The Keep It Clean Plan

Let's do it FOUNDATION

Written by:

Knowledge Team, Let's Do It Foundation 2018
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Disclaimer:

Table of Contents

Foreword

We believe that there is no single solution to the worldwide waste problem. Why? Because there are 8 billion-plus individual solutions – depending on who and where you are. The following is a set of guidelines that state the overall principles and vision for the sustainable management of resources and waste, together with step-by-step solutions and examples of best practices.

Yes, we believe that every single person on this planet is contributing to the world waste problem and, therefore, can solve it too. Here is how you will find the following chapters most useful:

- **Step 1:**
  Before reading any further, write down who you are.

  - Woman
  - Mother
  - Member of a community
  - Member of a civil society organisation
  - Entrepreneur
  - Voter
  - Member of a board of trustees

- **Step 2:**
  Based on the information that you wrote down, identify how you influence the world waste problem. Think individually, as part of civil society, part of a business or government.

- **Step 3:**
  Read the roadmap. Tick the actions that you have already taken or have influenced others to take. Set new targets that are measurable. The following chapters give you technical insights for choosing the best way forward.

Individual:

- don't buy single use items
- consume less
- buy second-hand
- borrow things from friends
- sort waste to improve recycling
- own a composter

Leader:

- inform and educate others on waste problems and possible solutions

Entrepreneur:

- don't use single use items
- support reuse systems
- create or support the creation of new reuse systems

Voter:

- always vote
- do prior research
- elect those who prioritise environmental and waste issues

- **Step 4:**
  Take time to evaluate your performance and revise the targets. If you want to take it seriously, audit your waste generation, involve experts, take it to the next level. Sounds simple? Yes. Try to follow it. Not that simple anymore!

- **Step 5:**
  Share your story! In order to reach 8 billion-plus people in the world, we need to talk about the solutions in a meaningful way. No multi-million advertising campaign can beat a story from someone that you trust to change your behaviour and you can always write to us at: info@letsdoitfoundation.org

Glossary

Key terms used in the document (unless described in dedicated sections):

- **Deposit Refund Scheme / Deposit Return System (DRS)**

  A scheme where an item is sold at a price which includes a deposit, whose amount gets returned to the customer once it's taken back to the same shop, or another aligned shop. A typical DRS example covers packaging (e.g. bottles, cans) and helps to achieve very high take-back rates, thus maximising reuse and recycling, and minimising littering the environment.

- **Extended Producer Responsibility (EPR)**

  An environmental protection strategy to decrease the total environmental impact from a product, by making the manufacturer responsible for the entire life-cycle of the product and especially for funding the take-back, recycling and final disposal. E.g. the producer of mobile phones has to fund the system of collecting and recycling of old telephones.

- **Hard-to-recycle plastics**

  Usually low-value, mixed plastic materials (crisp packets, sachets), which are usually not worth the cost of separation from the larger plastic mass. Some processes, e.g. extrusion, may help recycle them into new mixed aggregates which can be used for various purposes.

- **Kerbside (UK)/curbside (US) schemes**

  Door-to-door collection of waste - a waste collection service provided to households, typically in urban and suburban areas where waste is left right outside each property ("at the kerb/curb") in a container and picked up by a passing vehicle.

- **Plastic extrusion**

  It's a remanufacturing process in which raw plastics, also made of various polymers, are melted and formed into flakes (which can be processed into floorings, pots, benches, etc.) or directly into final objects, like pipes and tubes.

- **Recovery**

  A general term covering all waste management practices included in the waste hierachy above landfilling - can mean both "material recovery" (recycling, composting, downcycling) and/or energy recovery (incineration[1], co-incineration of refuse derived fuels e.g. in cement kilns). Since it is destructive of materials and resources, "energy recovery" is anyway considered as a "leakage" of resources from Circular Economy. Throughout this document, priority is given to material recovery and avoiding energy recovery altogether.

- **Residuals / residual waste**

  Waste which has not been reused, or separately collected for recycling and composting, thus requires final disposal.

- **Waste audit**

  An inventory of the amount and type of solid waste that is produced at a specific location (e.g. home, office, company) or an assessment of the composition of the municipal waste produced by a community. Waste audits provide valuable info to help understand what materials are worth taking action on.

[1] In order to be classified as "energy recovery", incineration must meet qualifying criteria of energetic efficiency. In the EU, the minimum energetic efficiency to qualify as "recovery" is e.g. set at 70%. If this is not met, incineration is classified as "disposal".

Keep It Clean Roadmap

We need a systemic shift in our approach to resources – drastically reducing the amount of waste created, and preserving all resources at their highest quality by reusing what we can, and recycling or composting everything else.

We also need a collective consensus on creating a healthy waste-free environment for all. We must shift our perspectives, and treat all waste as a precious resource - just like nature does. It's only waste when it's wasted.

This will require a collective effort from all levels of society – revising our policies, planning, supply and packaging of goods, decision-making, and business models, while simultaneously transforming public attitudes and behaviours across all generations.

"If a product can't be reused, repaired, recycled, composted or redesigned, then industry shouldn't be producing it"

Paul Connett, one of the founders of the zero waste movement

Governments (local & national)

Immediate actions

- **Plan and measure**
  Make or renew your waste management (WM) strategy, and set goals, priorities, and deadlines. For example a National WM Act, National WM Plan, or local WM programme.
  - Prioritise waste reduction. Set targets for the amount of waste produced, ban unnecessary items like many single-use plastics, redesign products to be durable, repairable, and reusable.
  - Outline how to better manage any waste that is produced, i.e. by making separate collections of different waste types compulsory, and ensuring recycling takes place as close as possible to where the waste is produced.

Long-term actions

- **Bring in rules**
  Once you have a strategy, support this with regulations defining permitting powers and procedures, waste accounting procedures, monitoring programmes, etc.

- **Consequences**
  Plan in enforcement and policing - what will you do if local authorities do not meet the targets? What will the penalties be for littering?

Governments (local & national)

Immediate actions

- **Responsibilities**

  Define roles and responsibilities of local governments and companies. For example, introduce Extended Producer Responsibility(EPR) schemes for industry and businesses to fund separate collections and recycling, and define whether recycling targets must be met at regional or municipal level.

Long-term actions

- **Money**

  Make goals set in the plan have funding, e.g. for prevention measures, awareness raising, reuse activities, waste collection infrastructure, incentives for local businesses to become less wasteful or for people to implement local recycling and composting activities. The economic benefits of better management of resources, reduced collection and disposal costs and jobs created in the new system will pay off!

- **Support the flow**

  Support the development of markets for recycled materials, e.g. promote Green Public Procurement, and give priority to recycled products.

- **Nurture**

  Trust the creativity of businesses, and create a favourable environment that supports waste-savvy innovations.

- **Rethink the cycle**

  Promote Extended Producer Responsibility (EPR) as a way to finance better management of waste items like packaging and electronics, and to support redesign of products by industries, in order to minimise the use of hard to-recycle materials. Promote Deposit Refund Systems (DRS) as the best way to ensure materials are preserved!

- **Knowledge**

  Support lifelong learning and research to build society's knowledge and skills around resource use and waste management.

Governments in highlight

- **India**

  The state of Kerala in India has started an initiative called Green Protocol. It requires event organisers not to use single use plastics (or other disposables) at events. *More info here.*

- **Austria**

  In 2020 the Austrian government set legally-binding quotas for refillables, requiring that 25% of beverages be sold in refillable bottles beginning in 2023 and increasing to 40% in 2025 and 55% in 2030.

Businesses

Immediate actions

- **Rethink**
  Recognise waste as a resource, and an opportunity to increase profitability – recycling and composting reduces disposal costs, and triggers new business opportunities.
- **Educate**
  Teach the customer – is your product recyclable? How and where should it be disposed of?
- **Be a pioneer**
  Deposit schemes (e.g. putting a small deposit on drinks containers to ensure take-back) can be launched even if no national scheme is in place.
- **Wrap it smart**
  Always opt for less packaging, smarter packaging, and reusable packaging. The same goes for products!
- **Stay safe**
  Compost can only be used in agriculture if not polluted by other waste. Recycling may require specific safeguards for workers. Some plastics include harmful substances, making them unsuitable e.g. for food packaging or toys.
- **The afterlife**
  What will happen to your product after use? Recyclable packaging that is in an area with no recycling collections may end up as litter. If compostable plastics end up in landfill they emit methane as they biodegrade.

Long-term actions

- **Inspire others**
  Create new markets based around innovative, reusable or resource-savvy products.
- **Rethink business models**
  'Do more with less' – e.g. create lending services, selling the use of an item, not the item itself.
- **Rethink resources**
  Use recycled materials rather than virgin resources – the possibilities for recycled glass, plastics, paper and metals are huge. Composted organics are a great replacement for peat or mineral fertilisers.

Businesses in highlight

- **ReCircle (Germany, Switzerland)**
  They offer reusable food containers and cutlery as a deposit system with washing service.
  https://www.recircle.ch/en
- **Nutriloop (Estonia)**
  Focuses on valorizing biowaste. For example, they cooperate with event organisers to collect all the food scraps from catering and turn it into valuable nutrients for the soil.
  https://nutriloop.org

Civil society

Immediate actions

- **Teach new habits**
  Raise awareness and change attitudes, especially among young people – “reuse is cool”!

- **Highlight**
  Point out wasteful design flaws in goods, and run waste audits to encourage redesign and green purchasing.

- **Act local**
  Create, support and connect with local solutions in your community. See an inspiring example *here.*

Long-term actions

- **Educate**
  Promote permanent education and research with resource management at the core.

- **Praise**
  Highlight best practice – either your own or others’, e.g. national awards for areas recycling the most, or wasting the least. Acknowledge governments’ and businesses’ efforts.

- **Guard**
  Make sure governments and businesses hold their promises.

- **Cooperation**
  Work with local municipalities to achieve goals.

Civil society organisations in highlight

- **Brand audits, since 2018 (global)**
  Around the time of World Cleanup Day, Break Free From Plastic movement mobilizes organisations and volunteers to conduct brand audits - determining which product and brand is most common among the litter picked up at cleanups. This sends a strong message to companies to redesign their packages.
  More info here.

- **Aliansi Zero Waste Indonesia**
  Formed in 2016 and consisting of 9 member organisatsions. Already in 2016 they managed to halt the planning of new incinerators in 7 cities. In 2018 they co-hosted an international Zero Waste Cities conference attended by people from 12 countries. You can read more about them *here.*

Individuals

Immediate actions

- **Refuse**
  Avoid single use items.
- **Reduce**
  Only buy things if strictly needed, and choose less packaging.
- **Reuse**
  Buy second-hand items, or if new – choose products built to last.
- **Recycle**
  Recycle what you can, and choose products made from recycled materials.
- **Know your hood**
  Find out what recycling and reuse options are near you.
- **Compost**
  Find a way to compost your organic waste.
- **Let your money talk**
  Vote with your wallet – buy less wasteful products. And demand more of them from producers!
- **Assess**
  Do a personal waste audit, to see where to improve.
- **Spread it!**
  Spread good ideas, and involve family and friends.

Long-term actions

- **Borrow**
  Create informal networks to lend out items.
- **Be a leader**
  No way to recycle? Consider starting a small recycling business yourself.
- **Stay smart**
  Educate yourself about the issues and solutions.

Lets Do It Foundation team's personal practises:

- bringing our own coffee cup, water bottle, spork
- buying food, shampoo, cleaning products in our own bags and containers
- buying second hand clothing
- reusable nappies for baby
- swapping children's toys and clothes
- reusable cotton rounds and feminine hygiene products
- sorting our waste (packages, deposit bottles, paper, biowaste, donating old clothes and things to reuse centers)
- working daily to make zero waste and circular economy a reality!

1. From Waste Back to Resources

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Our words matter

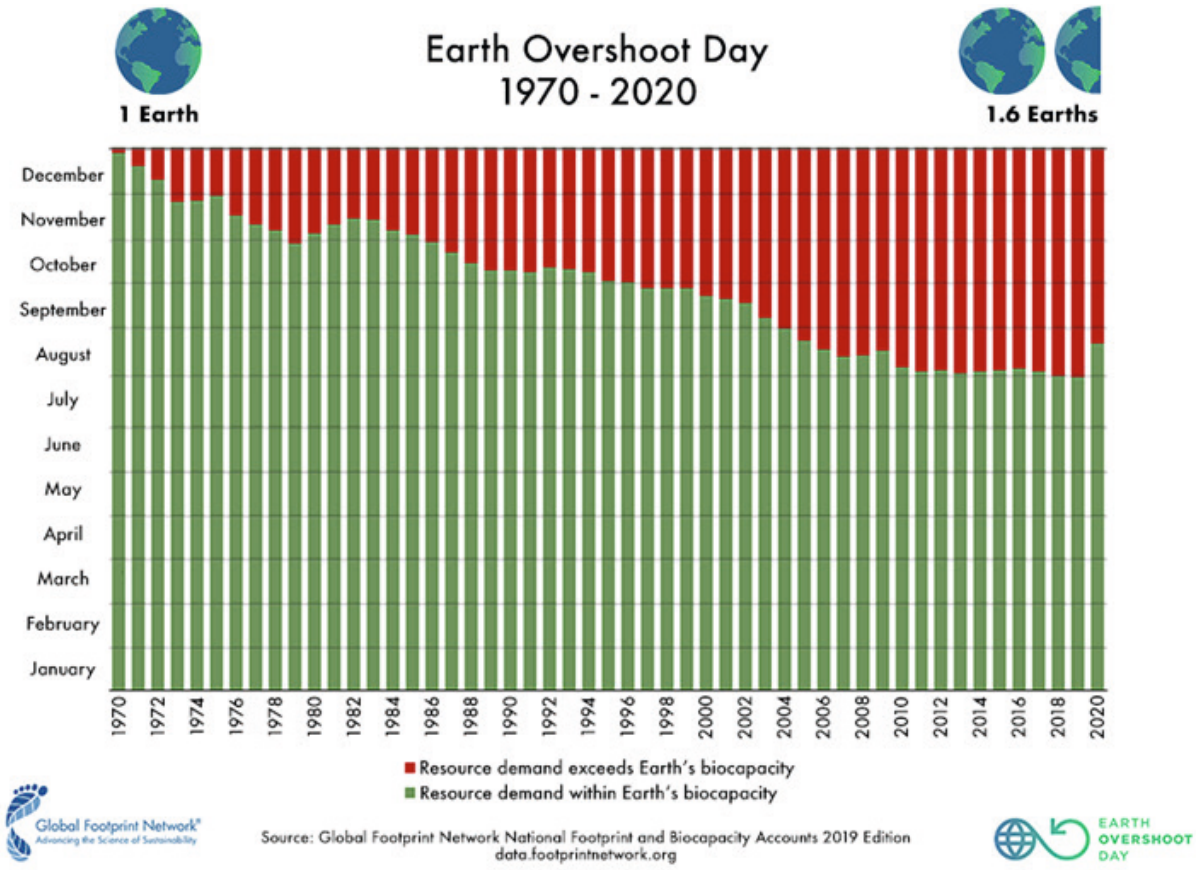
It's only waste when it's wasted. We want to stress the value of materials we throw away and call waste. That's why instead of **"waste"** we also use words like:

- **post-use materials;**
- **discards;**
- **resources**.

Global trends and the resource scarcity crisis

Saving post-use materials from littering, land-filling and incineration not only means better management of waste, but also saves resources, makes them available for reuse and recycling, and decreases the need for new primary raw materials to be extracted.

Mankind is currently consuming more resources than what the planet creates, which is destroying the ecosystems that support us, putting the needs of our future generations at risk.



The "ecological debt" of our consumption patterns is known as the **"Earth Overshoot Day"**[2]. It is a date calculated every year, on which humanity as a whole has consumed more from nature than our planet can renew, and exceeds the so-called ecological budget for the year. Until 1970 this day

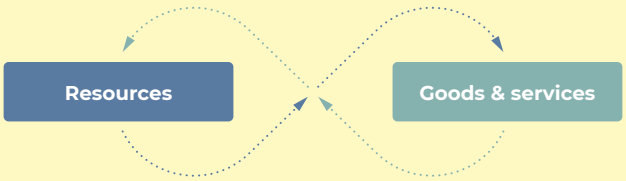
Our vision is a clean and healthy world, and our main aim is to preserve resources.

was after December 31st, meaning that humanity didn't consume more than Earth could regenerate, but in the last few decades the day has arrived sooner and sooner. In 2019 it was on July 29th – for the rest of the year we will be consuming more than we can repay; we'd need approximately 1.7 planets to meet our needs. In 2020 it was almost a month later - on August 22nd - the effect of the lockdowns due to COVID-19 pandemic. But as Earth Overshoot webpage says - we should achieve sustainability by design, not by disaster.

One of the reasons for overconsumption is our linear economy model: it is the "take, make, waste" approach. It's not just the waste problem (littering, landfilling and incineration) - we keep needing more new primary raw materials (oil, wood, metals, rare earth elements, etc). The less waste we produce and the more we reuse and recycle, the fewer new resources we need to extract from nature. Good waste management therefore is a way to keep our production and consumption patterns "sustainable", i.e. able to meet the needs of the present, without compromising the needs of future generations[3].

Linear model

Circular model



[2] *Click here for the source.*

[3] This is the internationally adopted definition of sustainability, first coined by the UN-appointed Brundtland Commission

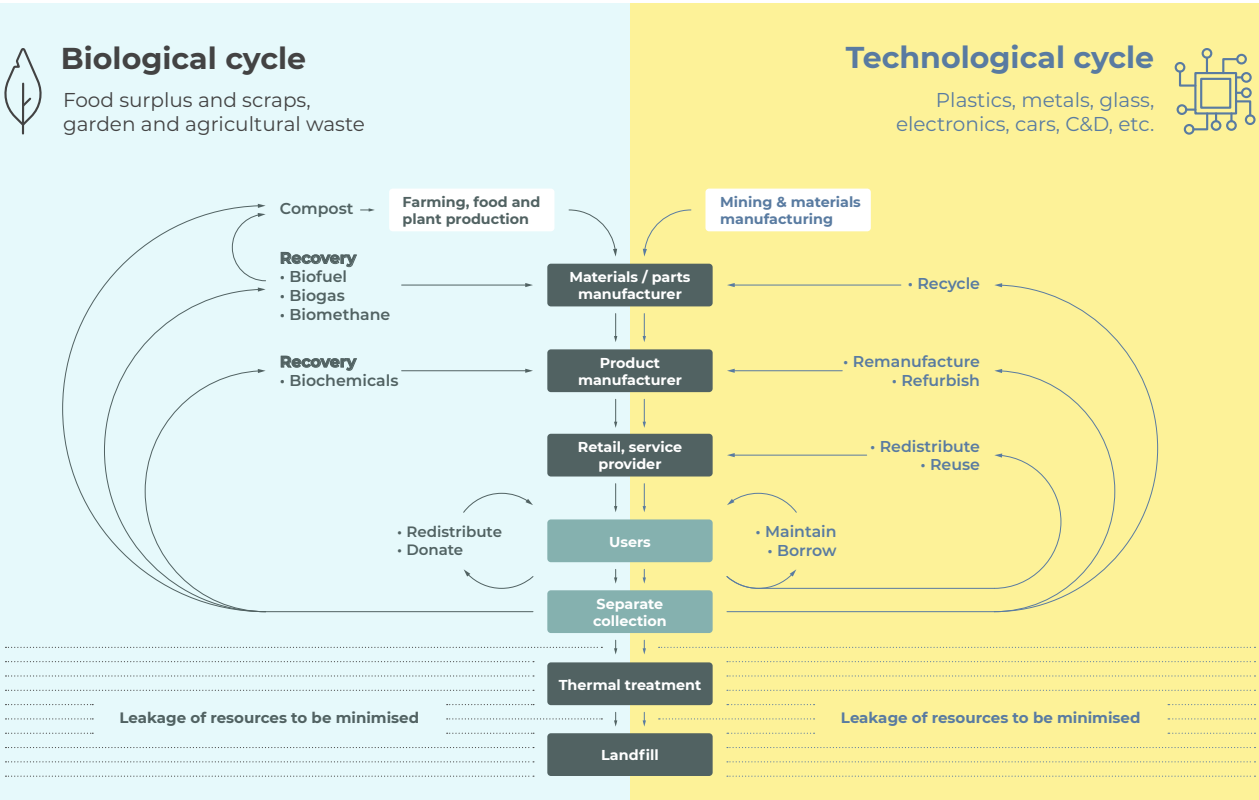
What is Circular Economy?

In a circular economy, the value of products and materials is maintained for as long as possible. Waste generation and resource use are minimised, and when a product reaches the end of its life, it is used again to create further value.[4]

Sustainability in the management of post-use materials is becoming a strategic priority, influencing the political agenda in many areas of the world. Europe has issued its "Circular Economy Package" aiming at maximum recovery of discarded materials, and minimal disposal.[5] The term "Circular Economy" (also worded as "Sustainable Material Management" in the US[6]) means using materials again and again in further loops of production / consumption / recovery, minimising reliance on new primary raw materials and on the need for disposal sites.

Circular Economy includes many actions and levels at which we can preserve resources: reduce the amount of materials that are used to produce and distribute goods, reuse materials, repair, separate materials suitable for composting and recycling, refurbish/repurpose some materials and items to bring them to new life.

The essence of circular economy is visualised by the "butterfly diagram", here based on the models by the Ellen MacArthur Foundation and the European Compost Network:



[4] Click here for the source.
[5] Click here for the source.
[6] Click here for the source.

We have many options, from the individual scale to low-tech solutions (sharing and reusing, re-purposing) to more complex systems requiring organisational and technological infrastructures (separate collection with industrial composting or industrial recycling, biorefineries to extract valuable compounds from bio-based materials, etc.). While thinking globally, we need to act locally, even before larger strategies are created by local or national governments.

At whichever level you can act, saving resources means reducing the pressure on the global need for new primary raw materials. This is a precious contribution to decrease the global crisis on the scarcity of resources, which otherwise triggers international tensions and fights for ownership and use of resources. Hence, be proud: any item you save, any kilogram of material you keep in the loop, is **part of a peace-making global strategy.**

Why keep resources in the loop?

If we want to value materials, minimise littering, and reduce the loss of materials, we can:

- promote and adopt less wasteful habits and products,
- establish formal collection schemes,
- promote local recycling and reuse activities,
- establish markets for recycled materials and compost.

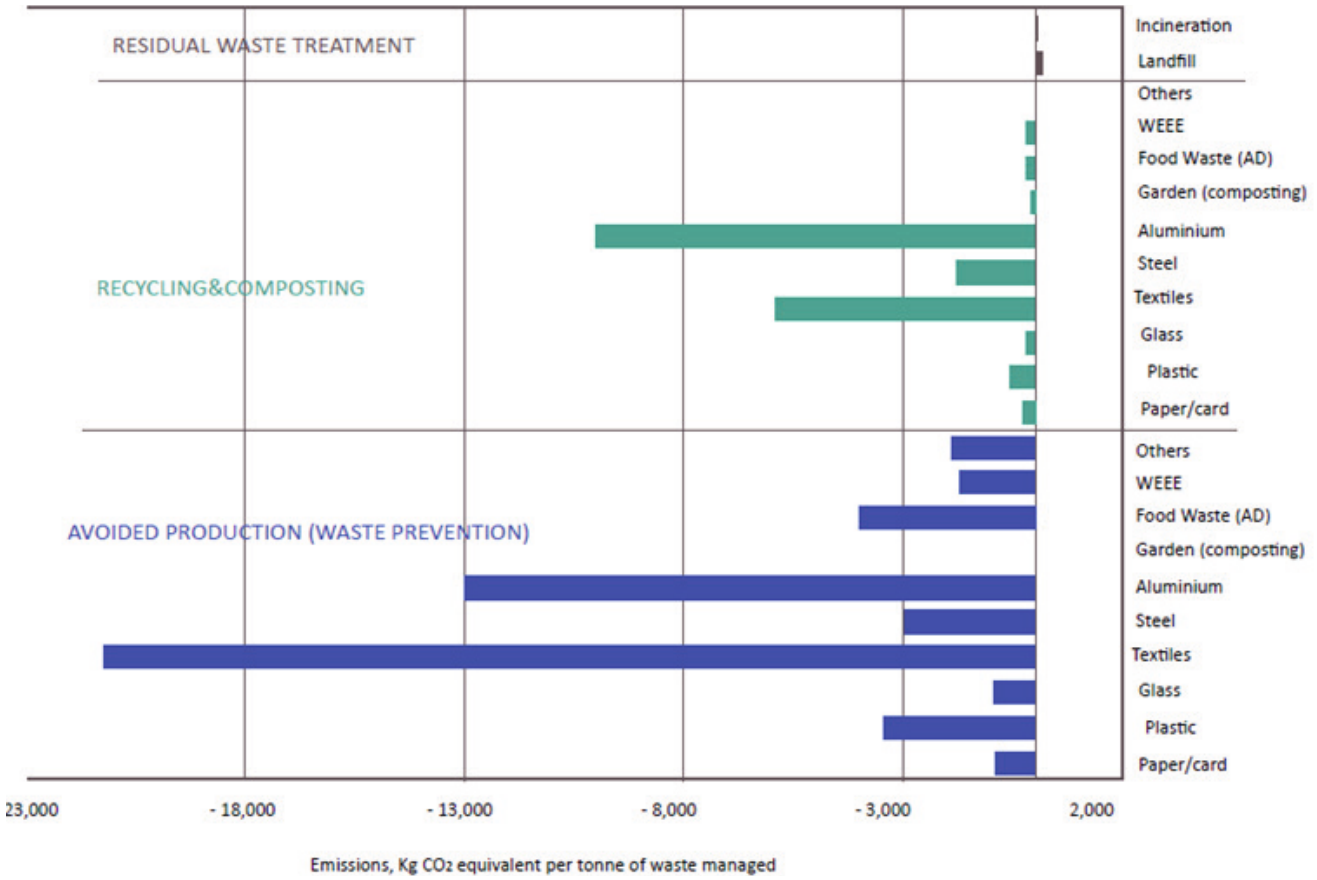
It is important to sharply cut the amount of waste scattered in cities, countrysides, waterways, and oceans. This is how we tackle the problem of plastic marine pollution, which has grown at a pace of 10 million tonnes each year. Garbage patches in the oceans, plastic entering the food webs and our drinking water, these are the main signs of a dramatic problem now at the top of the public agenda.
Sustainable management of waste doesn't only reduce litter, minimise the need for landfills and incinerators and lower the environmental impacts. It also brings wider social benefits – job opportunities, increased income and living standards.

Some key facts and figures:

- Going circular would mean a higher efficiency in the economic system: fewer resources used and lower expenditures for disposal of discards. Some estimates show impressive economic advantages of this "efficiency plan": e.g. 1.8 trillion Euros of economic benefits by 2030 for the EU switching from current practice to circular economy[7].
- Separate collection, recycling, composting, reuse and repair are labour-intensive activities. Managing resources through such activities, instead of disposal at landfill and incineration sites, would mean new jobs. For example, 1.1 million jobs could be created if the US aimed for recycling 75% of waste and composting through a Zero Waste approach[8]. A report by RREUSE[9] shows occupational figures for different options to manage 10 000 tonnes of waste/materials:
  - 1 job at incinerators
  - 6 jobs at landfills
  - 36 jobs at recycling/composting sites
  - 296 jobs at reuse centres

[7] *Click here for the source.*
[8] *Click here for the source.*
[9] *Click here for the source.*

- Reducing waste, reusing and sending it to recycling and composting is also a great measure for climate-mitigation. It helps to preserve the "embodied energy" of materials, i.e. the energy which has been used to extract, transport, transform, distribute them[10]. As a consequence, reducing landfilling and incineration also minimises greenhouse gases from the waste sector (estimated to be between 4 and 12% of the total generation of greenhouse gases), as seen from this graph:



Savings (negative values) of greenhouse gases or contribution to greenhouse gases (positive values) through waste prevention, recycling/composting or disposal of mixed waste (Source: EUNOMIA)

- Circular management of resources contributes to many of the Sustainable Development Goals (SDGs) defined by the United Nations[11], with particular reference to the goals seen on the following page.

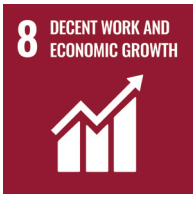
- Preserving resources in materials and goods is always a win-win situation. Whatever we do around this key principle, from our individual choices (less wasteful lifestyles) to a larger organisational complexity (separate collection schemes, recycling infrastructure, industrial policy for promotion of redesign for durability and repairability) is always worthwhile.

[10] *Click here for the source.*
[11] *Click here for the source.*

SDGs and resource management

Unsafe waste management (dumping, open burning) can pollute waters, soil and air and in turn our health. Proper waste separation and collection, handling hazardous materials separately lowers greatly the risks of infection and injuries.

Waste, if not properly managed, may be one of the top water polluters and therefore cause of many water-borne diseases or vector of organic/inorganic pollutants. Good waste collection and handling prevents waste or its leakages ending up in water bodies.



Waste management is a big job provider and can create even more jobs when counting work in reuse systems and circular economy. It's also important to consider the working conditions of informal waste pickers and creating decent working conditions and livelihoods for them.

Zero waste cities movement is growing in almost all continents. It saves local governments money and resources, creates local jobs and gives a cleaner and healthier urban environment.

In the circular economy model we greatly reduce the amount of resources we need to extract from nature. Materials and goods are kept in circulation. And the first steps of waste hierarchy are Refuse and Reduce, so we can all start by consuming less.

SDGs and resource management

Poor waste management like dumping, open burning and incineration all are sources of GHG emissions. On the other hand, the production of each new product emits GHGs as well. Restricting the use of single-use items, certain materials (like plastics) and keeping materials in circulation (through reuse) all contribute to lowering GHG emissions.

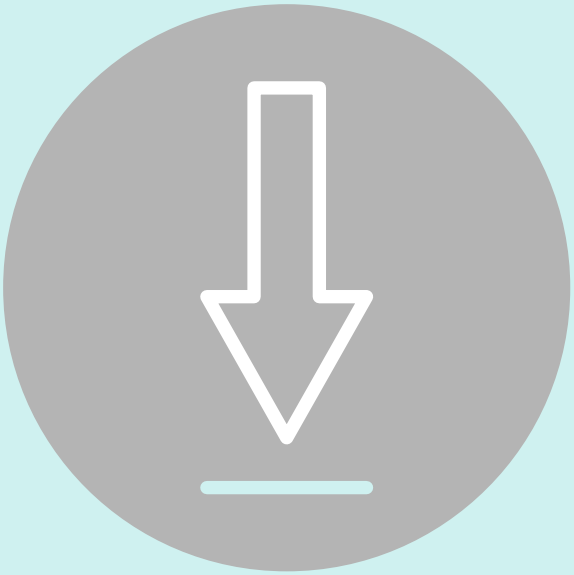
Dumping waste into water or leaving it mismanaged often means it ends up in water bodies. Apart from turtles and other sea creatures tangled in plastic items, waste can be extremely harmful for many marine species (toxic chemicals, microplastic etc). Restricting the use of some lightweight and easily littered items (like single use plastics) also serves to protect these species.

Before reaching the rivers and seas, waste can also harm wildlife on land, when it's littered or dumped, not to mention possibly polluting the soil. On the other hand, the less we need to produce new things and keep reusing and recycling existing materials, the less we harm ecosystems for resource extraction and final disposal.

Reducing the quest for primary resources through circular management of materials reduces geopolitical frictions over resource management. Also, for decades, western waste was being shipped to Asian countries. Luckily several countries have started to ban these exports and demand Europe and North- America to take responsibility for their waste and its proper management.

Creating circular economy models means cooperation with all the stakeholders and supporting each other. It also means allowing countries with developing waste infrastructure to implement zero waste methods and not get into lock-in by building incinerators (which need huge investments and work against the waste reduction aims).

2. Top-down approach: the principles



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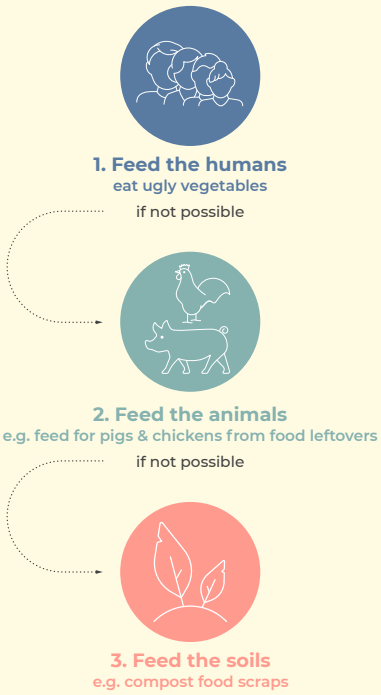
Steps to preserve resources

The best principle to embody this effort is the **"cascading use of materials".** It can be defined as keeping the resources in the highest status for as long as possible. Here are two examples of how this principle works in practice:

Durable plastics (bottles)

Organics



The approach to move from linear to circular use of resources, can be described with the **"4R's"** strategy, i.e. the combination of the following actions:

- **Reduce (and refuse):**
  Choose goods and services that create less waste, refuse single use items (straws, bags, etc.) when not strictly needed.
- **Reuse:**
  Choose durable products and use them again and again; give second life to stuff which is not useful anymore for you, but may still meet the needs of somebody else.
- **Recycle:**
  Separate your waste by type and find a way to recycle (and compost) them.
- **Rethink-Redesign:**
  Materials and items that can't be reduced, reused, recycled or composted should all be redesigned by industries and made durable, reusable, recyclable.

Note: Attention should be paid to the importance of **"waste audits"** - analysing what kind of waste you create the most. It is a great way to get information on what to reduce or redesign for reuse/recyclings and connect the last "R" back to the first ones, creating an endless loop of implementation / testing / assessing / redesigning.

What is Zero Waste?

"Zero Waste" can be seen as the "toolkit" to turn the Circular Economy vision into practice. The first Circular Economy Package proposed by the EU in July 2014, was sub-titled "A Zero Waste Programme for Europe".

The guiding principle of Zero Waste (ZW) is the commitment to constantly:

- improve the management of resources;
- reduce progressively the amount of waste;
- increase the percentage which is reused/recycled/composted;
- assess what is not recovered in order to have it redesigned.

This approach connects with the 4 R's strategy, and has already proved to be a powerful driver to minimise leakages of resources from their circular use (dumping, landfilling, incineration).

Sometimes the term "Zero Waste" is **misused**, either

- in a simplified way ("no production of waste", and "no need to have waste processing sites, whatever their nature", which doesn't show the need to manage reusable materials and reprocess recyclable and compostable waste), or
- including technologies and processes (e.g. incineration, pyrolysis or other types of thermal treatments) that do not belong in the ZW path. They destroy resources and require a long-term fixed amount of materials to burn (that is to say - more waste is constantly needed) and this is in contradiction with the principle of improving recycling rates and minimising residual waste.

The official Zero Waste definition, adopted by Zero Waste International Alliance[12]:

***Zero Waste:* The conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health.**

Actually, ZW has been formally adopted as a guiding waste management strategy by a growing number of municipalities and communities all over the world. Typically, ZW schemes include the following key points (sometimes in different order and combination)[13]:

1. Avoid waste by reuse, repair and deconstruction.
2. Encourage waste reduction initiatives.
3. Sort at source wherever waste is produced.
4. Collect sorted waste separately.
5. Compost organic waste.
6. Recycle all materials.
7. Study residual waste to find better options for material separation and redesign.

[12] *Click here for the source.*
[13] *Most often used list of 10 steps of Zero Waste.*

8. See landfilling as a temporary solution, with decreasing amounts. Minimise impacts through pre-treatment[14].

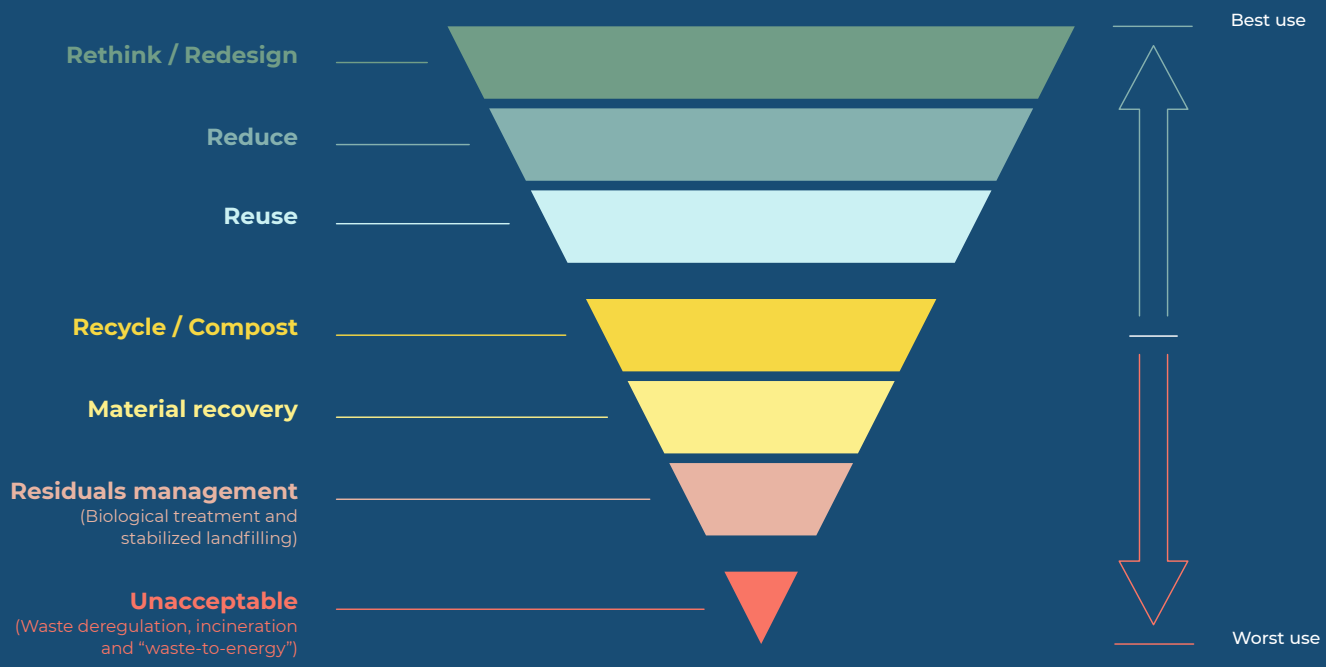
9. Apply industrial design and help to change consumer behaviour.

10. Use economic incentives to encourage all of it!

The Zero Waste International Alliance (ZWIA) has framed an "operational roadmap" - the "Zero Waste Hierarchy of Highest and Best Use" (meaning the cascading approach) showing all options to retain resources in their highest status, what to do with residual waste (mixed garbage) and what is not acceptable in the ZW approach[15].

The following chart[16] visualises the hierarchy as a "funnel":

The Zero Waste Hierarchy



[14] "pre-treatment" aims at minimising impacts and volume of landfills. It may also be performed through comparatively simple processes, such as: 1. sorting materials that may be recycled, 2. run a "biological stabilisation", a sort of "dirty composting" (also through low-tech, low cost systems as windrowing) to reduce fermentability of the biodegradable materials included in waste to be landfilled, so as to minimise the impacts of landfills and release of methane (a potent greenhouse gas) after burying them in the landfill.

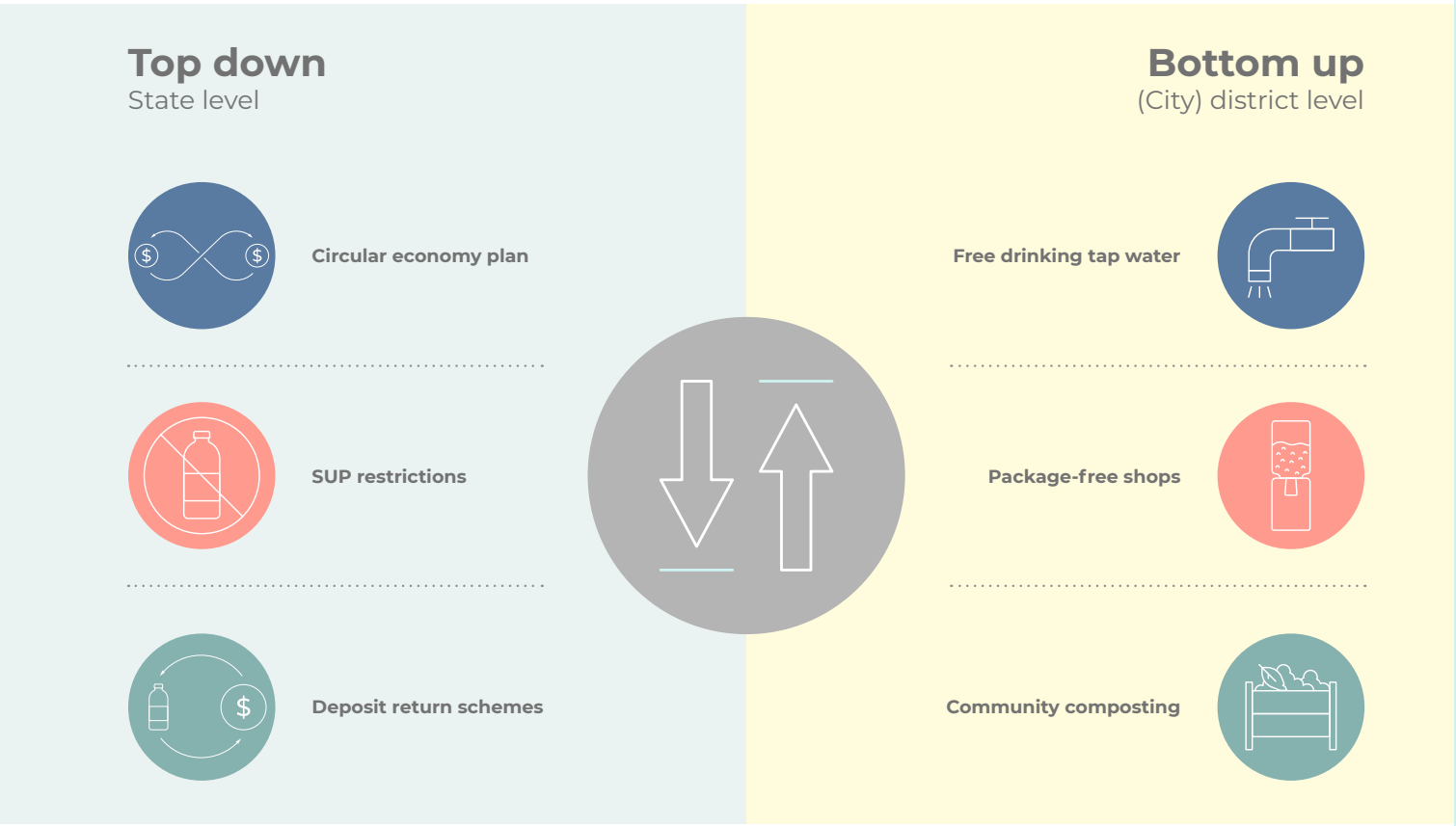
[15] The full ZW Hierarchy can be found at *here.*

[16] Credits: ZWIA, Certifications Committee

Zero Waste principles in waste policy

By its nature, ZW is a process to be put into practice at local level, by communities (villages, municipalities, neighbourhoods, etc.). Local implementation is what "makes it happen", and shows the way to other communities to follow. However, local initiatives can benefit from a good regulatory framework and ZW-oriented "top-down" policy. This can frame the steps towards ZW, provide for economic incentives, define clear conditions for markets for recycled materials, and/or provide the legal basis for bans and restrictions.

While community-based ZW initiatives **"make it happen"**, ZW-oriented policies **"make it possible"**; good interaction between the two is the best way to have fast and successful implementation of the ZW approach.



Some examples of ZW-oriented policy:

- The previously mentioned **EU Circular Economy Package** borrows many of Zero Waste guiding principles:
  - emphasis on ecodesign and redesigning for durability;
  - increasing the targets for recycling and composting (a recycling target of 65% of actually recovered materials, minus the materials rejected from recycling/composting processes, by 2035);
  - the need to avoid any "lock-in" effect potentially caused by investments in technologies (as incineration and other thermal treatment options) requiring a secured tonnage of mixed waste to be financially viable. For more info on the topic, read the *"Communication on the role of waste-to-energy in the Circular Economy"* by European Commission.

- **Bans and restrictions** play a major role in a Circular Economy and ZW programmes, and promote innovation and new business models. An increasing number of countries (or jurisdictional sub-divisions, e.g. states in the US, cities in Germany, etc.) have or are planning to ban or tax one or more of the following:

  - plastic bags (e.g. Kenya, France, California, Italy),
  - single-use plastic cutlery and coffee pods (e.g. France, Hamburg),
  - cotton buds (e.g. United Kingdom, Italy)
  - all single-use plastics (e.g. India, Costa Rica).

  More similar examples can be found *here.* In 2019 European Union released it's *Single Use Plastics Directive*, which gives basis to restrict, ban or reduce the use of several single use items across the 27 Member States.

- Economic tools can help to move away from wasteful behaviours and purchasing habits, and drive innovation:

  - **Extended Producer Responsibility (EPR)**

    For separate collection and recycling schemes funded by packaging producers (EPR schemes collect unit fees from producers, then the budget is allocated to compensate municipalities for the cost of separate collection, and/or to support/reward recycling activities). EPR has long been adopted in Europe for packaging waste, electric/electronic waste, and for other types of goods and materials. Also important: EPR schemes should not be designed to kill local recycling initiatives, but to support them - EPR schemes must simply fund the system, not run the business.

  - **Deposit Refund Schemes (DRS)**

    Have proved to be the most effective way to have a high return rate of specific items: customers return the item (e.g. beverage bottles and cans) to the shop where purchased or (more commonly) any cooperating shop, to get the deposit back. This maximises the collection rates of items within the DRS, boosts their reuse or recycling, and minimises littering of those items. Well-working DRS systems have been adopted for various containers by Denmark, Estonia, Germany, single states in the US, parts of Australia, etc. Good overview of all the countries can be seen *here.*

3. Bottom-up approach: local Zero Waste schemes

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A Zero Waste (ZW) approach should be based on an existing good strategy, which includes short- and long-term actions. Some actions can be carried out regardless of the surrounding conditions (e.g. promotion of simple waste prevention initiatives like home composting); others need more effort to fit into an existing regulatory framework (e.g. some financial incentives and pay-as-you-throw systems).

A great guidance for communities willing to implement a ZW strategy is the "*Masterplan" by Zero Waste Europe.* Although it refers mainly to the EU context, it has good hints and examples for implementing a ZW scheme in general. Another great resource is the *"Zero Waste City Manual"*, developed by Global Alliance for Incineration Alternatives, which is in a wider global setting.

Whatever the situation, always think of the ZW mindset: "Always happy, and never satisfied". There are possibilities for modular implementation of ZW schemes, doing what is currently possible/viable, celebrating related achievements, while still planning for next steps to further improve the situation. Because ZW-minded people love being ambitious.

Waste prevention/reduction initiatives

This is the highest ranking step in the hierarchy and should come first. Always keep in mind that the best waste is the one which is not produced.

Some examples of the first steps in waste prevention are:

- **Promoting tap water**
  Whenever suitable for human consumption: a free water supply must be a fundamental human right - a priority in many cooperative and infrastructural programmes. Also in the Global North many municipalities are building "water houses" to remind people that tap water is perfectly good for drinking (which many don't know). Large cities in Europe are starting to promote the use of water from their fountains, sometimes with extra incentives: for example, presenting tourists with durable, reusable bottles/canteens with a specific logo (suitable as souvenirs).

A great example for reduction of waste comes from an initiative in **Rome, Italy**.

Water houses (or "water kiosks") were installed in Rome to deliver still and sparkling waters for free. Similar initiatives to promote tap water – offering filling points for bottles to reduce need for buying bottled water – are booming in other large cities and small villages.

- **Package-free shops**

  Can simply keep the traditional shopping systems alive. In the Global North it may mean promoting new business models at markets (and supermarkets), to attract conscious consumers (and often, also economic incentives by local authorities for the businesses creating less waste). Some examples of working package free shops are *Original Unverpackt* in Germany and *Negozio Leggero* in Italy. And *this page* allows you to find shops that sell goods in your own container all over the world.

- **Home and neighbourhood composting**

  It's always a great action, connecting commitment to ZW and the importance of organic matter for soils, gardens and agriculture. For details, you can read our paper on *handling biowaste.*

- **Cloth (washable) nappies/diapers**

  Typically a baby uses around 2000 nappies by the age of two. This accounts for about 1 tonne of not recyclable waste. Whenever running water is available, and young parents have time, switching to washable nappies would make a big impact. In some advanced economies, there are even collection services for dirty nappies, with centralised washing/drying outlets. It is a good idea for the environment, and also turns a disposal cost into jobs and wages.

There are many more examples of waste prevention/reduction, e.g. local mug circulation systems like *MyCup* in University of Brighton or reusable cutlery/cups/dishes system *reCircle* for restaurants and cafes.

The key role of kerb/curbside collection

Curbside (N.America) / kerbside (Europe) is collection at the doorstep, i.e. a scheme where each household or housing unit (e.g. a block of flats in the same building) or business are provided with containers for different materials, and are held responsible for their management and the quality of collected materials.

It's a great way to ensure the highest collection rates and best quality of recyclable and compostable materials. With adaptation, kerb/curbside collection can be implemented in densely populated areas (e.g. San Francisco, Milan, pilots in many other cities) to pave the way for others to follow.

In low-income countries, if formal collection is not fully implemented through a public service, the value of materials may pay off the cost of collection, therefore informal schemes may be possible. And that can help collect most of the waste materials.

Some operational principles:

- **Always include organics in the scheme**

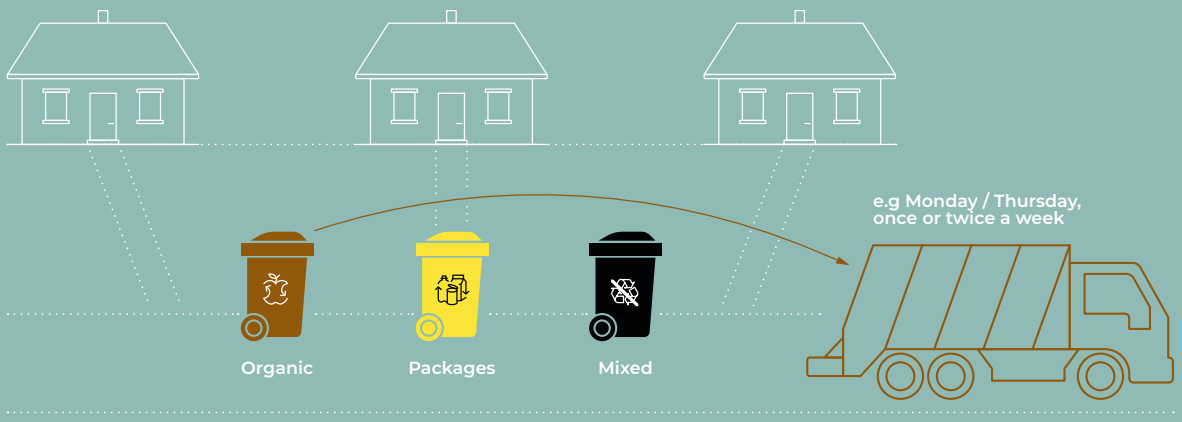
  The largest contributor to total amounts of municipal waste (i.e. household waste + small businesses), from 30% in large cities in North America and the EU, up to 80% and more in rural areas and the Global South. Even more importantly, a good separation of organics means reducing the collection rounds of residual waste (which is much less fermentable). This is a further driver for better separation of plastics, paper, glass, etc. as it will make collection of unsorted waste less comfortable, so people will be more eager to sort their waste as much as possible.

- **Packaging waste**

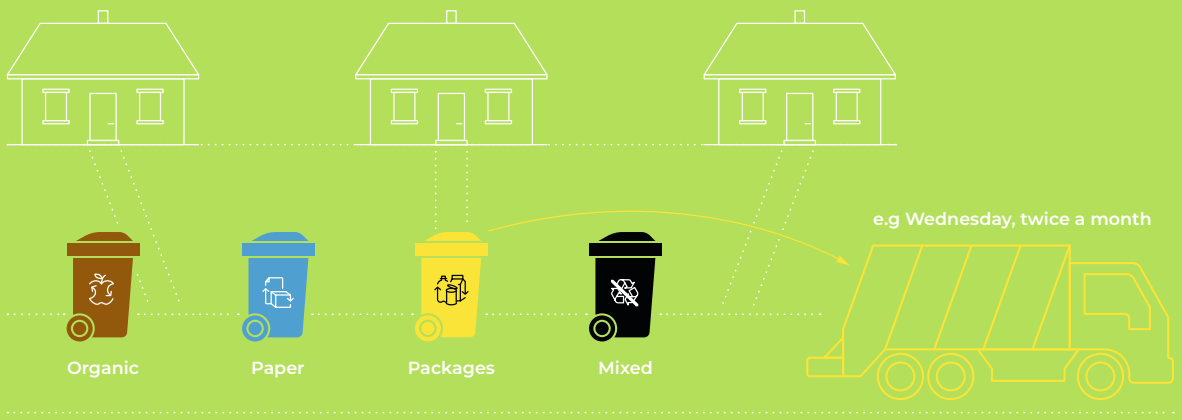
  Usually plastics, metals, glass, paper and other similar materials (e.g. newsprint with packaging paper) are also included. Often this is connected to, or funded by, EPR schemes.

Examples of curbside schemes

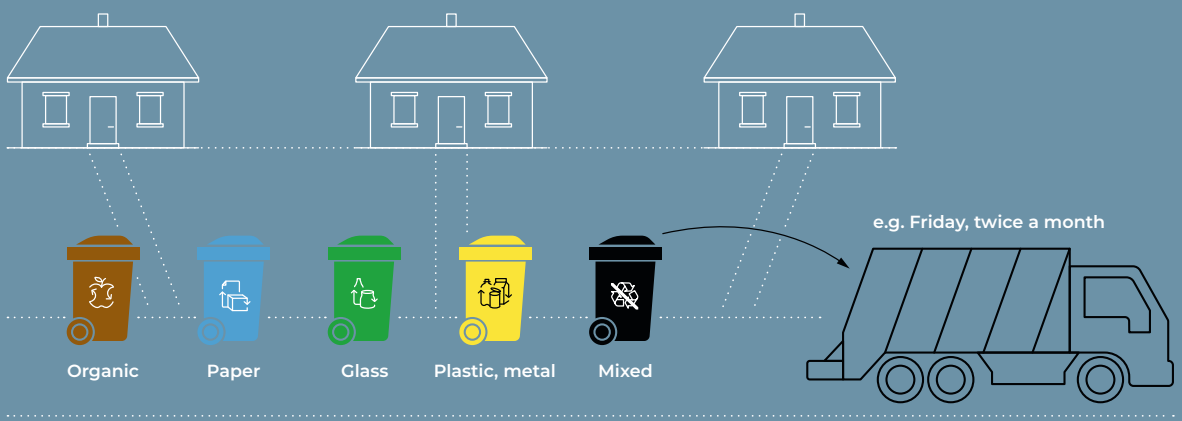
3 streams



4 streams



5 streams



Collection days and frequencies vary across the world. In hot climates collection is organised more often, above all for organics and residual waste. The colours of the containers for different waste streams may vary from country to country.

- Some communities tend to simplify the collection of such materials, with a **common container** to include all packaging waste (e.g. the "3 streams" approach in the US: organics, packaging waste, residuals). This may require further costs as the different materials need to be separated at recycling facilities, and typically means **lower quality** (some people tend to get confused by the wide variety of materials fitting into one bin).

- Othes have adopted **"dedicated" collection** of different materials: one scheme for paper, one for glass, and one scheme for plastics and metals (metals and plastics may be collected together, since they are lightweight, compactable and easy to separate with magnetic and eddy current separators). This tends to give **higher quality**, which is becoming more and more important as many countries are restricting the imports of low-quality materials in the international market for commodities. Also, it is economically better, since the collected materials may typically get revenues right after collection instead of paying the costs for selection. For more details you can watch *this clip.*

- **Municipal Recycling Centre**

  In our daily life we literally handle dozens of different materials. Not everything can be collected at the kerb/curbside. Apart from the "priority streams" (organics, packaging waste, residual waste) you can **establish a Municipal Recycling Centre** (or whatever may act as that), i.e. a controlled area where other materials - smaller amounts randomly scattered across the different households at any given time - may be collected separately in dedicated containers ("bring systems"). This can still catch a relevant percentage of the total waste created in the community: e.g. appliances, garden waste (if not collected mixed with food scraps – recommendation is a dedicated scheme for food scraps only), textiles/clothes, and also some hazardous waste from households and small businesses.

Tackle the organics

Organics can be managed at different levels:

- promote home composting (in the backyard),
- promote community-composting initiatives (even in large cities, e.g. Zurich, *Besançon*),
- roll out collection schemes to collect organics and send them to professional composting (or anaerobic digestion) sites, which may be large- or small-scale sites (e.g. "Rural Composting" sites run by farmers in Austria).

As already specified, organics are key from both the quantitative (largest part to prevent from disposal) and operational standpoint (better management of other streams, too). For more info see *our paper* on the management of organics and *ZWIA's article* on decision-making factors to choose between composting and anaerobic digestion.

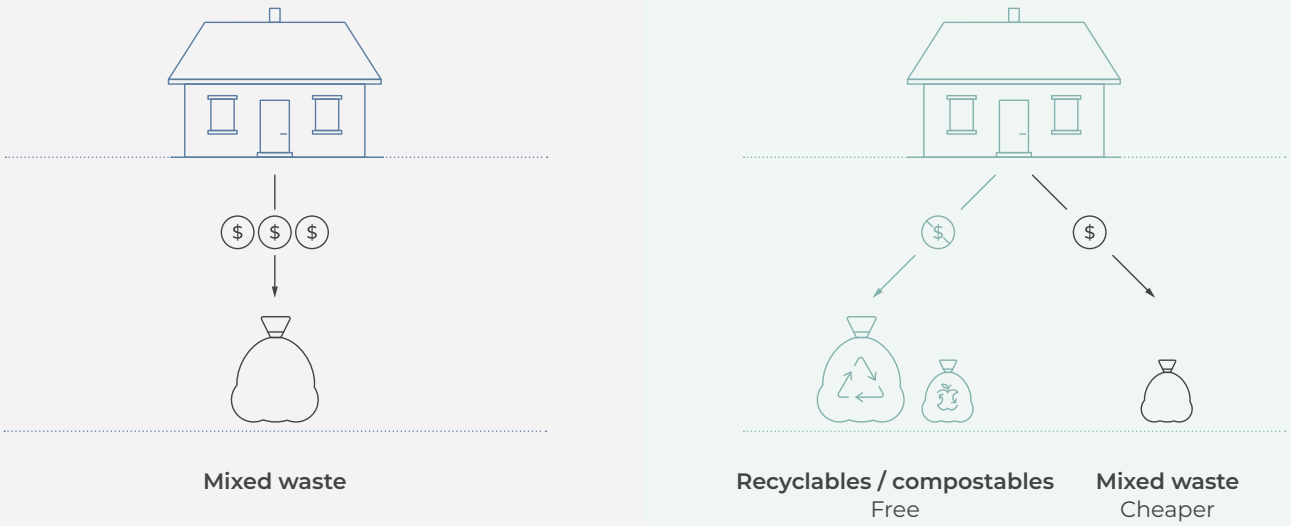
Financial incentives

Financial incentives are a great tool to on board taxpayers and businesses, and shorten transition time to better practices. Some incentives are typically in the power of national or regional governments (e.g. establishing EPR schemes, promoting and regulating DRS) while others can be adopted locally.

One such local incentive is **"Pay As You Throw"** (PAYT) scheme, where the cost of waste management is not paid for through general taxation (or through a property tax on houses), but, at least partly, is correlated to the amount of unsorted collected waste, which can only go to disposal. This keeps households and businesses mindful of the possible management of goods and related packaging after use, and tends to encourage less wasteful purchasing habits and lifestyles.

PAYT schemes have been implemented in various ways around the world, sometimes with pre-paid bags (mixed waste can only be delivered in a specific bag whose cost mirrors the cost of the disposal of materials included), other times with a registration fee for a specific service, in which case the fee varies based on frequency of collection and volume of containers; sometimes, with more technological tools using tagged bags and bins, where the ID gets recorded whenever mixed waste is delivered.

Pay As You Throw



Reuse and repair centres: keep things in use

Reuse is one of the priorities. It keeps resources at the highest levels in the waste hierarchy and is a great way to promote sharing of resources in the community, and create jobs.
It's been calculated that the value of materials handled at a Reuse Centre can be around 2000 USD/t - it's impressive, considering that the cost of waste disposal can range from a few USD/t to 100 USD/t, and the same basically applies to the value of recyclable materials.

The potential added value is a great opportunity to create jobs and benefit your community: by teaching locals simple repairing/refurbishing skills, you make items attractive to new potential users, while saving them from disposal, and the newly instructed workers are paid. It can be a great way to offer work to disadvantaged people. As noted, managing 10 000 tonnes/year through a reuse/repair centre can create up to 296 jobs (for incineration, only 1, managing landfill, 6, and 36 jobs for recycling/composting).

However, keep in mind that even without establishing related economic activities, repairing and reusing is fun and great for the environment! Many cities and local networks have promoted **"Repair Cafés"** whereby ordinary people get how-to-repair-it help from skilled persons. They see how their stuff may be brought to new life - and may even be swapped with others.

The last step: residual waste audit as feedback

While ZW programmes continuously strive to increase recovery of resources, they put analyses of residual waste at the core of a constant process for improvement and optimisation. Residual waste is a great place to investigate "systemic mistakes", i.e. what is blocking the system from going totally disposal-free.

Through residual waste audits, the "rethinking/redesigning" element may powerfully open the way to:

- **Producer responsibility**
  to have hardly recyclable/compostable items redesigned for better recyclability, compostability and durability.
- **Community responsibility**
  to single out materials that most often mistakenly end up in residual waste, while they could be collected separately for recycling/composting (or taken at a reuse centre).

One great example was the initiative in **Capannori, Italy**, the first municipality to have formally committed to a ZW programme in 2007.

After reaching around 80% separate collection, audits by their ZW Research Centre exposed a growing number of coffee capsules which are impossible to recycle.

The information was passed on to industrial coffee-makers, who started dedicated research for reusable or compostable capsules (which can be collected together with organics). Hence, a local community-based ZW scheme was able to give info and feedback on the problematic items in the residual waste; the company took responsibility and redesigned the capsules.

Other items which are commonly found in residual waste:

- nappies/diapers (see the paragraph on waste reduction),
- hard-to-recycle plastics (e.g. multi-layered packaging, sachets in Asian countries).

Residual waste audits can be a powerful tool to push for redesign of flawed products and systems as well.

Annex I: a strategy to tackle the growing problem of plastics

Let's do it FOUNDATION

The size of the global issue

The problem of plastic pollution is now globally known. The extensive use of plastics has helped to improve many lives, but there are also serious downsides.

Plastics are relatively lightweight and can easily be carried by wind, water, gravity. They are resistant to biodegradation, but fragment into smaller and smaller bits which attract and absorb other pollutants and enter the food web, thereby affecting living organisms. Microplastics (coming from fragmentation of larger plastic items, but also from microbeads intentionally added to toothpastes and scrubs, or from tyres and washing of plastic-based textiles like fleece) are everywhere - they have been found in drinking water, in air, in soils. Their impacts on human health are still largely unknown.

Many governments and agencies have decided to act on the plastic problem. The UN Environmental Assembly has started dedicated discussions, some countries or coastal regions have banned various types of plastics (mainly certain single-use items). The EU issued a "Plastic Strategy"[17], i.e. a framing document for actions to tackle the problem, which was followed by a Single-Use Plastics Directive that gives direction to reduction targets for many types of single-use plastics, and even bans for others (e.g. straws, stirrers, tableware).

The plastic problem in a nutshell:

- Since 1950, the production of plastics has grown from 2 million tonnes a year (1950) to 381 million tonnes a year (2015)[18]; the total amount of plastics ever manufactured is more than 8 billion tonnes.
- Every year around 10 million tonnes of plastics are estimated to get into seas and oceans – a truckload a minute; which is "turning oceans into a plastic soup".
- With no action to cut the pace of plastics entering seas, by 2050 we'd have more plastics than fish mass in the oceans[19]. A recent study[20] estimated that in a "business as usual" scenario, the amount of plastics entering our oceans would triple by 2040.
- Over time, the flow of plastics into oceans has created the so-called "garbage patches" (e.g. the Great North Pacific Garbage Patch, estimated to have more than 5 trillion plastic pieces weighing over 250 000 tons[21]).
- Importantly, 80% of the plastics getting into oceans comes from land-based sources[22], thus emphasising the need for targeted actions on production and consumption of plastics.

A great infographic on sources and fate of plastic marine litter may be found *here.*

[17] *Click here for the source.*
[18] Geyer, R., Jambeck, J. and Lavender, K. 2017. Production, use, and fate of all plastics ever made. Science Advances 3:7
[19] *Click here for the source.*
[20] *Click here for the source.*
[21] *Click here for the source.*
[22] *Click here for the source.*

How to reduce plastic pollution and create circularity

On the global scale, the plastic tide is, first and foremost, **a problem of overproduction.** Many of our everyday plastic items, mostly single-use, are not vital, or could be replaced by durable materials (e.g. straws). For example many packaged foods don't really need the packaging. The key argument "packaging helps to reduce food waste" has been recently debunked, showing that plastic waste is growing in parallel with food waste (and to some extent, even contributes to it: e.g. packages require standard food sizes, which results in food scraps caused by trimming to fit the right size[23]). Also, the argument "plastic waste is preferable to food waste" is not always valid: food waste can be composted, while some low-value plastics are hard to recycle and, without suitable technology to process them, end up in incinerators or landfills or in the environment.

In many parts of the world, waste collection systems have not been formally established yet, so plastics end up in open environment, and are often thrown into waterways (rivers, channels) to finally flow into seas.

Recycling helps to tackle the problem in the medium term, but the disproportion between the amount of plastics produced and the amount being recycled is huge. Even in the countries with a long tradition of recycling, with EPR schemes funding and promoting separate collection of plastics (which should increase recycling), only about 30-40% of packaging plastics are actually recycled. Globally, the OECD[24] estimates that as little as 15% of plastic is recycled. Also, some separately collected plastics are typically rejected by recycling businesses as low-value materials; that further lowers the potential of recycling to be a final solution.

Incineration is never a solution. It actually worsens the total environmental footprint of plastics, since it turns them into fossil-based CO_2 - a greenhouse gas contributing to climate change (as mentioned by EU Plastic Strategy).
While we are working towards more recycling, the most reasonable way forward is to **reduce plastic production.** Recycling is a fundamental "Plan B for sustainability" (Plan A being reduction and reuse, which lowers the environmental footprint).

We want to increase the level of recycling, but we cannot wait until it achieves 100% to have the plastic problem finally sorted. Simply put, in the first place, we must avoid all avoidable plastics.

For the non-avoidable ones, we must maximise reuse and recycling, and minimise disposal.

Key actions to reverse the plastic tide:

- **Avoid avoidable plastics!**
  Always think before you buy: is this single-use plastic really necessary? Could it be replaced by an alternative?
- **Design plastics for durability and reuse.**
- **Adopt deposit refund schemes (DRS)**
  to increase the take-back rate and improve reuse and high-quality recycling.
- **Implement separate collection**
  for those plastics which cannot be avoided.
- **Extended Producer Responsibility (EPR)**
  as a way to fund collection/recycling (or reuse) schemes. EPR should primarily fund the system, not run the system (funding supports local recycling initiatives; the latter might kill them).
- **Minimum Recycled Contents**
  If you are a policy-maker, put in place compulsory (sector-specific) Minimum Recycled Contents for products as a mid-term tool to maximise actual recovery rates of plastics.
- **Recycle low-grade, low-value mixed plastics**
  Open the doors to innovation, and promote activities to recycle low-grade, low-value mixed plastics, those that typically get rejected at the end of sorting lines. Such low-value materials can still be recovered through e.g. extruding

[23] *Click here for the source.*
[24] *Click here for the source.*

systems, which blend various polymers into new compounds. This may be done also on a small-scale, with simplified approaches, although this requires:

- proper safety measures for workers (extrusion may release volatile compounds that can be harmful);
- a thoughtful assessment of the final use of the recovered materials (the original material may include harmful substances). Typically, the best use of such materials is for low-risk applications (no indoor use, no direct contact with food) such as benches, paddle boards, floorings. Most sensitive uses such as toys and food packaging should be avoided.

There are many tools and approaches: choose the ones suitable to your local situation and capabilities, regulatory framework and marketing context.

Tackling single use plastics

Single-use plastics (SUPs) are a sub-set of plastics, items with the shortest lifespan, making the largest contribution to plastic pollution.

Many SUPs have improved our life greatly (e.g. some medical equipment), but most of them are not vitally needed; we've long been able to live without them. Many countries and International Institutions as the EU, have adopted restrictions or even bans on some or many of them; or have introduced taxes/levies to discourage their use. A comprehensive list of possible actions and initiatives in various countries or cities can be found from the *Single Use Plastics Roadmap* by UNEP.

Most commonly found single-use plastics in litter[25]:

- plastic shopping bags
- beverage cups and lids
- cotton buds
- beverage containers
- bottle caps
- wet wipes
- balloons and balloon sticks
- plastic tableware (dishes and cutlery)
- food wrappers and take-away containers
- straws and stirrers

Most such items are not "vital" in most situations – there is room for initiatives to reduce their use, or even phase them out.

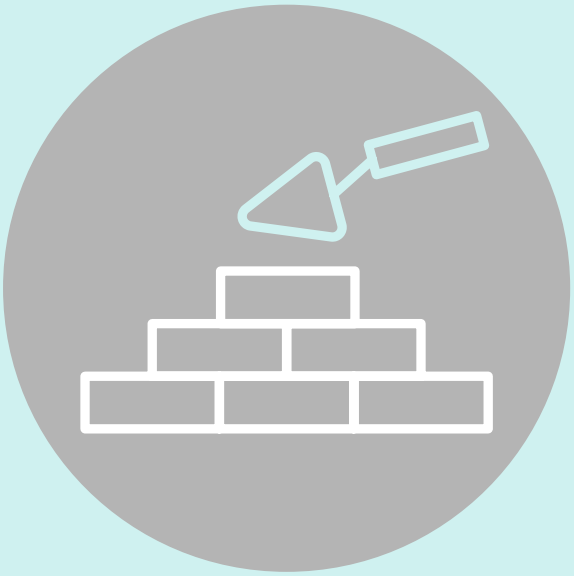
There are many tools for reducing the use of SUPs:

- bans (e.g. many countries have already established bans on plastic bags, some on cotton buds);
- reduction targets (e.g. the EU has adopted a "usage cap" on the number of plastic shopping bags per person and year; some EU member states have issued total bans);
- design requirements (e.g. the "leash the lid" initiative, to have bottle caps tethered to bottles to prevent scattering);
- EPR (producers may be required to fund collection schemes, or even cleanups, as it is in the EU SUP Directive for some items).

All these tools should also be supported by proper enforcement. In a few cases, bans include exceptions for biodegradable (or compostable) plastics, which are not a solution to littering, but may be used as tools for separate collection of organics and composting (e.g. biobags to improve collection of organics in separate collection schemes). For more info on the topic, see our paper *"What are biodegradable plastics".* However, even before any relevant policy, it's up to each one of us to use the right to refuse and avoid the unnecessary single use plastic items.

[25] *Click here for the source.*

Annex II: starting from scratch – building up waste management



Let's do it FOUNDATION

Managing waste poses particular challenges in many parts of the world, where fewer economic resources are available. Sufficient infrastructure may be missing, organisational and legal framework may be not (fully) established, recycling and compost services might not exist. Lack of funds create barriers for quick implementation of all the needed framework.

This requires a bottom-up approach, and some creativity, to implement and run at local level the activities - separation, recycling, disposal - not provided by relevant institutions and authorities. On the other hand, the value of recyclable/compostable materials in less wealthy economies may be an important economic driver, which can compensate for the lack of budget by state or local institutions, and involve the needed workforce, even informally.

Guiding principles for local action:

- **Separate organics and handle them separately as much as possible**

  If organic waste is properly separated from other materials then composting can be easily done with small-scale, low-tech systems. Such compost has a value for your farmlands or gardens. By composting, we reduce the amount of waste to be landfilled, and we minimise the impact on the final disposal sites. Always remember that food and garden waste make up a large part of waste in low-income economies; once tackled properly, you solve much of the waste problem. For easy composting instructions, look into our *biowaste paper.*

- **Harness the potential of reuse**

  Low-income economies may value materials (e.g. clothing, furniture, used appliances) whose importance can be overlooked elsewhere.

- **Look for local markets for various materials**

  Are there any? Who could help you connect with them? A great example is the long established informal (but perfectly working) recycling scheme run by the *Zabbaleen community* at the "Garbage Village" in Mokattam, near Cairo, which recycles about 80% of waste through simple low-tech collection systems. You can also connect to activities such as the *"Waste Banks"* in many parts of South Eastern Asia. Many other informal recycling activities are run throughout the world by people creating value out of waste, and who can help to implement and provide some local recycling schemes, turning a problem into new opportunities for people.

- **"Creative recycling"**

  For the materials with no local market, think of some "creative recycling", e.g. use tyres as pots; make paper into pulp and turn pulp into sculptures. For various options for local scale, low-tech activities and creativity, see our paper *"Some recycling options for different materials".*

- **Always assess the benefits and downsides**

  Compare every recycling/reuse option to the usual local practice: balancing pros and cons will let you take the best option to improve the situation (which is ultimately our goal). If there are no other options, using plastic bottles as ecobricks may not be the "best" option ever (their safety is sometimes questioned, since plastics may include some harmful substances such as softeners/plasticisers), but they are still a "better" solution, if the only local alternative is burning them at dumpsites. Burning plastic is extremely harmful.

- **Keep waste that can't be reused or recycled in one place**

  This is always better than letting it scatter across the land. A single location may ensure a proper siting far enough from water sources and water bodies, a better control of fire hazards, a lower risk to spreading diseases to the community. For more info, look into our paper on *creating a resource station.*

For a comprehensive overview of the "early steps" and actions that may be implemented at local level, you can check out WasteAid website. It's a great resource to understand the basics, and to make your system work when there is no infrastructural support, and little money. *Their toolkit* and how-to guides address various possibilities to help improve local waste management schemes.

Landfill basics

Proper siting, design and management of disposal sites, and the challenges that come with managing waste that cannot be recycled are very important. Here are some basics to help understand related issues and needs.

First, let's start with a glossary:

- **Dump**
  Generally refers to a place for disposal of domestic waste, where little or no environmental and occupational safety measures are taken in account.
- **Landfill**
  Some engineering principles are followed, e.g. waste is confined to as small an area as possible, waste is compacted to reduce volume, and covered now and then with layers of soil.
- **Sanitary landfill**
  Site where waste is isolated from the environment. Waste is compacted in thin layers, covered by soil every evening, leachate and gas are collected and treated, and a monitoring program is applied. Waste is weighed and inspected to exclude unwanted items.

Good reference for design and management of landfill sites is the *EU Landfill Directive* and related technical information. It can be a guide to design, build and manage landfills in order to minimise environmental impacts. It includes provisions on engineering of landfills, but also pretreatment of waste prior to landfilling. Pretreatment reduces impacts related to fermentation of organics (leachate, odours, methane, attraction of pests, etc.), but also causes an important economic side-effect, as it makes landfilling more expensive, and recycling cost-competitive.

At the opposite end, for simplified, low-tech approaches when resources are limited, while still addressing most of the issues around landfilling, you can look into the Waste Aid how-to guide on *waste disposal sites.*

Environmental effects

Landfilling has many negative environmental effects during its operational life (while it's being filled) and even after its closure. Below, we address key concerns and the way to minimise them.

Risk	Origin/reason of risk	How to improve
• **Landfill gas**	Organic waste is decomposed biologically under anaerobic conditions. End-product of this process is landfill gas – a mixture of methane and carbon dioxide. Methane in particular is a powerful greenhouse gas. Landfill gas is flammable, and contains trace compounds that are toxic to humans. The gas is explosive if there is 5 to 15% methane in air.	Landfill gas has to be collected[26]. Preferably, gas should be used for energy production (heat, electricity). If this is not possible, gas should be destroyed by burning, to reduce the risk of spontaneous fires, odours, greenhouse gas emissions and migration of gas to nearby houses. To prevent gas emissions, reduce the disposal of organic wastes. Even mixed

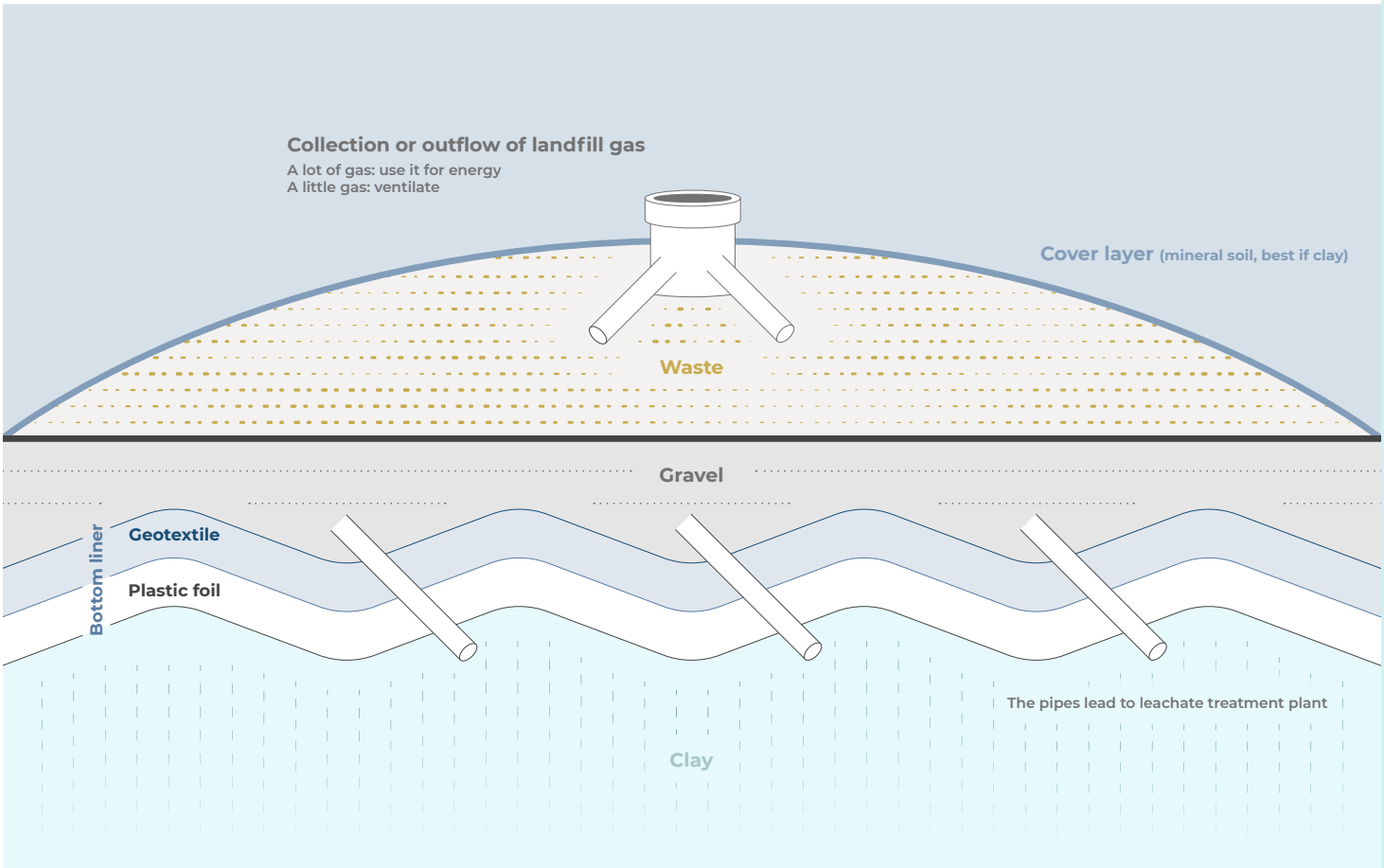
[26] For more information on landfill gas management, here are some addtional resources
Click here for the source.
Click here for the source.

Risk	Origin/reason of risk	How to improve
• **Landfill gas**		waste can be „stabilized“ (a natural, operationally boosted degradation, similar to composting, to reduce fermentability) prior to landfilling.
• **Odours**	Unpleasant odours from degradation of organic waste are most common during the early degradation phase of the wastes.	Reduce organic content of waste (by separating and composting/stabilizing it).
• **Fires**	Most wastes burn easily, thus landfill fires last for a long time, are difficult to fight, and create very toxic smoke. Highly combustible landfill gas increases fire risk.	Collect and burn landfill gas. Reduce organic content of waste. No open fires at landfill site! No hot or smouldering ash should be accepted! Waste likely to catch fire should be kept separately or treated/stabilised before disposal. Cover waste with mineral soil.
• **Leachate**	All water (rainwater and surface water) which has been in contact with waste is polluted! Groundwater pollution is the biggest risk.	Water contamination can be minimised by proper design of landfills, by leachate collection and treatment.
• **Landslides**	Slope failures are a serious risk, caused by poorly compacted waste, degradation of organics and rainwater intrusion.	Compact waste in thin layers, reduce organic content of wastes, stabilize, collect and remove leachate by draining.
• **Fly waste, dust, dirt**	Fly waste, dust and dirt are typical nuisances at a landfill site. Dust is a problem during dry periods, and wherever ash is deposited.	When waste is off-loaded from trucks, contain it in as small an area as possible, and surround it with portable fencing. Wash truck wheels if dirty. Irrigate when dusty.
• **Vectors**	Insects, birds and animals seek food and can nest in waste. They may spread diseases and cause hygienic problems.	Reduce organic content of waste. Cover freshly disposed waste with mineral soil every day. Use rat poison and similar measures. Stabilize organic-rich waste by relatively simple systems, similar to composting (e.g. some windrowing).
• **Noise**	Noise is a typical nuisance at landfills which is created by road traffic, waste compactors and other large heavy-duty equipment.	Build noise barriers (like lines of trees, walls) around the landfill. Most efficient option to limit noise is restricting operation hours.

Landfill design

The most important elements of a modern landfill facility are:

- bottom liners (the lowermost base of the landfill),
- collection and treatment system for leachate and gas,
- cover layers (top liner) with various functions, and monitoring system.



An example of a basic landfill construction

Bottom liner

The purpose of the bottom liner is to separate waste from the environment, collect leachate and drain it out of the landfill body. Bottom liners should be functional throughout the whole lifecycle of a landfill.

The best bottom mineral material for a landfill is clay. If clay is not available, plastic liners are used.

Plastic membranes are made of PE, PVC or PP, and they are typically 1–3.5 mm thick. Plastic liners have to be protected against uneven settling and punctioning holes by a thick layer of geotextile. On that, the leachate collection layer with leachate collection pipes is placed. Only then, can waste disposal take place.

Top liner

The design of the cover layer has to meet some of the following requirements:

- it has to reduce infiltration of rainwater and reduce the amount of leachate;
- enhance surface runoff and evaporation;
- reduce gas emissions by either sealing of wastes, or supporting biochemical degradation of gas (oxidation of methane while passing through the layer);
- provide a physical barrier between waste and the environment. The use of a fully sealed non-permeable cover will minimise the amount of leachate.

Leachate

Leachate quality depends on waste and its degradation phase. Leachate from newly built landfills contains much more organic material and salts than municipal wastewater. The concentration changes in time, as organic material is degraded and mineralised.

The leachate can be released to a wastewater treatment plant or treated on-site. Fresh leachate, like wastewater, is easily treatable but old leachate is difficult to treat through biological processes such as those typically adopted in wastewater treatment, because most of the degradable material has already been degraded. Physical-chemical cleaning can be used in combination with biological treatment.

Low-tech methods such as treatment in constructed wetlands offer a low-cost after-treatment option.

Recycling leachate to the landfill increases gas creation, which may be the desired option in the case of gas collection and energy use. Reduction of leachate by evaporation may be used in dry climates.

For economic reasons, the filling period of a landfill should be at least 15–30 years. It is desirable to build landfills in relatively small cells, to minimise the area that is open to elements.

Waste hierarchy aims at reducing landfilling, which is a “leakage of resources” from circular systems, and improving reuse, recycling, composting, and continued redesigning of materials which are hard to recover. A **landfill tax** is often applied in developed countries to reduce disposal and increase recycling.

In brief:
the do's and don'ts

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The do’s:

- **Be ambitious and improve your behaviour and habits**
  “Always happy, never satisfied” is the best attitude to value all efforts – both your own and your community’s – and keep improving.

- **Choose durable & reusable over recyclable**
  Choose both over easily disposable items.

- **See if Extended Producer Responsibility or a Deposit Refund Scheme is working in your area**
  This means that collection and treatment of a material/item is already paid for. Learn which goods it applies to and where you can return them for free (or even get deposit back).

- **Make your hands the tools to build the clean world you want**
  It’s our hands that make the difference – if they sort, we’ve got resources; if they don’t, we’ve got waste.

- **Choose deposit and/or refillable bottles**
  over single-use ones.

- **Compost organics by yourself, or separate them for professional composting**
  Composting sends organic carbon and nutrients back to the soil – and makes management of other discards much easier.

- **Always share your knowledge with others**
  Learn from those who know better, and pass it on to your loved ones, friends, colleagues and neighbours.

- **Let your words show you value resources**
  Remember “it’s not waste until it’s wasted”. Instead of “waste”, try to say “post-use materials”, “discards”, or “resources”.

The dont’s:

- **Never litter**
  One moment of careless behaviour - a long time spoiling our landscapes and environments, and harming wildlife.

- **Never burn plastics or mixed waste**
  in open fires, nor allow them to be burned at dumpsites. This releases harmful gases. Always aim for reusing, recycling or landfilling plastics in a controlled way.

- **Never mix hazardous waste and non-hazardous materials**
  It is important to manage different materials properly.

- **Never dump waste into water**
  With 10 million tonnes of plastics entering our oceans every year (most being transported there by rivers and waterways), we’re turning our seas into a plastic soup.

- **Avoid single-use plastics and overpackaging**
  Buying less packaged or packaging-free goods can make a big difference for the environment. Many single-use plastic items may be easily and comfortably replaced by durable, reusable alternatives (flasks, mugs, steel straws, reusable cutlery, etc.).

- **Only consider landfilling as the last resort**
  as it loses resources instead of keeping them available for use in the Circular Economy.

- **Refrain from investing in incineration**
  Besides destroying resources, incineration works against the Zero Waste vision and strategies, as it needs huge amounts of waste daily. This weakens the incentive to reuse, recycle and compost more.