UBS

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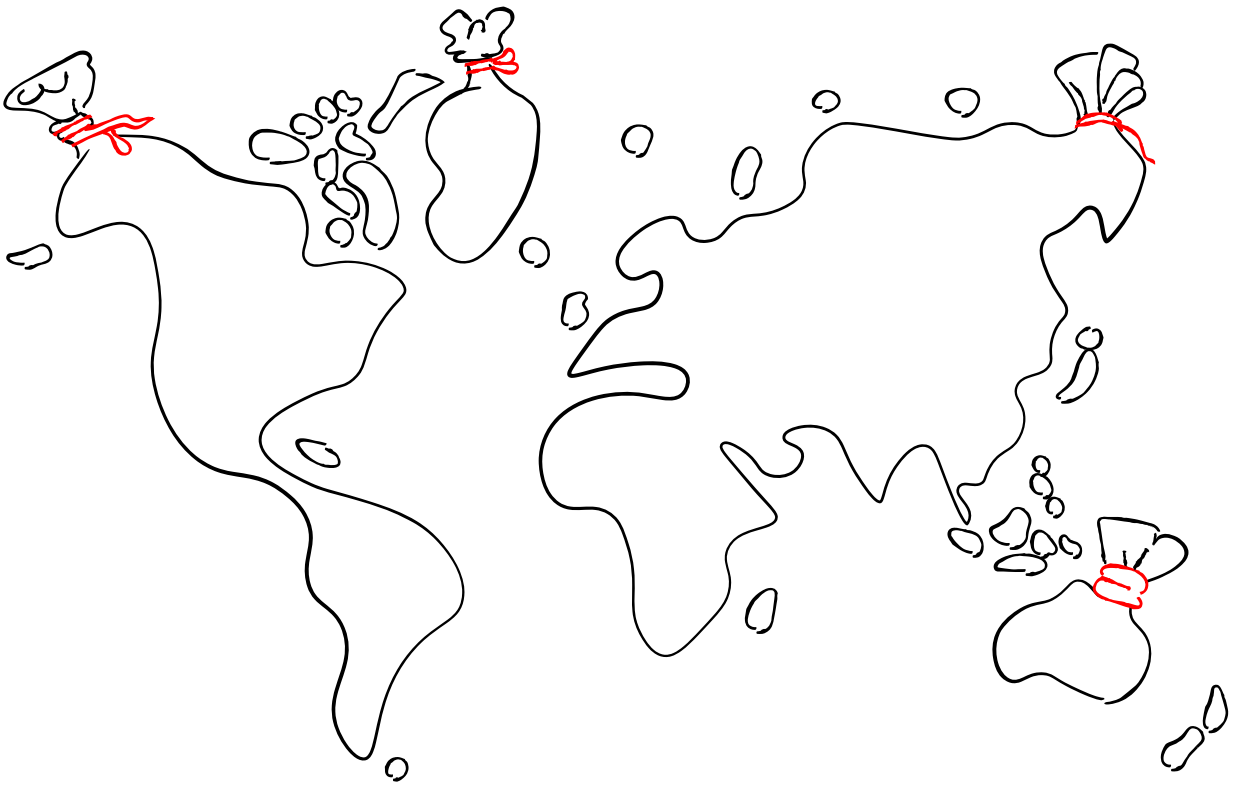
Chief Investment Office GWM
Investment Research

Future of waste

Finding opportunities in waste reduction



Content

The future of waste
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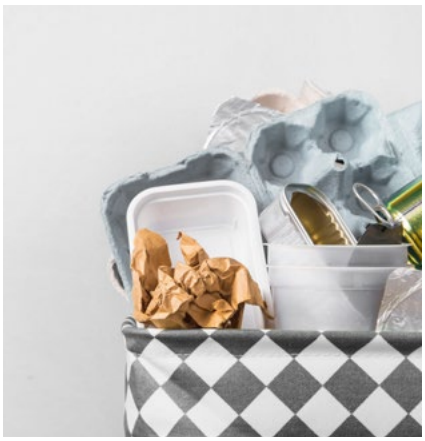


Regional, country, and sector insights on waste

Key findings

Reducing waste boosts companies' profits while lowering costs to the consumer. And what's more, it can also improve broader societal outcomes.

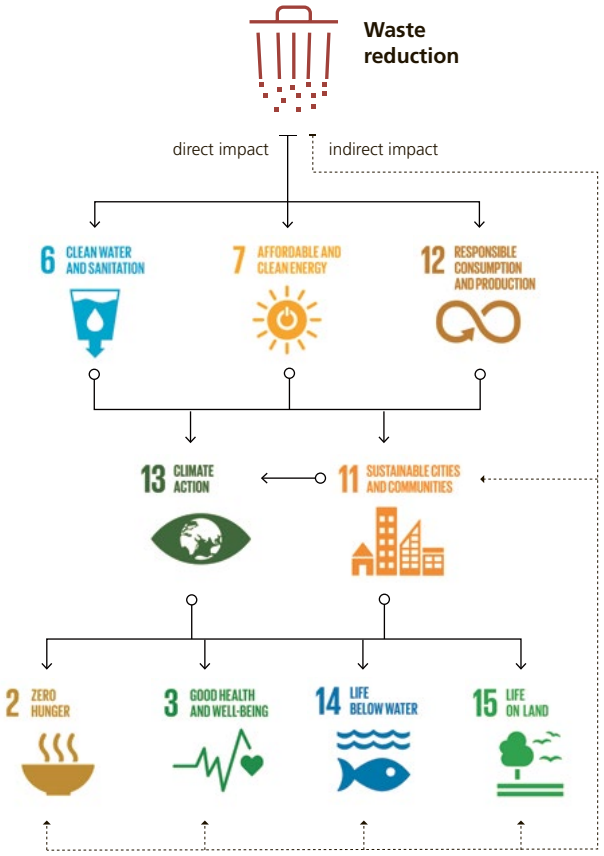
We currently waste around 30% of all food globally at a cost of USD 1tr a year. Meanwhile, 10% of the global population goes hungry. Plastic packaging volumes are expected to more than quadruple by 2050, yet 95% of the value of such plastic is lost after one use, at a cost of up to USD 120bn each year. And, without change, plastics in the sea could outweigh fish by 2050.

This report offers concrete waste reduction solutions that can increase businesses' financial returns. **We highlight mainstream and innovative companies** that have cut fuel costs by billions of dollars, slashed landfill waste by up to 90%, or reduced food spoilage to less than 1%. In our view, investors can capture long-term returns by investing in waste reduction opportunities. Doing so aligns both with lawmakers' drive for stricter regulation, and with growing consumer demand for companies that make a positive impact.

In this report we list the dedicated management companies in the waste sector, one part of an overall waste market whose estimated size of USD 2tr is twice that of Australia's stock market (MSCI Australia Index). **We flag the equities and bonds of companies** that generate material levels of waste but reduce it more proactively than peers. And we identify the equities and bonds of companies that have made strides—or have the potential to—in tackling waste (including cases where shareholder or bondholder engagement could boost corporate and investment performance).

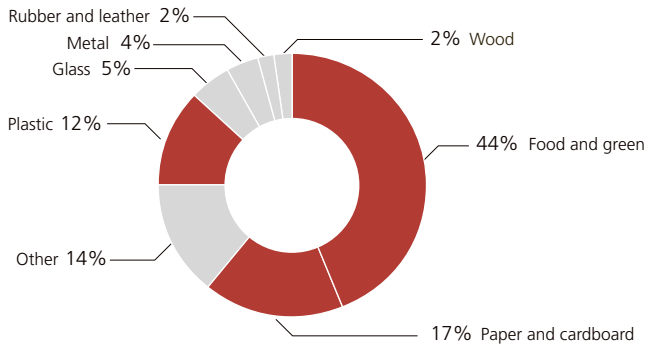
The following chapters analyze the main sources of waste (p. 6–18) and the impacts of that waste (p. 19–24). We present potential best practices to address waste that can prove profitable for businesses and investors (p. 25–37). And, in the final chapter, we use data from UBS Evidence Lab to highlight regional, country and sector insights on waste.

Waste reduction and its link to the UN's Sustainable Development Goals



Source: UBS

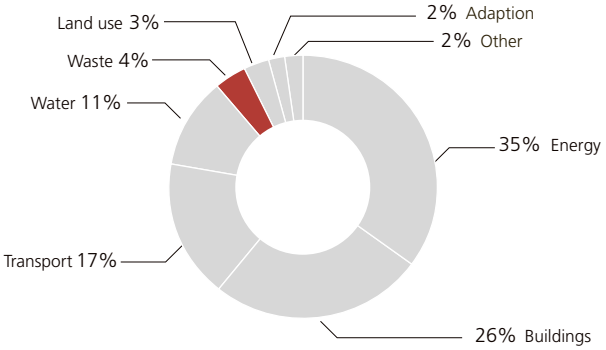
Global solid waste composition



Source: World Bank, 2019*

*Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO

Just 4% of green bonds actively address waste—an opportunity for growth?



Source: Climate Bonds Initiative, UBS

External views

Interview highlights*

"Waste management is going to play an increasingly important role in delivering commercial returns as well as tackling the climate crisis. The sector is growing significantly—we expect it to double between 2017 and 2025. And although the majority of people think waste starts in the home, residential accounts for only 10% of it. Bigger areas of waste generation and opportunity are in the construction and industrial sectors."*

Urs Wietlisbach
Partner, Co-Founder, and Member of the Board of Directors, Partners Group

"Energy waste is a major challenge both at the country and company level. I'd draw particular attention to energy waste in buildings. In the US, commercial buildings use 20% of national energy consumption. They waste 30% of this energy, accounting for around 12% of US greenhouse gas emissions."*

Professor Donald Sadoway
John F. Elliott Professor of Materials Chemistry
Massachusetts Institute of Technology; Co-Founder, Ambri; UBS Global Visionary Alumnus

*This interview contains views which originate from outside Chief Investment Office Global Wealth Management (CIO GWM). It is therefore possible that statements herein do not fully reflect the views of CIO GWM

Chapter 1

What are the major types of waste?

How waste is defined varies. In our analysis, we focus on two main categories: solid waste (also known as municipal solid waste, or MSW) and energy waste.[1] Throughout this report we'll explore each category in turn, first looking at the major contributors to these types of waste.

Solid waste

The majority of the world's solid waste consists of food and green materials (44%), followed by paper and cardboard (17%), and plastic (12%) (Fig. 2).

All waste is not created equally—or rather, different countries and regions produce solid waste in different quantities and proportions. In absolute terms, the US and China are the world's largest solid waste producers, followed by Brazil and Japan.

At a regional level, East Asia and the Pacific account for nearly a quarter of all solid waste, while Europe and Central Asia account for 20% of the total and North America 14% (Fig. 1).

Solid waste generation also changes as national income changes. High-income countries generate 34%, or 683 million metric tons, of the world's waste even though they're home to just 16% of the world's population. Low-income countries are home to 9% of the world's population and generate about 5% of global waste, or 93 million metric tons.[2]

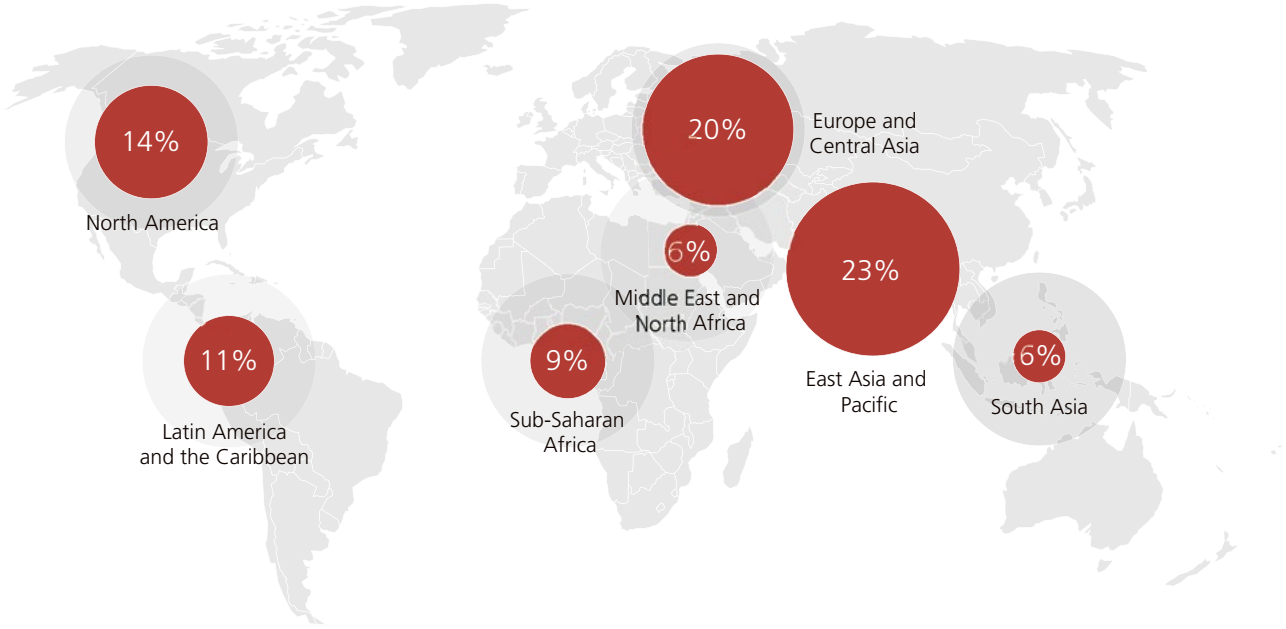
[1] For more details about global waste, included special wastes such as industrial, agricultural, medical, and e-waste, please see Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[2] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

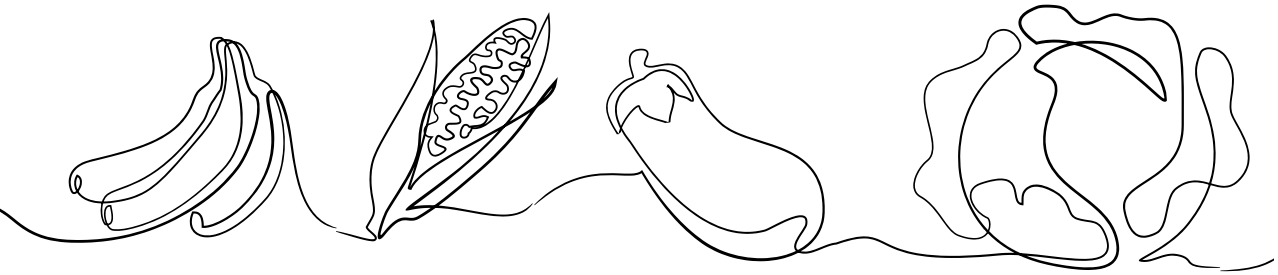
Fig. 1

Which regions produce the most solid waste?

Solid waste generation by region



Source: Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: *A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

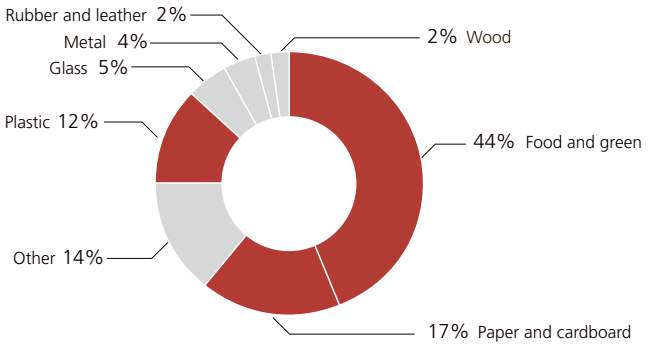


Solid waste composition differs by national income levels. The share of food and green waste is lower in high-income countries than in others, and richer nations produce considerably higher percentages of waste from manufactured or finished materials such as paper, plastic, and glass (Fig. 3).

Exploring each and every category of solid waste is beyond the scope of this report. Instead, we want to focus on the types of waste that have the biggest impact on people, the planet, and profits. Below we explore in more detail the three largest contributors to solid waste: food waste, paper and cardboard waste, and plastic waste.

Fig. 2

Global solid waste composition



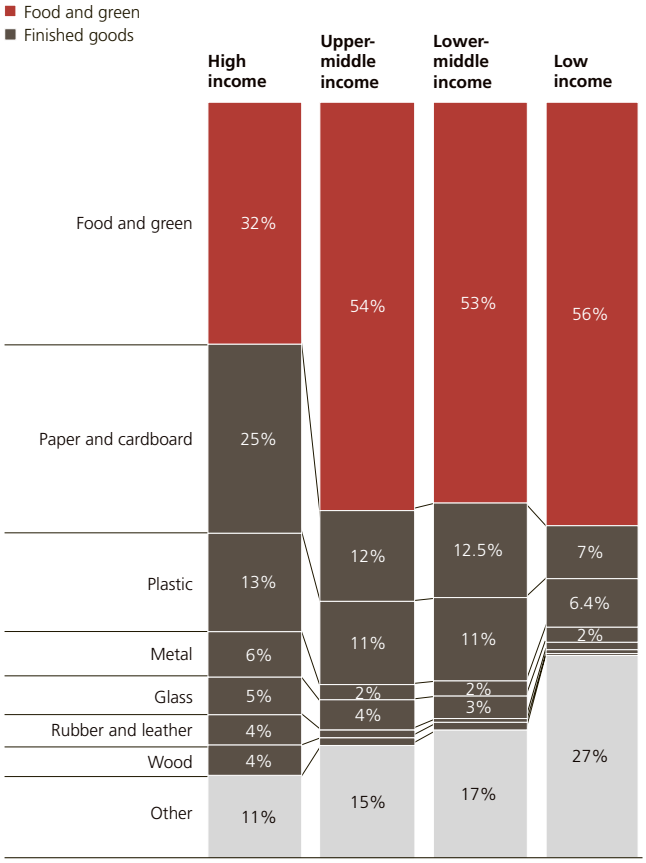
Source: World Bank, 2019*

* Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO

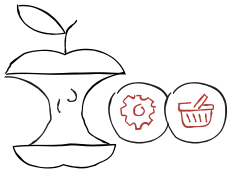
Fig. 3

Richer countries waste more finished goods, poorer ones waste more food

Solid waste composition by income level



Source: World Bank, 2019



Food waste

Food loss and waste (FLW) is a global issue, with the main drivers being supply chain inefficiencies in developing economies, and consumers buying more food than they end up consuming in richer nations.

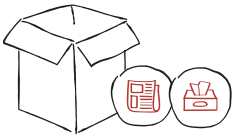
Food waste threatens food security, food safety, the economy, and environmental sustainability. Although there are no definitive data on the global scope of food waste, one study indicates that we squander around 30% of all food globally (UN FAO 2015).[3] Barclays estimates this wasted food costs the world economy around USD 1tr each year, potentially rising to USD 1.5tr by 2030.[4] Meanwhile, more than 10% of the global population currently goes hungry. Global food waste translates into the equivalent of six refuse trucks of edible food being wasted every second.[5]

Food waste comes at a cost. According to the Ellen McArthur Foundation, production and processing inefficiencies contribute 1.1 billion metric tons of waste per year, and 0.5 billion metric tons of food waste in cities through flawed transport and sales channels. This amounts to an annual economic loss of around USD 1.6tr each year.[6] For particular foodstuffs like meat, waste or losses account for a fifth of production, the equivalent to 75 million cattle every year.[7]

The reasons for food waste differ by region (Fig. 4). In emerging economies, there is typically a lot of waste in the supply chain due to infrastructure inefficiencies. In high-income countries, waste is generally concentrated in consumer-facing sectors although it can also occur in earlier stages such as when agricultural subsidies lead to overproduction of farm crops.[8]

In the US, for example, 43% of food waste happens in consumer-facing businesses and 40% at home, according to ReFED's *A Roadmap to Reduce U.S. Food Waste By 20%*.

The reasons for meat waste match those for general food waste. In more developed economies the majority of losses can be traced back to consumers, whereas production and distribution challenges explain waste in less economically developed regions (Fig. 5).



Paper and cardboard waste

The second largest contributor, paper and cardboard account for 17% of all global solid waste. The main drivers of paper waste are fine paper and tissue, with processed foods dominating as the end use for US corrugated board consumption (Fig. 6).

Processed foods dominate as the end use for US corrugated board consumption, as shown in Fig. 6.

In spite of technological developments (such as the rise of e-documents and online distribution), paper and cardboard are still widely used resources in the world economy. And some of the fastest growing economic sectors (such as e-commerce) may be driving increased use of cardboard for packaging.

In aggregate, global paper and cardboard waste (expressed as the ratio of consumption to production) has dropped modestly over the last 10 years (Fig. 7).

However, there is considerable opportunity to increase efficiency and reduce waste across the sector. Waste levels have scarcely improved for fine paper used for printing and writing over the last decade—and have worsened in both tissue and newsprint. Waste management has improved in cardboard, albeit modestly (Fig. 8).

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[3] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[4] Barclays Equity Research—Sustainable & Thematic Investing—*Food Waste: Ripe for Change* (4 March 2019).

[5] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

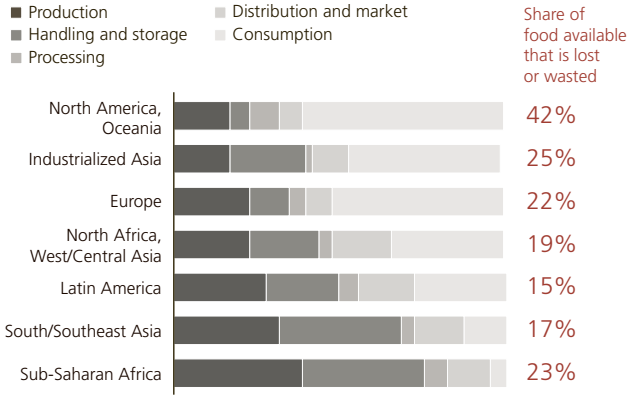
[6] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[7] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[8] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

Fig. 4

Where is food wasted along the supply chain?*



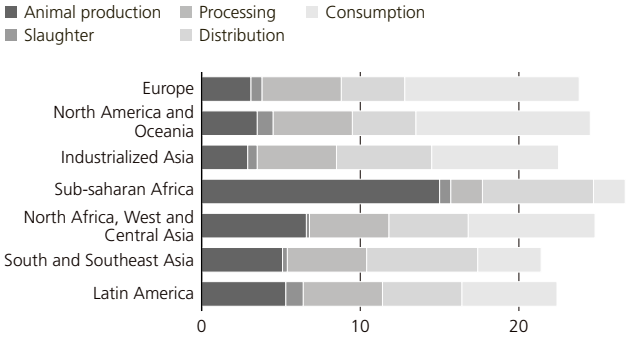
* Source: Graph derived from WRI Reducing Food Loss and Waste: An Overlooked Strategy for Creating a Sustainable Food System—October, 16 2014.

URL:www.wri.org/blog/2014/10/reducing-food-loss-and-waste-overlooked-strategy-creating-sustainable-food-system

Fig. 5

Where is meat wasted along the supply chain?

In %

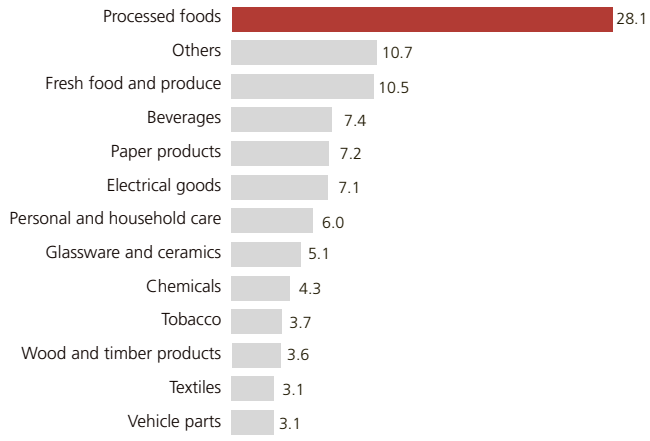


Source: URL http://www.fao.org/3/a-i2697e

Fig. 6

Processed foods are the biggest use case of cardboard in the US

Consumption of corrugated board, 2017, by end-use application, in %

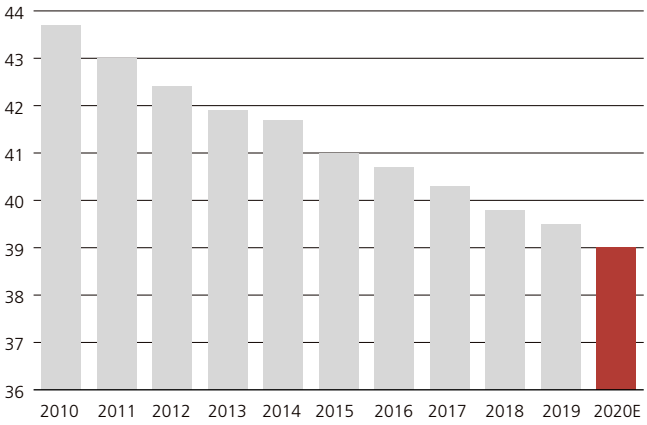


Source: Smithers, 2018: The Future of Corrugated Packaging to 2023. https://www.smithers.com/resources/2019/jan/trends-changing-the-corrugated-packaging-market, accessed as of 7 February 2020

Fig. 7

Paper and cardboard waste is falling

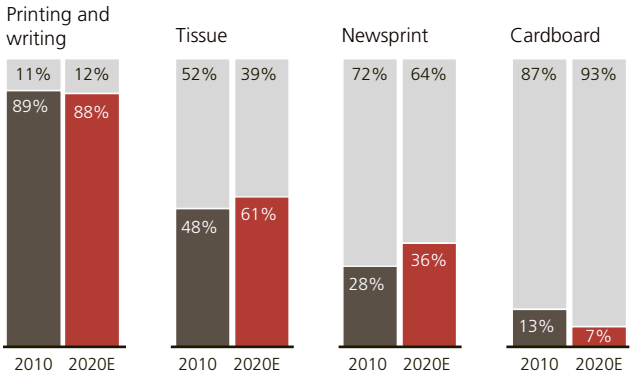
Ratio of consumption to production in %



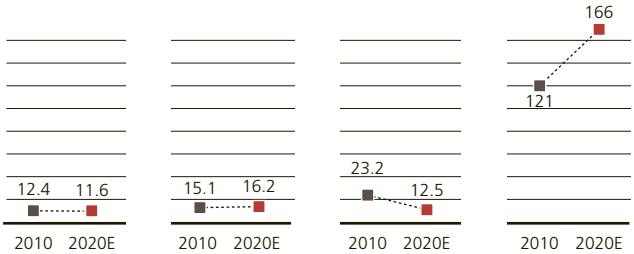
Source: Fastmarkets RISI, BofA Global Research, UBS, as of January 2020

Fig. 8

There is still considerable opportunity to reduce paper waste



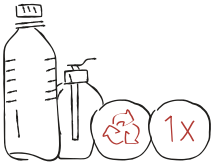
Figures in the line charts indicate domestic consumption* in megatons



* Domestic consumption is defined as production plus imports – exports

Waste 2010
Waste expected 2020
Consumption

Source: Fastmarkets RISI, BofA Global Research, UBS, as of January 2020



Plastic waste

Plastics (including plastic packaging) account for 12% of the world's solid waste. The main drivers of plastic waste are excessive plastic packaging and low levels of recycling.

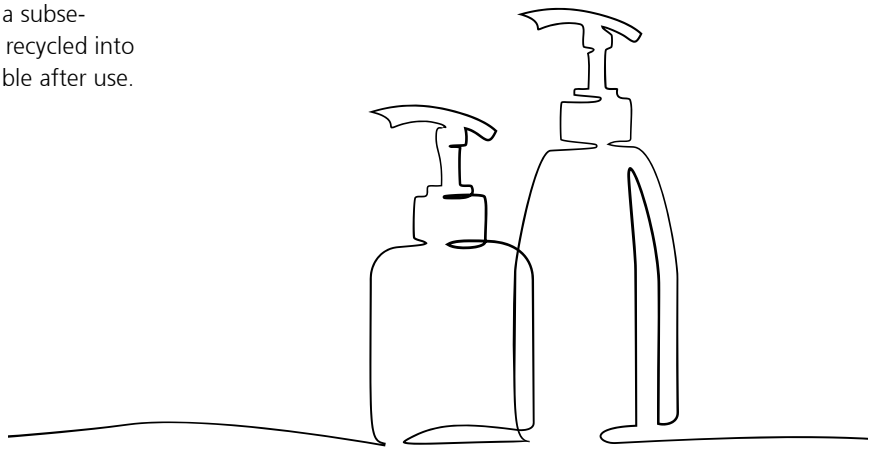
Despite their environmental impact, plastics remain an important part of the global economy. Plastic production grew from 15 million metric tons in 1964 to 311 million metric tons in 2014.Volumes are expected to double again over the next two decades, as plastic usage widens.[9]

The share of plastic packaging in global packaging volumes has increased from 17% to 25%, and the global plastic packaging market is growing at around a 5% annual rate. In 2013, the industry sold 78 million tons of plastic packaging, worth USD 260bn. Plastic packaging volumes are forecast to double within 15 years and more than quadruple by 2050, to 318 million metric tons annually—exceeding the size of today's total plastics industry.

However, the current use of plastic has important negative side effects. Today, 95% of plastic packaging's material value, or USD 80–120bn annually, is lost after just one use (Fig. 9). Just 14% of plastic packaging is collected for recycling. And when additional value loss in sorting and reprocessing is factored in, only 5% of material value is retained for a subsequent use. Plastics that do get recycled are mostly recycled into lower-value applications that are not again recyclable after use.

The recycling rate for plastics in general is even lower than for plastic packaging, and both are far below the global recycling rates for paper (58%) and iron and steel (70%–90%). PET (used for drinks bottles) is the most widely recycled type of plastic, but overall rates are low, with just 7% recycled from one bottle to another, and near half not collected for recycling in the first place. In addition, plastic packaging is almost exclusively single-use, especially in business-to-consumer applications.[10]

There is a disconnect between where major plastic producers and consumers are located, and where plastic ocean leakage is found (Fig. 10). Although nearly all the top 20 plastic producers are located in the US and Europe, just 2% of the ocean's plastics come from these two regions. Asia is home to 10% of the world's 20 biggest fast-moving consumer goods (FMCG) companies (and none of the world's biggest producers), yet the region accounts for 82% of plastic ocean leakage.

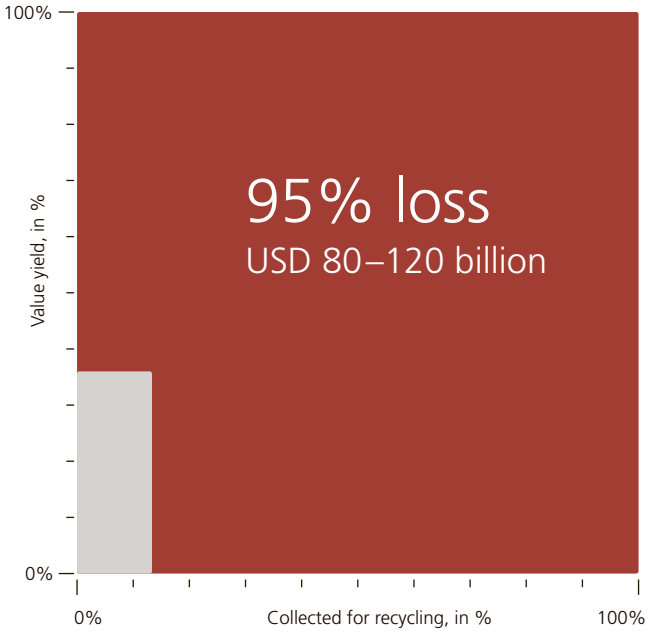


[9] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action*, (2017), http://www.ellenmacarthurfoundation.org/publications.

[10] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action*, (2017), http://www.ellenmacarthurfoundation.org/publications.

Fig. 9

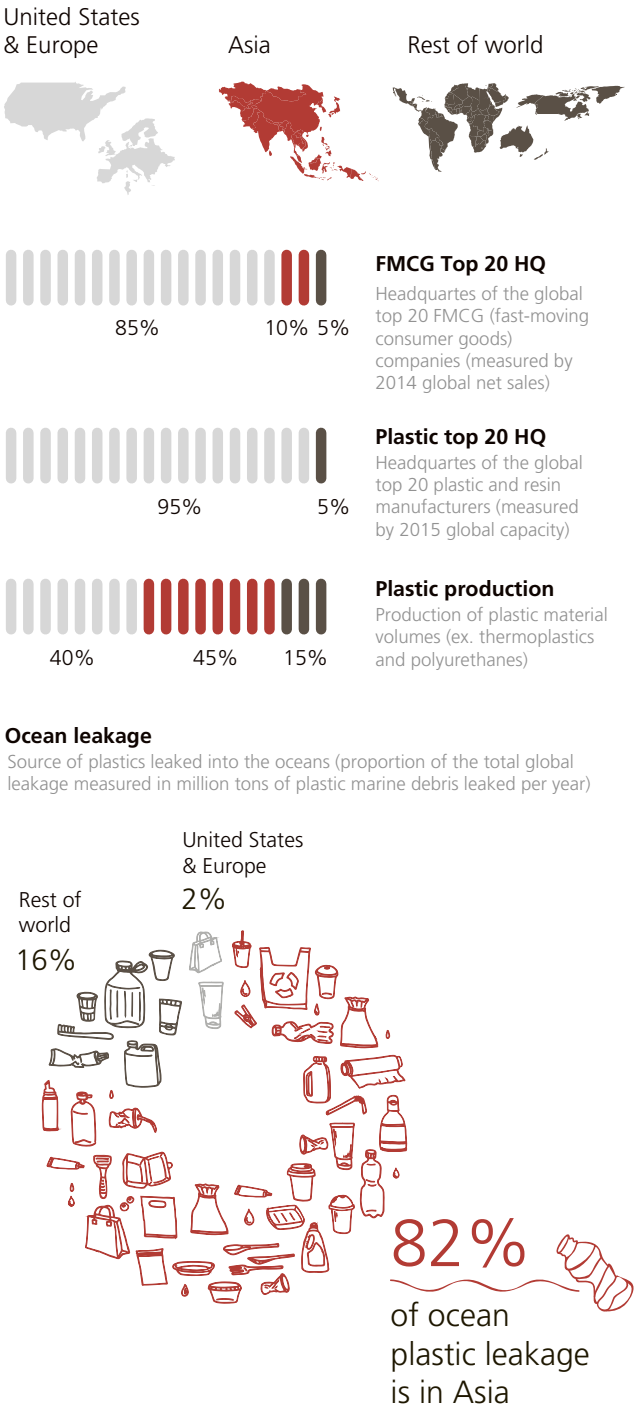
95% of plastic packaging's value is lost after just one use



Source: Ellen MacArthur Foundation, The new plastics economy: *Rethinking the future of plastics & Catalysing action,* (2017), http://www.ellenmacarthurfoundation.org/publications

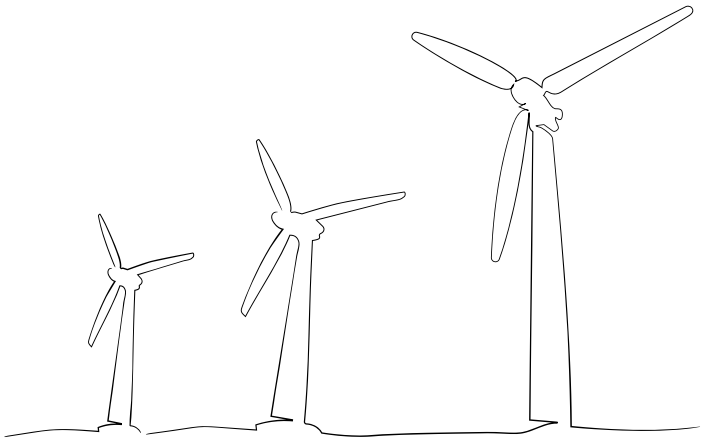
Fig. 10

10%–80% of ocean plastic leakage is in Asia



Source: Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics &atalysing action, (2017),* http://www.ellenmacarthurfoundation.org/publications

Energy waste



Measuring solid waste is relatively straightforward. Measuring energy waste and its implications is not. The main byproducts of energy waste are emissions and pollution. While greenhouse gas emissions tend to have global consequences (so looking at aggregate data makes logical sense), pollution impacts tend to be more localized. So it's difficult to collate meaningful high-level data on actual waste figures for the energy sector.

Regional data is available on annual CO_2 emissions. Analysis by Citi shows that China, the US, and the European Union accounted for 52% of world emissions in 2017 (Fig. 11). Although a different base year, 2016 data from the International Energy Agency (IEA) shows emissions per head are highest in Australia, the US, and Canada (Fig. 12). Yet, some of the Middle Eastern countries may well generate even higher per-capita emissions thanks to their hydrocarbon- and commodity-geared economies and population sizes.[11]

We adopt a more pragmatic approach, instead looking at current emissions by global sectors. The three largest contributors to energy emissions are industry (including energy generation from extraction to generation), which accounts for nearly 40% of emissions; buildings at around 18%; and transport at close to 15% (Fig. 13).

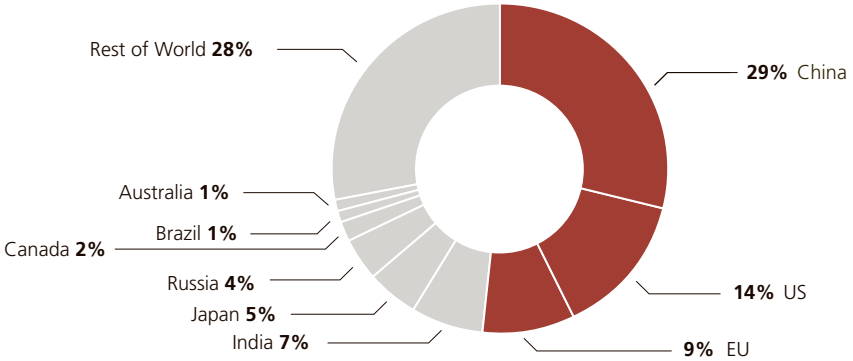
While measuring energy waste is more challenging, the imperative of tackling significant and material energy waste cases remains strong. Reducing waste in each of the three areas previously outlined (industrial processes, buildings, and transport) will have important implications for reducing emissions and pollution while raising efficiency. We explore each in more detail below.

[11] Citi Global Perspectives and Solutions (September 2019) *Energy Darwinism III—The Electrifying Path to Net Zero Carbon*

Fig. 11

China, the US, and the EU produce more than half the world's CO_2 emissions

Share of annual global CO_2 emissions, 2017

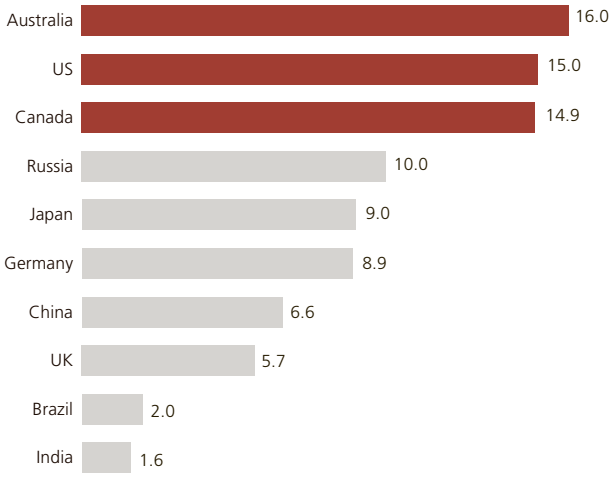


Source: Citi Global Insights, cited in Citi Global Perspectives and Solutions (September 2019) *Energy Darwinism III—The Electrifying Path to Net Zero Carbon*

Fig. 12

Australians, Americans, and Canadians produce the most CO_2 per head

Annual global CO_2 emissions per capita in 2016, in tCO_2/capita



Source: IEA, cited in Citi Global Perspectives and Solutions (September 2019)
Energy Darwinism III—The Electrifying Path to Net Zero Carbon

Fig. 13

Energy emissions (CO_2 equivalent)

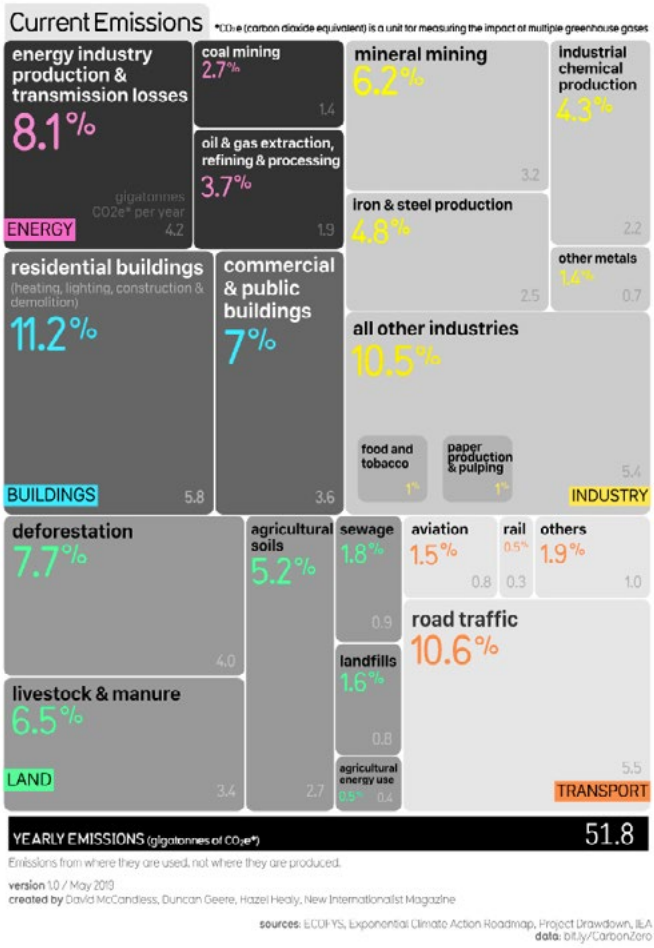
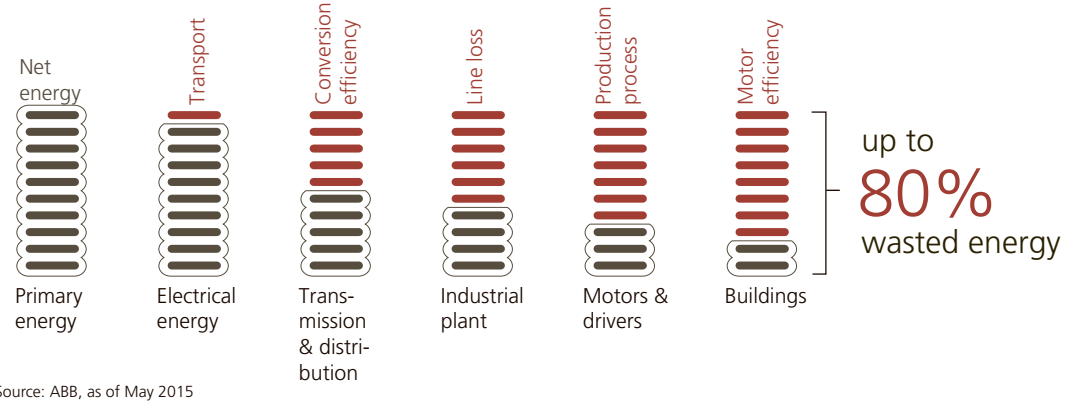


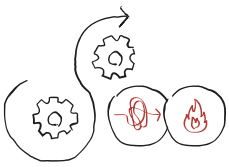
Fig. 14

Up to 80% of energy is wasted from primary energy to end use

Capital goods companies can help reduce waste along the value chain



Source: ABB, as of May 2015



Industrial processes

Industrial processes are the largest contributor to energy waste, accounting for nearly 40% of energy emissions (including indirect). The main drivers are inefficient energy or fuel mixes and poor conversion rates from inputs to outputs.

Why does industry account for such a large share of energy emissions? Energy mix is a major factor—the industrial sector remains dominated by fossil fuels (70%), mainly coal (accounting for around one-third of the total demand).[12] ABB estimates that aroup to 80% of energy is lost between extracting a resource (like coal) and the final use case (like electricity). In between, multiple industrial applications transport energy and drive production of final end products (Fig. 14).

Energy efficiency measures could help to reduce waste, lower emissions, and cut pollution. For every unit of electricity saved, three units are saved at the power plant, as most thermal power plants only have conversion rates of 35%. Modern combined-cycle gas turbines have even better conversion rates of 60%.

The IEA estimates that, with today's technology, one-third of energy could be saved (following a best-in-class approach). The expected payback period would only be three years in OECD countries and five years in non-OECD countries. The largest industry sectors in terms of energy consumption are steel production, chemical companies, non-metals (cement, glass, ceramics), and the paper industry. Reducing waste in these sectors would not only have positive impacts on carbon emissions, but also reduce solid waste and pollution.[13]

Buildings and construction

Buildings and construction are the second biggest contributor to energy emissions. Here the main drivers of energy waste are energy-inefficient buildings and excessive use of building materials.

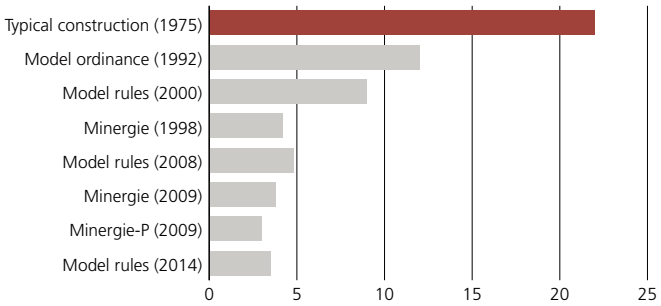
Buildings offer considerable potential for reducing energy consumption. The buildings segment currently accounts for around 36% of global final energy use and 39% of direct and indirect CO_2 emissions.[14] Based on IEA forecasts, new technologies and techniques for constructing and retrofitting buildings could improve energy efficiency (and reduce energy waste) by close to 40% by 2040.[15]

Opportunities to improve energy efficiency within buildings abound. Water heating, lighting, and space heating consume a lot of energy, though efficiency rates vary across countries (Fig. 13). Energy-efficiency measures in these areas can reduce

Fig. 15

Stricter regulation has slashed Swiss buildings' energy consumption for heating since 1975

Consumption in liters of oil equivalent per m^2 and year



Note: Minergie is a Swiss-registered quality label for new and refurbished low-energy-consumption buildings.

Source: EnDK (Konferenz Kantonaler Energiedirektoren, April 2008), Schweizerische Energie-Stiftung SES (URL: https://www.energiestiftung.ch/energieeffizienz-gebaeudestandards.html, accessed 17 February 2020).

[12] IEA (Tracking report—May 2019), https://www.iea.org/reports/tracking-industry-2019. All rights reserved.

[13] UBS Longer Term Investments—Energy Efficiency

[14] International Energy Agency and the United Nations Environment Programme (2018): 2018 Global Status Report: towards a zero-emission, efficient and resilient buildings and construction sector. All rights reserved.

[15] IEA (2018) Market Reports Series (Energy Efficiency 2018: Analysis and outlook to 2040). All rights reserved.

waste, carbon emissions, and pollution. Examples include building insulation; a switch to LED lighting (particularly relevant when considering that lighting accounts for 15%–20% of all global electricity consumption); and building automation for climate control, lighting, and electricity outside of office hours.[16]

Reducing energy waste also makes commercial sense, as operating costs dominate the lifetime costs of a building. The National Institute of Building Sciences (NIBS) has pointed out that the operating costs of a building account for 60%–85% of the total life-cycle costs (fuel, maintenance, and repair, etc.), compared with just 5%–10% spent on design and construction, and 5%–35% spent on land acquisition, conceptual planning, renewal or revitalization, and disposal. Energy efficiency is therefore a simple way to cut maintenance costs.[17]

Regulation has a role to play in driving better energy efficiency in new or retrofitted buildings. Data from Switzerland shows how progressively tighter standards have pushed down buildings' energy consumption for heating per square meter by around 75% since 1975 (Fig. 15).

Transport

The transport sector is the third largest contributor to energy emissions. The main drivers of waste are growing transport demand, high energy intensity for road travel, and limited adoption of zero- or low-emission modes of transport.

The sector consumes significant energy and generates large amounts of waste. For example, road travel is estimated to account for 73% of total transportation fuel use (Fig. 16). At the same time, road travel is significantly more energy intensive than other modes of transport (Fig. 17). Large passenger cars are more than six times as intensive as trains, and regular passenger vehicles have comparable intensity to planes. Medium and heavy freight trucks are the most carbon-intensive ways to move cargo, many more times wasteful than either rail or shipping.[18]

Road vehicles have different energy efficiencies across regions, and vehicle makers may be subject to different levels of regulatory and consumer pressure to reduce overall energy waste. The overall expectation is that vehicle energy intensity will fall universally by 2030 (Fig. 18).[19]

But will this be enough to reduce transport energy emissions? European Union data shows that between 2000 and 2017, the reduction in CO_2 emissions from newer vehicles was offset by transport demand growth (Fig. 19). And the promise of zero- or low-emission cars and trucks has yet to translate into demand—despite the EU's global leadership on the topic, around 96% of cars and 99% of trucks still run on petrol or diesel (Fig. 20)[20]

Other forms of transport have made progress in reducing waste. According to a study by the International Council of Clean Transportation (icct), the compound annual reduction in fuel burn of new aircrafts was 1.3% between 1968 and 2014, or a total reduction of about 45%.[21] In the marine industry, rising focus on reducing waste through stricter regulation (such as the International Maritime Organization's 2020 rules on adopting compliant lower-sulfur fuels with a cap on sulfur oxide pollutants) can help to reduce emissions and pollutants alike.[22]

Aside from energy efficiency, there are also opportunities to reduce waste by using products more intensely. For example, the average European car is parked 92% of the time and when the car is used, only 1.5 of its 5 seats are occupied. To improve utilization, business models and assets should be designed to be fit for purpose. For example, many of the cars in shared car fleets may not need to hold four passengers. Smaller cars, for one- to two-passenger trips in the city, may be sufficient to deliver their service.[23]

[16] UBS Longer Term Investments—Clean Air and Carbon Reduction

[17] NIBS, National Institute of Building Sciences (December 2010): Federal Green Construction Guide for Specifiers, Section 01 81 10 (01120)—Facility Service Life Requirements

[18] UBS Longer Term Investments—Energy Efficiency

[19] UBS Longer Term Investments—Clean Air and Carbon Reduction

[20] European Environment Agency (EEA), January 2020, *National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism* (URL: https://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-15); European Environment Agency (EEA), December 2019, *Monitoring of CO_2 emissions from passenger cars – Regulation (EC) No 443/2009* (URL: https://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-16), both accessed 13 February 2020.

[21] icct (Anastasia Kharina, Daniel Rutherford, August 2015): Fuel efficiency trends for new commercial jet aircraft: 1960 to 2014

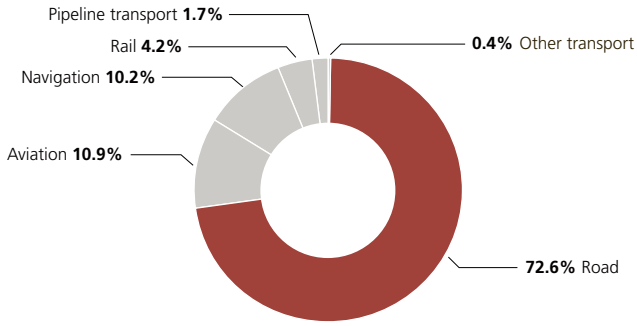
[22] For more details please see UBS Global Research (October 2019) *Global Marine Sector—UBS Evidence Lab inside: counting down to IMO 2020—will it really have an impact?*

[23] Ellen MacArthur Foundation, *Completing the Picture: How the Circular Economy Tackles Climate Change* (2019) www.ellenmacarthurfoundation.org/publications

Fig. 16

Road transportation dominates total transport fuel use

Transportation fuel by end market 2015

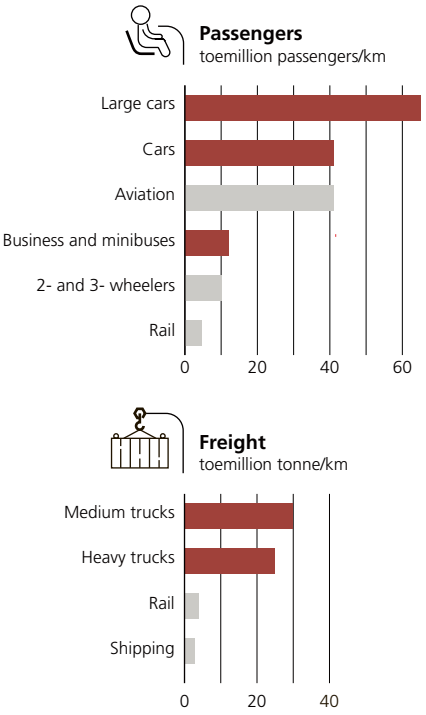


Source: OECD/IEA 2017, (Railway Handbook 2017, elaborating by Susdef based on IEA 2017)

Fig. 17

Cars and trucks are some of the least energy efficient modes of transport

Average energy intensity of different transport modes worldwide



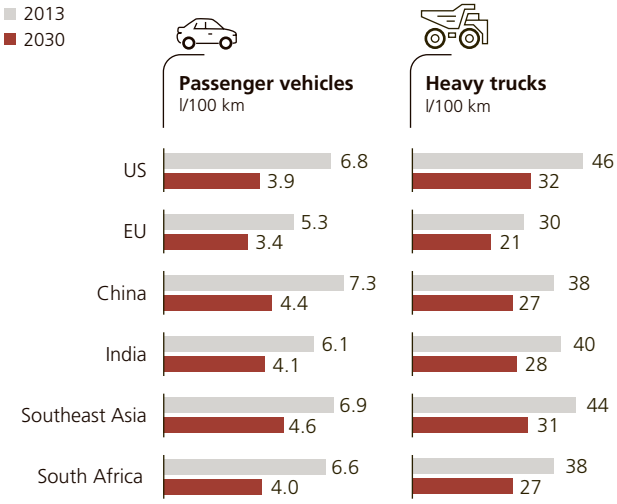
Note: toe = tonne of oil equivalent

Source: IEA (The Future of Rail Opportunities for energy and the environment, 2019). All rights reserved.

Fig. 18

Stricter regulation will drive cleaner cars and trucks

Energy efficiency in transport by 2030



Source: OECD / IEA*, UBS
* Based on Energy and Climate Change—WEO Special Report ©OECD/IEA 2015, IEA Publishing; modified by UBS AG. License: iea.org/t&c

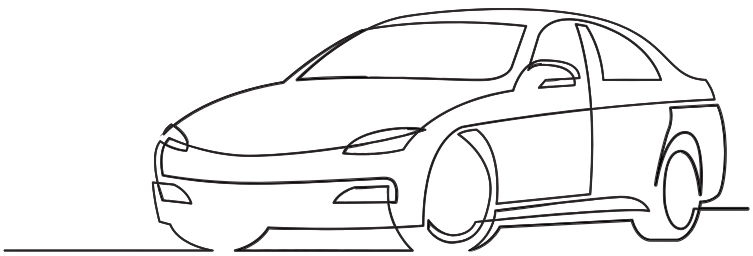
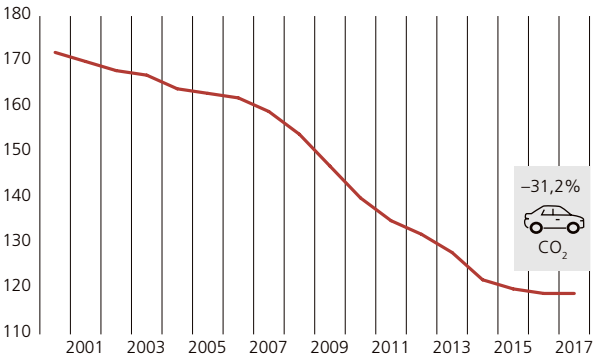


Fig. 19

While new EU cars are cleaner, demand growth is offsetting emission improvements

Average CO_2 emissions of new cars in G CO_2/km, 2000–2017



Source: European Environment Agency (EEA), January 2020, National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism (URL: https://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-15), accessed 13 February 2020.

CO_2 from road transport EU and GDP growth, 2000–2017

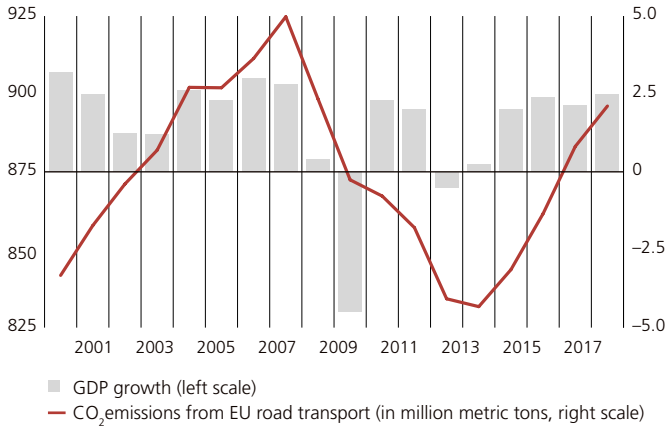
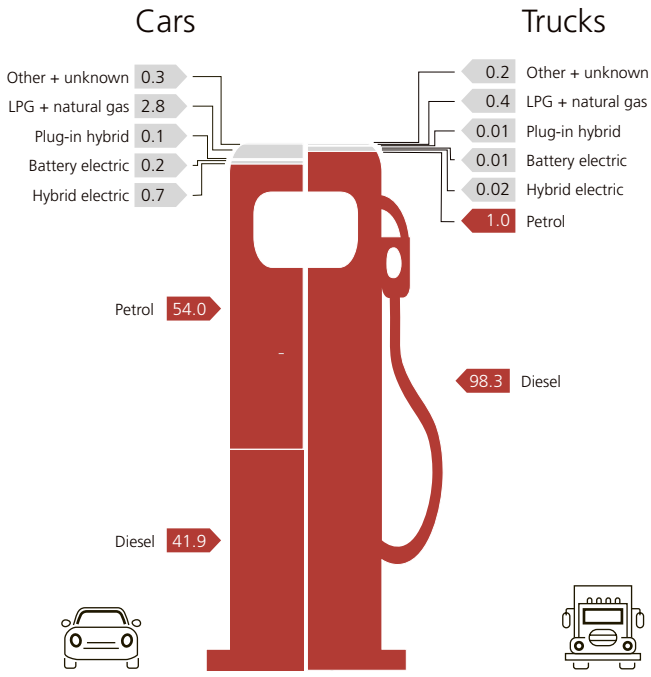


Fig. 20

Zero- and low-emission cars have yet to become mainstream in the EU



Source: European Environment Agency (EEA), December 2019, *Monitoring of CO_2 emissions from passenger cars—Regulation (EC) No 443/2009* (URL: https://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-16), accessed 13 February 2020.

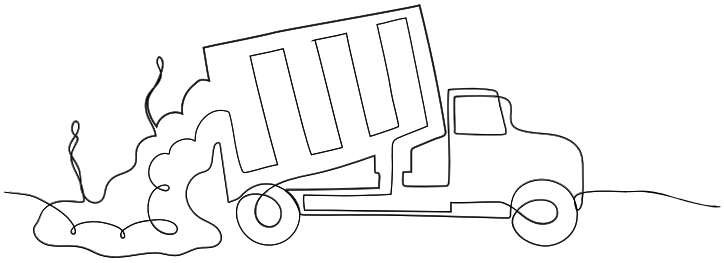
Chapter 2

What are the impacts of waste?

Source: Gettyimages

Impacts of overall waste

Solid and energy waste both have direct and indirect impacts on a number of the UN Sustainable Development Goals (Fig. 21). These impacts are typically environmental (through emissions or pollution) or social (such as health effects) in nature. This report explores the diverse impacts of waste across regions and sectors.



Impacts of solid waste

Solid waste has a number of direct and indirect impacts both on the environment (through emissions or pollution) and on society at large (such as health effects).

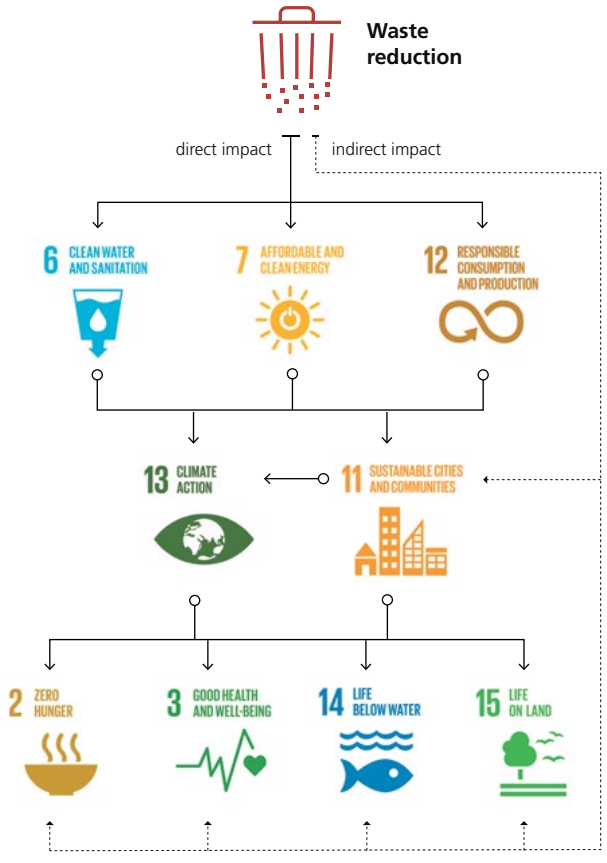
In 2016 solid waste management generated around 1.6 billion metric tons of carbon dioxide-equivalent (CO_2-equivalent) greenhouse gas emissions, roughly 5% of global emissions. Without improvements in the sector, solid waste-related emissions are anticipated to increase to 2.6 billion metric tons of CO_2 equivalent by 2050.[24]

Waste management, especially in urban areas, has an economic cost. It can be the single highest budget item for many local administrations in low-income countries, where it comprises nearly 20% of municipal budgets, on average. Solid waste management typically accounts for more than 10% of municipal budgets in middle-income countries, and about 4% in high-income ones.[25]

The costs of collection are, however, far lower than the costs of not tackling solid waste. A study focused on Southeast Asia estimated the economic cost of uncollected household waste that is burned, dumped, or discharged to waterways to be USD 375 per metric tonne (McKinsey 2016). For the same region, the World Bank estimated the integrated waste management costs for basic systems meeting good international

Fig. 21

Waste reduction and its link to the UN's Sustainable Development Goals



Source: UBS

[24] World Bank: Wh Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[25] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. *2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

hygienic standards to be USD 50–100 per metric tonne.[26] Inadequate waste collection can also have negative health consequences. In urban low-income neighborhoods, up to two-thirds of solid waste is not collected (Baker 2012). In areas with poor service coverage, the incidence of diarrhea is twice as high and acute respiratory infections are six times higher than in areas with frequent waste collection (UN-Habitat 2010).[27]

Solid waste in each of the three largest contributing sectors—food, paper and cardboard, and plastics—results in varying impacts.

Impacts of food waste

Food waste has an obvious environmental impact, contributing up to 8% of global greenhouse emissions.[28] But food production and waste also costs society as much as USD 5.7tr each year. By contrast, minimizing food waste can lead to substantial food security and environmental gains.[29]

Food loss and waste (FLW) affects food supply chains by lowering producer incomes, raising costs for consumers, and reducing food access.[30] Current food systems rely heavily on natural resources along the supply chain. For every calorie consumed in the US, the equivalent energy of 13 calories of oil is burned to produce it.[31] According to one estimate, the resource impact of food wastage in the US accounts for a quarter of all freshwater usage and 4% of total US oil consumption. The same food waste leads to 33 million tons of landfill waste and USD 750mn in waste disposal fees every year.[32]

Current farming methods also contribute to pollution. The agrifood industry is estimated to account for a quarter of all human-produced emissions, making it the world's second largest emitter of greenhouse gases.[33] Pesticides and artificial fertilizers used in traditional farming can worsen air pollution, contaminate soils, and leach chemicals into water supplies. Poor management of animal fertilizers, food waste, and the byproducts of the food supply chain also contribute to water pollution, especially in less economically developed countries.[34]

As for ecological damage or wasted natural resources, 39 million hectares of soil are degraded each year globally, 70% of global freshwater demand is used for agriculture, and 73% of deforestation between 2000 and 2010 is attributable to unsustainable agricultural use. Modern agrifood systems have driven a greater than 60% decline in biodiversity over the last four decades, as the world relies on just three crops for more than 50% of its plant-derived protein. Today's food systems are also more dependent on chemical inputs, while more at risk from diseases and agricultural pests.[35]

Food production and managing its byproducts also have negative health consequences, estimated at USD 1.6tr each year. By 2050, around five million people a year—double the number of the world's obese population today—could die due to unsustainable food production.[36]

These health costs include:

- Farm worker exposure to pesticides (USD 900bn—chronic exposure to low levels of pesticides has been linked to numerous health problems, two of which (reduced IQ and higher rates of attention deficit hyperactivity disorder) cost the EU an estimated USD 150bn annually.[37]
- Antimicrobial resistance (USD 300bn).[38]
- Air pollution from agriculture (USD 200bn and accountable for 20% of particulate air pollution)[39]
- Water contamination and foodborne diseases (USD 200bn)[40]

[26] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. *2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[27] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. *2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[28] Barclays Equity Research—Sustainable & Thematic Investing – *Food Waste: Ripe for Change* (4 March 2019)

[29] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[30] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. *2018. What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[31] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[32] Food Waste Reduction Alliance (Spring 2014: Volume 1) *Best Practices & Emerging Solutions Toolkit.*

[33] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[34] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[35] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[36] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[37] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[38] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[39] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[40] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

Impacts of paper and cardboard waste

Paper and cardboard waste leads to increasing consumption and production of pulp, a commodity that in many parts of the world is linked to negative environmental impacts including water consumption (as deforestation can both affect water courses and contaminate water supplies), pesticide contamination, loss of biodiversity, genetic engineering, peat degradation, and related greenhouse gas emissions. Logging and pulpwood plantations may have negative social consequences (such as land-grabbing and displacement of indigenous communities).[41] And replacing old trees with younger ones can lead to lower carbon capture and negative climate effects, given the delays between harvesting old forests and planting new ones and the fact that older trees typically absorb far more carbon than younger ones.[42]

By contrast, using recycled materials to make cardboard consumes less energy and produces fewer emissions. In the US in 2014, 89 million tons (80.7 million metric tons) of materials including cardboard and plastics were recycled or composted, with a reduction in emissions equivalent to that of 38 million passenger cars according to the EPA.[43]

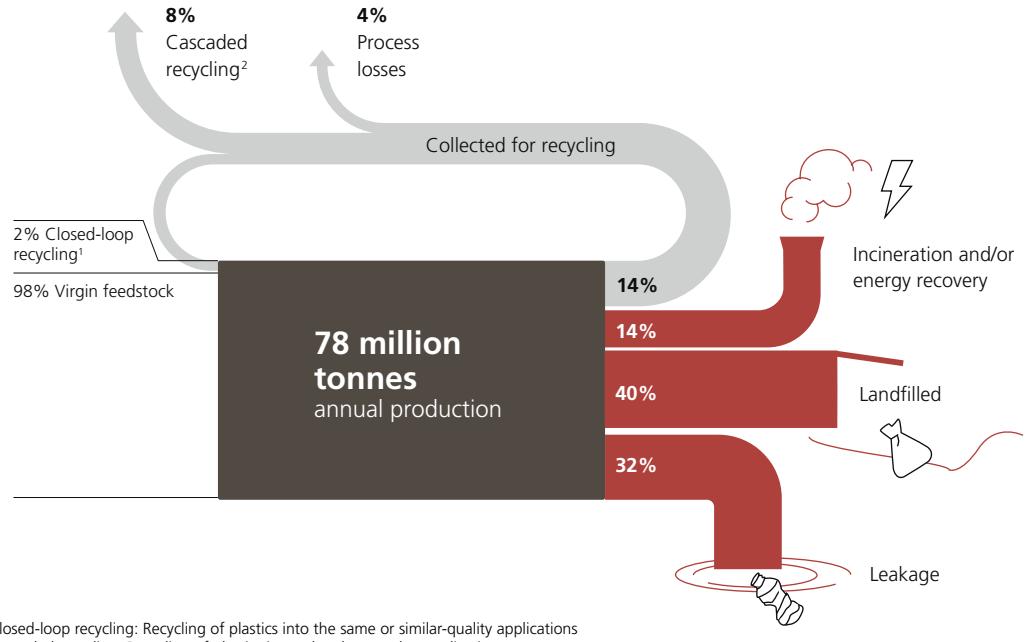
Impacts of plastic waste

Plastic packaging generates large social costs, with the United Nations Environment Programme estimating them at USD 40bn, more than the industry's total profits. These figures are set to rise if volumes continue to grow. At least eight million metric tons of plastic leak into the ocean each year – the equivalent of dumping a refuse truck's worth of plastic into

Fig. 22

32% of plastic packaging leaked into oceans in 2013, damaging the environment

Global flows of plastic packaging materials in 2013



[1] Closed-loop recycling: Recycling of plastics into the same or similar-quality applications
[2] Cascaded recycling: Recycling of plastics into other, lower value applications

Source: Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action*, (2017), http://www.ellenmacarthurfoundation.org/publications

[41] Environmental Paper Network (April 16 2019) *Event Highlights: Paper Saving—Packaging in Focus*. URL: https://environmentalpaper.org/2019/04/event-highlights-paper-saving-packaging-in-focus/, accessed 3 February 2020.
[42] The Telegraph (23 January 2020) *Planting tress cannot offset burning wood, warn experts after government advisers recommend it as renewable fuel*. URL: https://www.telegraph.co.uk/news/2020/01/23/planting-trees-cannot-offset-burning-wood-warn-experts-government/, accessed 3 February 2020.
[43] US Environmental Protection Agency, 2014: *Advancing Sustainable Materials Management*. URL: http://www.epa.gov/sites/production/files/2016-11/documents/2014_smmfactsheet_508.pdf

the ocean every minute. Without action, this leakage is set to double by 2030 and quadruple by 2050.[44]

Estimates suggest that 32% of plastic packaging leaks into the natural environment, generating economic costs by contaminating oceans (Fig. 22). Best estimates conclude that there are over 150 million metric tons of plastics in the ocean today.[45] Without change, the ocean is expected to contain a metric tonne of plastic for every three metric tons of fish by 2025. And by 2050, plastics could outweigh fish in the seas (Fig. 23).

Not only is packaging the largest application of plastic, making up 26% of volumes, its small size and low residual value also makes it especially prone to leakage. One indicative data point is that plastic packaging comprises more than 62% of all items collected in international coastal cleanup operations.[46]

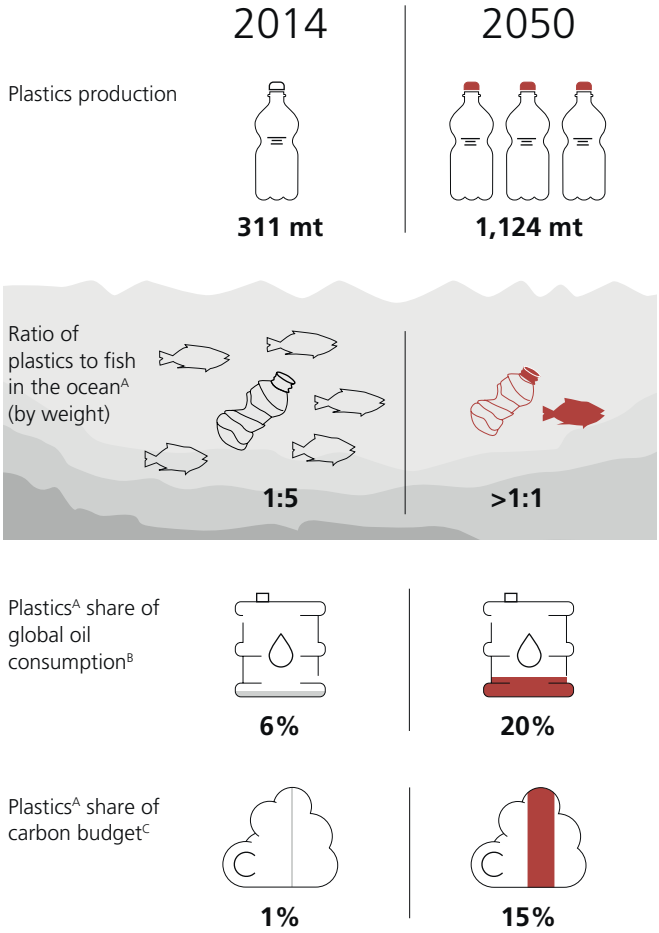
Making plastic also has a material carbon footprint given the use of fossil fuels in production. Over 90% of plastics produced come from virgin fossil feedstocks, while the figure is even higher for plastic packaging. This represents about 6% of global oil consumption (with use split equally between material feedstock and fuel for production), the same as the global aviation sector. If present plastic production growth of 3.5%–3.8% per year continues (compared to expected oil demand growth of 0.5% annually), the plastics industry will account for 20% of total oil consumption and 15% of the global annual carbon budget (if the planet is to remain below a 2°C increase in global warming) by 2050, underscoring the importance of tackling plastic production's greenhouse gas impact and treatment after use.

Plastics can also generate negative social costs. They often contain a complex mix of chemicals, some of which can have negative effects on human health and the environment. Although the scientific community has not reached a consensus on the drivers and links between plastics and health, more research and industry change look likely.[47]

Fig. 23

Plastics could outweigh fish in the ocean by 2050

Forecast of plastics volume growth, externalities and oil consumption in a business-as-usual scenario



[A] Fish stocks are assumed to be constant (conservative assumption)

[B] Total oil consumption expected to grow slower (0.5% a year) than plastic production (3.8% until 2030, then 3.5% until 2050)

[C] Carbon from plastics includes energy used in production and carbon released through incineration or energy recovery after use. The latter is based on 14% incinerated or energy recovery in 2014 and 20% in 2050. Carbo budget based on 2 degrees scenario.

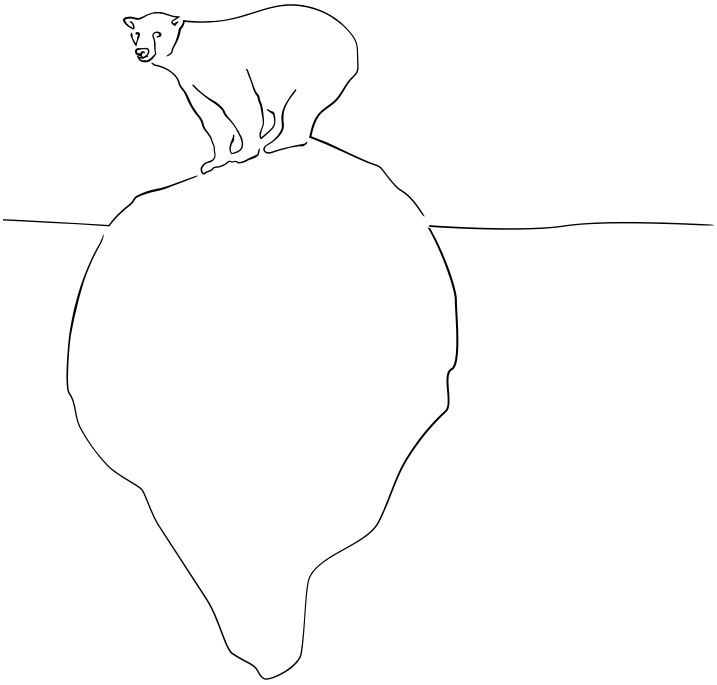
Source: Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action*, (2017), http://www.ellenmacarthurfoundation.org/publications

[44] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action,* (2017), http://www.ellenmacarthurfoundation.org/publications.

[45] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action,* (2017), http://www.ellenmacarthurfoundation.org/publications.

[46] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action,* (2017), http://www.ellenmacarthurfoundation.org/publications.

[47] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action,* (2017), http://www.ellenmacarthurfoundation.org/publications.



Impacts of energy waste

As previously highlighted in chapter 1, the primary impacts of energy waste are environmental, in the form of carbon emissions and pollution (such as particulates from burning heavy fossil fuels). Again, energy waste has a number of direct and indirect impacts on a number of the UN Sustainable Development Goals (SDGs), the majority of which are environmental.

There are more specific impacts of energy waste in the three sectors that most contribute to it: industry, buildings and construction, and transport.

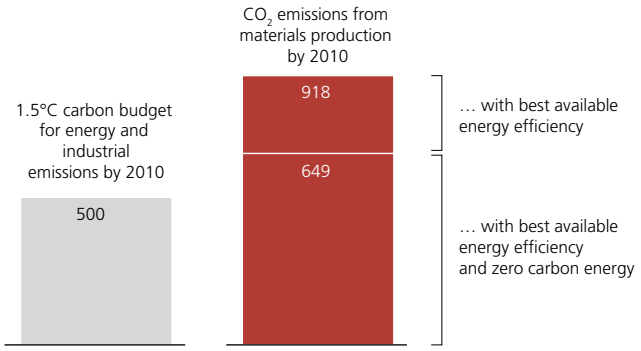
Major trends such as increased urbanization and rising incomes in developing countries are expected to increase the greenhouse gas emissions generated by construction and its attendant waste. Demand for industrial materials such as steel, cement, aluminum, and plastic is projected to increase by a factor of two to four, according to the Ellen MacArthur Foundation. Emissions from the production of steel, cement, aluminum, and plastics could reach 649 billion metric tons CO_2 by 2100—even if energy comes from zero-carbon sources and its efficiency significantly increases (Fig. 24).[48]

By contrast, improving on construction and demolition waste recycling for reuse in buildings could have cost and environmental benefits. Recycled materials (especially cement) could save up to 0.3bn metric tons of CO_2 emissions each year by 2050. And the processing of recycled aggregates produces up to 70% fewer CO_2 emissions than producing them from scratch.[49]

With respect to transport, overall road travel dominates in terms of emissions and pollution significance. It accounts for 75% of all transport sector emissions. Without changes in the sources of vehicle fuel, emissions are set to rise by 2050, given one estimate that the global number of cars will more than double by then.[50]

Fig. 24

Steel, cement, aluminum, and plastic production greatly contribute to CO_2 emissions



Source: Tong D. et al. Committed emissions from existing energy infrastructure jeopardize 1.5°C climate target, Nature 572, 373–377 (2019).
Material Economics, *The Circular Economy—A Powerful Force for Climate Mitigation* (2019)

[48] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action,* (2017), http://www.ellenmacarthurfoundation.org/publications.

[49] Ellen MacArthur Foundation, *The new plastics economy: Rethinking the future of plastics & Catalysing action,* (2017), http://www.ellenmacarthurfoundation.org/publications.

[50] Ellen MacArthur Foundation, *Completing the Picture: How the Circular Economy Tackles Climate Change* (2019) www.ellenmacarthurfoundation.org/publications

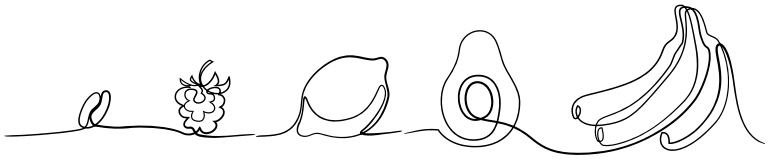
Chapter 3

What are the best ways to reduce waste?

This report has identified the major sources of solid and energy waste and their social and environmental impacts.

Source: Gettyimages

This section explores some of the ways that mainstream and innovator companies are tackling solid and energy waste, with a look at the top three waste contributing sectors for each category. It also examines how dedicated waste management companies are dealing with waste, as they can provide potential examples for others.



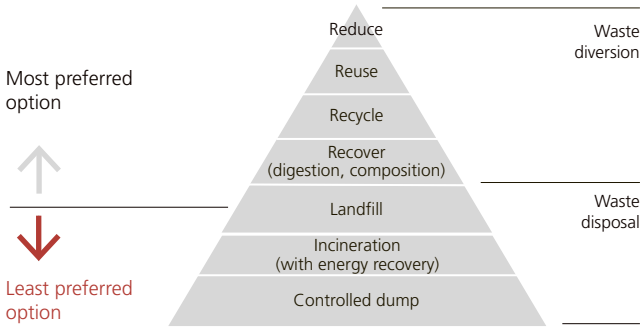
Reducing solid waste

Waste management companies

Waste management companies operate across a three-part value chain: upstream, midstream, and downstream. The upstream business involves transport and collection—competition is fiercest and margins lowest. The midstream part includes waste treatment, sorting, and recycling, with potentially attractive margins depending on the region. However, certain parts (such as industrial waste) can be volatile given high gearing to the economic cycle. Last, downstream businesses include landfills and incineration facilities.[51]

Fig. 25

The waste hierarchy offers pointers on how to reduce it



Source: Bhada-Tata, Perinaz; Hoornweg, Daniel A.. 2012. What a waste? : a global review of solid waste management (English). Urban development series knowledge papers; no. 15. Washington, DC : World Bank Group. http://documents.worldbank.org/curated/en/302341468126264791/What-a-waste-a-global-review-of-solid-waste-management

Waste treatment has historically followed a waste hierarchy first mentioned in the 1970s, the so-called four R's: recover, recycle, reuse, and reduce (Fig. 25). The hierarchy encourages minimizing greenhouse gas (GHG) emissions. The most sustainable form of "treatment" is outright waste reduction, though other methods, including recycling, also mitigate environmental damage.[52]

Innovators

Architects in less developed economies are increasingly using waste to build. In South Africa (where 41% of households lack basic waste collection and only 10% of waste is recycled), architect Kevin Kimwelle has built recycling depots, rainwater tanks, solar panels, and a school using recycled materials and waste. Materials are collected from local businesses by people working in the informal recycling sector, providing a source of employment. A local childcare center he built was made entirely from recycled materials—including a glass wall made from 2,500 wine bottles sourced from local restaurants. One future project intends to use two-liter bottles filled with plastic waste as building blocks for a children's play and learning center.[53]

[51] UBS Longer Term Investments—Waste Management and Recycling

[52] UBS Longer Term Investments—Waste Management and Recycling

[53] The Guardian (22 October 2019) *'There is ingenuity in Africa': the architect who builds with trash.* URL: https://www.theguardian.com/cities/2019/oct/22/ingenuity-south-africa-architect-kevin-kimwelle-builds-with-trash, accessed 23 January 2020.

Food waste reduction examples

Food and green waste account for 44% of the world's solid waste. While food waste and its impacts present major environmental, economic, and social challenges, reducing food waste also offers numerous potential opportunities for mainstream and innovator companies.

Mainstream companies
Conventional companies are increasingly exploring innovative ways to help reduce waste, often by harnessing the power of new technologies. For example, 900 Finnish supermarkets within the S-market chain hold a daily "happy hour" to reduce food waste by selling close-to-sell-by-date items at steep discounts. The group is aiming to reduce its overall food waste by 15% by 2020.

Governments can also play a role in reducing food waste. San Francisco introduced legislation in 2009 mandating that food waste be composted. France has led the world in using regulation to curb food waste, introducing a 2016 law that forbids supermarkets from wasting unsold food and requires them to donate it to charities or food banks. And a number of Swedish cities turn food waste into biogas used to propel vehicles and heat homes or businesses.[54]

Innovators
Farmers are increasingly experimenting with holistic managed grazing techniques that improve soil health without using artificial fertilizers, while also providing farmers with a greater number of income streams. One farm in North Dakota, for example, mixes grazing and no-tilling crops to raise immediate revenues and to act as cover crops. The ranch also raises pigs, hens, and broilers, whose waste provides several types of natural nutrient-cyclers. Despite being environmentally degraded, the farm's organic soil content (a store of carbon and beneficial bacteria) has risen to 14% (from 1% before). The soil's capacity to store water (and therefore reduce water waste) is more than three times bigger than it was in the degradation phase.[55]

External example from the UBS Industry Leader Network*

One entrepreneur who runs hospitality businesses in Egypt (and who is a member of the UBS Industry Leader Network of private business-owning clients) is tackling food waste by shifting the costs of it from kitchens to consumers. Guests at hotels are now encouraged not to waste food through their pockets, as they are charged a penalty for collecting food from the buffet and leaving it on their plates.

*The UBS Industry Leader Network is a global group of UBS clients and prospects who are private business owners and executives. Their views may differ from those of UBS.

Turning to specific company examples, China Everbright International offers one example of how food waste can be turned into other commercial uses. Using steam generated from a waste-to-energy facility, the company's plant in Sanya runs a food waste treatment project which is currently processing double its daily target of 100 tons of food waste. Food waste residue is processed and incinerated in the waste-to-energy operation, while methane gathered from the food waste facility powers combustion at the waste-to-energy site. The gross margin for the food waste business is estimated at 30%–40%.[56]

A second example is the Danish company Too Good To Go. Run by Mette Lykke, it has created the world's largest food waste app with 18 million users and covering more than 37,000 restaurants, bakeries, hotels, and supermarkets. The company uses technology to connect users across 2,000 cities

[54] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.* Urban Development Series. Washington, DC: World Bank. doi: 10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO.

[55] Ellen MacArthur Foundation, *Cities and Circular Economy for Food* (2019).

[56] Citi (17 December 2019) *China Everbright International—High Level Operation in Waste-to-Energy & Food Waste Treatment*

Interview

Marc Zornes

This interview contains views which originate from outside Chief Investment Office Global Wealth Management (CIO GWM). It is therefore possible that the interview does not fully reflect the views of CIO GWM.

Marc Zornes
Founder of Winnow
and UBS Global Visionary

Marc, how can businesses and households most effectively reduce food waste in a commercial and environmentally friendly way?

First, we need to use technology and data to identify food waste, uncover inefficiencies, and monetize waste reduction. Here at Winnow we use our proprietary technology, Winnow Vision, to take photos of the food that's thrown away in commercial kitchens, capture that data, and use computers trained via artificial intelligence techniques to analyze food waste data.

We then propose ways that kitchens can change their processes to minimize waste, maximize profits, and reduce negative environmental impact. We estimate reducing food waste by half can typically save between 3% and 8% of food costs. Today we're working in 1,300 kitchens across 40 different countries, saving our clients around USD 33mn in food costs and saving the planet from 42,000 tons of CO_2 emissions according to our data. And our ambition is to help our clients save USD 1bn by 2025.

Second, I think we need to help consumers better understand how to manage food freshness without wasting produce. We can start by removing the confusion around sell-by dates, best-before dates, and use-by dates. Very few date codes relate to consumer health considerations, but rather quality control. Standardization of date codes would help reduce unnecessary food waste, and smart labeling would be even better. This is an exciting growth area—one company recently raised USD 110mn of funding for its product, date coding using a tasteless, edible material for food labels that has doubled product shelf life.

And third, we need continued innovation. It can range from more progressive regulation to applying circular economy techniques that turn food waste into other uses. Just one example is using black soldier flies to consume leftover food and for the fly larvae to become sustainable feedstock replacements for small fish for the growing aquaculture industry.

Minimizing food waste and ecological damage will help us feed the world's population more sustainably. Making targeted payments that help the poorest buy high-quality food could be a better and more sustainable option than today's widespread food production subsidies.

And focusing just on producing cheap food isn't the answer—it's about making healthy food affordable and reducing waste, while pricing food properly to reflect its societal costs.

and 12 countries with a bag of surplus food that would otherwise have been wasted. Users pay a small fee but are guaranteed produce worth three times the amount they pay for it. Since inception in 2016, the app is estimated to have saved more than 29 million meals each year, and avoided the equivalent of 73 million kilograms of CO_2 emissions.[57, 58]

A third example is Winnow. The company works by measuring food waste data from commercial kitchens and using analytics to understand how food is planned, prepared, and served. It captures data from cameras pointed at the bin in a commercial kitchen, then uses artificial intelligence technologies and algorithms to identify what's being thrown away, put a value on that waste, calculate why it was wasted, and suggest how to optimize production practices such that less food is leftover at the end of service (for more details please see the interview on the previous page).

Crop One Holdings, the world's largest vertical farming operation, is yet another example of an innovator company. Vertical farming redistributes agricultural infrastructure so that it sits closer to the consumer, cutting waste along several parts of the food value chain. Due to production techniques that minimize exposure to bacteria, the company's salad product lasts 60 days in the fridge according to the company's CEO Sonia Lo, as opposed to others with far shorter shelf lives (and a greater likelihood of wastage).[59] Ms. Lo also noted that their salads typically have 1/600th of the bacteria of field-grown washed product, thanks to no contact with human hands and a delivery time from "field" to consumer of 24 hours.[60] Compared to general food waste figures globally of 30%[61]—and 37% for the US based on USDA data—Crop One Holdings's techniques have reduced spoilage rates on their products to less than 1%.[62] Post-consumer food waste in developed countries accounts for approximately 25% of the carbon emissions of those countries, based on USDA data.[63]

Paper waste reduction examples

Paper and cardboard account for 17% of the world's solid waste. We noted in Chapter 1 that there remained considerable scope to reduce wastage, especially in the fine paper segment. A number of companies are embracing new technologies (such as a shift to e-documents) to limit paper and cardboard waste. At the same time, newer more cardboard-intensive industries (such as e-commerce) are finding innovative ways to design less wasteful products, delivering measurable commercial and environmental benefits.

Mainstream companies

In an example that hits close to home, UBS has made significant strides in reducing paper waste. We have reduced paper consumption by more than 60% over the last ten years. This effort is thanks to a combination of shifting to e-documents instead of printed ones for clients, and using a secure printing system (whereby employees can only collect printouts by swiping their security card on a device). This second initiative has not only meaningfully reduced paper waste, but also enhanced security and confidentiality.

A second mainstream example comes from Amazon, whose position in the e-commerce market means it's a big consumer of paper and especially cardboard. The company uses a number of strategies to optimize its paper and cardboard production and to reduce waste and costs. It also applies machine learning to monitor feedback that comes in from customers via call centers and social media on damage during transit, balancing customer satisfaction against design specification and material reduction priorities.

Amazon has also collaborated with companies in the glue and tape industries to create new designs that can be scaled up. These include fully recyclable plastic-free padded envelopes to replace ones made from bubble wrap and paper. Amazon claims that, combined, these methods have reduced packaging material by 19% in volume versus a 2016 baseline.[64]

[57] Data sourced from Mette Lykke, CEO of Too Good to Go,as of February 2020.
[58] Data sourced from Too Good to Go website. URL: https://toogoodtogo.org/en, accessed 6 February 2020.
[59] Source: Crop One Holdings, as of January 2020. This is based on side-by-side tests conducted at Crop One Holding's farm in Boston, where their product was bought alongside another salad at the same store, same shelf, and same date, and then kept in the same condition for 60 days.
[60] Source: Crop One Holdings. Based on independent test lab verification by the company
[61] Source: Crop One Holdings, UN FAO 2015.
[62] Source: Crop One Holdings, based on feedback from its customers.
[63] Source: Crop One Holdings, USDA.

[64] CNN Business (July 16 2019) *Amazon's incredible, vanishing cardboard box.* URL: https://edition.cnn.com/2019/07/16/business/amazon-cardboard-box-prime-day/index.html, accessed 24 January 2020.

Plastic waste reduction

In Chapter 1 we noted that plastic (and plastic packaging) account for 12% of the world's solid waste. In Chapter 2 we highlighted that the societal costs of plastic may exceed the industry's total profit pool. So corporate examples of how to reduce plastic waste or or how to find new circular-economy uses for it could generate commercial and positive societal returns alike.

Mainstream companies

One example of reducing plastic waste comes from Pennon Group Limited's Viridor arm. In response to rising restrictions on exporting plastic waste to Asia (where historically it was incinerated or dumped), it is building a new dedicated plastic recycling facility in Avonmouth, UK.

The facility aims to process around 80,000 metric tons of input plastic and generates around 60,000 metric tons of plastic output to be reused in other applications. The facility will save around 12,000 metric tons of CO_2 through co-location with an energy recycling facility and around 1 metric tonne of CO_2 compared to "virgin" polymer production. The project has an estimated internal rate of return of 15% and a four-year payback period, while supporting the UK government's targets for 30% recycled plastic content by 2030 and for 70% of all plastic packaging to be recycled by 2025.[65]

Innovators

One innovative example of how to reduce plastic waste comes from Mondi. The company specializes in craft paper and paper bags but is exploring new solutions to reduce both paper and plastic waste. Several of their new flexible plastic solutions reduce the amount of plastic required by 70%.

The company is also looking to produce two new flexible plastic packaging products: a recyclable plastic for flexible packaging made using a proportion of post-consumer waste, and a form fill and seal (FFS) pouch for food applications. By reducing the use of multilayer laminates in food packaging, it hopes to increase recyclability rates and bring circular economy principles such as reusing waste into the mainstream. The group's EcoSolutions division also advises customers on how to design and produce more sustainable packaging, using paper in place of plastic where possible.[66]

[65] Pennon Group Ltd (2019) *Viridor Plastics Reprocessing Developments.* URL: https://www.pennon-group.co.uk/system/files/uploads/financialdocs/viridor-plastics-reprocessing-developments-12-september-2019_0.pdf, accessed 15 January 2020.

[66] Mondi, 2017.URL: https://www.mondigroup.com/en/newsroom/eco-packaging-breakthrough-biodegradable-paper-liner-for-ffs-machines-reduces-plastic-by-70-percent/, accessed 7 Feb 2020.

Reducing energy waste

In Chapter 1 we highlighted the data limitations to comprehensive measurement of energy waste. Instead, we've looked at energy waste's negative impacts through emissions and pollutions. In Chapters 1 and 2 we focused on the three largest contributors to energy eemissions—industry, building and construction, and transport. Below we offer examples of how mainstream companies and innovators are trying to reduce waste across each of these three areas.

Industrial energy waste reduction

Mainstream companies

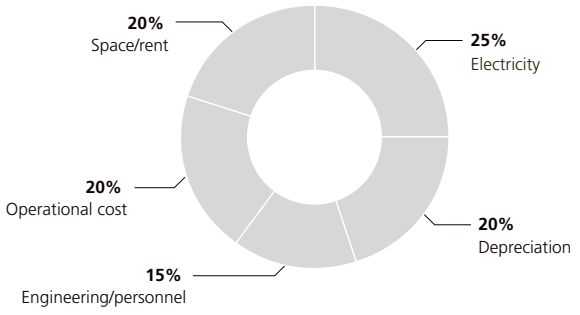
One way mainstream companies can reduce energy waste is by increasing their adoption of cloud computing. IT infrastructure-related investments are typically about 20% of total business capital expenditure. Studies by companies such as Amazon and IBM highlight that enterprises can reduce their carbon emissions by more than 50% if they migrate their data storage operations to the cloud from in-house data centers—25% of whose costs typically come from electricity and 20% from renting physical premises which may waste heat and lighting energy (Fig. 26).

One concrete example of industrial energy waste reduction comes from DuPont. The company was able to reduce its overall energy usage by 18% and save USD 6bn in costs between 1990 and 2010, while growing production by 40%. Its specific actions were either in the line of ordinary business or required little spending, and the return on its energy-saving investments is estimated at 65%. Examples of measures it took include repairing and improving steam traps to reduce leakage; rectifying metering problems around its purchased energy; upgrading boilers and equipment design to raise efficiency; building efficient heat and power cogeneration plants; and fostering a waste-focused culture across the company.

Fig. 26

A quarter of an in-house data center's costs come from electricity—moving to the cloud could cut this

Cost breakdown of a traditional/internal data center



Source: Company reports, UBS

In 2008 DuPont launched its "Bold Energy Plan" whose aim was to drive all its plant to accelerate energy efficiency improvements with a view to reducing energy use by 5% each year, while targeting 65% lower greenhouse gas emissions in 2020 (compared to 1990 base levels).[67] Since inception, the initiative has led to the completion of more than 2,200 projects, savings of more than USD 350mn year-over-year, and reduced CO_2 emissions equivalent to taking 300,000 cars off the road for a year. In one energy-from-waste example, DuPont switched its Grindsted site in Denmark from coal-fired fuel sources to wood chip, reducing its CO_2 emissions by 45,000 tons directly and by 64,000 tons of CO_2 equivalent per year overall (thanks to delivering surplus heat production back into the local community).[68]

Innovators

Another example of innovation comes from Mironivsky Hliboproduct (MHP), the largest chicken meat producer in Ukraine. The company has had a long-standing engagement with environmental, social, and governance issues, most notably setting a goal to achieve energy independence by using environmentally sustainable energy. MHP built its first biogas plant in 2014, using fermentation technologies to convert organic chicken waste into bio gas. With an initial capacity of 5MW/h (the equivalent to what's needed to supply power to 15,000 apartments and thermal heating to 1,500 apartments), MHP's plant had produced 19 million m^3 of biogas generating 38.4 million KW / year by 2017. In total 38% of the company's energy consumption was self-generated, reducing costs and increasing energy independence.

Today the company produces more than 70% of the total biogas in the Ukraine and controls 45% of the Ukrainian market in electricity generated from biogas. Building on its biogas capabilities, MHP has announced a USD 27mn project to build

[67] Goldman Sachs Global Investment Research (GIR), as of February 2019.

[68] Sustainability Roadmap—DuPont (July 2019). URL: https://www.dupont.com/content/dam/dupont/amer/us/en/corporate/about-us/Sustainability/DuPont%20Sustainability%20Roadmap_final.pdf, accessed 8 January 2020.

a second plant with total capacity of 20 MW, with production scheduled to start in 2020.[69] Overall renewable energy is expected to make up 8% of Ukraine's energy mix by 2020, with 5% from biofuels and waste.[70] However, MHP's example may help to accelerate renewable energy generation in a country still heavily reliant on more polluting coal (and nuclear) power.

A third example is CLEAResult,[71] a third-party energy efficiency program administrator and solution provider for the utilities sector in North America. The company works with a variety of utility firms to optimize their energy generation programs. Working with one of the world's largest private impact funds, the company aims to reduce carbon emissions from electricity and heating while also advocating for energy-saving measures with businesses, utilities, and their residential consumers. The impact fund that has invested in CLEAResult has underwritten it to reduce CO_2 emissions by 22 million metric tons.

Green filter solutions from CNH Industrial serves as our fourth example. The company started using metal-free oil filters ten years ago, developing plastic and fully recyclable solutions. An oil filter's metal casing is typically 80% of the part's total weight, whereas metal-free filters consist of filter paper and plastic components that are up to 70% recyclable. To date the company has made 30% of vehicle and engine filters spare parts metal-free; other applications include pollen filters, blow-by filters, oil filters, diesel fuel filters, and engine air filters. The company aims to extend metal-free material use right from the design phase through to suppliers to reduce materials waste and extend sustainability throughout the value chain.[72]

Construction and buildings energy waste

There are general opportunities to reduce waste and emissions from the steel, plastic, aluminum, and cement used in buildings at the design and construction stages. By one estimate, emissions could fall by up to 1.2 billion metric tons of CO_2 per year by 2050. If the world also used circular economy tech-

[69] MHP, 2019

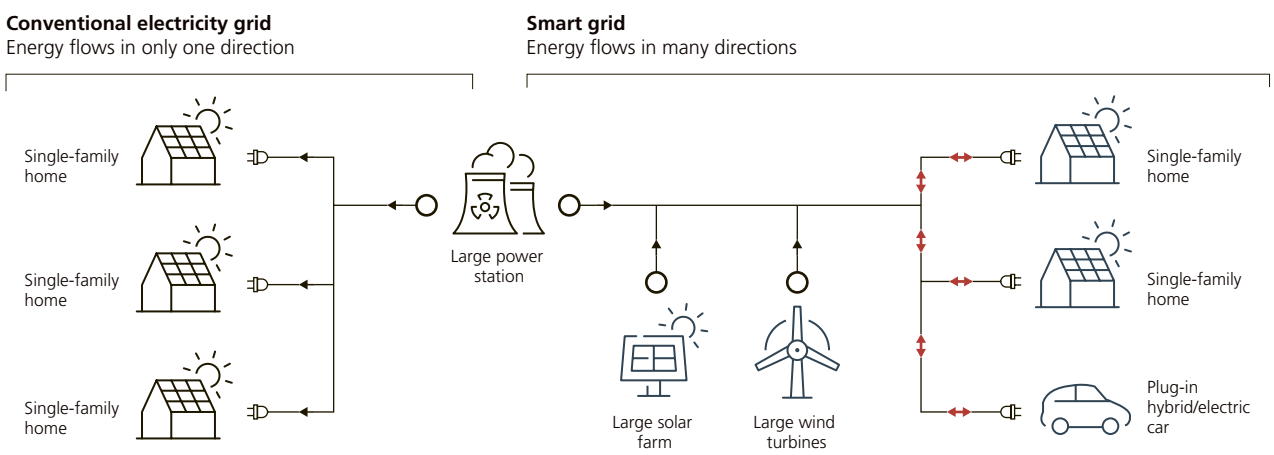
[70] KPMG (July 2019) Renewables in Ukraine. URL: https://home.kpmg/ua/en/home/insights/2019/07/renewables-in-ukraine.html, accessed 3 February 2020.

[71] The Rise Fund *CLEAResult*. URL: https://therisefund.com/portfolio/clearesult accessed 14 February 2020.

[72] CNH Industrial, 2018: *Sustainability report*. URL: https://www.3blmedia.com/sites/www.3blmedia.com/files/other/CNH_Industrial_Sustainability_Report_2018.pdf, accessed 7 February 2020.

Fig. 27/28

Smart grids could help to reduce energy waste and deliver potential economic benefits



Source: Nomura, UBS

niques like sharing, reusing, and recycling (especially cement recycling), annual emissions could fall by around 40% (2 billion metric tons of CO_2 per year) from a 2050 baseline estimate of the Ellen MacArthur Foundation. One reason for this potential reduction is that standard construction practices often use excessive materials. It would be possible to achieve the same structural strength using only 50%–60% of the amount of cement that is currently being used, according to one estimate. Reduced over-specification, improved design, and use of high-strength materials (like steel) all have the potential to reduce material usage by 30%.[73]

New approaches to the construction and operation of buildings can make a difference in reducing solid waste and pollution. Construction and demolition waste accounts for around 40% of urban solid waste. Globally 20%–30% of construction and demolition waste is recycled or reused. And in Europe, 54% of it is sent to landfills. New technologies and processes (such as prefabrication, offsite construction, and 3D printing have the potential to reduce material and waste generation while also lowering costs by as much as 60%. For example, building pieces away from the main site can increase build quality and control while potentially curbing on-site waste generation by up to 90% versus standard building techniques.[74]

Turning to specific examples of reducing energy waste from buildings and construction:

Mainstream companies
One example of energy waste reduction in construction and building comes from Microsoft. The company has employed a variety of strategies to keep as much as 90% of its waste out of landfills and was the first of the major technology firms to receive a Zero Waste certification from the US Green Building Council. Microsoft also focuses on reducing energy waste by, for example, using a dedicated power management system to control 160,000 of its computers (reducing power usage by 27%).[75]

External example from the UBS Industry Leader Network*

One entrepreneur who runs hospitality businesses in Egypt (and who is a member of the UBS Industry Leader Network of private business-owning clients) is tackling energy waste by switching energy sources for the kitchen and boilers and replacing air conditioning units with energy-efficient models.

The entrepreneur estimates such energy waste reduction and energy efficiency measures have had a tangible impact on costs, reducing energy bills by 10%–12% per year.

*The UBS Industry Leader Network is a global group of UBS clients and prospects who are private business owners and executives. Their views may differ from those of UBS.

Innovators
More broadly innovative companies are introducing technologies to reduce energy waste in "smart" buildings. They use building management systems (hardware and software) to centralize control of lighting, heating, climate control, and ventilation systems. Relying on a variety of technologies (including increased use of sensors, the Internet of Things, and big data processing), smart systems can help to reduce energy waste, save costs, and limit greenhouse gas emissions from wasteful energy use.[76]

"Smart" electricity grids can also help cut energy consumption, wastage, and CO_2 emissions by enabling a move from traditional (and inefficient) transmission and distribution networks to a decentralized model (Fig. 27/28).

Smaller decentralized grids allow for a two-way flow of energy production and consumption between power generators and users via solar panels and energy storage solutions (such as electric cars or home storage batteries). Grid operators will also be able to collect and analyze data on electricity demand and supply in real time to optimize energy production and cut waste.

[73] Ellen MacArthur Foundation, *Completing the Picture: How the Circular Economy Tackles Climate Change* (2019) www.ellenmacarthurfoundation.org/publications
[74] Ellen MacArthur Foundation, *Completing the Picture: How the Circular Economy Tackles Climate Change* (2019) www.ellenmacarthurfoundation.org/publications
[75] Rubicon Blog (1 November 2017) *10 Zero Waste Companies Leading the Charge*. URL: https://www.rubiconglobal.com/blog/companies-zero-waste/, accessed 3 February 2020.
[76] UBS Longer Term Investments—Energy Efficiency

Interview

Professor Donald Sadoway

This interview contains views which originate from outside Chief Investment Office Global Wealth Management (CIO GWM). It is therefore possible that the interview does not fully reflect the views of CIO GWM.

Professor Donald Sadoway
John F. Elliott Professor
of Materials Chemistry,
Massachusetts Institute of Technology;
Co-Founder, Ambri;
UBS Global Visionary Alumnus

Donald, how big is the problem of energy wastage?

Energy waste is a major challenge both at the country and company level. I'd draw particular attention to energy waste in buildings. In the US, commercial buildings use 20% of national energy consumption. They waste 30% of this energy, accounting for around 12% of US greenhouse gas emissions.[1]

What are the most common reasons for energy wastage?

The greatest source of energy waste is inefficient climate control systems. The primary reason for energy waste is old and inefficient equipment. The fuels used to power these systems are often carbon intensive too. Lighting and water use in buildings is often wasteful—incandescent lightbulbs, for example, convert just 10% of energy inputs into light output, the remainder into heat[2]—but the environmental and financial consequences pale in comparison to climate control systems.

In US households, energy waste also results from inefficient household utilities such as fridges, hot water heating, and appliances. Other factors include old US housing stock that adheres to prior regulations (which did not account for environmental considerations). Furthermore, residential design often prioritizes natural light, even though large glazed areas can compromise building efficiency without the installation of expensive insulation and thickened windows.

So how can we most effectively reduce energy waste in a commercial and environmentally friendly way?

Businesses should consider three simple steps.

- First, encourage employees to turn off equipment when not in use.
- Second, raise employee awareness of energy use and waste. In today's competitive and globalized business landscape, smart energy usage and a collective responsibility to reduce energy waste can deliver tangible cost savings, while also aligning with employees' increasing desire for their employers to practice environmentally sound business practices.
- Third, businesses should pay due care to their equipment and its environmental footprint.

Actions can include regular equipment maintenance to maximize efficiency and correct defects; capital replacement in "quick win" areas (such as replacing all incandescent lighting for LED bulbs); and installing energy management systems to turn off devices, computers, or other equipment automatically outside of business hours.

What are the potential commercial and environmental advantages of new energy storage solutions?

New energy storage systems will be critical to the success of future energy grids that rely on renewable energy sources. We must acknowledge that many renewable energy sources are intermittent unlike their fossil fuel equivalents. And so supply will therefore fluctuate, and fail to be in balance with demand. The grid operates such that supply is in perfect balance with demand everywhere at all times. The grid is the world's largest supply chain operating with zero inventory. Without adequate and scalable energy storage solutions, the current push for renewable energy grids risks supply falling short of demand. This would be unacceptable to consumers or businesses, likely resulting in back-up power generation fueled either by natural gas or diesel. In this instance, the final outcome is more expensive electricity which still does not meet environmental targets. Storage would do for our electric grid what refrigeration did for our food supply.

New technologies can store intermittent renewable energy more efficiently. They can store supply when it exceeds demand, typically at night, and release supply when demand peaks, typically to double its average in the middle of the afternoon. In the same way that a car runs most economically when driving at a constant speed, new storage capabilities can iron out the greenhouse gas emissions per unit of energy generated across low- and high-demand periods. This results in more efficient use of capital assets employed in generation, transmission, and distribution. Think about this: Generation capacity is sized to meet peak demand which can be double the average demand and required less than 2% of the time.[3] Imagine an airline that 98% of time idled 50% of its fleet of airplanes. You'd say that's a bad business model. Well, that's how today's grid is configured.

1 C. Martani, D. Lee, P. Robinson, R. Britter, and C. Ratti (2012). ENERNET: Studying the dynamic relationship between building occupancy and energy consumption. Energy and Buildings, DOI: 10.1016/j.enbuild.2011.12.037, 2012.
2 University of Wisconsin Stevens Point Energy Education: Concepts and Practices. URL: https://www.uwsp.edu/cnr-ap/KEEP/nres633/Pages/Unit2/Section-D-Energy-Efficiency.aspx, accessed 10 February 2020.
3 US Energy Information Agency (2014) Peak-to-average electricity demand ratio rising in New England and many other U.S. regions. URL: https://www.eia.gov/todayinenergy/detail.php?id=15051, accessed 10 February 2020.

In the future, larger numbers of consumers could become suppliers too, with more widespread selling back to the grid operator of any surplus home-generated electricity stored in batteries. Grid managers could respond to swings in power generation from renewable sources by discharging battery-stored energy at demand peaks and recharging batteries when demand falls. Such new infrastructure would promote greater transparency of energy consumption and electricity costs, enhanced by the increased use of smart meters.[77]

Advancements in energy storage, especially to cope with more intermittent generation from renewable sources, represent another area ripe for innovation. New forms of storage are vital to support greener energy generation (and lower waste) by providing power smoothing, wider application of distributed networks, emergency power coverage in natural disasters, and greater cost efficiency across renewable and non-renewable sources.[78]

Professor Donald Sadoway, Professor of Materials Chemistry at the Massachusetts Institute of Technology and a UBS Global Visionary (please see the interview on the previous page for more of his thoughts on reducing energy waste), introduced a new innovation for energy storage. He and his team created a liquid metal battery that can store renewably sourced energies at grid scale. The liquid metal technology underpinning the batteries has far less wastage (100% discharge even after four years of use) than lithium-ion equivalents and at potentially 70% lower costs by the mid-to-late 2020s. To commercialize this idea, Prof. Sadoway co-founded the liquid metal battery company Ambri with USD 50mn of investment—with the first supporters being Bill Gates and Total.[79]

Transport energy waste

Mainstream companies

The cruise operator Carnival Group serves as another example of a mainstream company working to reduce transport energy waste.

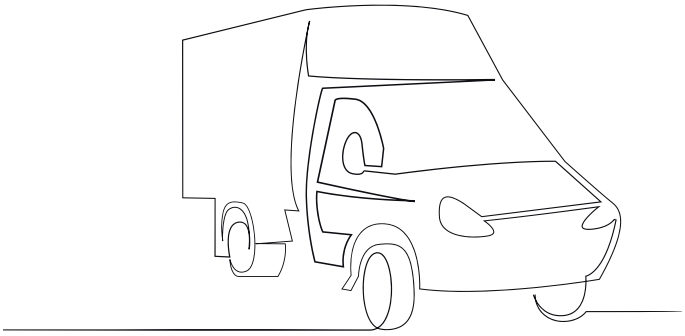
From 2007–2014, Carnival increased its fleet's overall fuel efficiency by roughly a quarter and saved around USD 2.5bn in fuel costs (using one billion fewer gallons of fuel). This cost and waste reduction resulted from technological advancements in areas like new hull coatings (reducing the growth of marine organisms and, by extension, drag), air conditioning (installing newer and more energy efficient systems), lighting (replacing traditional lighting with LED bulbs), water production (enabling freshwater production from sea water), and propulsion (achieving greater energy efficiency of vessel engines).

Education and training also helped raise awareness of energy use and ways to reduce energy waste among both crew and passengers.[80]

Increased use of video conferencing and telecommuting could help reduce transport energy waste and emissions, as well as cut down on the time previously spent commuting. A US federal study found the average American spends 264 hours every year commuting to work.[81]

The shipping company United Postal Service (UPS) offers a second example. By avoiding left turns whenever possible on the US's right-hand drive roads, UPS was saving an estimated 10 million gallons of fuel per year by 2017, with drivers covering 6–8 fewer miles per route. UPS has achieved this waste reduction by applying routing software to each of the 18 million deliveries it makes in the US every day (as of 2017), analyzing 250 million

[77] UBS Longer Term Investments—Energy Efficiency
[78] Citi Global Perspectives and Solutions (September 2019) *Energy Darwinism III—The Electrifying Path to Net Zero Carbon*
[79] Source: Crunchbase. URL: https://www.crunchbase.com/organization/ambri#section-investors, accessed 6 February 2020.
[80] Goldman Sachs Global Investment Research (GIR), as of February 2019.
[81] UBS Longer Term Investments—Energy Efficiency



address points a day, and performing 30,000 route optimizations per minute. This optimization has also saved the company USD 300–400mn a year in fuel, wages, and vehicle running costs.[82]

In terms of future developments, UPS intends to pilot self-driving vehicles between depots and stores in Arizona; to acquire 10,000 electric delivery vans that are customized to local needs; and to trial delivering medicines and light packages via drone to the residential sector in North Carolina.[83]

More generally, the ubiquitous use of smartphones, equipped with Global Positioning System (GPS) technology and other apps, provides mainstream companies (and consumers) greater opportunities to optimize routes, significantly reduce travel times, and cut fuel consumption. Emerging markets may offer the greatest potential given lower penetration rates.

Rising e-commerce volumes may boost transport sector energy efficiency (though not necessarily waste through packaging). E-commerce can replace consumer journeys with deliveries and take advantage of economies of scale in warehousing and logistics. Studies by Alibaba and Amazon suggest e-commerce energy consumption is up to one-third below that of the traditional brick-and-mortar retail model.[84]

A third example can be found at the BMW Group. Between 2006 and 2017, the company reduced waste for disposal by an average of 80% and process wastewater by 51%. Overall resource consumption and emissions per vehicle fell by 53%. Drivers of this waste and emissions reduction included: the installation of in-plant cogeneration systems, which provide almost half the heat required and 10% of the plant's electricity; and switching to LED lighting in all production areas, which reduced energy consumption by more than one gigawatt hour per year.

The company also set up an energy-optimized operating system across several areas of mechanical production. Like the auto start-stop feature used in cars, the system automatically switches to standby if there are no parts awaiting processing.

At Plant Steyr, one of its production plants, BMW has become wastewater-free through a combination of various membrane technologies, such that all production wastewater from the plant can be optimally processed and fed back into production. Water waste is significantly reduced and no production wastewater enters the public sewage system.

The aluminum chips generated during the production of cylinder heads and crankcases provide a good example of how to manage resource cycles. Chips are collected according to type and processed to produce liquid aluminum. This liquid aluminum is then further processed at the BMW foundry in Landshut to form new engine components.

Finally, BMW delivers products and materials in mesh containers to save packaging material and reduce waste.[85]

Innovators

One example of more innovative ways to tackle transport waste comes from Valeo. The company is a major supplier of automotive parts in Europe. It fits one in every three vehicles worldwide with electrical systems for reducing CO_2 emissions.

The company invented the stop-start system, which now equips millions of vehicles across the world and significantly reduces emissions by optimizing engine running. It is also driving car hybridization, producing around 25 million 12 Volt systems per year.[86]

[82] Goldman Sachs Global Investment Research (GIR), as of February 2019.

[83] The Verge (29 January 2020) *UPS is buying thousands of electric vans and teaming up with Waymo to accelerate the future of deliver.* URL: https://www.theverge.com/2020/1/29/21112001/ups-waymo-self-driving-arrival-ev-delivery-vans, accessed 3 February 2020.

[84] UBS Longer Term Investments—Energy Efficiency

[85] BMW, 2018: *Sustainability value report.* URL: https://www.bmwgroup-werke.com/steyr/en/responsibility/sustainability-and-efficiency.html

[86] Valeo, 2018. URL: https://www.valeoservice.co.uk/en-uk/newsroom/valeo-innovations-are-reducing-co2-emissions, accessed 7 February 2020.

Dedicated waste management companies

Waste management and reduction companies can be overlooked as potential tools to tackling global waste. However, successful programs can often yield substantial commercial and environmental benefits.

Mainstream companies

Renewi is one such company working to more effectively manage waste within the sector. By applying a waste-to-product business model that is focused on extracting value from waste, rather than on its disposal through mass incineration or landfill, the company seeks to encourage more capital-efficient ways of recycling and managing commercial and municipal waste.

The company wants to create valuable products from materials that are otherwise discarded. It collects or receives waste, then sorts it into specific categories and waste streams for treatment. It then looks to create and sell new products from these segregated streams. Renewi recycles or recovers energy from nearly 90% of the waste it receives, and, in doing so, estimates it prevents around 2.88 million tonnes of carbon dioxide emissions each year—equivalent to the total emissions of almost all the households in Amsterdam.

The company has also struck major so-called "closed loop" partnerships deals with large manufacturers. One is with electronics, healthcare, and lighting technology company Philips to produce a vacuum cleaner made from 36% recycled plastic from discarded old vacuum cleaners. Another partnership is with household goods company Miele, to deliver back cast iron for washing machines, produce bricks from ashes formed by incinerators, and create packaging from crop waste.

Covanta is an example of another company aiming to more efficiently manage waste. The company's facilities convert about 21 million tons of waste into power each year, enough for more than one million homes. The firm also recycles approximately 600,000 tons of metal—the equivalent to manufacturing three billion aluminum beverage cans every year.[87]

More generally, mainstream companies are also looking at waste-to-energy applications as a way to tackle waste in commercial and environmentally sound ways.[88] According to the US's Environmental Protection Agency for every ton of municipal solid waste processed at energy-from-waste facilities, greenhouse gas emissions are reduced by approximately one tonne. This is due to the avoidance of methane from landfills, the offset of greenhouse gases from fossil fuel electrical production, and the recovery of metals for recycling.

China Everbright International provides an example of waste-to-energy practices. It uses co-integrated waste-to-energy and food waste techniques to generate commercial returns and environmental benefits for one of China's regions with a fast-growing population.

Its Sanya waste-to-energy operation diverts 1,200–1,300 metric tons of waste each day (out of an expected daily household waste output of 2,350 metric tons per day in 2019) and uses three incinerators to transform waste into energy and slag (for potential use in heavy metal recycling, construction, and soil remediation). The project generates commercial returns from waste management fees and selling its electricity, with an estimated internal rate of return of 8%. Greenhouse gas emissions from the project (looking at daily and hourly average levels of gas emissions) are far less than landfilling the waste, and are superior than local Chinese regulations and the EU's 2010 requirements.[89]

Innovators

One innovative company tackling general waste is WasteZero, a company that works with fast-moving consumer goods groups to support the rollout of 100% recycled product lines. It also drives sales among eco-friendly consumers by mounting waste reduction-led sales campaigns. To date the company has reduced US waste by 6.7mn metric tons and GHG emissions by more than 15.6mn metric tons (equivalent to taking 2.5mn cars off the road). Estimated commercial benefits total USD 1.6bn for communities—all with an annual client retention rate of 96%. The company's long-term ambitions are to reduce overall US waste by half and bring a closed-loop or circular economy into the mainstream.[90]

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87 Covanta website. URL: https://www.covanta.com/, accessed 3 February 2020.

88 UNEP/IETC (2019) *Waste to Energy: Considerations for Informed Decision Making* URL https://www.unenvironment.org/ietc/resources/publication/waste-energy-considerations-informed-decision-making, accessed 5 January 2020.

89 Citi (17 December 2019) *China Everbright International—High Level Operation in Waste-to-Energy & Food Waste Treatment*

90 Company factsheet, with more information at WasteZero website. URL: http://wastezero.com/, accessed 7 February 2020.

Chapter 4

Where are the investment opportunities in waste?

Source: Plainpicture

The overall waste sector is growing quickly. Municipal solid waste is one part of a market that, in 2018, had an estimated size of around USD 1.7tr. By the end of this year that figure is projected to reach USD 2tr. And higher value-added treatment plus better waste collection rates should increase the industry's size in the coming decades. In addition, energy waste reduction opportunities should abound.[91]

Investment opportunities in waste (across both public and private markets) are likely to be concentrated in three categories.

Mainstream companies who operate in sectors where waste is of significant importance and have proven to manage waste and pollution proactively

The first category includes mainstream companies who operate in sectors that generate a material amount of waste, and that have proven to manage waste and pollution proactively.

Doing so may give these companies cost advantages (reducing waste and unnecessary expenditures), a more loyal customer base, or new lines of revenue (such as opening up their own specialized waste treatment programs to external clients).

To establish whether waste has a significant impact on a sector's financial performance and to evaluate how companies within this sector manage it, investors can use a waste and pollution data set as part of a wider methodology that analyzes companies on several sustainability criteria. Applying materiality principles to conventional sector classification highlights four key sectors where waste is of significant importance: consumer discretionary, energy, materials, and utilities. Below is one example of such a methodology from the UBS Chief Investment Office Global Wealth Management (CIO GWM, see breakout box).

Examples in this category include:

- *Equities of large mainstream companies* (constituents of the MSCI All Country World Index) that tend to tackle pollution and waste more proactively than their peers and operate in sectors where waste is of significant importance.
- *Investment grade bonds* of issuers that tend to tackle pollution and waste more proactively than their peers and operate in sectors where waste is oof significant importance. Further, certain *municipal bonds* in the US may be relevant for investors interested in the waste and pollution theme.

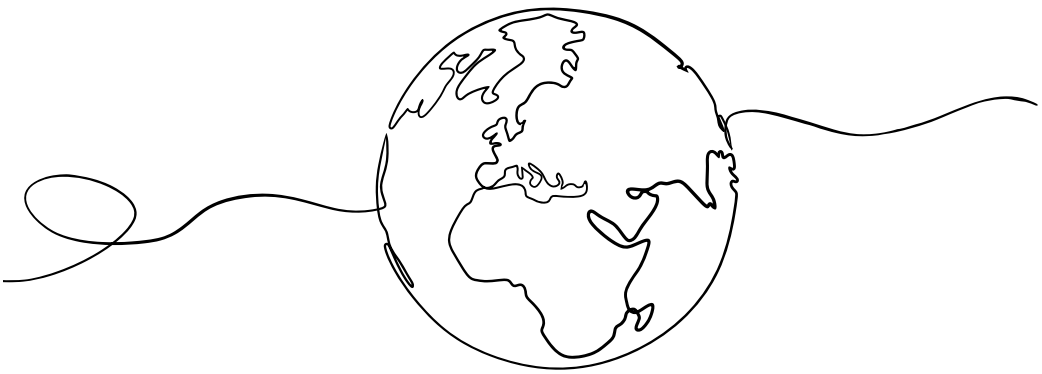
[91] Data taken from UBS CIO GWM Longer Term Investment theme: Waste Management and Recycling, published in May 2018. For more information please see here or contact your UBS representative. Please note this market size also includes specialized waste markets beyond the scope of this report (among others industrial waste, waste water, and e-waste). This report focuses on municipal solid waste and energy waste, the latter's size being hard to quantify due to problems of data availability and complexity.

UBS CIO GWM waste and pollution data set: How does it work?

There is no universally agreed-upon approach to evaluating sustainability. Its assessment depends on different client interests around sustainability—some investors care about environmental issues, others social ones. And sustainability data is subject to far wider variation than financial metrics. For example, opinions differ far more on how to define a company's waste footprint than they do for the price-to-book ratio.

UBS CIO GWM developed an in-house proprietary data methodology to assess company and country performance on sustainability. Using more than 500 environmental, social, and governance indicators and applying them to near 11,000 equity and bond issuers, the data methodology provides aggregated data on company and country performance in six sustainability topics. One of these is pollution and waste. According to our definition, "companies that have good environmental management policies and systems, reduce packaging, recycle materials, manage hazardous waste, limit toxic emissions; and governments that manage their air and land resources well" would score well in this area.

The data methodology gives a numerical "score" for a country or company based on each of these six sustainability topics. The methodology also assigns a "headline score" for a company's overall sustainability, using the Sustainability Accounting Standards Board (SASB) Materiality Map. Using this map helps to ensure greater comparability across regions and sectors by accounting for different levels of "materiality." Put simply, data on carbon emissions will likely matter more for utilities or materials companies than financials due to their underlying activities.



1 2 3

Companies whose primary line of business is dedicated waste management or companies that issue debt specifically to tackle waste

A second category includes companies whose primary line of business is dedicated waste management or companies that issue debt with the specific purpose of tackling waste.

Increased focus on reducing solid and energy waste is most likely to have a positive impact on these firms' revenue and profitability through higher volumes. Examples in this category include:

- *Equities of dedicated waste reduction and recycling companies* with sales exposure such that more than 35% of their revenues come from managing waste (see table 1).
- *Green bonds that contribute to reducing company waste* (see table 2).
- Investments in waste management companies and assets in private markets.

Table 1

Dedicated waste management companies

This is not a list of recommendations, nor is it comprehensive.

Region	Company name	ISIN identifier	M'Cap. in mn USD	Currency	Thematic sales exposure
Americas					
United States	Waste Management, Inc.	US94106L1098	52496	USD	100%
United States	Republic Services, Inc.	US7607591002	30829	USD	100%
Canada	Waste Connections, Inc.	CA94106B1013	26420	CAD	100%
United States	Clean Harbors, Inc.	US1844961078	4774	USD	65%
United States	Advanced Disposal Services, Inc.	US00790X1019	2942	USD	100%
United States	Casella Waste Systems, Inc. Class A	US1474481041	2422	USD	99%
United States	Covanta Holding Corporation	US22282E1029	2023	USD	76%
United States	US Ecology, Inc.	US91734M1036	1192	USD	96%
Europe					
France	Veolia Environnement SA	FR0000124141	16467	EUR	39%
Belgium	Umicore	BE0974320526	11689	EUR	50%
France	SUEZ SA	FR0010613471	10241	EUR	36%
United Kingdom	Pennon Group Plc	GB00B18V8630	6067	GBP	52%
Norway	TOMRA Systems ASA	NO0005668905	4526	NOK	45%
Asia					
Hong Kong	China Conch Venture Holdings Ltd.	KYG2116J1085	8638	HKD	73%
Australia	Cleanaway Waste Management Ltd.	AU000000CWY3	2702	AUD	100%
China	Grandblue Environment Co., Ltd. Class A	CNE000001675	2183	CNY	37%
China	China Tianying Inc	CNE000000FN8	2111	CNY	59%
China	Tus Environmental Science & Technology Development Co., Ltd. Class A	CNE000000BX6	1984	CNY	52%
Australia	Sims Ltd.	AU000000SGM7	1445	AUD	90%
China	Chifeng Jilong Gold Mining Co., Ltd. Class A	CNE000001H94	1561	CNY	67%
China	Zhongzai Resource & Environment Co., Ltd. Class A	CNE000001113	1179	CNY	100%
China	Jiangsu Huahong Technology Stock Co., Ltd. Class A	CNE1000019V6	515	CNY	69%
China	Anhui Shengyun Machinery Co Ltd Class A	CNE100000QV7	273	CNY	84%

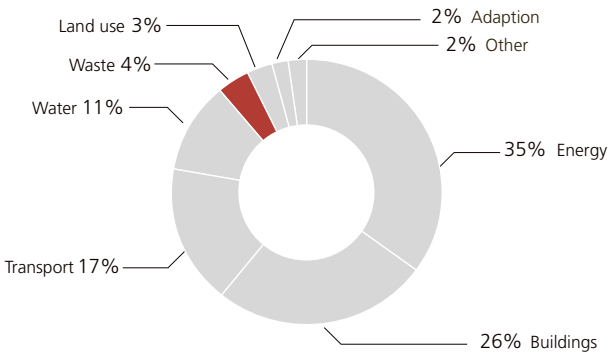
Source: Factset, UBS, as of 7 February 2020

Important note: This is a company reference list with relevant waste management and recycling stocks globally. To select the stocks in this list we have used the FactSet business classification system (RBICS) that uses a bottom-up approach to classify companies according to the products and services they provide. To find the relevant stocks and sales exposure to our investment theme we have identified five out of more than 1,500 subsectors in the FactSet RBICS classification that we believe fit our theme well. To find stocks with relevant exposure to our investment theme we have filtered the five subsectors for stocks with at least 35% sales exposure to the respective subsector. We have excluded stocks with a market capitalization of less than USD 250mn and a daily trading volume of less than USD 5mn (average last six months).

Please note that this list is only for reference and is not a recommendation list.

Fig. 29

Just 4% of green bonds actively address waste—an opportunity for growth?



Source: Climate Bonds Initiative, UBS

Green bonds that contribute to reducing company waste

Waste prevention, reduction, and recycling form part of the eligible project categories laid out in the Green Bond Principles (GBPs) published by the International Capital Markets Association (ICMA) that can be financed by the proceeds of green bonds. In the absence of official regulation, which is currently being worked out by the EU, green bonds are essentially self-labeled by the issuer. Most large issuers, but not all, choose to obtain a third-party verification of their green bond program by institutions like Cicero, VigeoEiris, Sustainalytics or ISS-oekom. In addition, the GBPs require green bond issuers to report on their effective use of proceeds and the climate-related impact achieved at least annually. A study by the Climate Bonds Initiative, however, found that only 74% of all green bond issuers were in compliance with the reporting requirement.

The cost of setting up a green bond program and providing regular reporting comes at additional cost to the issuer, while the bonds are priced at yields similar to those of non-green bonds from the same issuer. Despite the absence of an outright financial benefit, we still see an economic value of green bonds to companies, such as the access to a long-term-oriented and fast growing audience of sustainable investors, as well as the signaling of environmental commitment. Diversification of creditors, particularly buy-and-hold-oriented ones, can add to more stable bond valuations in adverse times and facilitate an easier rollover of maturing bonds during periods of market stress. Still, the additional cost of maintaining a green bond program may be perceived as a hurdle by companies, especially by those without a large pool of recurring funding needs.

Table 2

Overview of green bonds using proceeds for waste-related projects

Considering all outstanding green bonds with a minimum issue size of USD 100mn, there are currently 213 that mention waste as a use of proceeds, and about half of these stem from companies (the remainder are public entities). Only three issuers exclusively refer to waste. We include these three and examples of other major corporate green bond issuers below.

Issuer	Green bonds mentioning waste (USD)	Use of Proceeds	Example waste projects
Paprec	4 (1.8bn)	100% Waste	Leading French recycling company across paper, plastics, and construction waste. Used proceeds for a recycling project, consisting of the acquisition of a specialized company.
California Pollution Control Finance Auth.	2 (345mn)	100% Waste	Construction of a waste rice straw conversion facility, construction of a food disposal facility including the conversion of biosolids to renewable energy and fertilizer.
City and County of Honolulu	1 (185mn)	100% Waste	Funding H-Power, a program to reduce the volume of municipal solid waste. The plant is reducing the amount of refuse going to landfill by 90%.
Apple	1 (1.5bn)	~2% waste	Apple's first green bond allocated USD 21mn to projects focused on recycling and recovering materials. E.g. 100% aluminum recycling halved the carbon footprint of the MacBook Air. A special robot disassembles iPhones to recover more materials than from traditional shredding. Apple estimates an impact of 47,600 metric tons of waste being diverted from landfills.
Klabin	2 (1bn)	~10% waste	Installation of a diluted non-condensable gas treatment system in its pulp manufacturing plant, reducing atmospheric emissions during 95% of operating time.
Stora Enso	1 (604mn)	Unspecified	Reducing waste in pulp and paper production and reusing waste and residuals (including ash, sawdust, bark).

Source: Climate Bonds Initiative, company reporting.

Waste currently represents only 4% of the reported use of proceeds of the USD 700bn green bond market, which is more tilted toward energy efficiency and green buildings (Fig. 29). In only a very few cases are proceeds from a green bond exclusively used for waste-related projects (e.g., the recycling company Paprec). Typically, waste is one of several projects categories financed by a specific green bond. This is the case for some of the largest green bond issuers, like France, Engie, Belgium or Indonesia and many regional public sector agencies.

Why do companies require financing to produce less waste?
Most often the waste projects financed by green bonds relate to managing waste, including recycling to conserve materials. Technology companies like Apple have introduced reuse programs for hardware. A typical example of waste reduction projects requiring a large amount of new financing is the building of new factories or the retrofitting of existing ones to create products with less waste, marrying an ecological rationale to an economic one. Therefore, waste reduction financing is mostly about companies investing in modern technologies that create a given output with less energy, less material, and less wastage. Typically, the greatest potential for this can be found in developing countries, where hazardous waste is currently being sent to landfills. While this problem is also being addressed by development programs in global multilateral development banks (MDBs), it often also affects subsidiaries of large developed country companies, which have access to global bond markets.

We see the most potential for issuing dedicated financing for waste reduction projects in companies active in packaging, as well as those producing very sensitive products, like food.

For example, companies may look to raise dedicated financing to follow Nestlé's example of sourcing up to two million metric tons of food-grade recycled plastics between now and 2025. Their aim is to make all their packaging recyclable or reusable by this date, while reducing their use of virgin plastics by up to a third and supporting efforts to clean waterborne plastic waste.[92] Companies may also want to raise dedicated funding to invest in new production processes or new partnerships. InBev, for example, has worked with partners including the Ellen MacArthur Foundation, the Closed Loop Fund, and the Glass Recycling Coalition to move to 100% product packaging that is returnable or predominantly made from recycled content by 2025 (from a 46% level today).[93]

The concept of Waste Reduction Bonds
A new concept for "Waste Reduction (WaRe) Bonds" also suggests a way for companies to tackle waste by raising dedicated financing for its reduction. One innovation could be waste-reduction-linked corporate debt. Like green bonds, these would be standard bonds that appeal both to mainstream traditional investors and to the growing cohort of sustainable investors.

Utilizing a simplified version of the ICMA Green Bond Principles, the overall structure of a WaRe bond could be an instrument where the proceeds would be exclusively used to finance new or existing eligible waste reducing projects, covering three broad areas: energy, packaging, and food. As with traditional and green bonds, they would also have a standard recourse-to-the-issuer and be priced at similar yields.

In contrast to the Green Bond Principles, WaRe bonds would not necessarily require the issuer to launch a dedicated program specifying the use of proceeds, the process for project evaluation and selection, and the management of proceeds and reporting. In particular, smaller companies tend to perceive these requirements—as well as the typical external auditing of the program—as a significant financial and operational burden.

To provide the required transparency and integrity of information necessary for sustainable investors to consider the bonds, companies should, however, disclose the intended use of proceeds at issuance, and provide both annual reporting on the effective projects financed and ideally also their respective waste reduction outcome.

At some point, such an innovation may lead to commonly accepted "WaRe Bond Principles." Forthcoming official regulation, as in the case of the EU's Green Deal, would likely also impact the development of such an asset class and its eligibility for commonly used sustainable investing benchmark indexes. Ideally, WaRe bonds should be of sufficient size to be liquid in the secondary market, to deliver competitive pricing for issuers, and to allow investors to actively trade the bonds.

[92] Nestlé Press Release (January 2020) *Nestlé creates market for food-grade recycled plastics, launches fund to boost packaging innovation*. URL: http://nestle.com/media/pressreleases/allpressreleases/nestle-market-food-grade-recycled-plastics-launch-fund-packaging-innovation, accessed 3 February 2020.

[93] AB InBev *Circular Packaging: Driving Sustainable Packaging*. URL: www.ab-inbev.com/sustainability/2025-sustainability-goals/circular-pakaging.html, accessed 3 February 2020.

Investments in waste management companies and assets in private markets

Tackling waste reduction requires innovative solutions and new processes, business models, and toolsets. Traditional companies look for new partners and talent to address waste in their existing businesses, which gives rise to enterprises with a specific focus on waste solutions. As regulatory and societal pressures grow, so does the demand for reducing pollution and waste across traditional sectors and industries. Technology-savvy entrepreneurs recognize the opportunity to develop new waste-related products and services and bring new business models to the market. In many cases, these are early- or growth-stage ventures, looking to finance their accelerated development. However, opportunities also exist in more established infrastructure-related assets. Investors who are willing to engage with impactful private companies—and can add illiquid assets to their portfolios—are well positioned to further the mission of waste reduction by dedicating capital to private markets.

While we are not making specific recommendations in private markets, we summarize in the table below a sample of current/recent offerings that appear to be related to waste reduction, as listed by the independent financial data provider PitchBook.

Table 3

Sample list of current/recent private market offerings of companies related to waste reduction

Name	Description	Why	Link	Location	Deal Type
Global Environmental Management Services	Provider of waste management, recycling, industrial and engineering services in Saudi Arabia. The company offers systems, products and services for waste management, industrial effluent treatment, sewage treatment, odor control, bioremediation, and environmental cleanup.	CleanTech / Industrials / TMT / Environmental Services (B2B)	gems-ksa.com	Jeddah, Saudi Arabia	Buyout / LBO
Renewi Canada	Provider of waste treatment services. The company specializes in the treatment and recycling of organic waste to create compost and non-agricultured sourced material (NASM) for the Canadian market.	CleanTech / Environmental Services (B2B)	renewi.ca	London, Canada	Buyout / LBO
HolaLuz	Developer of a cloud-based energy analytics platform designed to monitor and optimize energy usage. The company's platform integrates sensors and analytics software that track individual energy consumption, recommend profitable rates, and suggest ways to reduce energy usage through green energy meters, enabling clients to save energy costs and reduce pollution.	Cleantech / Saas, TMT / Energy Production	holaluz.com	Barcelona, Spain	Later Stage / VC
Allied BioScience	Developer of clean surface coating products created to deliver eco-friendly, research-driven products and services, resulting in cleaner human environments. The company's clean surface coating products are used to reduce the presence of pathogens on hard and soft surfaces within a hospital setting or, for example, on a cruise ship.	CleanTech / Industrials / Life Sciences / Environmental Services (B2B)	alliedbioscience.com	Dallas, TX	Angel (Individual)
Natural Air E-Controls	Developer of HVAC control systems designed to incorporate residential building ventilation. The company's systems provide fresh air and remove pollutants by taking in outdoor air in amounts needed to improve indoor air quality, enabling users to stay healthy.	CleanTech / Electronics (B2C)	naturalair.com	Lake Wales, FL	Angel (Individual)
ION Engineering	Developer of carbon dioxide capture technology designed for greenhouse gas mitigation. The company's technology uses an advanced liquid absorbent system to capture carbon dioxide, providing industries with efficient commercial options, while significantly reducing capital and operating costs.	Other Equipment	ion-engineering.com	Boulder, CO	Angel (Individual)
Phytonix	Operator of an industrial biotechnology company intended to produce sustainable chemicals directly from carbon dioxide. The company uses a process that employs cyanobacteria, which are the same organisms responsible for creating a breathable atmosphere on Earth, enabling a wide variety of industries to produce butanol at less than half the current cost of using propylene in a sustainable manner.	CleanTech / TMT – Multi-line	phytonix.com	Black Mountain, NC	Later Stage / VC

Name	Description	Why	Link	Location	Deal Type
Simply Good Jars	Developer of smart jars designed to reduce food waste. The company's product is portable with no checkout required at the purchase point, using advanced convenience technology.	FoodTech / Food products	simplygoodjars.com	Philadelphia, PA	Seed Round
Onvector	Developer of water treatment technologies designed for sterilization and oxidation of industrial wastewater. The company's water treatment technologies use ddirected energy to treat water and wastewater treatment non-chemically, with a high-voltage plasma-based technology for wastewater disinfection and oxidation as well as a low-voltage radio-frequency technology for cooling water scale suppression, enabling clients to reduce energy costs.	Cleantech / Other equipment	onvectorllc.com	Somerville, MA	Grant
Oceanvolt	Developer of hybrid electric power and propulsion systems designed to manufacture clean and silent electric motors for boating. The company's propulsion systems use a folding propeller to regenerate electricity that can be used onboard to power the electronics and appliances or charge devices and batteries while sailing, providing clients with technology that makes sailing safer, quieter, and more pleasant and ecological.	CleanTech, Industrials / Manufacturing / Electrical Equipment	oceanvolt.com	Vantaa, Finland	Angel (Individual)
MICROrganic Technologies	Developer of a transformative technology intended for industrial and municipal wastewater treatment. The company's technology makes bio-electrochemical systems that convert the chemical energy of organic waste to electricity for high energy efficiency in wastewater treatment, enabling people to get sustainable organic waster services.	CleanTech / Environmental Services (B2B)	microrganictech.com	Castleton-on-Hudson, NY	Seed Round
Divinia Water	Producer of purified bottled water. The company's product is water that is purified through a patented technology that removes pollutants and contaminants. The water is then sold and distributed in environmentally friendly glass bottles.	LOHAS & Wellness, Beverages	diviniawater.com	Idaho Falls, ID	Product / Crowdfunding
Stella Carakasi	The company primarily operates in the clothing industry. Stella Carakasi was founded in 2012 and is headquartered in Berkeley, California.	E-Commerce, LOHAS & Wellness, Clothing	stellacarakasi.com	Berkeley, CA	Seed Round
StixFresh	Developer of a food sticker created to curb fruit wastage. The company's sticker coating contains compounds that plants naturally make to protect themselves from predators and can be easily used, keeping fruit fresh up to seven days longer.	FoodTech / Other Consumer Non-Durables	stixfresh.com	Kirkland, WA	Product Crowdfunding

Source: PitchBook, 2019

Interview

Urs Wietlisbach

This interview contains views which originate from outside Chief Investment Office Global Wealth Management (CIO GWM). It is therefore possible that the interview does not fully reflect the views of CIO GWM.

Urs Wietlisbach
Partner, Co-Founder, and Member of the Board of Directors, Partners Group

Urs, how important is reducing waste to improving financial and environmental outcomes?

Waste management is going to play an increasingly important role in delivering commercial returns, as well as tackling the climate crisis. The sector is growing significantly—we expect it to double between 2017 and 2025. And although the majority of people think waste starts in the home, residential accounts for only 10% of it. Bigger areas of waste generation and opportunity are in the construction and industrial sectors.

In what ways can private capital investments play a role in tackling waste?

There are multiple investment channels to tackle waste. It's easiest to illustrate their diversity by giving some specific examples.

First, we have made a number of investments into catering and grocery businesses that explicitly tackle food waste while delivering commercial returns. In one Partners Group investment into an organic grocery chain in Brazil, we identified significant food waste because customers wouldn't buy blemished goods. Creating a process to turn these otherwise discarded fruits and vegetables into soups has cut food waste and generated savings of around USD 600,000 per year. Similarly, we made an additional substantial investment into a Western European cafeteria business; the money was used to create software that shows managers and cooks what people eat at different times of the year. The data collected helped the company to design seasonal eating plans to meet demand and reduce waste—and the investment's payback period was just a year and a half.

Second, we believe waste-from-energy projects could generate potential investment opportunities. For example, PG Impact Investments came across a Kenyan company that installs lavatories in some of the country's poorest areas. 125,000 people use these every day, improving social conditions and making waste collection cleaner and easier. By introducing worms into the waste, it can be turned into safe organic fertilizer for agriculture, and the worms can be sold as feedstock for pigs, chickens and to fish farms. Importantly, private investments in these areas could provide services at scale, at pace, and at a fraction of the cost of the government doing it.

Third, digitalizing businesses can also be an opportunity to reduce waste. In one of Partners Group's portfolio companies, a European real estate management business, we identified high paper consumption as a critical environmental issue we needed to tackle. By investing in digitalization initiatives, such as launching a platform to share documents with clients and suppliers electronically instead of posting them, the company was able to reduce its paper consumption by 49 tons in a year, equivalent to saving 1,180 trees.

Mainstream companies with potential for corporate engagement to improve company waste management and commercial performance

A third category includes mainstream companies with potential for corporate engagement to improve company waste management and commercial performance.

This category applies to companies that seem not to be addressing waste management in their operations but for whom waste is material to their operations (i.e., it has a large impact on their commercial performance). Examples in this category include:

– Engagement opportunities in equities and bonds of companies that tend to tackle pollution and waste less proactively than their peers, and that operate in sectors where waste is of material importance and where sentiment toward waste is negative (i.e., companies view waste as a business risk rather than an opportunity).

Examples of investors using engagement strategies to reduce waste, emissions, and pollution could include: encouraging construction firms to apply new design and build techniques that reduce waste; pressing them to reduce waste and raise efficiencies across supply chains; and engaging with them to drive up energy-efficiency levels both in new and in existing buildings.

However individual investors are unlikely to be able to engage directly with companies to drive waste and pollution reduction. Engagement is more likely to take place through an investment manager that uses commercial expertise and their financial power (as a significant holder of company equity or debt and with potential voting or board influence) to effect corporate change that can improve company performance and enhance investor returns.

One way to identify engagement opportunities could be to use a waste and pollution data set to establish the materiality of waste for business operations and then use search techniques to scan a variety of information sources about the company to see how frequently they mention waste or related terms (as a proxy for their actions on tackling waste or related terms in their business) or to gauge their sentiment towards waste (i.e., whether waste is perceived as an opportunity or a threat). In the next column is one example from UBS Evidence Lab of how such search techniques could work (see further regional, country-level, and sectoral details in the next chapter).

UBS Evidence Lab search techniques: How do they work?

UBS Evidence Lab is developing a set of search technique tools that can identify particular search terms related to a broad theme (such as waste) and find terms that frequently occur together with the original thematic search term (such as energy waste co-occurring with the term waste) in a statistically meaningful way.

The search technique tools would then search across multiple data sources (including earnings calls transcripts, news, blogs, industry journals, company fillings, and UBS Group Research reports) and aggregate the number of mentions of a thematic term (like waste) or related terms (such as energy waste or food waste).

Over time such search technique tools could be extended to analyze the sentiment around a theme and its related search term(s). For example, do companies talk about waste in a positive way (as a driver of revenue, for example) or in a negative one (as a source of costs, for example)?

Knowing how often a search term is mentioned across company publications can indicate the importance of that theme and related search terms to a company's day-to-day operations or financing. Such search technique tools can also be combined with sustainability data sets to identify companies, regions, or sectors where waste is not frequently mentioned in company data (and by inference is not a high operational or financing priority), but where waste is material (i.e., waste has a major commercial influence on a company's costs or revenues).

Chapter 5

Regional, country, and sector insights on waste

Powered by UBS Evidence Lab

Source: Gettyimages

Our analysis in collaboration with UBS Evidence Lab, of waste and pollution data and search techniques across regions, countries, and sectors yields three main insights about trends in waste. These may indicate opportunities to tackle waste and pollution in a more targeted way, such as through an engagement strategy.

1) American companies mention waste most often but tackle it less proactively than Asian or European companies.

The average number of corporate mentions of waste or related terms for American companies is nearly 50% higher than for those in EMEA and more than double those in Asia. However, aggregate waste and pollution data suggests that while American firms talk most about waste, they may be less proactive in actually tackling it than companies in other regions.

In addition, corporate sentiment toward waste is most positive in APAC and less so in the Americas and EMEA, potentially suggesting Asian companies see waste as more of a business opportunity (i.e., a way to reduce costs or open new lines of revenue) than a risk.

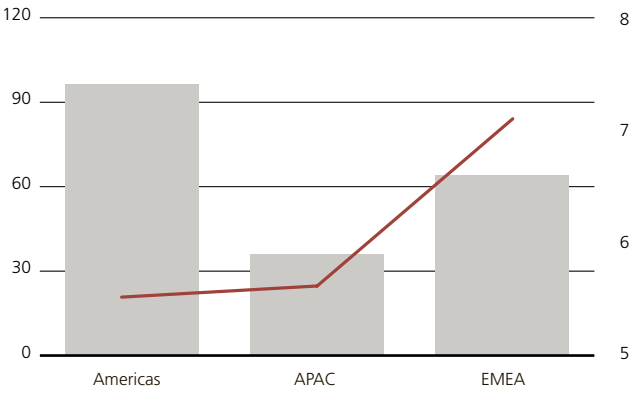
Overall this data indicates that companies in the US mention waste most frequently (as it may be particularly material to their operations), but offer the most potential for improvement on waste and pollution reduction (including through engagement strategies).

2) The majority of countries where waste is most often mentioned appear least proactive in tackling it.

Companies in France and the US mention waste more frequently than other countries. Nevertheless, it's interesting to note that in many of these countries companies generally tackle waste and pollution less proactively than others, especially when compared to companies operating in Northern and Western Europe.

Fig. 30

American companies talk most about waste but seem less proactive in tackling it



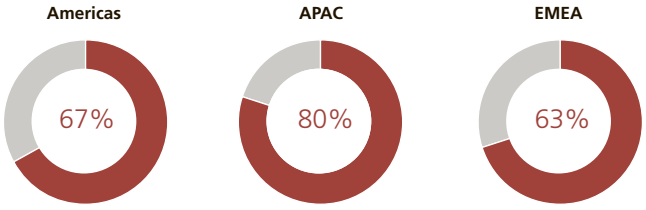
Average number of mentions per company (2010–2019, companies with at least one waste keyword mentioned, left scale)

Average pollution and waste score (CIO methodology, as of January 2020; industry average calculated based on MSCI ACWI companies only, right scale)

Source: UBS Evidence Lab, UBS CIO GWM, as of February 2020

Fig. 31

Share of positive and neutral sentiment about waste in all mentions



Positive and neutral sentiment

Negative sentiment

Source: UBS Evidence Lab, UBS CIO GWM, as of February 2020

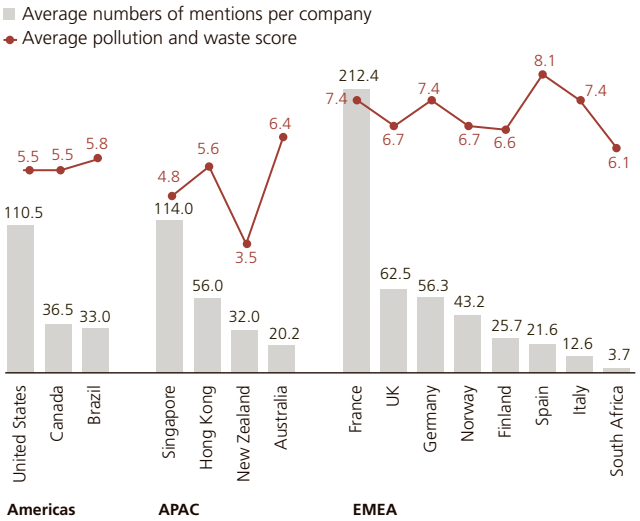
There are a number of possible explanations for these results, including stricter environmental regulation or increased stakeholder pressure to tackle waste in Europe relative to other parts of the world. However, the data may offer investors particular pointers on those countries where companies in certain parts of Europe stand to benefit most from tackling waste and pollution more proactively.

3) Companies in sectors where waste is important mention it more (on average) in their company reports. However, these companies also tend to manage pollution and waste less proactively than companies in other sectors.

This suggests that companies that produce the most waste as part of their operations are well aware of its importance (and so discuss it more frequently in company disclosures or other news reports). Nevertheless, they seem to manage waste and pollution less proactively than companies operating in other sectors.

Fig. 32

The majority of countries where waste is most often mentioned appear least pro-active in tackling it



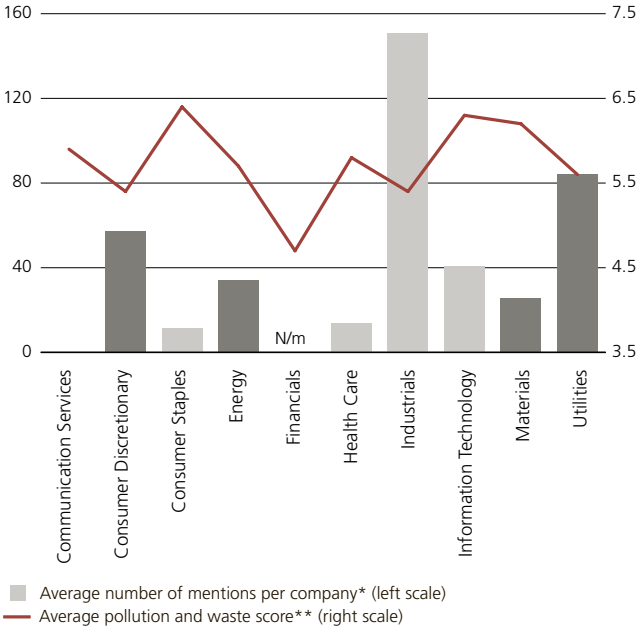
Source: UBS Evidence Lab, UBS CIO GWM, as of February 2020

This data may offer insights as to where investors could engage with corporate managers to improve waste management practices and most effectively boost corporate and financial performance. Logically it would make sense to target companies working in sectors where waste matters most, and companies that have a less proven record of managing waste and pollution relative to peers.

Industrials are a notable outlier in this sectoral analysis. Companies in this sector mention waste (on average) the most and seem to tackle it proactively, yet waste is not deemed material for the aggregate sector as a whole. Here aggregate data hides the wider variation at the subsector and company level, with waste being material for some parts, but less so for others.

Fig. 33

Companies in sectors where waste is material mention it more…yet seem less proactive in tackling it



* 2010–2019, companies with at least one waste keyword mentioned.. Material industries in darkened color. N/m refers to insufficiently lower number of companies with mentions.

** CIO methodology, as of January 2020; industry average calculated based on MSCI ACWI companies only.

Source: UBS Evidence Lab, UBS CIO GWM, as of February 2020

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