

Waste: Avoiding, Managing or Designing it Out



October 2014: Affluence, consumption, and waste go hand-in-hand. Countries are becoming richer, urbanization is exploding, new technologies are constantly being launched, and the global middle class is growing, all of which is changing the global waste landscape. More money buys more products, increasing garbage from packaging material, to broken toys, to electronic devices and appliances. Make, use, and throw away has become the mindset of the generations following the Industrial Revolution.

Global waste has increased ten-fold in the last century. The urban lifestyle, in particular, is rapidly changing how much waste is generated as urban-dwellers produce four times as much waste as people in rural areas. While today the developed world is the biggest producer of waste, the developing world is rapidly urbanizing, getting richer, and consuming more as populations also grow. Already East Asia has the dubious role of being the world's fastest growing region for waste but this is likely to be ceded to South Asia (mainly India) by 2025, and then to sub-Saharan Africa around 2050. (Source: [Nature](#))

Current levels of consumption and waste generation are clearly not sustainable long term. As we fill up, in many cases already overflowing landfills, the environment is suffering. Waste-driven environmental hazards are becoming a huge headache for many countries as toxic leakages from landfills and plastic in oceans and rivers damage – if not destroy – the world's ecosystems.

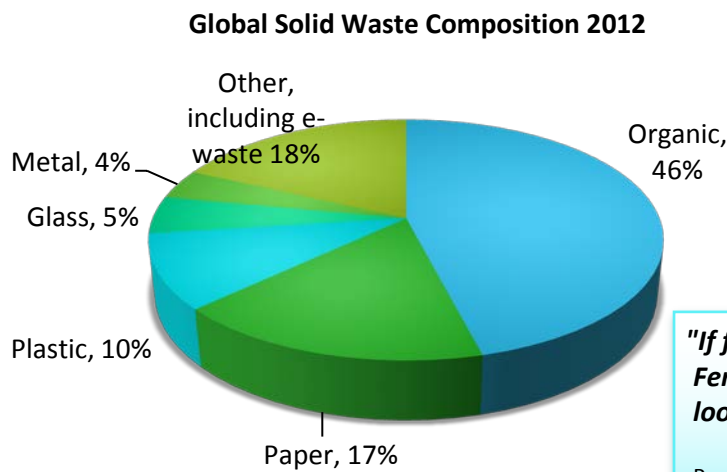
However, trashing our planet is not the only reason that it is critical to reduce the piles of waste accumulating around the world. With an insatiable demand for the “new,” world consumption patterns are draining our natural resources while health epidemics emerge as a consequence of affluence. Think obesity, diabetes and other lifestyle illnesses.

The most effective solution to solve the world's waste problem is not to waste at all – societies worldwide are demanding that companies, governments, and communities take action to reduce current and future trash piles. An increasing number of organizations, both private and public sector, are taking on the challenge by using and developing new technologies, as well as rethinking production processes and product design. However, the biggest challenge of all will be to change the mindset of the modern consumer towards wasting less by recycling and reusing, and ultimately by consuming less and smarter.

Living in a world of waste

By 2000, the 2.9 billion people living in cities (49% of the world's population) were creating more than 3 million tons of solid waste per day. By 2025 it will be twice that – enough to fill a line of rubbish trucks 5,000 kilometers long, every day. Also consider that if no food were wasted there would be enough food for everyone in the world. (Sources: [UN/FAO](#), [Nature](#)). While organic waste presents a significant problem, new technologies are adding to ever increasing number of discarded

electronic devices in need of disposal. Typically, within one to three years of purchase electronic devices become obsolete or unwanted and this global mountain of waste is expected to continue growing 8% per year, indefinitely. (Source: [e-Stewards](#))



Source: [World Bank report "What a Waste"](#)

"If food was as expensive as a Ferrari, we would polish it and look after it."

Professor Per Pinstrup-Andersen, Head of an independent panel of experts advising the UN's Food and Agricultural Organization (Source: [BBC](#))

Troubling waste facts from the [World Bank](#), [The World Counts](#), and [UN/FAO](#)

- The global cost of dealing with all the world's waste will rise from US\$205 billion a year in 2010 to US\$375 billion by 2025, with the sharpest cost increases in developing countries.
- 3,476,229,569,059 is the number of plastic bags produced this year. (As of Sep. 12, 2014)
- 33% of all food is wasted which is an estimated 1.3 billion tons.
- 6-10% of greenhouse gasses come from waste food.
- US\$750 billion is the cost of wasted food.
- 27,809,836 tons of electronic waste has been thrown out globally this year to date. (As of September 12, 2014)
- 278,098,365 tons of hazardous waste has been thrown out this year to date. (As of September 12, 2014)
- 1,473,921,337 tons of waste has been dumped in the oceans this year to date. (As of September 12, 2014)

Managing waste using technology

The consumption habits of the modern consumer are filling up local landfills. To cope, many developed countries have, for years, exported waste from these overfilled sites to the developing world resulting in devastating impacts on ecosystems and populations around the world. However, today companies and scientists are developing new ways to recycle different types of waste from food to heat to water. The potential of doing so is enormous, in particular, to generate energy to power urban communities and businesses, but also to create new products. In Sweden, for example, two million tonnes of waste, some imported from the UK, Italy, Norway and Ireland, is burnt to produce 670,000 tonnes worth of fuel oil energy providing one million homes with heating and 260,000 with electricity. (Source: [Impactlab](#))

The development of new technologies is not only important in preventing environmental and cultural disasters around the world, it also helps poor communities improve living standards,

provides water scarce areas with access to clean water supplies, and reduces the world's reliance on fossil fuels and other scarce natural resources.

In Action!

From waste to plastic: It can take 18 months to 10 years for a cigarette filter to decompose; meanwhile it leaches toxic chemicals into the ground and waterways, polluting the environment. Many billions of cigarette butts and tobacco waste end up in dumpsters and landfills, or get tossed on to shorelines, parks, and roads across the world. In the U.S., 38% of litter on the road is cigarette and tobacco product waste. [Terracycle's Waste Brigade](#) has launched a recycling program in the U.S. and in the [City of Vancouver, Canada](#) to collect cigarette and tobacco waste in order to recycle it into a number of industrial products such as plastic pallets. Scientists from [Athanassia Athanassiou, the Italian Institute of Technology](#) also report that a new process could turn waste from rice, parsley and other foods into biodegradable plastic, addressing both agricultural and plastic waste problems. (Source: [Phys.org](#))

Reusing municipal wastewater: A couple of years ago multinational [Dow Chemical](#), operating in the small, water-stressed town of Terneuzen in the Netherlands, began cooperating with the town municipality to treat and reuse water. Previously, Dow had used desalinated water for its steam generation and industrial processes. Today, it uses 7500 cubic meters of treated wastewater from the community of Terneuzen. The wastewater is treated using osmosis and sent directly to the Dow plant. It is less expensive for all parties involved and requires 65% less energy to demineralize than saltwater. The town municipality believes this kind of partnership can easily be replicated and is working with the Zeeland Water Board and the Dutch central government to offer it as a solution to water-scarce regions. (Sources: [IBM](#), [Water](#))

From waste to fuel: To keep the ever-increasing amount of food waste out of the landfills more and more sewage treatment plants in the U.S. and Europe are processing food waste in an [anaerobic biodigester](#), mixing it with human waste and turning it into biogas that can be burned as fuel. In 2017 [Preem](#), Sweden's biggest gasoline and diesel producer, expects to launch a gasoline product made from leftovers of the forest industry. To grow awareness of the product and put pressure on the government for support, [Preem](#) is now giving away one litre of fuel to whoever wants it. In the U.S. the first of several plants to produce large-scale cellulosic ethanol from farm waste (corn plant waste or stover, as well as grasses and wood) has just opened this September. (Sources: [Yale](#), [PSFK](#), [Fortune](#)) Or what about fuel from bacon grease waste! It is possible. To read about the bacon-fuelled motorcycle ride across the U.S. click [here](#).

Look Out For...

Converting waste heat to energy: Heat is a natural by-product of using energy. Unfortunately most of it gets lost as waste heat. While larger quantities and higher temperatures of waste heat are often re-used, for instance in production, lower temperature waste heat like kinetic energy (energy of an object, human or otherwise, due to motion) is often lost completely. However, it is a reliable and cost-effective alternative power source. In Stockholm's Central Station the body heat of the rush-hour throng moving to and from the underground station is captured and converted to produce hot water, which is then pumped to the heating system in a nearby building to keep it warm. In Ghana playing on a merry-go-around turns into clean power for school students. The London 2012 Olympics were partly powered by kinetic-power-lit pavements making it the most energy-efficient Olympics ever. In Brazil's slums, around 200 player-powered, energy-capturing tiles are feeding electricity to floodlights on a soccer field allowing players to play when it is dark. (Sources: [CBSnews](#), [BBC](#), [Treehugger](#))

From waste to recreational space: What should we do with the amount of plastic waste that already exists? [WHIM Architecture](#) in the Netherlands wants to create a [Recycled Island](#) made from marine litter in the North Pacific Gyre, roughly the same size as the main island of Hawaii.

The Recycled Island would be a way to reuse the non-biodegradable plastic, and prevent it from reaching the North Sea. The architects also have ambitions about using plastic when building homes. The typical components of the family home: shared space, private space, garden, and service spaces are being rethought to use these new materials, as recycled plastic creates the possibility of translucent materials and more fluid connections between spaces. (Source: [PSFK](#))

Nanoscopic Robot Recyclers: Robotic technology is permeating all aspect of our lives and, according to [Imagine 2050 from Veolia](#), nanobots could signal the end of household bins, as we know them. How is that possible? Veolia suggests that machines will sort products being recycled, separating materials into categories based on their size, shape, and color and on their physical and chemical properties. In the future, these mixtures of materials will be shredded into microscopic particles so that nanoscopic robots can recognize different types of materials and collect them in a pure form, to be reused by industry. The potential result: reducing the amount of waste that cannot be used and has to be thrown away today to almost zero.

Designing out waste in a circular economy

Today we consume 26 times more than we did 150 years ago. The sheer scale of waste and pollution created by the world's seemingly insatiable consumption is hard for most people to imagine. While the only real solution is to cut down on consumption – what is necessary, and what is not – it is also critical to rethink production and business systems such as logistics, and to redesign future products to avoid waste or improve recyclability. The aim: to develop a more circular economy that significantly improves resource usage and minimizes waste as well as promoting green growth.

Recycling and reusing resources makes sense for organizations, both private and public, e.g. to ensure environmental sustainability, overcome lack of natural resources, and reduce cost. It also offers the potential for innovative ways of driving job creation, economic growth, and even new ways of differentiating offerings to customers and consumers. Should we believe the report "[Towards the Circular Economy](#)" from [World Economic Forum](#), [the Ellen MacArthur Foundation](#), and [McKinsey & Company](#), the arguments for the shift towards a circular economy is compelling from a business point of view. They suggest that such a shift could add more than US\$1 trillion to the global economy by 2025 and create 100,000 new jobs within the next five years.

In Action!

The quest for zero waste: The philosophy of zero waste is to redesign the whole life cycle of resource use, including product design, use and disposal, so that all elements of a product can be reused, eliminating waste to landfills and incinerators. A number of automotive companies have been leading the charge. Subaru, Toyota and General Motors have already made a number of their plants landfill-free, and plan to continue to do so. Subaru has implemented comprehensive strategies for every step of production through to waste vehicle collection, ranging from selecting materials that are easy to recycle, easier identification of materials, and increased use of recycled materials throughout the vehicle. In 2007 it recorded a 73% recycling ratio rate for its end-of-life vehicles. It has also developed partial zero emissions vehicles that dramatically reduce emissions from petrol-fuelled vehicles. (Source: [Global Trends](#))

More cradle-to-cradle: Companies and consumers have created massive amounts of waste for years. It worked fine when the globe's resources and capacity for waste disposal seemed to be infinite but not any longer. Closed loop or cradle-to-cradle systems share the goal that materials – including metal, paper, plastic, and even food – are (as far as possible) completely recycled or find their way back into the natural environment. A true closed-loop system in which materials are reused indefinitely is not yet a reality but could be within a few years. Examples of these processes now exist in many industries. One cradle-to-cradle leader is [DSM](#), the Dutch materials giant. The company has worked with suppliers and [MBDC](#) to develop programs that would allow its plastics to be recycled with minimal effects on quality. The office furniture company [Herman](#)

[Miller](#) uses materials that can be recycled or composted. Even [Rungis](#), Paris's largest wholesale market, avoids sending waste to landfill and uses it to fuel its operations and part of the energy needs of Orly airport. (Source: [Guardian](#)). Also check out the Cradle-to-Cradle Marketplace [here](#) that provides access to Cradle to Cradle certified products, through B2B, C2C, B2C and C2B relationships.

Look Out For...

Business models already driving the circular economy: Building a business model that doesn't create waste is easier said than done. In the linear economy the resources in a product are inputs and the customer is the buyer. However, to make a business more circular the product should be seen as an asset and the customer as a user. [FastCompany](#) has identified five business models that are contributing to making circular businesses a reality: 1) Product as services – leasing access to and not selling ownership of a service, e.g. [Vodafone's Red-Hot plan](#); 2) Next Life Sales – efficiently recovering and re-conditioning products after use and then putting the same products into the market, e.g. [Tata Motor Assured](#); 3) Product transformation – not all products can be reconditioned in their entirety but most products have components that can be reused, e.g. [BMW](#); 4) Recycling 2.0, e.g. [Starbucks](#) turns thousands of tons of its waste coffee grounds and food into everyday products by using bacteria to generate succinic acid which can then be used in a range of products from detergents to bio-plastics and medicines; 5) Collaborative Consumption – using social media platforms, e.g. [ThreadUP](#) to browse like-new clothing at significant reductions from families whose children have outgrown their clothes.

The end of the digital dump: E-waste isn't just any kind of waste. It contains large amounts of highly toxic substances, e.g. mercury, lead, cadmium, arsenic, beryllium and brominated flame retardants. Many of these chemicals do not break down over time and consequently contribute to destroying ecosystems and causing health problems around the world. Only a very small percentage of e-waste is recycled today. The video [Re-thinking Progress](#) from [the Ellen MacArthur Foundation](#) explains how we can make the products of today into the resources of tomorrow by suppressing our "throw away and replace" mindset and instead adopting a "return and renew" culture. Part of this change requires rethinking our operational systems. One solution may be to rethink how consumers and companies view ownership – instead of owning, e.g. phones, computers, and appliances, these could be licensed to the consumer. That means, when the consumer doesn't want or need the product anymore, it can go back into the operational system to be reused or recycled resulting in less e-waste. Watch the video [here](#).

The ultimate goal: Avoiding waste by influencing consumer behaviors

While it is encouraging that many companies are starting to adapt their operations in line with the aims of the circular economy, don't expect a sudden transition. To join the circular economy, companies must put in significant work and upfront costs – that will typically be offset by substantial benefits over time – and the development of new approaches to business models, production, logistics and waste handling operations.

Simultaneously, it is critical to work on changing the mindset and behaviors of consumers around the world. There is no "magic bullet" approach, but below you will find some examples of creative solutions for curbing the world's insatiable consumption appetite, in particular, the rampant food waste problem. From smart swapping, sharing, finding a new use for previously discarded inputs, direct incentives for recycling, and even the heavy hand of regulation, the ideas are all aimed at influencing behaviors to reduce waste – which can your company borrow with pride?

- In an earlier [briefing](#), we noted the edible packaging technology [WikiCells/Wikipearl](#) that, for example, holds pumpkin soup in a spinach membrane, lemon juice in a lemon membrane, and melted chocolate in a cherry membrane – so waste is eliminated. We also mentioned [MonoSol's](#) edible film that is soluble, biodegradable and can even be flavored. But have you

ever heard about edible cutlery from [bakey's](#), or the [Edible Blob](#) that is a water bottle without plastic?

- In Denmark, [DanChurchAid](#) is opening a store with surplus food in cooperation with the Danish Food Bank and Danish Supermarket. The store ReFood will open in Copenhagen at the beginning of 2015 and will be for those seeking low budget shopping as well as for those who are already trying to avoid food waste. The profit from the store will go towards DanChurchAid's work in fighting hunger in some of the world's poorest countries.
- [CropMobster](#) is a simple alert system for farmers and grocers in the San Francisco Bay Area. Producers and vendors post entries (e.g. tomatoes, eggs available), which are shared via email, Twitter, and Facebook, and eventually the unwanted food finds a home.
- [Spoiler Alert](#) is an app created by two MIT business school graduates that serves as an online marketplace for the real-time exchange of local supply-and-demand information about excess, expiring, and spoiled food.
- [LeftoverSwap](#) is an online marketplace for leftovers that lets people share and swap food with neighbors. It started in the U.S. in 2013 and is now expanding to Europe.
- [Halfsies](#) has been launched in Texas and New York. The idea is that diners pay full price for a meal but receive only half of the portion size. The other half is sent to people in the city who do not have enough money to buy their own food. Unless you use a doggie bag every time (and finish the leftovers within a few days), it's pretty clear that the other half of your meal is going to be put to better use. (Source: [PSFK](#))
- French supermarket, Intermarché, is making fruit and vegetables that are too ugly to sell into a healthy new brand. Its new soups and juices called Les Fruits & Légumes Moches aims to teach customers about food waste, and it's working: An average of 1.2 tons of ugly fruit and veg and related products sold in the first two days after launch. (Source: [Springwise](#))
- [H.J. Heinz Co.](#) may profit from the discarded peels, stems and seeds of the tomatoes it uses to make ketchup thanks to a new partnership with [Ford](#), which is researching ways that tomato fibers could be used to create sustainable material for car components. (Source: [JWT Intelligence](#))
- In late August 2014, the California state legislature enacted a ban on plastic grocery bags which could, if signed into law, be the first of its kind in the US. (Source: [Reuters](#))
- On September 22, 2014, Seattle voted to introduce fines for people who throw away too much compostable waste including food and some paper products. New offenders will get a US\$1 fine if these products are more than 10 percent of their home garbage, while for repeat offenders it goes up to US\$50. (Source: [Reuters](#))
- In Beijing, the city is giving free train rides to people recycling plastic. Across the city, machines take your used water bottles, calculate their worth and issue a credit to your public transport pass. (Source: [The Guardian](#)) Does it work or is it only raising awareness?
- In the U.K. 2.5 billion difficult to recycle paper cups end up in landfills every year. However British entrepreneur and engineer Martin Myerscough has come up with an alternative to make recycling easier. The [Green Your Cup](#) looks and feel like a regular takeaway coffee cup but is a 100% paper product ready for recycling.

In November: Look out for trends in action on Wearables: Fab, fashion or functional?