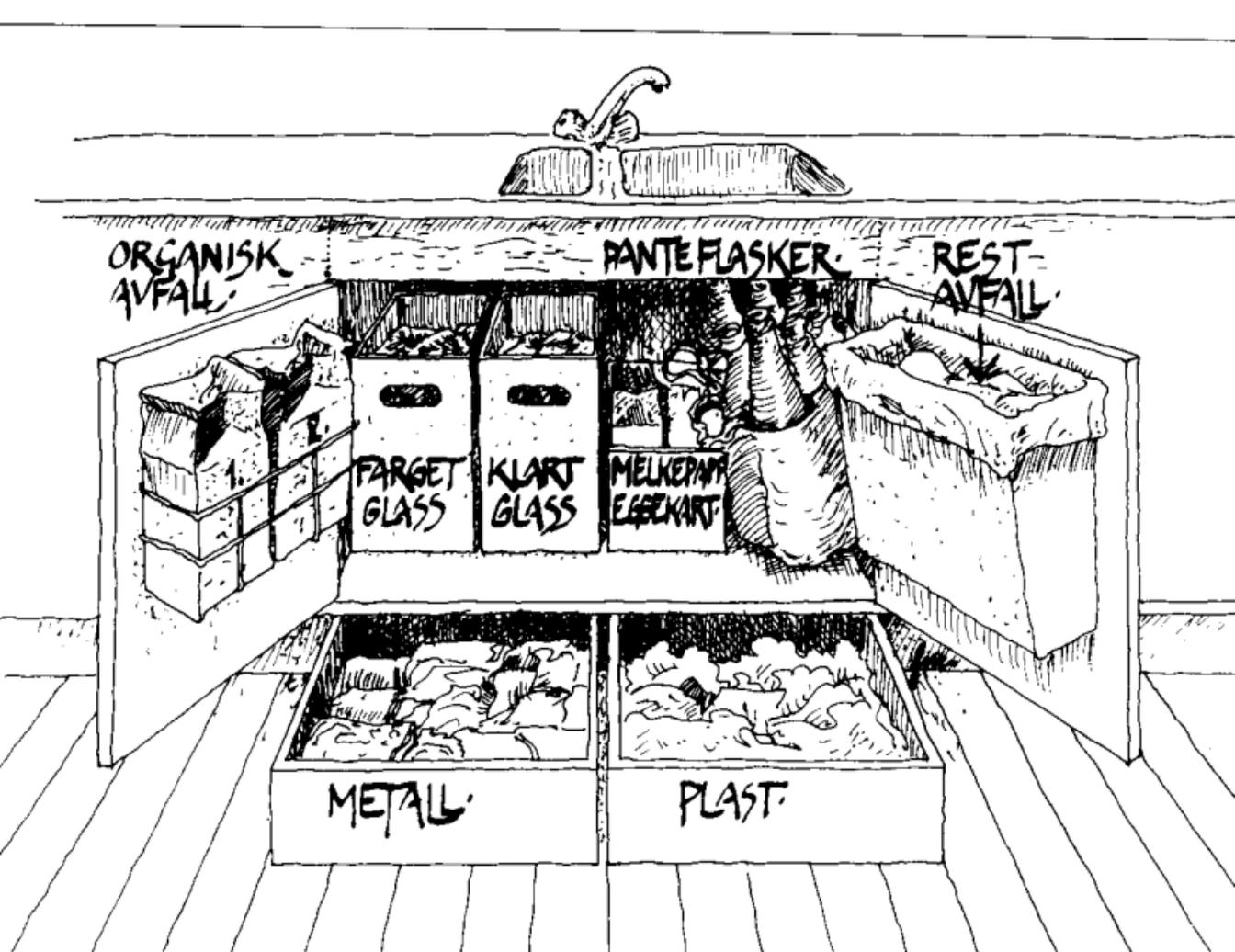
This generic chart lets us make these big and very useful observations:

- Just two categories, paper and plant debris, make up 50% of the total discards.
- About 85% of the discards are organic, carbon-based compounds.
- The original "Earth Day" recycling focused on post-consumer cans, bottles, and newspaper. We have not achieved total success in these categories — really subcategories — but if we did, that would give us a recycling rate somewhere between 15% and 25%.
- From an entrepreneurial point of view, the current public preoccupation with plastics recycling obscures much more viable business opportunities with bigger potential impacts. Reusable goods, plant debris, soils, ceramics, putrescibles, and textiles can be harvested more easily and profitably than plastics, and they represent 56% of the total, compared to plastics' 7%.
- Had the early recyclers concentrated on reusable goods — the single most valuable category per ton of the twelve — they could have tapped into a financial resource that would have stabilized and underwritten their losses elsewhere without diminishing the environmental impact of their efforts. Reusable goods are equal in volume to glass and metal, and salvaging them conserves the manufacturing energy embodied in them.

Food flow-chart  
Supply and recirculation Rural dwelling situation

supply situation    supply character    primary handling    primary product    consumption demand    secondary product    secondary handling    tertiary product    recirculation situation





ORGANISK  
AVFALL

PAPPER  
FLASKER

REST-  
AVFALL

FARGET  
GLASS

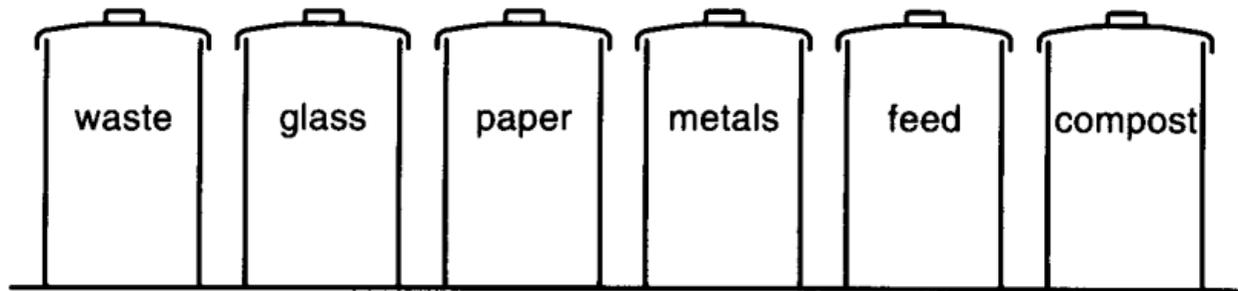
KLART  
GLASS

MELKEPAPP  
EGGERKART

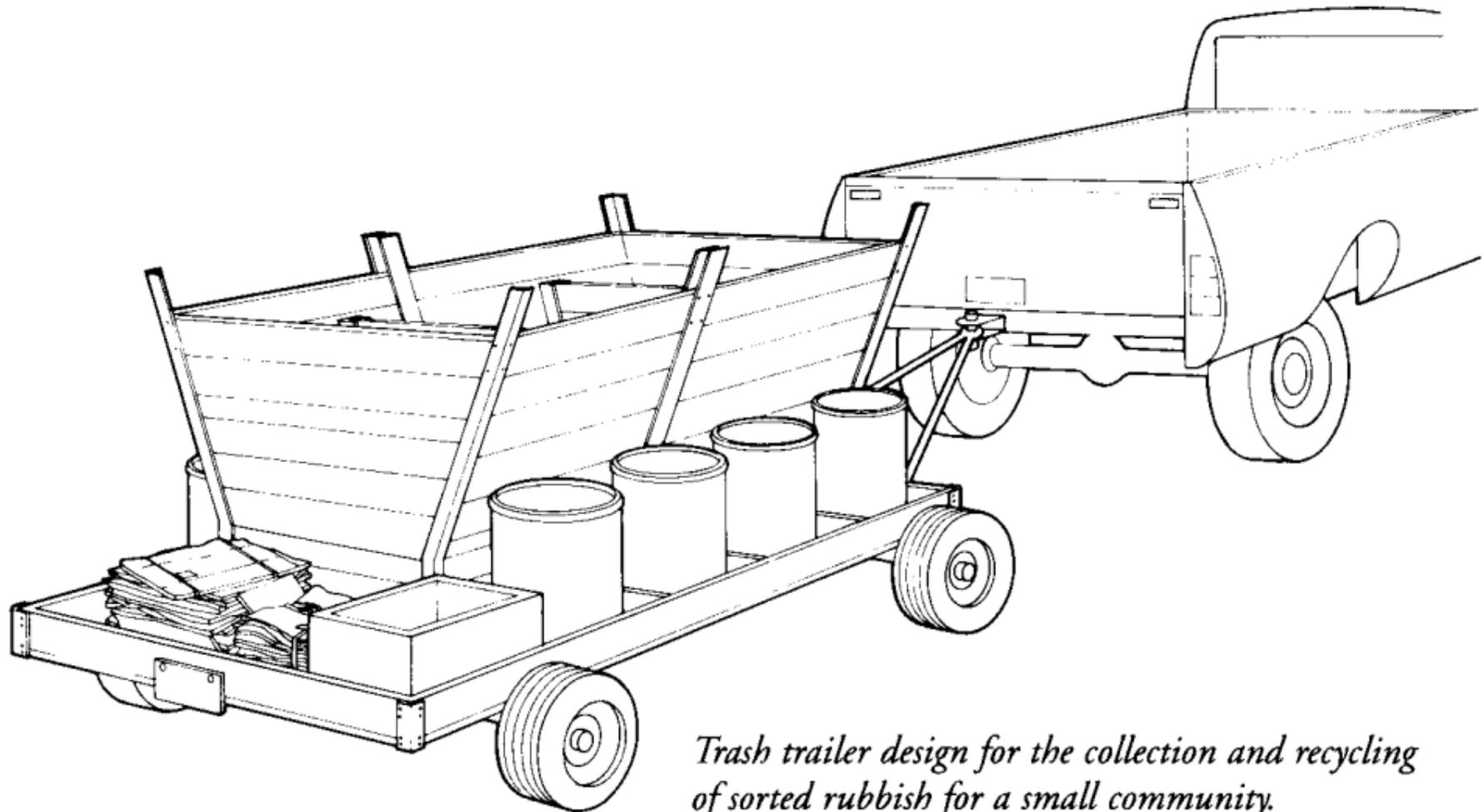
METALL

PLAST

Figure 18: Potential Domestic Rubbish Collection



Bins can be used for different categories of waste. One labelled 'waste' would be for things that cannot be used or recycled, such as plastics. The animal feed bin could be combined with the compost bin. They should be placed where they can be conveniently used, perhaps under the kitchen sink or outside the back door.



*Trash trailer design for the collection and recycling of sorted rubbish for a small community.*