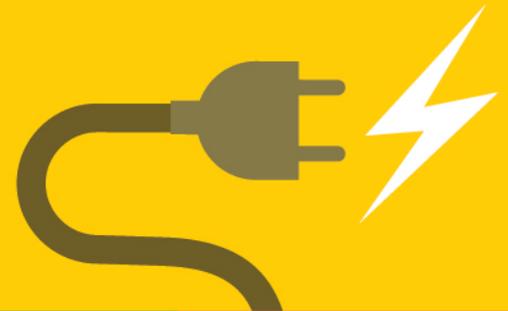


Together We Can:

8 Habit changes for below 2°C

- SAY NO TO CARS
- FLY LESS
- WATCH ELECTRICITY BILLS
- CHANGE ONLINE HABITS
- RETHINK DIETS
- CUT FOOD WASTE
- TWEAK ONLINE SHOPPING
- SLOW DOWN FAST FASHION



Together We Can:

8 Habit changes for below 2°C

Authors:

Dawn McGregor
Debra Tan
Woody Chan

Published:

Mar 2022

Copyright:

© China Water Risk,
All rights reserved, 2022

Graphics & layout:

Cheddar Media
cheddarmedia.com

Contact us:

For any enquiry,
please contact:
info@chinawaterrisk.org

Without cutting enough emissions on time, we are heading towards a 2°C - 3.7°C warmer world by 2100 and with it, an onslaught of worsening climate impacts. Water is how “feel” most climate impacts and to reduce water risks, we must also rein in emissions. So, while this is not a typical water & climate risk report from CWR, we felt that we must do this to help people save both water and emissions.

In an ideal world governments, companies and investors would be leading the charge but they aren't. UN secretary-general António Guterres described the latest Sixth Assessment IPCC report released in February 2022 as “*an atlas of human suffering and a damning indictment of failed climate leadership*”.

Many of us want to do something about climate change but don't know where to start or feel disempowered as our actions are insignificant. The IPCC is calling for transformative changes in our economies, cities, energy and food systems as well as consumerism and lifestyles – these, at the most basic level are our actions, which we can do something about.

With this report you can find out how to take action and it shows that if enough of us made simple habit tweaks across eight areas of our daily life from food, online shopping to internet surfing plus more, we could save more than two billion tonnes of greenhouse gas – equivalent to the combined emissions of Japan and South Korea in 2015.

The habit changes were selected because they are very doable and because of their significant impact and despite using the latest scientific data, multiple assumptions had to be made as many data gaps persist.

Although by no means exhaustive, there is something for everyone to do in this guide, which aims to inspire but not prescribe habit changes. Together we can.

About CWR

CWR (China Water Risk) is a non-profit think tank that aims to create a world where water and climate risks are embedded in business & finance. Since its launch in 2011, it has worked from its Hong Kong base to engage with global business and investment communities in understanding and managing various types of water and climate risks in China and across Asia. CWR's collaborative reports with financial institutions, IGOs, scientists as well as government related bodies have been considered ground-breaking and instrumental in understanding Asia's water challenges. They have help inform better decision-making today for a water secure tomorrow. Join the conversation at www.chinawaterrisk.org

Acknowledgements

CWR would like to thank Nelson Leong for making this report possible.

ABBREVIATIONS

APAC	Asia Pacific region, including East Asia, South Asia and Oceania
CDP	Carbon Disclosure Project
CO₂e	Carbon dioxide equivalent
EIB	European Investment Bank
EVs	Electric vehicles
GHG	Greenhouse gases
GtCO₂e	Gigatonnes of carbon dioxide equivalent
HKH	Hindu Kush Himalayas
IEA	International Energy Agency
IPCC	Intergovernmental Panel of Climate Change
kgCO₂	Kilograms of carbon dioxide
kgCO₂e	Kilograms of carbon dioxide equivalent
Kg/cap	Kilograms per capita
MtCO₂e	Million tonnes of carbon dioxide equivalent
PTSD	Post-traumatic stress disorder
SLR	Sea level rise
tWh	Terawatt hour (1 billion kWh), a unit of energy consumption

TABLE OF CONTENTS

5	FOREWORD
6	WHY WE ARE WRITING THIS REPORT
8	SECTION I: TOGETHER WE CAN
9	Big savings can be made by people making small changes
12	We can save much more if we all did it
13	SECTION II: WHY TAKE ACTION?
14	It's urgent – we're running out of time
15	If we caused it, we can fix it
19	Nine doom-and-gloom impacts to avoid at all costs
25	SECTION III: ACTIONS FOR A BELOW 2°C WORLD
26	Action 1 – Say no to cars
34	Action 2 – Fly less
43	Action 3 – Watch electricity bills
50	Action 4 – Change online habits
58	Action 5 – Rethink diets
68	Action 6 – Cut food waste
75	Action 7 – Tweak online shopping
83	Action 8 – Slow down fast fashion
92	METHODOLOGY
94	DISCLAIMER
95	REFERENCES



FOREWORD

We are living in extraordinary times. For the first time in the history of humankind we are facing a crisis that may destroy the earth's ecosystem and many of us along the way. It is a crisis that is mostly human made. Yet, many of us go about our lives ignoring this crisis or believing that it doesn't actually exist.

Well, it does exist - climate change and its impacts on us and planet earth are real. It's not something that will happen in the future, it is here already. The latest IPCC Sixth Assessment reports released in August 2021 and February 2022 are full of facts and science that paint a bleak picture of our future if we do not cut enough emissions on time. UN secretary-general António Guterres says its "*an atlas of human suffering and a damning indictment of failed climate leadership*", which is why it is important for us as individuals to step up.

Time is running short, but it has not run out. We still can make an impact. According to the IPCC, there's a narrowing window of opportunity to limit global warming to 1.5°C; and stay well below 2°C by 2100. Its recent report calls for transformative changes in our economies, cities, energy and food systems as well as consumerism and lifestyles – these, at the most basic level are our actions, our habits.

So, what can we do? There is an enormous amount of facts and data out there on climate change, making it difficult to know what we can do about it. Plus, we all have busy lives, and it is very easy to put the blame and the lack of action on our governments, businesses or financial systems. But we can and must do something in this eleventh hour.

With this report you can find out how we as individuals and we as a group can do something. In fact, we can actually do quite a lot. The habit changes highlighted in this report across 8 everyday action areas are by no means exhaustive – it only scratches the surface. But it is a start, and the point of the report is to show that individuals can help cut emissions with only small changes to our lifestyles.

The report is meant to inspire, not prescribe. Also, many data gaps still exist, and multiple assumptions had to be made. So, while this report is far from perfect, it still serves to inspire individuals to make a start; and starts don't have to be perfect they just have to happen.

I hope everyone that reads this report will learn something about climate change and then make some or all of the 8 actions part of their daily lives. And also spread the word. The power of one is strong, the power of a group is even stronger. We can all make a positive impact towards the survival of this wonderful and beautiful planet we call home.

Together we can.

Nelson Leong



WHY WE ARE WRITING THIS REPORT

We have all heard about climate change – and it’s already here. In a matter of months, Australia went from fighting fires the size of England to severe floods between late 2019 and early 2020.^{1,2} This coincided with Antarctic temperatures rising above 20°C for the first time on record.³ In the US, sea level rise (SLR) has been accelerating and fire seasons in California may become a year-round phenomenon.^{4,5} In Southeast Asia, changing monsoon patterns are affecting water resources. In Europe, England could face water shortages in 25 years.^{6,7} Water shortages and natural disasters are expected to become even more frequent and severe as our world warms. Without unprecedented change, we are heading towards at least a 2.7°C warmer world by the end of this century.⁸ This is our new climate reality.

Just a few degrees warmer makes a big difference. We know how bad global warming is for coral reefs, the Arctic and Antarctica. The consequences for people are also dire.⁹ A third world war may be unimaginable but the death toll from air pollution alone if our world warms by 2°C instead of 1.5°C by 2100 is estimated at 150 million people – twice the number of those who perished in World War II.¹⁰ The impacts could snowball (see ‘9 doom-and-gloom impacts to avoid at all costs’ in Section II).

The good news is we can fix it but the clock is ticking. To limit warming by 2°C by 2100, we have only eight years left to raise our current ambitions on cutting greenhouse gas (GHG) emissions by three times.¹¹ Yet emissions are still rising (see ‘It’s urgent – we’re running out of time’ in Section II).

Governments have faltered, so it’s up to us to take action. In an ideal world, governments should be addressing climate change. But they are mostly failing to plan for the inevitable crises ahead, as evidenced by the lack as evidenced by the disappointing United Nations Conference on Climate Change COP 26 in November 2021. The United States, once expected to exercise global leadership, pulled out of the Paris Agreement on Climate Change that went into force in 2016, although it re-joined with a new president taking office in 2021.¹² Companies, investors and banks are meanwhile moving too slowly, almost entirely addicted to business as usual. So, it is up to us to take action as we are responsible for our bad habits too (see ‘If we caused it we can fix it’ in Section II).

All this is daunting, but we remain positive. We do not believe that individuals don’t care but are simply overwhelmed by the problem and not sure where or how to take action. By writing this report, we hope to use science-based evidence to show that if enough of us take action we can make a difference.

We can affect greenhouse gas emissions through changing habits across 8 actions. When everybody stayed in and cut back on consumption during the COVID-19 outbreak in 2019-20, global GHG emissions dipped.¹³ We clearly have the power to reshape a 2°C world, but can we sustain this when the lockdown eases? What good habits can we maintain post-pandemic? We have set out in this fact-based report simple actions across 8 areas to form new habits for a below 2°C world:

1	Action 1 Say no to cars	2	Action 2 Fly less
3	Action 3 Watch electricity bills	4	Action 4 Change online habits
5	Action 5 Rethink diets	6	Action 6 Cut food waste
7	Action 7 Tweak online shopping	8	Action 8 Slow down fast fashion

Together we can save 2 Gt; equivalent to the combined GHG emissions of Japan and South Korea in 2015. Although the list of actions in this report is by no means exhaustive, we have used these 8 action areas to demonstrate the possibility of a 'big save' through collective action. By tweaking various habits across 8 action areas, we can save 2 GtCO₂e; this is equivalent to the 2015 GHG emissions of Japan & South Korea, combined. Climate change is not too big to solve.

If all of us took two food actions, savings could reach 8 billion tonnes. Saving our planet is not just down to high consuming groups from developed countries - those from developing countries also have a part to play in avoiding excessive consumption. Savings can be massive if we all took action in a single area – food, one of our most carbon-intensive daily activities. For example, if everyone in the world shifted 30% of their consumption of ruminant meat (from cattle and sheep) to plant-based foods and cut food waste by 25% by 2050, we could save up to 8.1 GtCO₂e a year¹⁴, which is more than the GHG emissions of the US in 2015.

We can build on COVID-19 emission cuts for a greener and more livable future. COVID-19 has provided a reprieve although estimated emission reductions of 4-7% by the end of 2020 are not enough. Getting back on track for 1.5°C by 2100 would require the pandemic to last another decade.¹³ It's time to take an honest look at our lifestyles, cut wasteful habits bad for the planet and take on new ones that will save it.

The choice is ours – change our individual habits collectively or perish. Actions to cut GHG emissions and reduce COVID transmission are similar. Both require individual and collective action. A single person is not going to stop climate change or prevent the spread of the virus. But collective action can succeed. It's time to be smart and responsible about our daily decisions.

Climate change is not too big to solve,
The power lies with each of us,

Together We Can.

Section I

Together We Can



Big savings can be made by some people making small changes

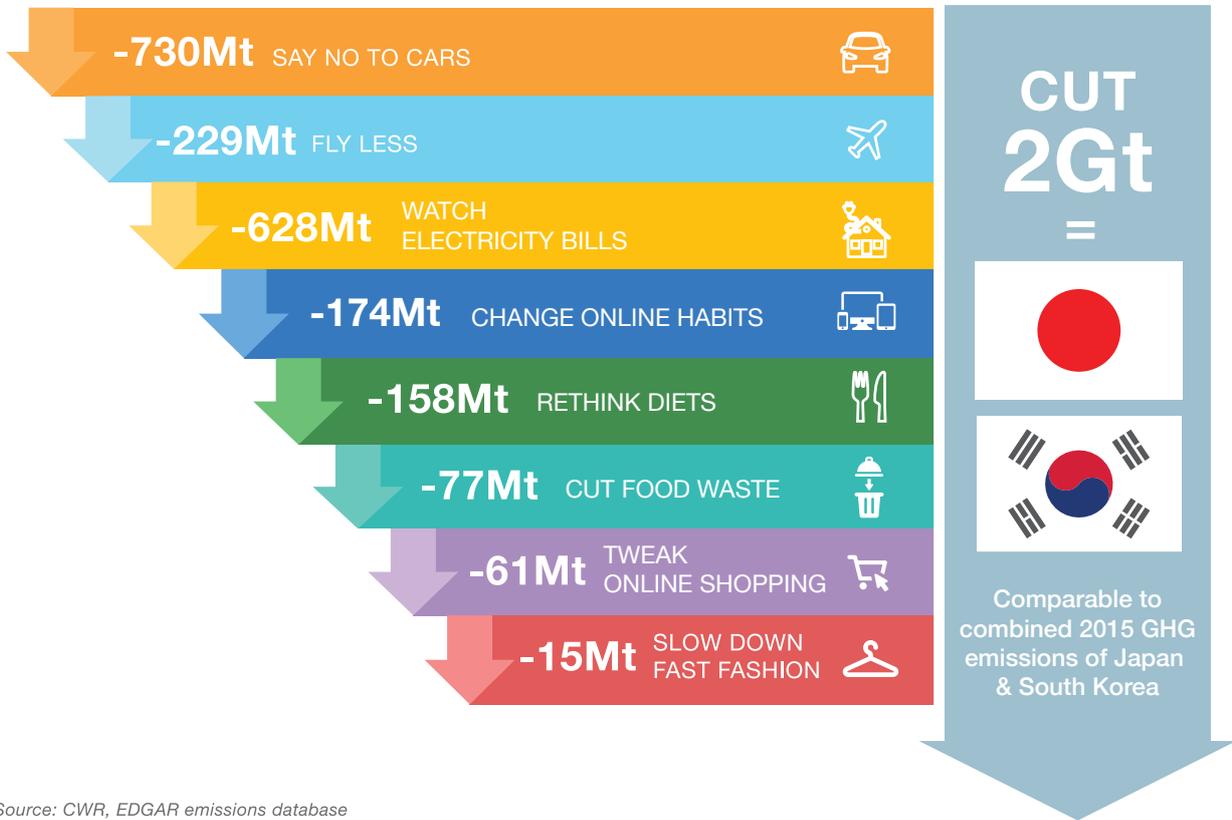
8 actions = 2 Gt saved = 2015 GHG emissions of Japan + South Korea

If some of us made small changes to our habits, greenhouse gas (GHG) emissions equivalent to those of Japan and South Korea in 2015 could be saved.¹⁵ Country GHG data used in this report is the latest full country data set available from the Emissions Database for Global Atmospheric Research (EDGAR) at the time of writing the report, which was 2015. We have identified habits we can realistically change in eight action areas. Based on scientific studies, we have also identified high-consumption groups who can do more.

With these parameters, we estimate that about two gigatonnes (two billion tonnes) of carbon dioxide equivalent (2 GtCO₂e) can be saved if people make simple changes to habits across the eight areas.

Note: The terms “people” and “willing individuals” are based on data available for each action, or as close to each action where people were willing to change their habits. Sources for all data are included in the text and graphics.

 CWR IF SOME PEOPLE CHANGED SOME HABITS IN 8 ACTION AREAS = CUT JAPAN'S & SOUTH KOREA'S GHG EMISSIONS COMBINED



Source: CWR, EDGAR emissions database
 NOTE: methodology for collective cuts is in this report
 © CWR, 2022 all rights reserved

Breaking the 2 GtCO₂e down ...

1

Action 1

Say no to cars

We can save 730 million tonnes if willing individuals from the US, the EU and China (the world's top car owners) commit to the following, with savings equivalent to the combined GHG emissions of Chile, the UK and Singapore in 2015:

- Walk instead of taking a five-minute drive every day for a year; and
- Take a train instead of a 15-minute drive every day for a year.



2

Action 2

Fly less

We can save almost 230 million tonnes if willing individuals from the US and China (two countries with the most flyers) commit to the following, with savings equivalent to the combined GHG emissions of Singapore, Ethiopia and Honduras in 2015:

- Cut one short-haul flight (about 1,400 km) once a year;
- Switch one long-haul flight (about 5,500 km) to a short-haul flight once a year; and
- Fly economy (business class emits three times more carbon).



3

Action 3

Watch electricity bills

We can save almost 630 million tonnes if willing individuals from the US, EU and China (3 regions with highest residential electricity consumption) commit to the following, with savings equivalent to the GHG emissions of the UAE, Qatar and Philippines in 2015:

- Halve air conditioner use for a year and use a fan instead; and
- Take 3 minute instead of 6 minute showers a day for a year.



4

Action 4

Change online habits

We can save more than 170 million tonnes if willing individuals from the US, the EU and industrialised Asia (3 regions with the highest data consumption) commit to the following, with savings equivalent to the combined GHG emissions of Singapore, New Zealand and Cambodia in 2015:

- Stream half of online videos over WiFi instead of mobile networks for a year; and
- Cut social media use by one hour a day for a year.



Breaking the 2 GtCO₂e down ...

5

Action 5 Rethink diets

We can save nearly 160 million tonnes if willing individuals from Argentina, the US and Brazil (the world's top 3 beef consumers) along with the EU, China and South Korea (the top 3 pork consumers) commit to the following habits, with savings equivalent to the combined GHG emissions of Hong Kong, Singapore and Denmark in 2015.

- Eat one fewer 8oz (220 gram) steak a week for a year; and
- Eat one fewer 4oz (110 gram) pork chop a week for a year.



6

Action 6 Cut food waste

We can save just over 75 million tonnes if willing individuals from the US, the EU and industrialised Asia (3 regions which waste the most food) commit to the following, with savings equivalent to the combined GHG emissions of Hong Kong and Croatia in 2015:

- Cut 10% of food waste for a year.



7

Action 7 Tweak online shopping

We can save just over 60 million tonnes if two thirds of online shoppers from the US, the EU and China (3 regions with more than 80% of global online shoppers) commit to the following, with savings equivalent to the combined GHG emissions of Switzerland, Liechtenstein and Honduras in 2015:

- Cut one online shopping return a month for a year; and
- Choose standard instead of express delivery twice a month for a year.



8

Action 8 Slow down fast fashion

We can save 15 million tonnes if willing individuals from the US and the EU (which consume about three times more apparel a year than the world average) commit to the following, with savings equivalent to cutting 20% of Hong Kong's GHG emissions in 2015:

- Buy 1 fewer pairs of jeans and 3 fewer t-shirts a year; and
- Extend the lives of a pair of jeans and 3 t-shirts by 9 months.

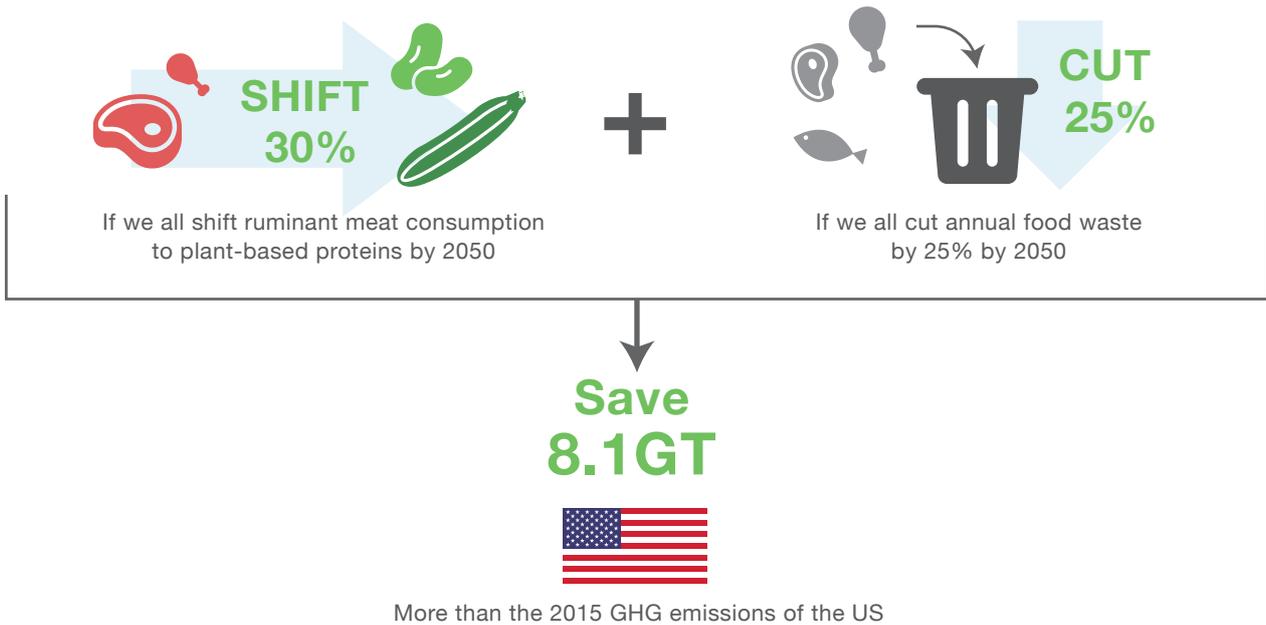


The rationale for selecting these action areas, specific habits and target consumption groups is detailed in the following pages along with ways to do even more.

We can save much more if we all did it ...
2 actions in food = 8 Gt saved > GHG emissions of the US

It's not just high consumption groups from developed countries who can take action. If we all took action, the collective impact would be greater. For example, if 30% of the world shifted the consumption of ruminant meats (from cattle and sheep) to plant-based foods and cut food waste by 25% by 2050, we could save 8.1 gigatonnes (billion tonnes) of carbon a year, more than the greenhouse gas (GHG) emissions of the US in 2015.^{14, 15}

 **CWR** IF WE ALL RETHINK OUR DIETS & CUT FOOD WASTE WE CAN CUT MORE THAN THE GHG EMISSIONS OF THE US



Source: CWR, World Resources Institute report "Creating a Sustainable Future" (2018), EDGAR emissions database © CWR, 2022 all rights reserved

Food: the most important action area

Changing how we eat is one of the most significant ways we can have an impact on the climate. It may not appear as the top priority action listed in this report because we focused on high meat-consuming economies and easily achievable changes to our habits such as eating one fewer steaks a week for a year. If there is only one action you want to take from reading this report, food should be the top priority (see 'Action 5' and 'Action 6' in Section III).

Beyond changing how we eat and habits in the other seven action areas in Section III, there are other ways to ramp up global impacts. Having fewer or no children is a significant way to reduce emissions. Furthermore, not all kids consume equally. In developed countries, having one fewer child can save 58.6 tonnes of GHG emissions a year.¹⁶ So while this was not included in one of the eight actions in this report, it is certainly one of the most impactful climate actions and a point to ponder.

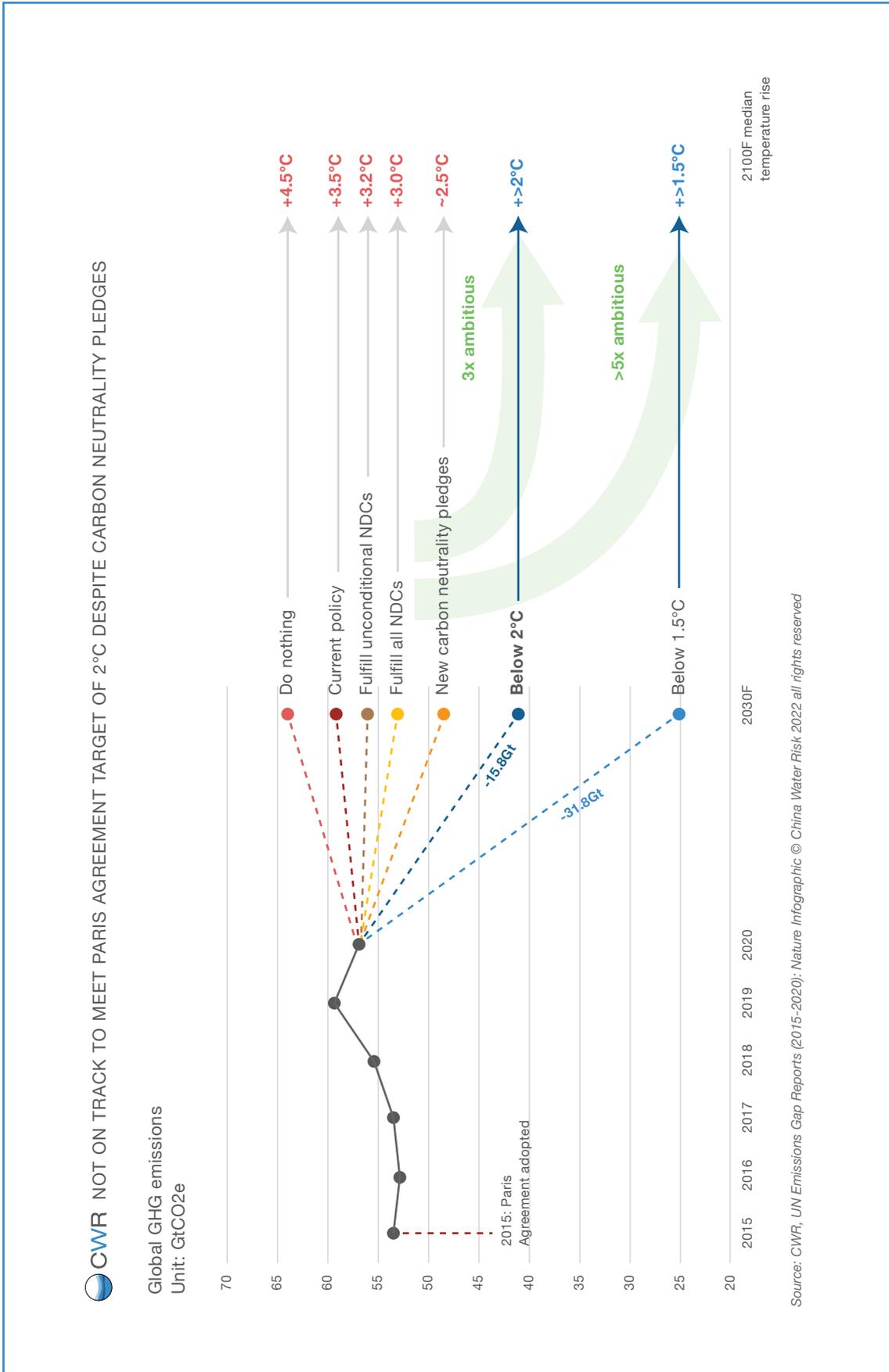
Section II

Why take action?



It's urgent – we're running out of time

To limit warming by maximum 2°C by 2100, we have only eight years left to raise our current ambitions on cutting GHG emissions by three times. Current pledges by countries aren't enough. See graphic below for current pathway options and which path we are on today.



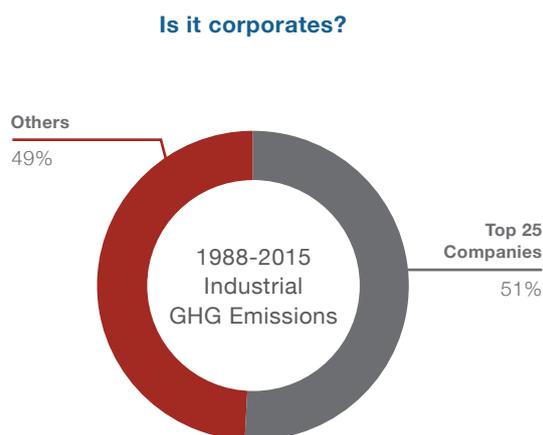
If we caused it, we can fix it...

With a rapidly narrowing timeframe, drastic action is needed to avoid catastrophe. We have already witnessed what such actions look like during the COVID-19 pandemic, which helped slow global GHG emissions. We need to ensure this is not just a blip. But who should be taking action? Should it be companies or industries that have emitted the most? Or is it up to governments? The truth is that we all have contributed to the climate crisis, so we all have a part to play to fix it.

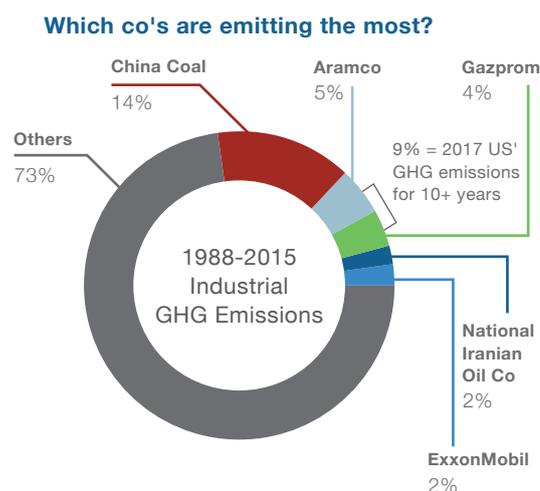
Are companies to blame?

Companies cannot avoid being blamed for contributing to the climate crisis. According to the CDP Carbon Majors Report, 25 companies were responsible for more than half of all global industrial GHG emissions between 1988 - 2015 (see chart below left).¹⁷ That amounts to 433 GtCO₂e in 28 years – or to put it another way, the whole world emitting greenhouse gases at our current rate for eight more years.

Some companies are bigger emitters than others. China Coal, for example, emitted 129 GtCO₂e from 1988 to 2015, accounting for 14% of industrial GHG emissions – equivalent to US emissions at the current rate for another 30 years (see chart below right).^{17, 18} Other big emitters in the same period included Saudi Arabia's Aramco (5%) and Russia's Gazprom (4%). But should fossil fuel companies take all the blame? China Coal helped lift hundreds of millions of Chinese out of poverty while Aramco and Gazprom provided energy to people beyond their own borders. Is there a greener development path? Given the collapse of oil prices during the COVID-19 pandemic, can we fast track the transition towards a low-carbon future?



Source: CWR, CDP Carbon Majors Report 2017



Source: CWR, CDP Carbon Majors Report 2017

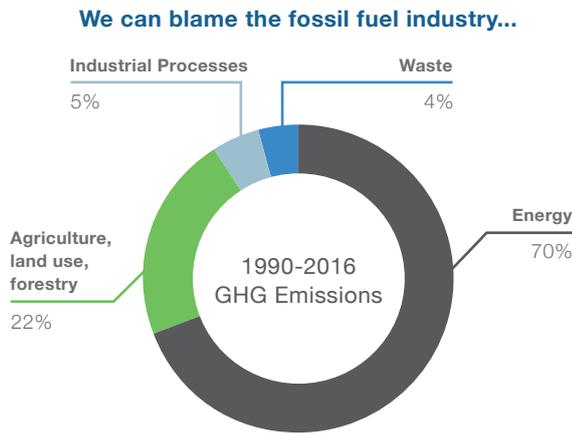
Top 25 Emitting Companies 1988-2015 (MtCO₂e)*

1	China (Coal)	128,933	14	Abu Dhabi National Oil Co	10,769
2	Aramco	40,561	15	Poland Coal	10,480
3	Gazprom OAO	35,221	16	Peabody Energy Corp	10,364
4	National Iranian Oil Co	20,505	17	Sonatrach SPA	8,997
5	ExxonMobil Corp	17,785	18	Kuwait Petroleum Corp	8,961
6	Coal India	16,842	19	Total SA	8,541
7	Pemex	16,804	20	BHP Billiton Ltd	8,183
8	Russia (Coal)	16,740	21	ConocoPhillips	7,463
9	Royal Dutch Shell PLC	15,017	22	Petroleo Brasileiro SA (Petrobras)	6,907
10	CNPC	14,042	23	Lukoil OAO	6,750
11	BP PLC	13,791	24	Rio Tinto	6,743
12	Chevron Corp	11,823	25	Nigerian National Petroleum Corp	6,491
13	PDVSA	11,079			

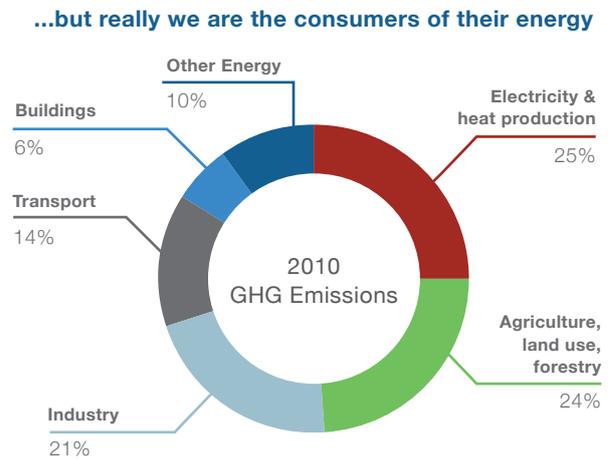
*1988-2015 Scope 1+3 of global industrial GHG
Source: CDP Carbon Majors Report 2017

It's not just fossil fuels – there are also emissions from producing our food & goods

The focus on the fossil fuel industry is understandable – GHG emissions from energy production amounted to 70% of cumulative global emissions between 1990-2016 (see chart below left). But it is not the only culpable industry. Over the same period, agriculture, land use and forestry accounted for 22% of emissions (see chart below left). The chart below right is a snapshot of GHG emissions in 2010. Immediately, it becomes evident that the energy produced by fossil fuel companies is used to manufacture goods and services for us all.



Source: CWR, WRI Climate Watch based on CAIT data



Source: CWR, IPCC "Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change" (2014)

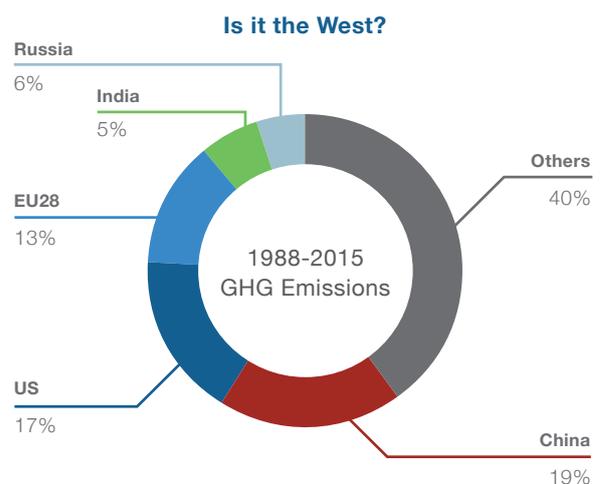
As shown in the above right chart, in 2010, 14% of GHG emissions came from transport and 6% from buildings while 25% was from generating electricity and heat. A further 24% came from agriculture, land use and forestry – key to our food production. We cannot survive without food and it's difficult to forego transport and electricity. What we can do is cut out unnecessary trips and excessive consumption to reduce demand on these carbon-intensive industries (see 'Action 1', 'Action 2', 'Action 5', 'Action 6' and 'Action 8' in Section III).

The "West" and industrialised Asia versus developing countries?

It's no secret that the rapid industrialisation of the "West" played a big part in getting to where we are now with climate change.

The US, the EU and Russia together emitted more than a third of global GHG emissions between 1988 and 2015 despite accounting for only 13% of the world's population.¹⁹

China and India, with rapid development, have been catching up, together accounting for 24% of emissions over the same period. This is understandable – China accounted for 19% of the world's population in 2015 while India accounted for 18%. But on a per capita basis, neither country is among the Top Ten emitting countries.



Source: CWR, European Commission report "Fossil CO₂ and GHG emissions of all world countries, 2019 report"

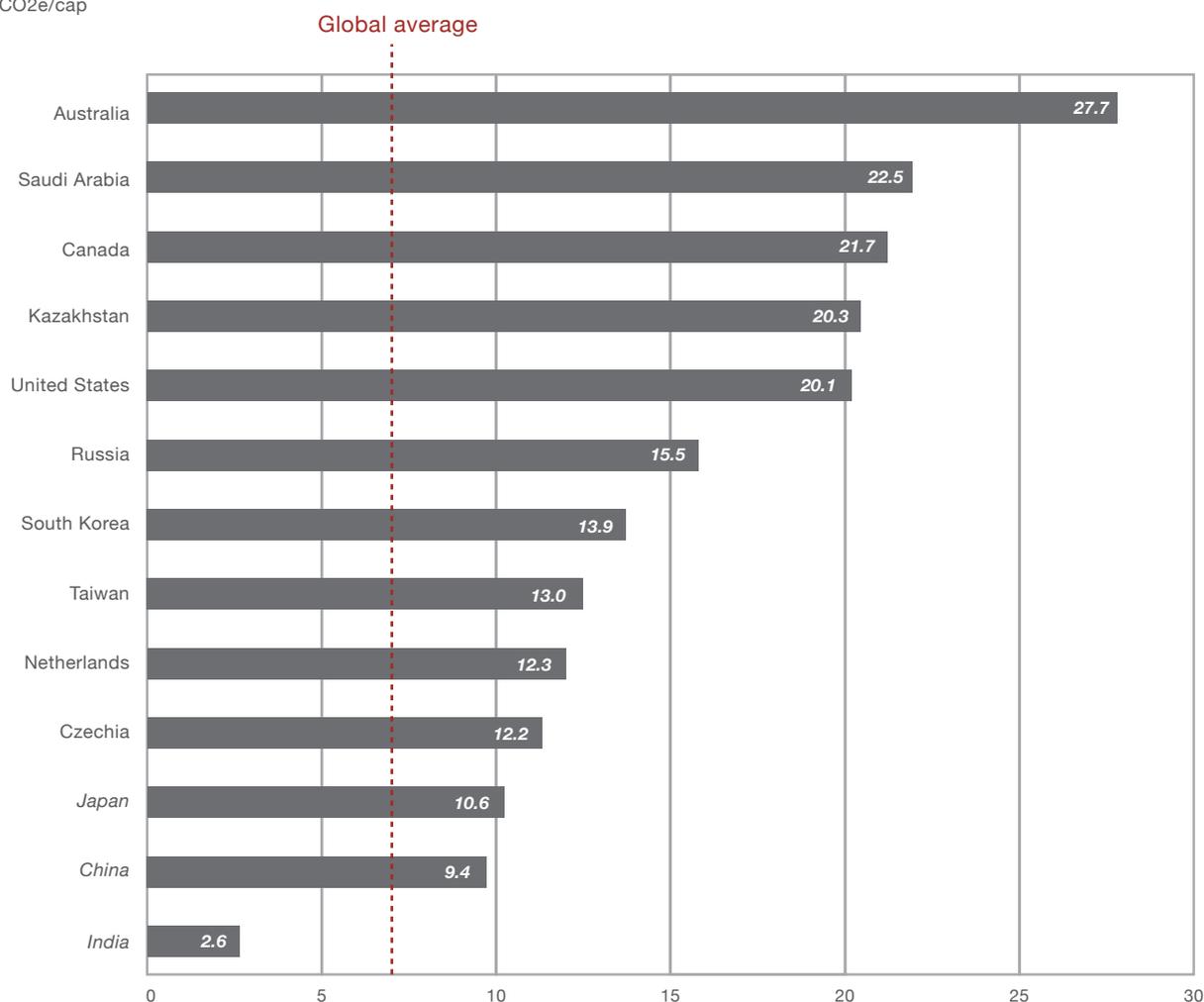
Top 10 highest per capita GHG emitters – are they the worst offenders?

The chart below shows the Top 10 countries with the highest emissions per capita in 2015. Australia tops the list at almost 28 tonnes of carbon equivalent (tCO₂e) per capita – almost 40% higher than the US and nearly three times the per capita emissions of China. While the Top Ten is dominated by major oil and gas producers, it includes South Korea (ranked 7th) and Taiwan (8th). Countries with lower emissions per capita include Japan (13th), China (18th) and India (47th).

If China and India were as “developed” as Australia and the US with their carbon-intensive habits, Chinese and Indian emissions would be sky high. Something has to give on all sides - emission-intensive countries should make drastic cuts whereas developing countries need to avoid over-consumption.

Top 10 highest per capita GHG emissions (2015)

Unit: tCO₂e/cap



Source: CWR, European Commission report "Fossil CO₂ and GHG emissions of all world countries, 2019 report"
 NOTE: only includes countries with a population higher than 10 million

Producers versus consumers – who's the guilty party?

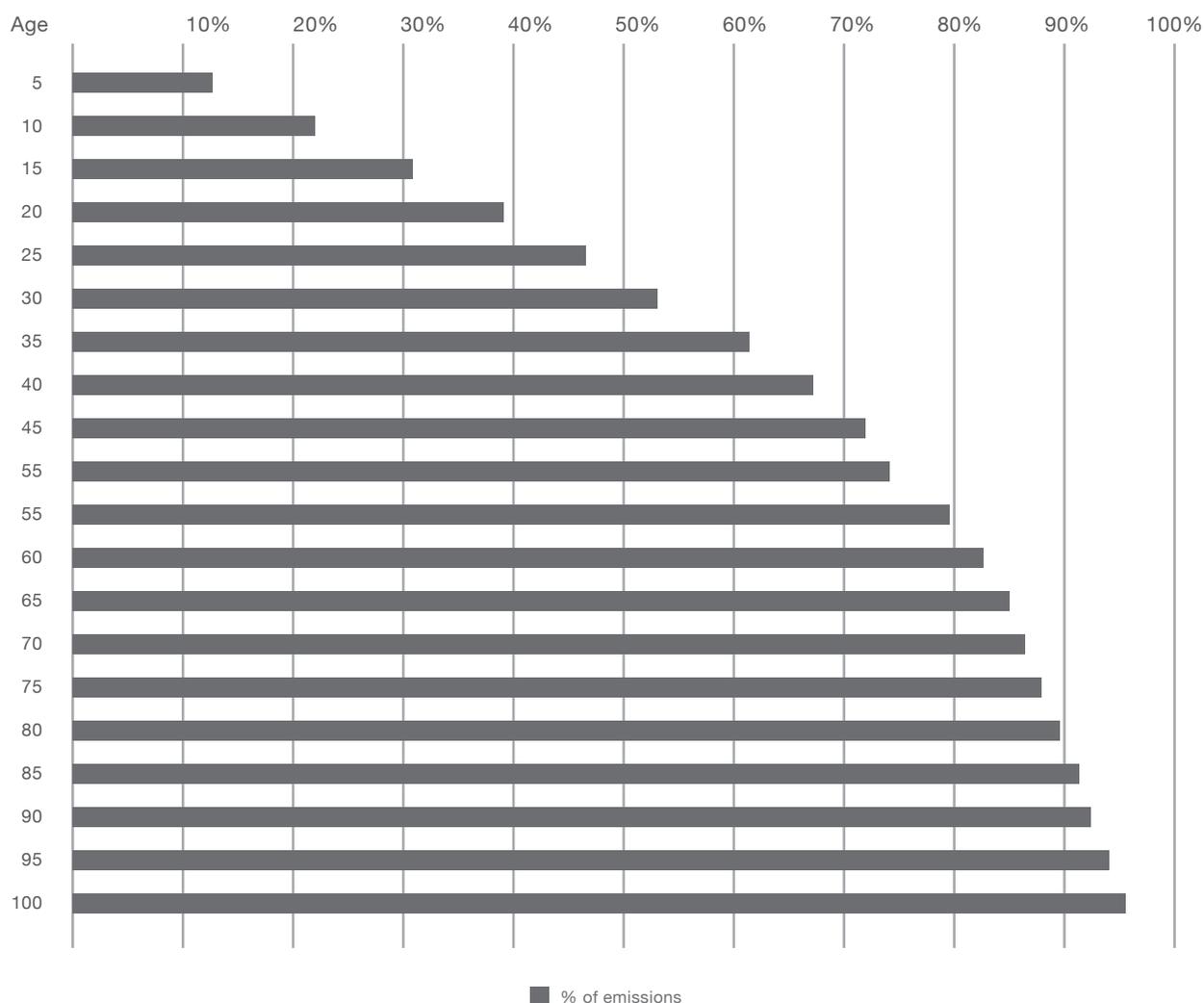
Countries like China, Australia and Saudi Arabia are big emitters because of the goods they make or the energy they produce. But who are the end consumers? About 70% of the oil produced in Saudi Arabia is exported and about two thirds of the energy consumed in China is by industry - and who doesn't own something made in China? ^{20, 21}

We need to look beyond production-based accounting of emissions to a consumption-based system to find out who is fuelling demand. We all need to cut back on consumption. We need new habits going forward to minimise the impacts of the climate crises ahead.

Youth also have a big role to play

Climate change cannot be blamed on older generations alone. As shown in the chart below, if you are 30 years old, more than half of all global fossil fuel emissions have occurred in your lifetime – about 9% of emissions for every five years of your life. With more than 80% of emissions occurring in the lifetime of a 60 year old, emissions every five years are less than 7%.

What percentage of global fossil fuel emissions (since 1751) have occurred in your lifetime?



Source: CDIAC

NOTE: refers to total carbon emissions from fossil fuel consumption and cement production; ages counted from 2014 due to data limitation

This is in part due to our increasingly power-hungry lifestyles. Flying used to be a luxury but is now widespread. Whereas households used to have one telephone, each member of most households now has at least one smartphone with additional functions like taking photos, navigating, sending and receiving emails and other messages, watching videos and dating. And whereas fashion used to be divided into four seasons, there are now as many as 52 with different clothes arriving every week at fast fashion stores (see ‘Action 8’ in Section III).

We often hear that technology can save us. Can technology address power-hungry lifestyles? Renewable energy, carbon capture, more efficient industrial processes and green buildings may reduce emissions. But a more holistic approach is required, especially to take into account new industries as they emerge. Bitcoin, for example, has been around for little more than a decade as the first cryptocurrency. But fossil fuel emissions from mining coins have overtaken emissions from all global solar power production to date.²² Such impacts are largely hidden as we unwittingly stack up unnecessary carbon emissions (see ‘Action 4’ in Section III).

The COVID-19 pandemic has given a taste of what’s needed to save the planet. With lives at stake, governments took drastic actions, companies adapted and individuals changed their habits.

9 doom-and-gloom impacts to avoid at all costs

We are clearly heading towards a climate crisis, but what does that really mean? Stranded polar bears? Flooded villages? Fewer coral reefs? It's hard to see how things like this impact everyday lives. Yet, the consequences of inaction risk huge repercussions. According to the UN Secretary-General, climate change is now an "existential threat" to humanity – endangering our very existence.²³ Below are nine concrete examples of what a warming world could bring.

It's not just happening tomorrow, it's already happening now.

1. Increasingly uncertain water availability

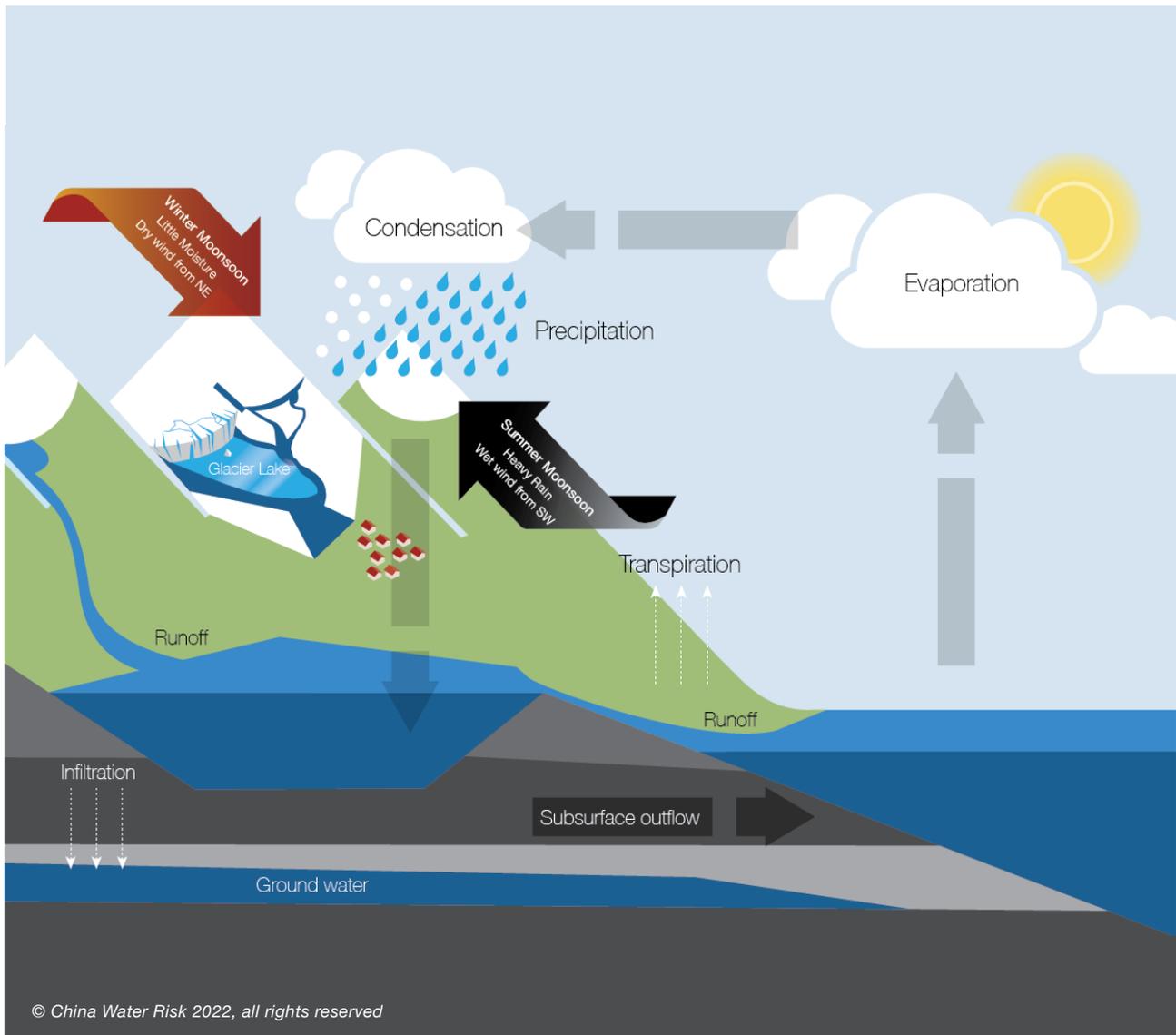
Water is life. We cannot survive without it. And the worrying news is that water is the most vulnerable resource to climate change and increasingly the climate crisis is threatening our freshwater availability. Just look at Cape Town – a global city that got dangerously close to running out of water, "Day Zero", due to mismanagement and unexpectedly low rainfall.²⁴ California, which emerged from seven years drought in 2019, had its driest February since 1864 in 2020.^{25, 26} As global temperatures rise, rainfall patterns are becoming more unpredictable.

Asia's water resources are particularly threatened. Many have heard of the melting North Pole or South Pole but how about the Third Pole? It is located in the Hindu-Kush-Himalaya region (HKH) – spanning Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan – and according to a landmark 2019 report by the International Centre for Integrated Mountain Development (ICIMOD) the glaciers of the HKH region are a critical water store for one in two Asian people. The livelihoods of an estimated 1.95 billion people depend on the 10 rivers that flow from its peaks including the Ganges, Indus, Mekong, Yangtze and Yellow rivers.⁹ According to CWR's report "No Water No Growth – Does Asia Have Enough Water To Develop?" the 10 river basins generate USD 4.3 trillion of GDP per annum, with each river accounting for material shares of country GDP.⁶ For example, a third of India's GDP is generated in the Ganges River Basin on which more than 600 million people depend.⁶

The ICIMOD report – produced by more than 200 scientists – warned that 36% of the glaciers will be gone by 2100 even if carbon emissions are dramatically cut and global warming is limited to 1.5°C. If emissions are not cut, two thirds of the glaciers will be lost.⁹ In either scenario, losses will affect glacier melt, snowfall, rainfall and even monsoon patterns. A separate report by CWR found that the Ganges and Indus rivers were projected to suffer from reduced runoffs by 2055.⁶

Elsewhere, in the US, University of Arizona researchers found in 2018 that the snowpack of the Rocky Mountains had declined by 41% over the previous three decades – equivalent to 8.84 billion m³ of water, enough to supply drinking water to Tucson and Phoenix for four years.²⁷ Lower snowfall is meanwhile set to shorten the winter recreation season across the US. According to a 2017 study, downhill skiing days are likely to be halved in some places by 2050 with as much as 80% fewer ski days at resorts by 2090.²⁸

In Europe, similar patterns can be seen in the Alps which are not just dotted with ski resorts but are also the source of major rivers like the Rhine and the Rhone. In short, freshwater availability worldwide is becoming increasingly uncertain.



2. Extreme storms, floods and droughts: more intense and more frequent

In 2012, Hurricane Sandy left 233 people dead across the Caribbean and North America. Super Typhoon Mangkhut disrupted power for three days in 2018. And millions of Chinese were evacuated during Typhoon Lekima in 2019. Such extreme storms used to be rare but are now projected to occur at least once a year by 2050, especially in tropical regions, according to the Intergovernmental Panel on Climate Change (IPCC).²⁹ Imagine a Hurricane Sandy or a Typhoon Mangkhut battering coasts in the US and Asia every year.

Extreme weather is not limited to storms. The climate crisis is also set to bring more intense and more frequent floods and droughts, with wetter areas likely to become wetter and drier areas getting drier. According to research, a third of the record dry months in Africa would not have occurred without the influence of climate change.³⁰

The Bulletin of the American Meteorological Society reported similar findings.³¹ Researchers found that heat waves off the coast of Australia in 2017 and 2018 would have been 'virtually impossible' without climate change. The heat waves led to the largest loss of glacial ice in the New Zealand Southern Alps since 1962 and major disruptions to marine ecosystems.³²

The climate crisis is also believed to have contributed to a drought in the northern Great Plains of the US and a pounding six-day monsoon storm in northeast Bangladesh in 2017 which affected food production - more on this later (see 'Going hungry').

3. Uncontrollable wildfires

As climate change brings hotter, drier conditions and more lightning strikes, the potential for fires is growing.³³ In 2018, wildfires burned through a record land area in California, killing more than 80 people and destroying 22,750 buildings.³⁴ The wildfire season in 2019 was not as severe but wreaked havoc. In late 2019 and early 2020, wildfires in Australia killed 28 people across the country. They also destroyed some 2,000 homes in the state of New South Wales alone where a record 4.9 million hectares of land was burnt – an area the size of England.^{35, 36} Madrid also succumbed to wildfires and Amazon rainforest fires burnt an area twice the size of India.³⁷

To prevent sparks from high-voltage power lines starting fires, California's largest power utility cut electricity to more than a million residents in 2019, plunging them into darkness for days.³⁸

4. Deadly heat waves

Even without wildfires, hotter weather is causing more heat waves. According to the Union of Concerned Scientists, climate change is likely to make extreme heat and associated health risks much more frequent in nearly every part of the US. By the end of the century, parts of the Gulf Coast could experience more than 120 days a year that feel like more than 37.8°C.³⁹ The World Weather Attribution network meanwhile found that climate change made Europe's record heat wave in 2019 up to '100 times more likely'.⁴⁰

Heat waves can be deadly.⁴¹ When temperatures reach 35°C and sweating cannot cool the body, a healthy person can die within hours, even under shade.³⁸ Heatwaves are already a major risk in South Asia, with a severe heatwave killing 3,500 people in 2015.⁴² Three quarters of the 1.7 billion people on the Indian subcontinent will be exposed to such extremes by 2100, according to a study by the Massachusetts Institute of Technology (MIT).⁴³

What's more, these heat waves will also lead to accelerated snow pack melt and in turn further constrain our limited water resources (see box on 'Tipping points and feedback loops' below).

5. More infectious diseases and poorer mental health

According to *The Lancet*, a leading medical journal, heat stress and heat stroke can exacerbate pre-existing heart and kidney conditions.⁴⁴

At the same time, climate change makes the transmission of infectious diseases like dengue more likely.⁴⁵ Due to changing climates in countries where dengue is endemic, the transmission capacity for one of its main sources – the *Aedes aegypti* mosquito – has increased globally by 9.5% since 1950.⁴⁴ Similarly, *The Lancet* reported in 2019 that the number of days suitable for the *Vibrio cholerae* bacteria in coastal areas had increased by 9.9% since the early 1980s.⁴⁶

Then there are ancient pathogens that could be released as ice melts.⁴⁷ Could these be even more deadly than COVID-19? For more on permafrost thaw and polar ice sheet instabilities, see box on 'Tipping points and feedback loops' below.

Climate change can also harm mental health. According to various studies, 14.5% of people affected by Hurricane Sandy developed symptoms of post-traumatic stress disorder (PTSD)⁴⁸ and 15.6% of a community affected by wildfires showed symptoms several years after the event.⁴⁹ Those not directly affected by climate change can develop 'eco-anxiety' over the existential threat.⁵⁰ The American Psychological Association has defined this as a 'chronic fear of environmental doom'.⁵¹ In the UK, the Climate Psychology Alliance is seeing increased requests for therapeutic support.⁵²

6. Coastal cities under water

Like the drowned city Atlantis, we could find ourselves under the sea sooner than we think. Alarm bells are ringing as sea levels rise due to rapidly melting ice sheets in Antarctica and Greenland. In the first two months of 2020, it was reported that sea levels rose faster along US coasts than in 2019, that Antarctica had its hottest day ever at 20.8°C and that warm water found beneath Antarctica that may accelerate melting.^{53, 54} The IPCC has revised upwards its worst-case sea level projections for by 2100, citing uncertainties in Antarctica.²⁶

Even with only a 1.5°C increase in temperature, rising sea levels will have catastrophic impacts, especially in the Asia-Pacific (APAC) region where many cities are located in coastal areas, according to a series of CWR reports in 2020.⁵⁵ Swathes of coastlines will be redefined. For 20 APAC cities alone, we estimated that 15,006 km² of land would be permanently submerged, displacing up to 28 million people at the 1.5°C locked-in median sea level rise (SLR) of 2.9 metres. These cities generate about USD 5.7 trillion in combined GDP, accounting for more than a fifth of the economic activity of the 14 countries and territories where the cities are located. In addition, we estimated that between 20 and 23 ports would be submerged along with between 12 and 25 airports.

The good news is multiple cities are taking action. Indonesia plans to move its capital from Jakarta which is sinking.⁵⁵ Singapore has set aside SGD 100 billion for tackling coastal threats.⁵⁵ In Europe, scientists are proposing two giant North Sea dams to protect 25 million people from rising sea levels.⁵⁶

7. Climate refugees

With the climate crisis wreaking devastating impacts on homes and livelihoods, the UN has forecast up to 1.5 billion environmental migrants by 2050.⁵⁷

According to a report by the Asian Development Bank (ADB) and the Potsdam Institute for Climate Impact Research, climate change could force mass migration of one billion people by 2100. The Asia-Pacific is the most vulnerable region with Bangladesh, China, the Philippines, the Indus Delta in Pakistan, the Mekong Delta in Vietnam and numerous small island states including Maldives and Fiji most at risk.⁵⁸

Climate change is expected to drive a surge in migrants seeking asylum in Europe, according to a study published in the journal *Science* in 2017. It found that the number of migrants seeking to settle in Europe each year will triple by the end of the century based on current climate trends alone, independent of political and economic factors. Even if efforts to curb global warming succeed, the number of asylum seekers could rise by a quarter.⁵⁹ With the UN ruling that climate refugees cannot be returned home, how will countries cope? ⁶⁰

Climate refugees are unlikely to be limited to Asia and Africa. Wildfires burned down homes in California in late 2019.⁶¹ Fancy houses and skyscrapers along the California coast could be flooded as seas rise and might become uninsurable (see box on next page). Directly or indirectly, climate change will affect both the rich and poor.



An uninsurable world?

As climate catastrophes become more frequent, our homes and assets may no longer be insurable. This is already happening. Over the past five years, California insurers have declined 350,000 insurance renewals. This is not surprising as California's wildfires in 2017 and 2018 cost insurers USD 24 billion in claims, erasing a quarter century of industry profits in the state.

Jacki Johnson, an executive at Australian insurance company IAG, has reportedly said that climate change could essentially make the world uninsurable, a prediction echoed by Henri de Castries, chairman and CEO of French insurance group AXA.

With our homes no longer insurable, we will not be able to mortgage them. This means that we may not be able to sell them either, rendering our assets worthless. Our pensions and savings are also at risk – see more in the box below.

Source: Acclimatise News, Forbes, Environnemental Finance

Even your savings are at risk

Still not convinced that climate change concerns you? Even if water and climate risks do not impact you directly, they could well be impacting the investments your pension fund is investing in. This was the focus of the report by CWR, Manulife Asset Management and Asia Investor Group on Climate Change (AIGCC), "Are Asia's Pension Funds Ready For Climate Change?"

The report identifies five key water and climate risks to illustrate how portfolios of Asian asset owners might be affected. These include the impact on logistics from rising sea levels and storm surges; increasing risks from extreme weather events affecting dense areas and regulatory risk triggered by wateronomic policies. How secure is your pension really?

Source: CWR, Manulife Asset Management and Asia Investor Group report on Climate Change (AIGCC), "Are Asia's Pension Funds Ready For Climate Change?" (2019)

8. Going hungry

Due to growing populations, the world faces an uphill battle to feed everyone. Earth is projected to have nearly 10 billion people by 2050 - about three billion more mouths to feed than in 2010. That means we need to be producing 7,400 trillion calories of food – 56% more calories from crops than in 2010, according to the World Resources Institute.¹⁴

With climate change, food production will become more volatile. As found by the IPCC Special Report on Climate Change and Land, a warming atmosphere is speeding up the rate of soil loss and land degradation. Moreover, higher concentrations of carbon dioxide in oil reduce the nutritional quality of food, and rising temperatures could cut crop yields and harm livestock. The report found that half a billion people already live in places turning into desert, and that soil is being lost 10 to 100 times faster than it is being formed.⁶²

In some cases, a changing climate can increase food production – warmer temperatures can boost yields of some crops at higher latitudes, for example. Overall, however, global crop yields are 'more likely than not' to decline by at least 5% by 2050 without adaptation with even steeper declines by 2100.⁶²

Agriculture and food production are nevertheless key drivers of climate change.⁶³ It's a vicious circle – increased food production accelerates climate change and makes it harder to produce food. Food may be a big emitter but it can also be a key saver (see 'Action 5' and 'Action 6' in Section III).

9. Collapsing plant and animal kingdoms

Climate change is the number one driver of biodiversity loss. A report in 2019 found that one million species are likely to become extinct during the period now known as the Sixth Mass Extinction.⁶⁴ While many of these plants and animals may not be as recognisable as pandas or polar bears, they are critical to our livelihoods. Bees, for example, contribute more than USD 15 billion to the US economy by pollinating crops. But climate change is sharply reducing bee populations.⁶⁵ At the same time, an estimated four billion people rely on natural medicines from plants or animals for their primary healthcare. The Guardian has reported that biodiversity loss in Europe alone costs the continent about 3% of its GDP every year.^{66, 67}

Biodiversity loss due to climate change also forms a vicious circle. For instance, coral reefs help absorb damage from storms and tsunamis. But the IPCC has warned that the world will lose all coral reefs by the end of this century if it stays on its current path.⁶⁸ As for the Amazon rainforest, its many plant species are essential in reducing carbon dioxide. But 57% of these species face extinction, according to a study in 2015⁶⁹ – before a huge chunk of it burned down in 2019.⁷⁰

Marine plants like plankton produce about 80% of the oxygen in our atmosphere. As oceans warm – at a rate equivalent to five atomic bombs every second – and become more acidic, the habitats of marine plants are threatened, affecting how much oxygen they produce.⁷¹

Tippling points and feedback loops

The nine impacts above are not even worst-case scenarios – expected to occur if climate tipping points are crossed, allowing vicious circles or ‘feedback loops’ to take over at which point the world becomes irreversibly locked into an uninhabitable planet:

1. **Ice-albedo effect** - One of the more well-known feedback loop is the ice-albedo effect, wherein the more ice that is melted, the less surface area there is to reflect sunlight. This in turn means the dark ocean surface gets more sunlight and accelerates the melt. We are already experiencing this feedback loop.
2. **Permafrost thaw** - As our world warms, permafrost (frozen ground) in polar and tundra regions begin to melt, releasing methane, one of the most potent greenhouse gases. This in turn heats the world even more, releasing more methane. “Permafrost experts agree that even a 30% loss of near-surface permafrost at 1.5°C warming may result in about 50 Gt additional carbon emissions by 2100: this, when the 2-degree carbon budget allows only for 275 Gt carbon released from all sources.” This additional release of carbon from permafrost has not yet been taken into account by current IPCC carbon budgets.
3. **Antarctica ice sheet instabilities** - Marine ice sheet and ice cliff instabilities in West Antarctica are also threatening to trigger runaway ice sheet retreat but its impact is still under investigation. Could the total collapse of Antarctica ice sheet triggering almost 60 metres of locked-in sea level rise become a possibility? While these may not happen within our lifetimes, we are getting closer to the tipping point where all three become locked-in and trigger inevitable climate catastrophes – we need to avoid this at all costs.

Source: CWR report, “Avoiding Atlantis: The CWR APACCT 20 Index – Benchmarking coastal threats for 20 APAC sectors with finance sector input”, November 2020

Section III

Actions for a below 2°C world

SAY NO TO CARS

FLY LESS

WATCH ELECTRICITY BILLS

CHANGE ONLINE HABITS

RETHINK DIETS

CUT FOOD WASTE

TWEAK ONLINE SHOPPING

SLOW DOWN FAST FASHION



1



Action 1

Say no to cars

SAY NO TO CARS

FLY LESS

WATCH ELECTRICITY BILLS

CHANGE ONLINE HABITS

RETHINK DIETS

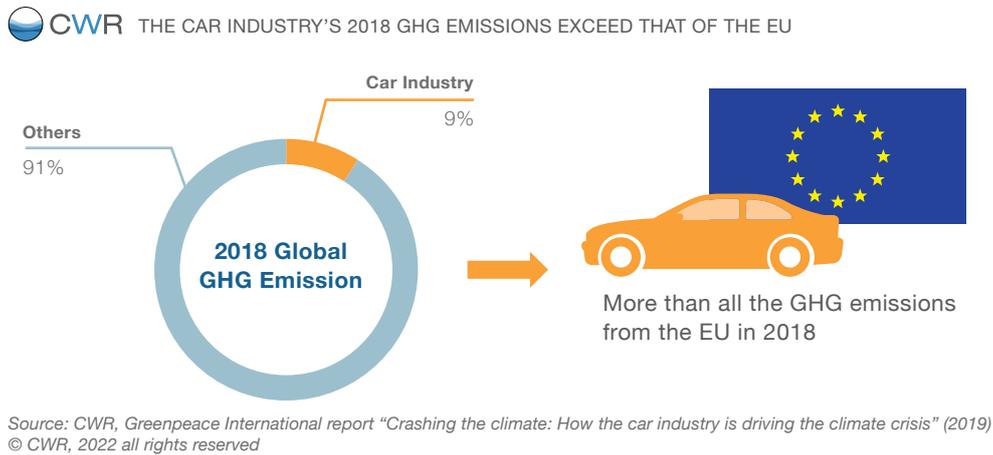
CUT FOOD WASTE

TWEAK ONLINE SHOPPING

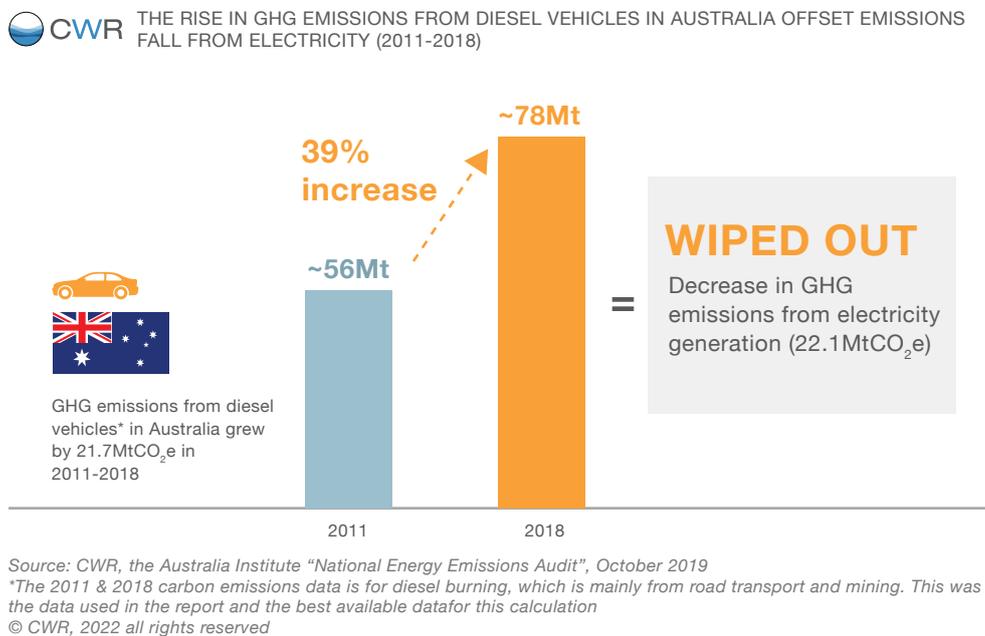
SLOW DOWN FAST FASHION

Why we chose this...

- Cars run on fossil fuels, and the transport sector is responsible for up to a quarter of total energy-related CO₂ emissions, according to the IPCC AR5 report.⁷² The global car industry accounted for 9% of greenhouse gas emissions in 2018 – more than the missions of the entire EU.⁷³



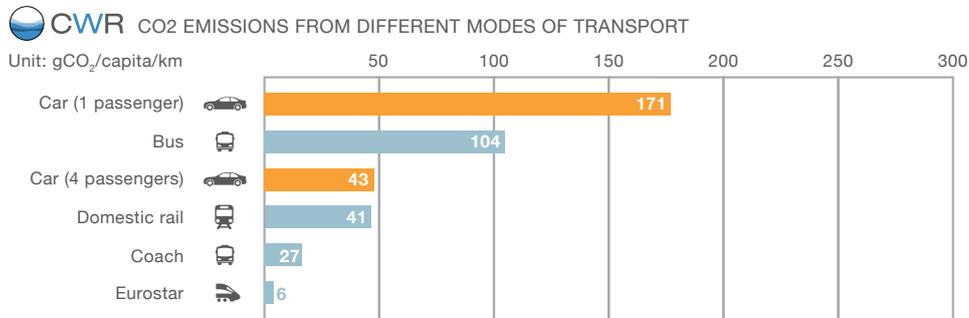
- And these emissions are doing some serious harm. Between 2011 and 2018, GHG emissions from diesel in Australia – mostly from road transport and mining – rose by almost 22 million tonnes of carbon dioxide equivalent (MtCO₂e), erasing a decline by a similar amount from all types of electricity generation in the same period.⁷⁴



- While the growing trend of electric cars (more on this in the 'Do More' section) is a step in the right direction and global sales of petrol and diesel vehicles appear to have peaked, most cars on the road today are still powered by fossil fuels.⁷⁵ Governments, businesses and investors are rethinking mobility from electric and self-driving vehicles to vehicles fuelled by clean hydrogen. In the meantime, individuals can say no to cars and walk, cycle or take buses or trains instead.

New habits to minimise/avoid car travel

So, what can we do? A good place to start is to wean yourself off your “car habit”, we look at two specific actions below. And if you’re still not convinced about making changes, look at the chart below that shows the benefit of various forms of public transport, which are much less carbon intensive.



Source: CWR, BEIS, Defra Greenhouse Gas Conversion Factors 2019
 Notes: cars refers to average diesel car; flight emissions include secondary effects from high-altitude, non-CO₂ emissions
 © CWR, 2022 all rights reserved

Two actions related to car use can have a big climate impact. We chose these because there is sufficient existing research on their impacts, and they are relatively achievable.

1. Walk instead of taking a 5 minute drive every day for a year

Walking does not produce any GHG emissions. Doing this saves almost 0.3 kg of carbon dioxide equivalent (kgCO₂e) for each journey. Over the course of a year, that saves about 94 kgCO₂e.



Walking instead of a 5 minute drive* every day for a year

Source: CWR, EIB Climate Survey , UK BEIS/Defra GHG Conversion Factors 2019, Google maps
 *Distance = 1.5km; assumes average diesel car and 1 passenger occupancy
 © CWR, 2022 all rights reserved

2. Take a train instead of a 15minute drive every day for a year

For every kilometre travelled, GHG emissions from trains are about a quarter of those from the average diesel car with one passenger. Taking trains saves 0.8 kgCO₂e or 303 kgCO₂e over a year.



Take a train instead of a 15 minute drive* every day for a year

Source: CWR, EIB Climate Survey , UK BEIS/Defra GHG Conversion Factors 2019, Google maps
 *Distance = 6.4km; assumes UK domestic rail & average diesel car and 1 passenger occupancy
 © CWR, 2022 all rights reserved

By taking these two actions, an individual can save nearly 400 kgCO₂e a year. Or find out how together, we can use these 2 simple actions to achieve sizeable annual emission cuts equivalent to the 2015 GHG emissions of Chile, Singapore and the UK combined.¹⁵

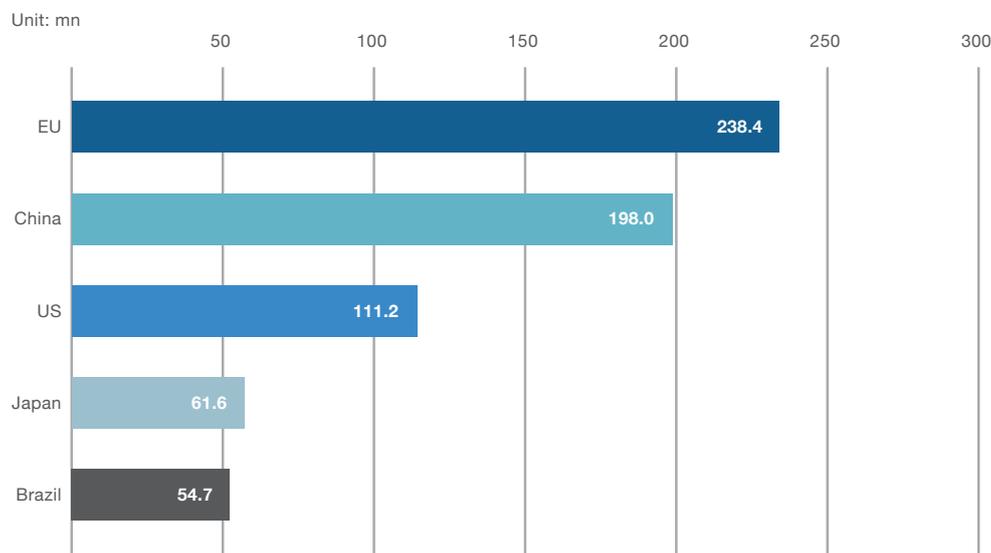
Beyond these two actions, there are plenty other ways to do more to say no to cars – we have set these out later in “6 ways you can do more” from car-shares to electric vehicles.

Together we can... 2 simple actions can cut up to 729.7 Mt of GHG emissions...

Some nations rely more on cars than others. For passenger cars worldwide, Europe ranks first with almost 240 million on the road in 2017.⁷⁶ China is not far behind with almost 200 million (2019) while the US has 111 million (2017).^{76, 77, 78} Japan and Brazil complete the Top Five (their combined number of cars matched the US in 2018).^{79, 80} Europeans, Chinese and Americans can clearly have the biggest impact.

Which countries have the most cars?

(various years 2017-2019 due to lack of data)



Source: CWR, various news sources & government statistics

NOTE: EU cars refer to passenger cars (2017); China cars refer to private cars (2019); US cars refer to automobiles & motorbikes (2017); Japan cars refer to passenger cars & motorcycles (2018) & Brazil cars refer to automobiles (2018)

© CWR, 2022 all rights reserved

We estimate that willing individuals from the US, the EU and China who adopt these two habits could save 729.7 MtCO₂e – equivalent to the GHG emissions of Chile, Singapore and the UK combined in 2015.¹⁵

1. Cut an unnecessary 5-minute drive or walk it daily for a year

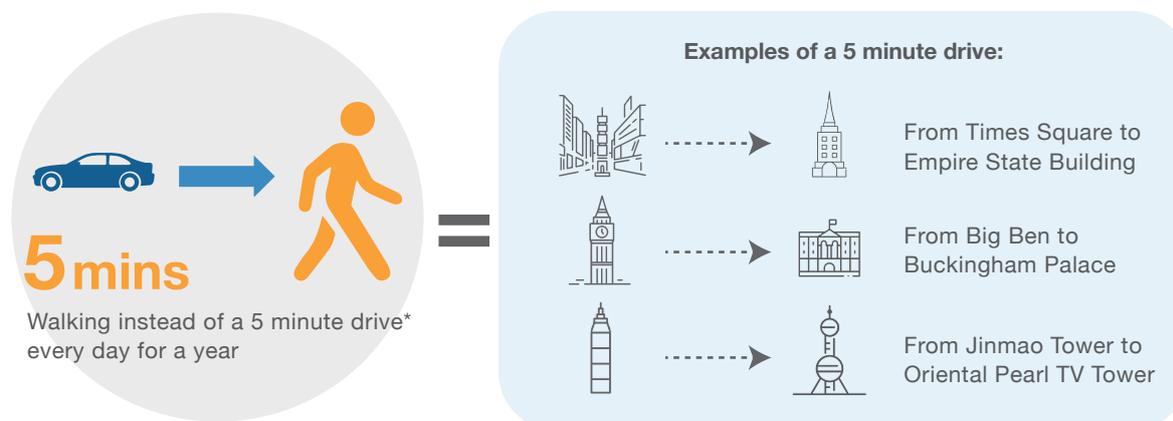
Think about the times you have driven in the past week. Have all of them been necessary or could some of them be consolidated or even better, replaced by walking?

According to the EIB Climate Survey, that 57% from the US, 76% from the EU and 93% from China intend to walk or cycle on daily trips soon to combat climate change.¹⁰⁰

Based on this we estimate that if roughly six in ten people from the US, roughly eight in ten people in the EU and nine in ten people China (totalling around 186mn, 390mn and 1,325mn people respectively) walked instead of a 5 minute drive (e.g. from Times Square to the Empire State Building in New York) every day for a year, 17.5 MtCO₂e, 36.5 MtCO₂e and 124.3 MtCO₂e can be saved, respectively.

Through this simple habit change, these people from the US, EU and China can together save 178.2 MtCO₂e, the GHG emissions of Chile and Singapore combined in 2015 (see graphic on next page).¹⁵

CWR CAR DRIVERS FROM THE US, EU & CHINA CAN SAVE THE EMISSIONS OF CHILE & SINGAPORE COMBINED BY WALKING INSTEAD OF DRIVING



 Six in ten*** people from the US doing this
Save **17.5Mt**

 Eight in ten*** people from the EU doing this
Save **36.5Mt**

 Nine in ten*** people from China doing this
Save **124.3Mt**

Save **178.3Mt**



Comparable to the 2015 emissions of Chile & Singapore combined

Source: CWR, EIB Climate Survey, UK BEIS/Defra GHG Conversion Factors 2019, Worldometer population data, Google maps, EDGAR emissions database

* Distance = 1.5km; assumes average diesel car and 1 passenger occupancy

**EIB Climate Survey found 57% from the US, 76% from the EU and 93% from China intend to use walk instead of drive on daily trips soon to combat climate change.

© CWR, 2022 all rights reserved

2. Take a train instead of a 15 minute drive every day for a year

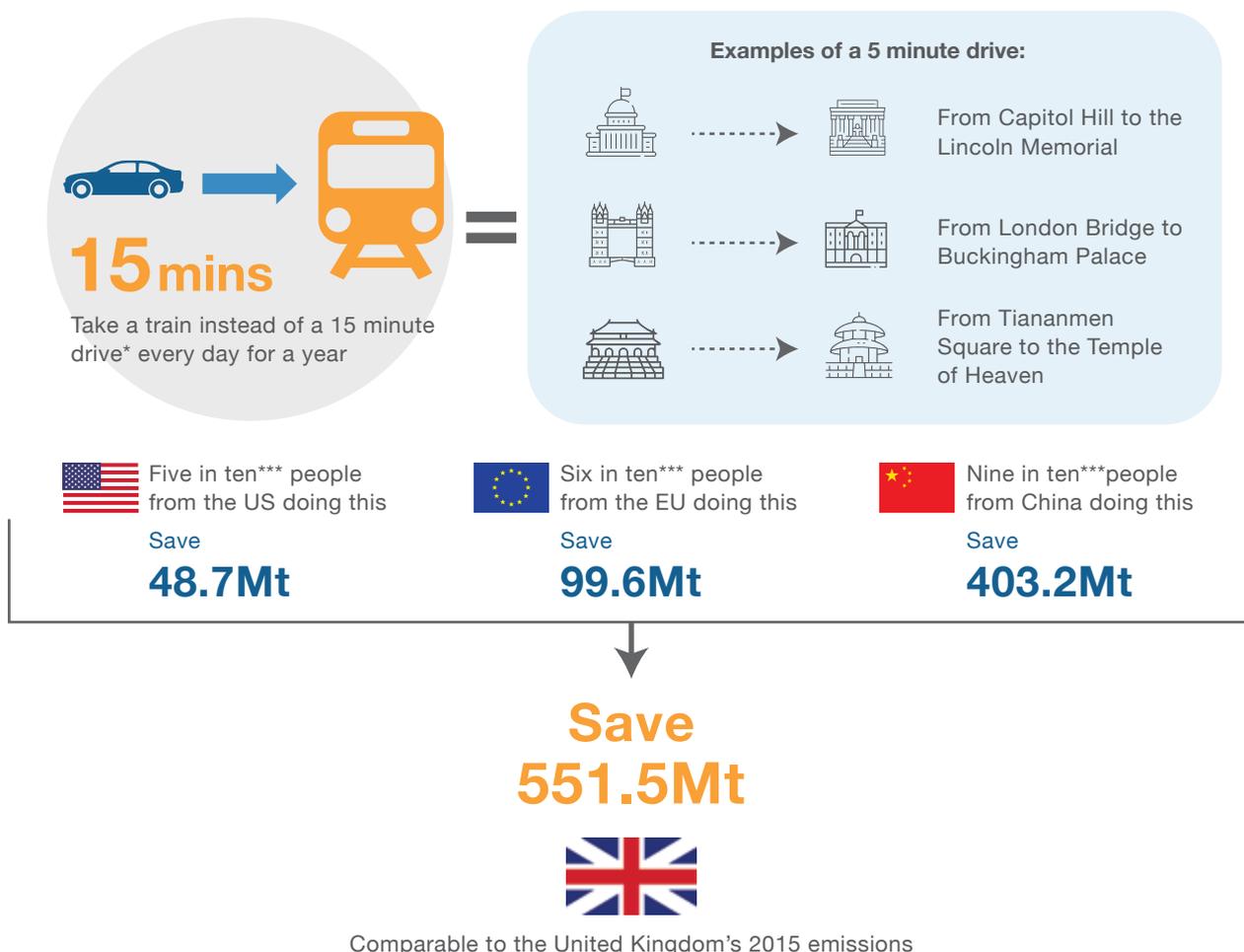
Taking a train – be it for your commute or trip to town – can have a big climate impact.

According to the EIB Climate Survey, 49% from the US, 64% from the EU and 93% from China intend to use public transport instead of drive on daily trips soon to combat climate change.¹⁰⁰

Based on this we estimate that if roughly five in ten people from the US, six in ten people in the EU and nine in ten people in China (totalling around 160mn, 328mn and 1,325mn people respectively) took a train instead of a 15 minute drive (e.g. from London Eye i.e. Waterloo station to London Bridge station) every day for a year, 48.7 MtCO₂e, 99.6 MtCO₂e and 403.2 MtCO₂e can be saved respectively.

Through this simple habit change, these people from the US, EU and China can together save 551.5 MtCO₂e, comparable to all annual GHG emissions from the United Kingdom in 2015 (see graphic on next page).¹⁵

 **COMMUTERS FROM THE US, EU & CHINA CAN SAVE ALL GHG EMISSIONS FROM THE UK BY TAKING THE TRAIN INSTEAD OF DRIVING**



Source: CWR, EIB Climate Survey, UK BEIS/Defra GHG Conversion Factors 2019, Worldometer population data, Google maps, EDGAR emissions database
 *Distance = 6.4m; assumes UK domestic rail & average diesel car and 1 passenger occupancy
 **EIB Climate Survey found 49% from the US, 64% from the EU and 93% from China already or soon intend to use public transport instead of drive on daily trips to combat climate change
 © CWR, 2022 all rights reserved

6 ways you can do more...

1. Think twice before using a ride-hailing app

Ride-hailing apps like Uber, Lyft, Didi and Grab have become immensely popular in recent years. By connecting drivers and passengers with a few taps, these companies hope to push people away from car ownership towards shared transport services. But the jury is still out on whether ride-hailing apps benefit or harm efforts to cut emissions.⁸¹

For instance, in 2017, a study by University of California at Davis found that ride-hailing boosted use of commuter rail but pulled people away from buses and light rail. It also found that between 49% and 61% of ride-hailing trips were previously made by walking, cycling or public transport – or not taking the journeys at all.⁸²

2. Cycle instead of driving

According to a study by the Institute for Transportation and Development Policy, an increase of about 20% in cycling worldwide could cut CO₂ emissions from urban passenger transport by nearly 11% in 2050.⁸³

What's more, you do not even need to buy your own bike. An estimated 800 cities already have bike-share schemes that allow people to cycle as long as they want by scanning a QR code.⁸⁴ In Barcelona, such a scheme has reduced the Spanish city's CO₂ emissions by about 9,000 tonnes a year, equivalent to taking more than 1,900 cars off the road.⁸⁵

3. Turn to veggie cars but with biofuels from waste

If you are going to drive, then a way you can do more is by driving your own veggie car. This may sound strange, but it is actually possible to run a diesel vehicle on vegetable oil and nearly eliminate your use of traditional gas or diesel.

In 2015, Dubai became the first city in the world to formally adopt biodiesel made locally from 100% waste cooking oil for use in its municipal vehicles.⁸⁶ But do make sure it is waste vegetable oil for using biofuel just for cars can be worse than diesel due to its land use and water impacts more on this in box below.⁸⁷

The problem with biofuels

Unlike fossil fuels, biofuels are produced from biomass. For instance, crops such as maize or millet are converted into biogas which can then be used in cars. While this emits much less carbon and can even be carbon negative, there are hidden risks. Biofuels currently account for 2-3% of the planet's water and agricultural land – which could feed about 30% of the world's malnourished population. Biofuels can therefore not be fully relied on as an energy source given the world's tight water-food-energy nexus.

Source: Rulli, M., Bellomi, D., Cazzoli, A. et al. The water-land-food nexus of first-generation biofuels. Sci Rep 6, 22521 (2016)

4. Switch to hybrid or fully electric cars

Electric vehicles (EVs) have taken the world by storm over the past decade with more than 1.3 million on the road. They reduce air pollution and can cut GHG emissions drastically.

Switching from a gasoline car to a hybrid car can save 400 kg of CO₂ a year and switching to a fully electric car can save 1,250 kg of CO₂ a year. Each driver who switches to an electric car saves about three barrels of oil a year. By the late 2020s, increased use of electric vehicles is projected to reduce crude oil consumption by about one million barrels a day.⁸⁸

What's more, it's also becoming cheaper to own EVs. Not only is electricity less expensive than gasoline, but battery prices are declining with technological developments. By the mid-2020s, EVs are expected to become cheaper to own and operate than cars with internal-combustion engines.⁸⁹ Yet, EVs still face constraints (see box below).

Are electric cars a solution?

As EVs run on a battery instead of a fuel combustion engine, they do not emit any waste gas but does “zero emissions” really mean they do not have a significant climate impact? Unfortunately, that is not the case, because it really depends on how the grid electricity that the car is powered on is generated. Take Australia or Poland for example. As most of their electricity is generated on thermal power, a large amount of greenhouse gases are still released.



Furthermore, more energy is still used to manufacture electric vehicles compared to traditional vehicles. According to the IEA, an electric car with a 400km range produced at the global average will have to be driven 60,000km just to offset the higher CO₂ emissions during the manufacturing stage. That means a new electric car driven the average 11,200km each year only pays off this “carbon debt” after five years.

Clearly there is some way to go before electric vehicles become a comprehensive solution.

Source: Australia Department of the Environment & Energy, IEA, The Australian “Extra emissions are the dirty little secret of electric cars” by Bjorn Lomborg, Mar 2020

5. Use car sharing and car pooling

The idea of bike sharing is expanding to cars. Instead of picking up and dropping off vehicles at designated rental establishments, car-sharing apps provide for more convenient locations. One shared car can take about 13 private vehicles off the road and each car sharer reduces CO₂ emissions by 726 kg a year.^{90, 91} The savings are equivalent to three return flights between Beijing and Shanghai a year.¹⁰⁵

At the same time, car pooling can cut unnecessary trips. When a driver takes three other passengers who would otherwise drive three other cars, carbon emissions are reduced by 75%. Car pooling can also save money. According to the Centre for Climate & Energy Solution, commuters car pooling 20 days a month reduce driving costs by as much as 50%, allowing drivers to save an estimated USD1,100 a year.⁹²

6. Use fuel-efficient cars

Cars that consume less fuel to travel longer distances are more efficient and have lower emissions. Savings from better fuel economy in more efficient gasoline cars can average 1,190 kg of CO₂ a year.⁹³ That's equivalent to a car ride from New York to Los Angeles every year.¹⁰⁵ Smaller models are more efficient (see box below).

Newer & heavier cars driving up emissions

As new generations of cars feature more and more high-tech gadgets, they are also becoming heavier and emitting more greenhouse gases.

According to analysis by Which?, since 2017 small petrol cars saw an average increase in CO₂ emissions of 11.2% (to 145.7g/km), while mid-size petrol SUVs rose by 20.4% (to 189.8g/km), and large petrol-electric hybrids were the worst offenders, with an average increase of 31.7% (to 117.4g/km).

This is especially worrying given the rapidly growing market share of larger heavier models. In Europe, the market share of SUVs increased more than 4x over the past 10 years – from 8% in 2008 to 32% in 2018, while total SUV sales in the US reached almost 70% in 2018.

Source: Which? Analysis (2019), FRED economic data

2



Action 2

Fly less

SAY NO TO CARS

FLY LESS

WATCH ELECTRICITY BILLS

CHANGE ONLINE HABITS

RETHINK DIETS

CUT FOOD WASTE

TWEAK ONLINE SHOPPING

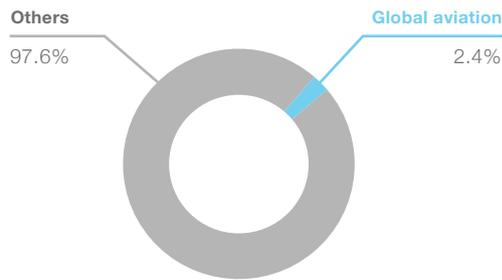
SLOW DOWN FAST FASHION

Action 2: Fly less

Why we chose this...

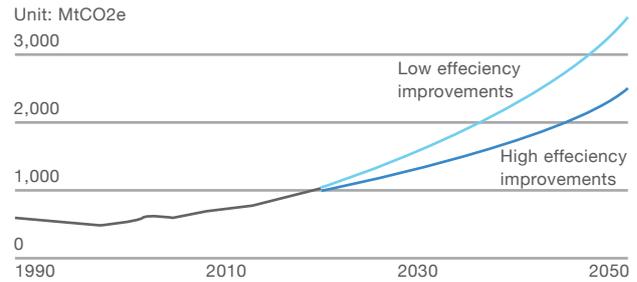
- If international aviation were a country, it would be among the Top Ten GHG emitting nations in the world.⁹⁴
- International aviation is not included in the Paris Agreement on Climate Change adopted in 2015 but domestic flights are.⁹⁵
- Aviation emissions are set to triple by 2050 (see chart below right) so flying less and flying sustainably is urgently required.

Aviation = 2.4% of Global CO2 emissions in 2018



Source: CWR, ICCT Working Paper (2018) "CO2 emissions from commercial aviation"

... and could triple in the next three decades



Source: The Guardian "How your flight emits as much CO2 as many people do in a year" by Niko Kommenda, Jul 2019, IEA, Lee (2019) based on Fleming & Ziegler (2016)

- COVID-19 has had a marked impact on flying globally (see box in following pages). Returning to 'business-as-usual' once flight restrictions ease must be avoided. Before the pandemic, the idea of flying less was already becoming popular across Europe, led by Sweden which invented the term *flygskam* ("flight shame").⁹⁶ Swiss bank UBS has estimated that this trend could halve projected growth in air traffic.⁹⁷
- Our individual flight choices matter and can help slow down aviation emissions.

CWR OUR FLIGHT CHOICES MATTER – THE EMISSIONS BEHIND OUR FLIGHTS



Source: CWR, Guardian's emissions calculator, flight-time calculator, US EPA greenhouse gas equivalencies calculator, google maps

Note: Short, medium & long-haul distances are within the specified ranges as per the atmosfair report 2018

* Refers to return flight

** Assumes average passenger car run on petrol; car occupancy = 1

© CWR, 2022 all rights reserved

New flying habits...

So, what can we do? We look at three actions that can have a big climate impact. We chose these because there is sufficient existing research on their impacts, and we believe they are relatively achievable.

1. Cut one short-haul flight (less than 800km) a year. This will save about 0.2 tonnes of CO₂ per passenger.

 **CWR** GHG EMISSIONS SAVED FROM CUTTING ONE SHORT-HAUL FLIGHT



Source: CWR, Guardian's emissions calculator, flight-time calculator

Note: Short, medium & long-haul distances are within the specified ranges as per the atmosfair report 2018

* Refers to return flight

** Assumes average passenger car run on petrol; car occupancy = 1

© CWR, 2022 all rights reserved

2. Switch one long-haul flight (more than 3,800km) to a medium-haul flight (between 800- 3,800km) per year. This will save around 1.3 tonnes of CO₂ per passenger.

 **CWR** GHG EMISSIONS SAVED FROM REPLACING ONE LONG-HAUL WITH A MEDIUM-HAUL FLIGHT



Source: CWR, Guardian's emissions calculator, flight-time calculator

Note: Short, medium & long-haul distances are within the specified ranges as per the atmosfair report 2018

* Refers to return flight

** Assumes average passenger car run on petrol; car occupancy = 1

© CWR, 2022 all rights reserved

3. Fly economy instead of business. This will cut CO₂ emissions by each passenger by two thirds.

 **CWR** GHG EMISSIONS CUT FROM FLYING ECONOMY INSTEAD OF BUSINESS



Source: CWR, BBC article – “Should we give up flying for the sake of the climate?” Feb 2020

* assumes International flights, to/from non-UK countries

© CWR, 2022 all rights reserved

These three actions can help individuals save at least 1.5 tonnes of CO₂ emissions. But the impact of collective action could be equivalent to the combined emissions of Singapore, Ethiopia and Honduras in 2015. Beyond these actions, there are many more ways to further cut flying emissions (see ‘6 ways you can do more’ in following pages).

COVID-19 has shown the impacts of not flying

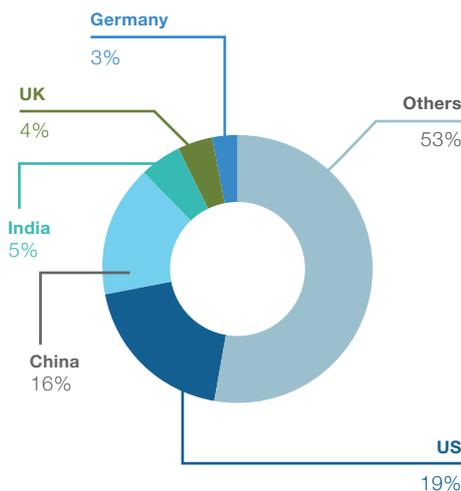
With thousands of flights cancelled amid lockdowns and fewer people flying, aviation emissions have plunged during the COVID-19 pandemic. According to the Australia Institute, global civil aviation emissions in 2020 were down 352.7 MtCO₂e from 2019 – comparable to the combined emissions of Spain and Andorra in 2015. In Australia alone, reduced flights by Qantas and Virgin were estimated to have cut the country’s aviation emissions by 56%.

Can reduced emissions be sustained? The International Air Travel Association (IATA) and airlines including Air France-KLM have called for relief from environmental taxes in Europe. There are also worries over the safeguard adjustment made for the 2021-2023 pilot phase of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). The emissions baseline above which airlines offset their emissions will now be calculated using only 2019 emissions, rather than the average emissions of 2019 and 2020. The adjustment will increase the baseline by around 30% and is likely to delay implementation of CORSIA carbon offsets by three to five years.

Source: The Australia Institute “Grounded- Civil aviation emissions reductions under COVID-19 in Australia and globally and the potential long-term impacts to emissions in the sector” (2020), Emissions Database for Global Atmospheric Research EU Commission, the Verge, IISD article, “CORSIA Baseline Adjustment in Response to COVID-19: A Blessing or a Curse?” Sep 2020

Together we can... 3 simple actions can cut up to 229 Mt of GHG emissions...

Who fly the most? (2017)



Source: CWR, IATA 62nd Annual Report

Some nations fly more than others and therefore can do more to cut flight emissions. According to the International Air Transport Association, of the 4.1bn flight passengers in 2018, 18.6% of them were from the US and 16.3% were from China. Together they account for more than a third of global passengers – clearly, they can do more.⁹⁸

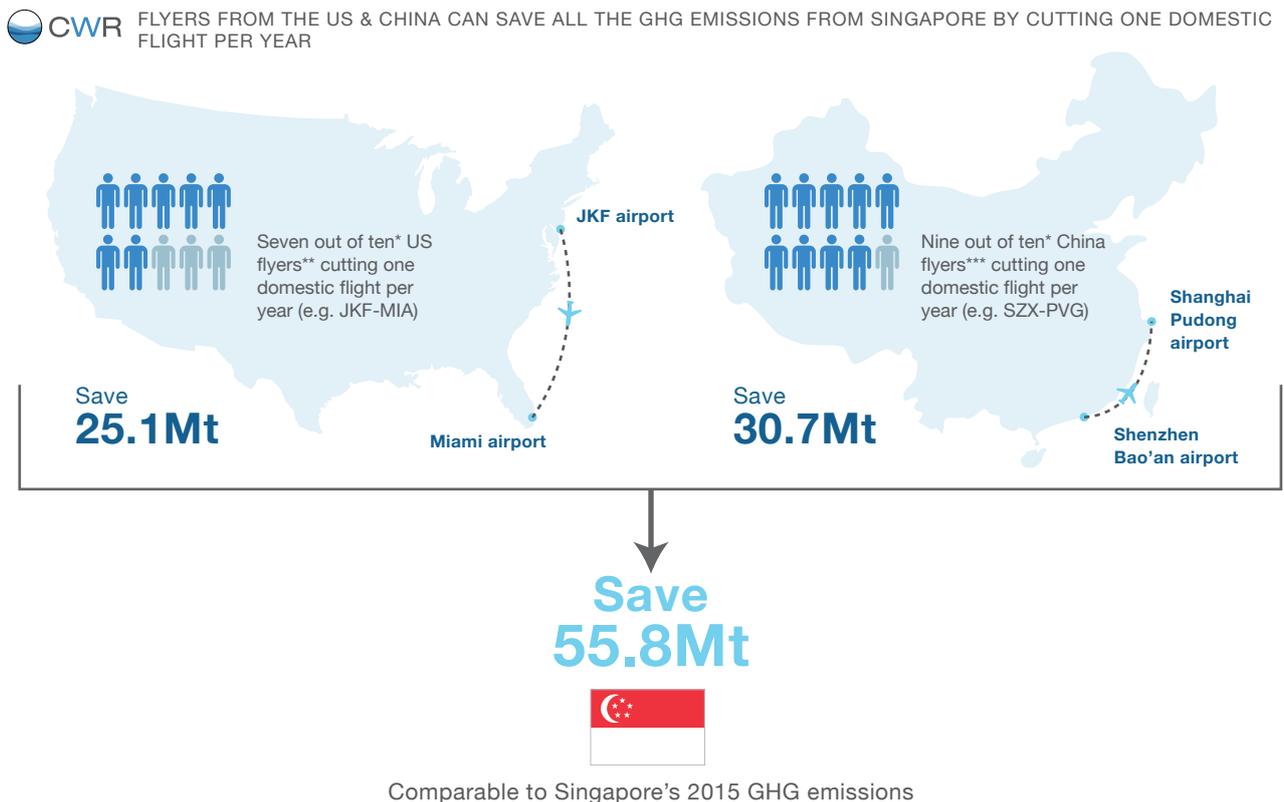
We estimate that willing individuals from the US and China who change the three habits would cut 229 million tonnes of carbon dioxide equivalent, which is comparable to the combined GHG emissions of Singapore, Ethiopia and Honduras in 2015.¹⁵

Of course, greater savings could be achieved if more people changed their habits.

And, beyond the top flying countries, we must also watch out for those fast growing. Vietnam, India and Saudi Arabia are forecast to be the fastest-growing markets for air passengers between 2017 and 2040.⁹⁹ But we focussed on how much the US and China can save as there is more research available on these countries.

1. Cut one domestic flight (about 1,400 km) a year

The European Investment Bank (EIB) found that 69% of US air passengers and 94% of those in China are either flying less or intend to fly less to combat climate change.¹⁰⁰ Using this we estimate that if roughly seven in ten of the 121mn adult flyers from the US changed this habit (totalling around 83mn people), 25.1 MtCO₂e can be saved. Similarly, if roughly nine in ten of the 157mn flyers from China did this (totalling around 141mn people), 30.7 MtCO₂e can be saved. The combined savings in the US and China of almost 56 MtCO₂e are equivalent to the GHG emissions of Singapore in 2015.¹⁵



Source: CWR, Guardian estimate based on Atmosfair data, EIB Climate Survey, US Bureau of Transport statistics, USEPA greenhouse gas equivalencies calculator, various news sources, The Annie E. Casey Foundation Kids Count Data Center, Airlines for America report 2018, Worldometer population statistics, EDGAR emissions database

* For the proportion of US and China flyers willing to take action we referred to the EIB Climate Survey, which found that 69% of US flyers and 94% of China flyers are either flying less to combat climate change or intend to do so

** Adult American flyers from 2017 totalled 120.7mn and they fly around 3.6 times domestically every year, according to data calculated from KidsCount and Airlines for America's 2018 report. The average US domestic short-haul flight distance is 1,485km, roughly the same distance as a 3-hr flight from JFK Airport to Miami Airport (1,754km). Taking this flight, which emits 301kg/capita of carbon as the mean, we can estimate that if seven out of ten US flyers cut one domestic flight per year, we could save 25.1MtCO₂

*** For Chinese flyers, there were 523mn China domestic flyers in 2017 and due to a lack of data we assumed 30% of those are frequent flyers. The average China domestic flight distance was ~1,400km, roughly the same distance as a 2-hr flight from Shenzhen to Shanghai (1,240km). Taking this flight, which emits 208kg/capita of carbon as the mean, we can estimate that if China flyers cut one domestic flight per year, we could save 30.7MtCO₂.

© CWR, 2022 all rights reserved

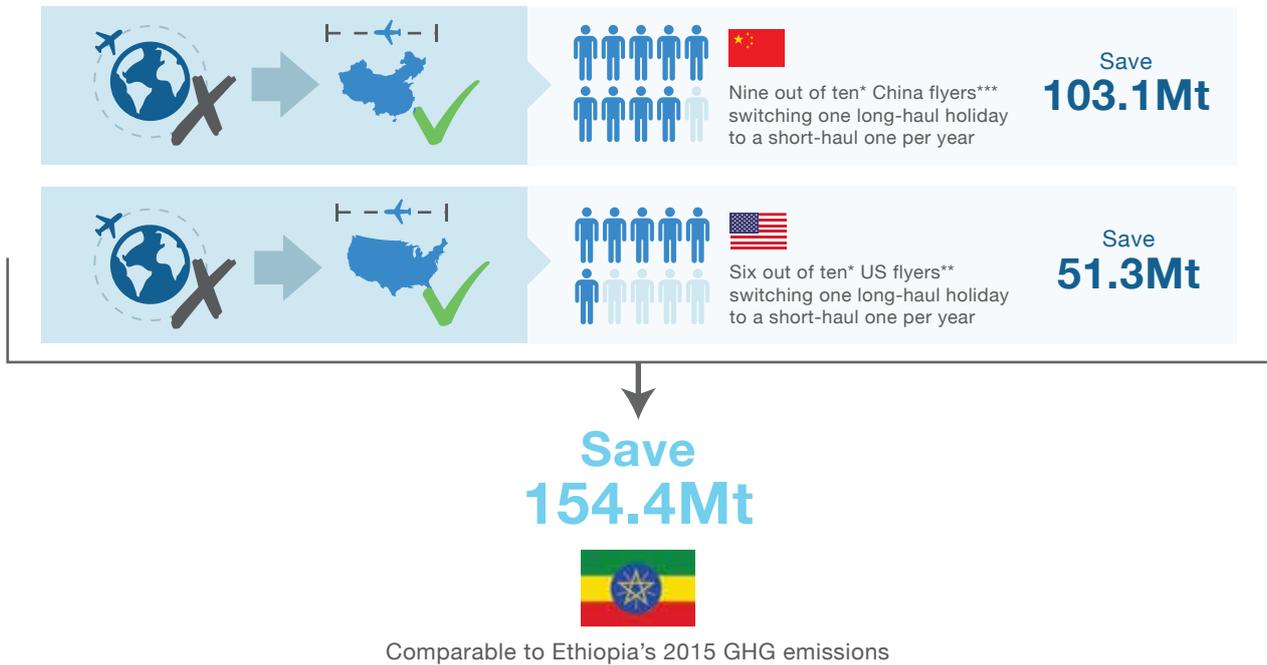
2. Switch one long-haul flight (about 5,500km) to a short-haul flight (about 1,400km) a year.

Cutting long-haul flights has more of an impact than reducing short-haul flights as longer flights are more resource intensive, especially when it comes to fuel. At the same time, long-haul flights are often on international routes beyond national GHG reduction commitments and get lost in the global tally.

The EIB estimated that 62% of US flyers and 89% of flyers in China were either willing to sacrifice holidays in distant locations for shorter trips or had already done so (see box on next page).¹⁰⁰ Based on these estimates, 75 million Americans could save 51 MtCO₂e by making the change and 147 million Chinese could save 103 MtCO₂e.

Through this simple habit change, these people from US and China can together save 154.4 MtCO₂e, comparable to the 2015 GHG emissions from Ethiopia.¹⁵

CWR FLYERS FROM US & CHINA CAN SAVE ALL GHG EMISSIONS FROM ETHIOPIA BY SWITCHING ONE LONG-HAUL HOLIDAY TO A SHORT-HAUL ONE PER YEAR



Source: CWR, Guardian estimate based on Atmosfair data, EIB Climate Survey, US BTS statistics, USEPA greenhouse gas equivalencies calculator, various news sources, The Annie E. Casey Foundation Kids Count Data Center, Airlines for America report 2018, Worldometer population statistics, EDGAR emissions database

* For the proportion of US and China flyers willing to take this action we referred to the EIB Climate Survey, which found that 62% of US flyers and 89% of China flyers are either willing to sacrifice the holiday of their dreams for a shorter trip or have already done so

** Adult American flyers from 2017 totalled 120.7mn and they fly around 3.6 times domestically every year, according to data calculated from KidsCount and Airlines for America's 2018 report. The average US short-haul domestic flight distance is 1,485km, roughly the same distance as a 3-hr flight from JFK Airport to Miami Airport (1,754km). The average US long haul international flight distance is 5,414km, roughly the same distance as a 7-hr flight from JFK Airport to London Heathrow Airport (5,541km).^{73,74} Given the per capita emissions of JFK-MIA and JFK-LHR (return) are 0.3kgCO₂ and 0.9kgCO₂ respectively, we can estimate that if two out of three US flyers switched one long-haul holiday to short-haul per year we could save 51.3MtCO₂.

*** For Chinese flyers, there were 523mn China domestic flyers in 2017 and due to a lack of data, we assumed 30% of those are frequent flyers. The average China short-haul domestic flight distance was ~1,400km, roughly the same distance as a 2-hr flight from Shenzhen to Shanghai (1,240km). As there was no average international long-haul data for China, we took 5,414km (see above as the average). This is comparable to flying from Beijing to Moscow (5,780km), which takes 8 hrs. Given the per capita emissions of SZX-PVG and BEI-SVO (return) are 0.2kgCO₂ and 0.9kg CO₂ respectively, we can estimate that if all China flyers switched one long-haul holiday to short-haul per year we could save 103.1MtCO₂.

© CWR, 2022 all rights reserved

Not just about the flight... we need to talk about our holidays

Our climate impact does not stop once we land at the airport but accumulates throughout our holiday or trip. Again, there is plenty we can do about it.

According to one study, global tourism emits 3.9-4.5 GtCO₂e per year. This means tourism-related activities such as consumption goods and supply chains combined account for about 8% of global GHGs. Clearly this is a concern, especially as the tourism industry booms, but holidays are also a time for enjoyment and indulging so what can we do without spoiling the fun?

For one, the study recommends trips closer to home and supporting tourism companies that aim to operate sustainably.

Source: Lenzen, M. et al (2018) "The carbon footprint of global tourism" in Nature Climate Change

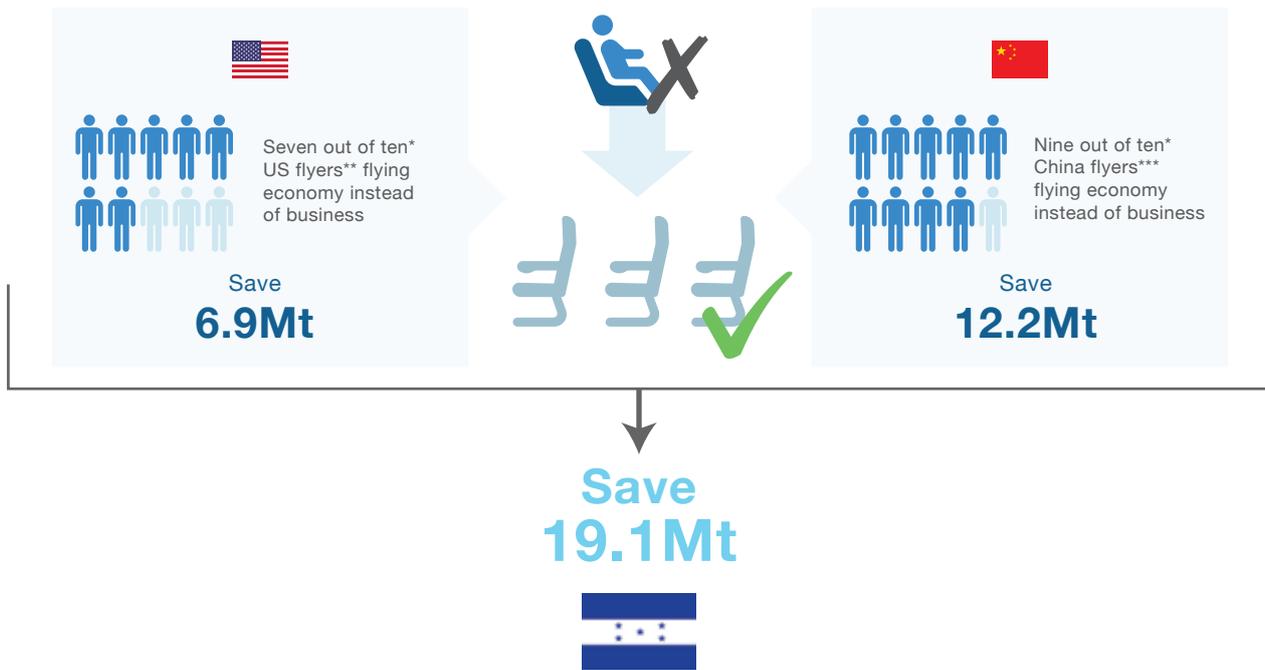
3. Business class emits 3x more carbon so, fly economy instead

Business class takes up much more space and weight on a plane, according to the Aviation Environment Federation.¹⁰¹ And then there is also the perks - silk pyjamas, face creams, indulgent food and drinks.¹⁰² Based on EIB findings that 69% of American passengers and 94% of Chinese passengers are either flying less or intending to fly less,¹⁰⁰ we assumed - in the absence of data - that those willing to do so would also switch from business to economy class.¹⁰⁰ Based on an Investopedia report, we estimated that 12% of passengers fly business class.¹⁰³

Based on this estimate, we calculated that 10 million business-class passengers in the US could save almost 7 MtCO₂e if they flew economy instead and that 18 million business passengers in China could save about 12 MtCO₂e if they did likewise.

The combined actions by Americans and Chinese would save about 19 MtCO₂e, equivalent to GHG emissions from Honduras in 2015.¹⁵

 **CWR** FLYERS FROM US & CHINA CAN HALVE ALL GHG EMISSIONS FROM HONDURAS BY FLYING ECONOMY INSTEAD OF BUSINESS



Comparable to half of Honduras' 2015 GHG emissions

Source: CWR, Guardian estimate based on Atmosfair data, EIB Climate Survey, UK DBEIS statistics, USEPA greenhouse gas equivalencies calculator, various news sources, Investopedia, The Annie E. Casey Foundation Kids Count Data Center, Airlines for America report 2018, Investopedia, Worldometer population statistics, EDGAR emissions database

* For the proportion of US and China flyers willing to take action we referred to the EIB Climate Survey, which found that 69% of US flyers and 94% of China flyers are either flying less to combat climate change or intend to do so. Due to a lack of data, we had to assume that those willing to fly less would also make this switch

** Adult American flyers from 2017 totalled 120.7mn and they fly around 3.6 times domestically every year, according to data calculated from KidsCount and Airlines for America's 2018 report. According to Investopedia, 12% of these flyers fly business and according to the UK DBEIS, the business class CO₂ multiplier is 1.8x.79 Given these and using a medium-haul flight (3,300km) as an average business class flight with CO₂ emissions per capita of 850kg, we estimate that if 2/3 adult flyers from the US flew economy instead of business, we could save 14.4MtCO₂e.

*** For Chinese flyers, there were 523mn China domestic flyers in 2017 and due to a lack of data, we assumed 30% of those are frequent flyers. Using the same business class assumptions as those above for US flyers, we estimate that if all of the 157mn flyers from China US flew economy instead of business we could save 12.2MtCO₂e.

© CWR, 2022 all rights reserved

6 ways you can do more...

1. Be there virtually instead

Applications like Zoom, Teams, Hangouts, Skype and FaceTime mean that conference calls with video for people on opposite sides of the planet are now clicks away at a fraction of the cost – if any. The use of such technology has exploded during the COVID-19 pandemic. According to one study, air travel by 6,741 participants at a single meeting of the American Association of Geographers in Seattle produced about 16,000 tonnes of carbon emissions, equivalent to 3,397 passenger vehicles being driven on gasoline for an entire year.^{104, 105} Yet, virtual meetings have potential pitfalls (see ‘Action 4’).

2. Take a train instead

Flying is the fastest mode of transport over long distances, but rail is a viable option for shorter journeys. It has been estimated that every passenger emits 96.5 kg of CO₂ flying 380km from London to Amsterdam but only 2.3 kg by taking the Eurostar.¹⁰⁶ Although the rail journey is two hours longer than the flight, trains save time as they are not encumbered by airport security. Air travel also emits more than cars. Each person traveling from London to Amsterdam in a gasoline-engine vehicle with a driver and three passengers emits an estimated 16.3 kg – one sixth of the amount emitted by air travel (for more on trade-offs between driving and taking the train, see ‘Action 1’).

In some cases, trains are faster than planes. China, for example, is prototyping a maglev train that can reach up to 600 km/h – three and a half hours between Beijing and Shanghai compared with about four and a half hours by plane, including time to prepare for the journey.¹⁰⁷

3. Choose your airline carefully - Some airlines emit more than others

Airline choice can be based on factors like price, comfort, convenience and loyalty programmes. Atmosfair’s Airline Index, which ranks 125 global airlines by carbon efficiency, allows climate change to be taken into account.¹⁰⁸

Hong Kong-Singapore flight

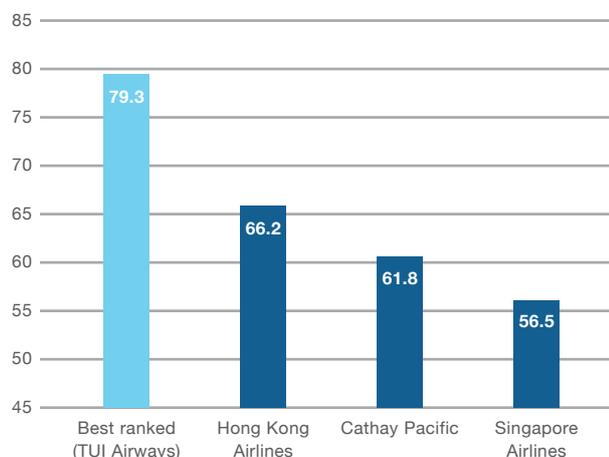
Among the three main carriers flying from Hong Kong to Singapore, Hong Kong Airlines leads with around 66 efficiency points followed by Cathay Pacific (62 points) and Singapore Airlines (57 points). But all three lag TUI Airways with 79 points.

London-New York flight

For the five main airlines flying from London to New York, Delta fares best with almost 62 efficiency points and Virgin Atlantic is worst at 51 points. Again, the major carriers are far behind TUI Airways with 79 points.

Comparing most efficient airline with 3 major carriers flying short-haul HK to Singapore route

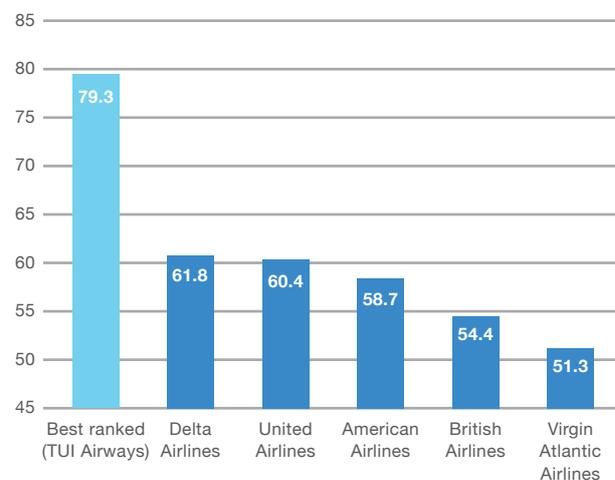
Unit: Efficiency points



Source: CWR, atmosfair Airline Index 2018

Comparing most efficient airline with 5 major carriers flying long-haul London to New York route

Unit: Efficiency points



Source: CWR, atmosfair Airline Index 2018

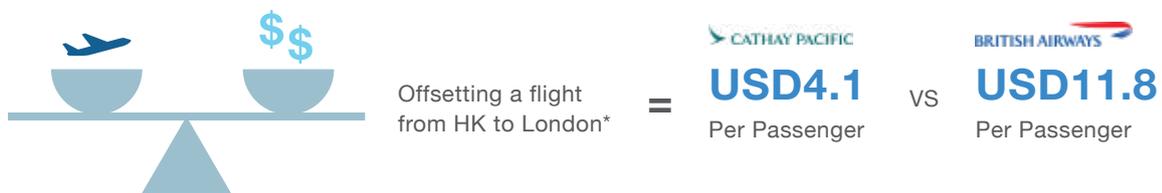
4. Carbon offset your flight, but beware offsetting methods are opaque

'Offsetting' is the idea that you can "compensate" for the carbon emissions of your flight by funding mitigation projects, such as renewable energy expansions. You can either choose projects yourself, or you can also pay extra to some airlines which will then forward it on to the project.

However, there are several caveats to this. For one, some criticise offsetting as it gives companies a license to emit. What's more, offsetting is often priced too low.

Let's take a look at Cathay Pacific's carbon offsetting – it only costs USD4.10 to offset a roundtrip flight from Hong Kong to London in economy class.¹⁰⁹ You cannot even buy a Starbucks Grande Latte in Hong Kong with this amount! How is USD4.10 going to suck out 1.66t of CO₂ of flight emissions (Cathay Pacific-specific)? By the way, 1.66t CO₂ is equivalent to driving an average passenger vehicle car on petrol for 6,629km.¹⁰⁵ In comparison, the cost to offset the same flight with British Airways is much higher at USD11.8.¹¹⁰

 **CWR** CARBON OFFSETTING A FLIGHT WITH CATHAY PACIFIC VS BRITISH AIRWAYS

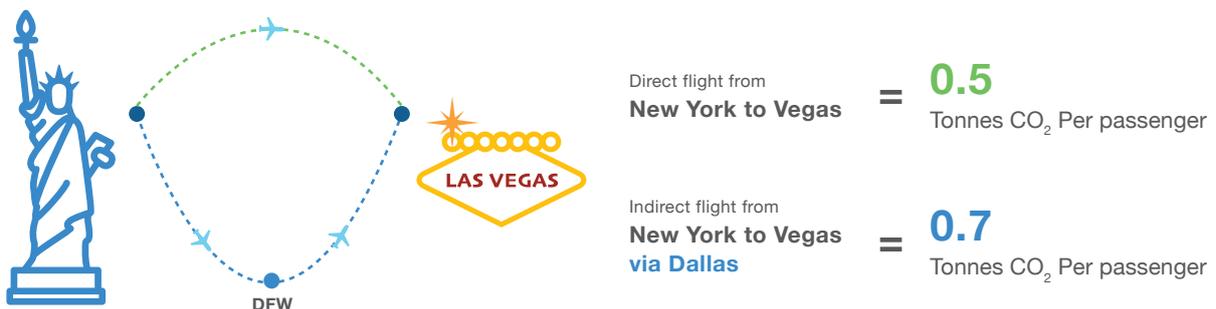


Source: CWR, Cathay Pacific website, British Airways website * assumes economy class flight
© CWR, 2022 all rights reserved

5. Flying direct helps as more stops = more carbon

Taking off is the most fuel-consuming stage of air travel so flights with multiple stops consume much more fuel than direct flights.¹¹¹ Flying from New York to Las Vegas, for example, each person emits 0.5 tonnes whereas flying via Dallas emits 40% more at 0.7 tonnes.¹¹² Direct flights are not only faster but are sometimes cheaper.

 **CWR** FLYERS CAN SAVE 200KG OF GHG EMISSIONS BY FLYING DIRECT FROM NEW YORK TO VEGAS

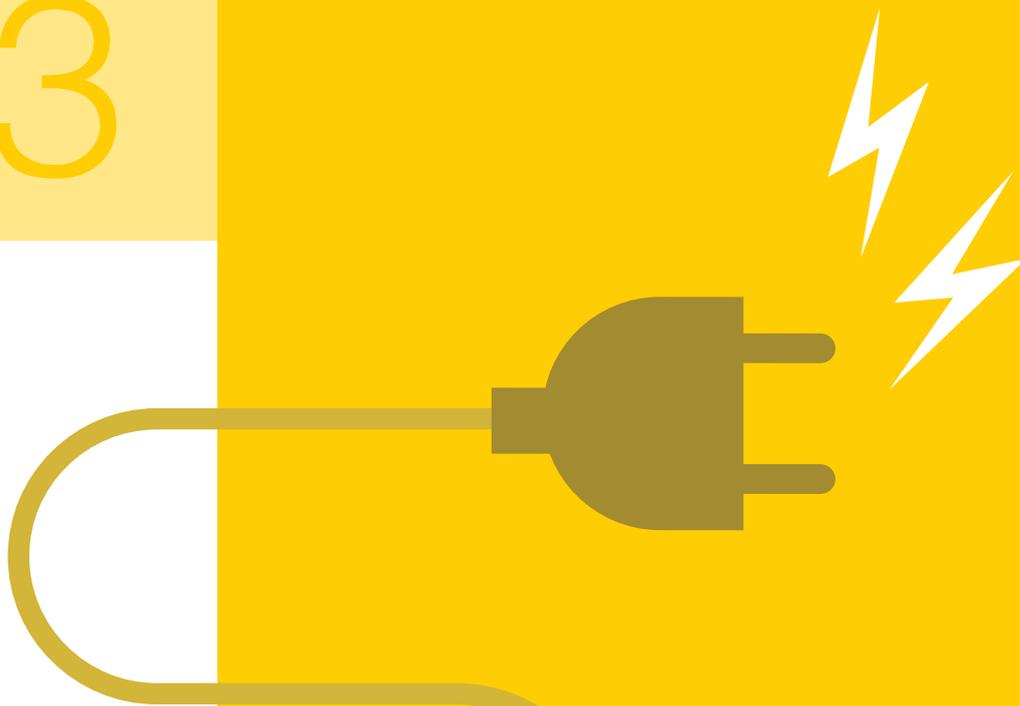


Source: CWR, Debbage, K. G., & Debbage, N. (2019). Aviation carbon emissions, route choice and tourist destinations: Are non-stop routes a remedy? *Annals of Tourism Research*, 79, 102765. doi:10.1016/j.annals.2019.102765
© CWR, 2022 all rights reserved

6. Pack light

The lighter the luggage the better. The weight of luggage (both checked and carry-on) adds to the amount of fuel being burned.¹⁰¹ Think before you pack.

3



Action 3

Watch electricity bills

SAY NO TO CARS
FLY LESS

WATCH ELECTRICITY BILLS

CHANGE ONLINE HABITS

RETHINK DIETS

CUT FOOD WASTE

TWEAK ONLINE SHOPPING

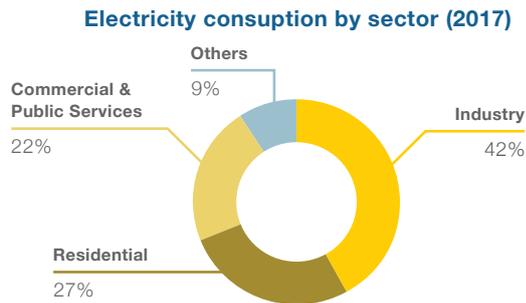
SLOW DOWN FAST FASHION

Action 3: Watch electricity bills

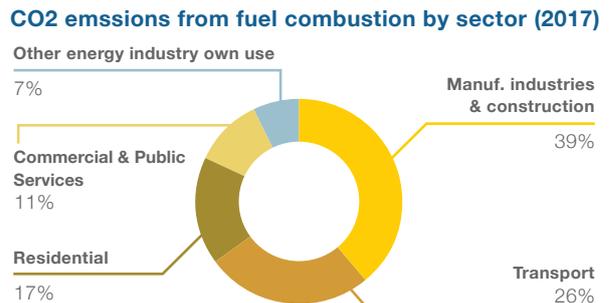
Why we chose this...

- Our daily electricity use at home may seem insignificant (except when the electricity bill arrives), but the lights, air conditioning, shower, washing machine, dishwasher etc. can add to the climate crisis, especially if not powered by renewables.
- The residential sector represents 27% of global energy consumption and 17% of global CO₂ emissions. In the EU, up to 25% of energy-related GHG emissions are from the residential sector.^{113, 114}

CWR THE RESIDENTIAL SECTOR ACCOUNTS FOR 27% OF GLOBAL ELECTRICITY USE & 17% OF GLOBAL CO₂ EMISSIONS



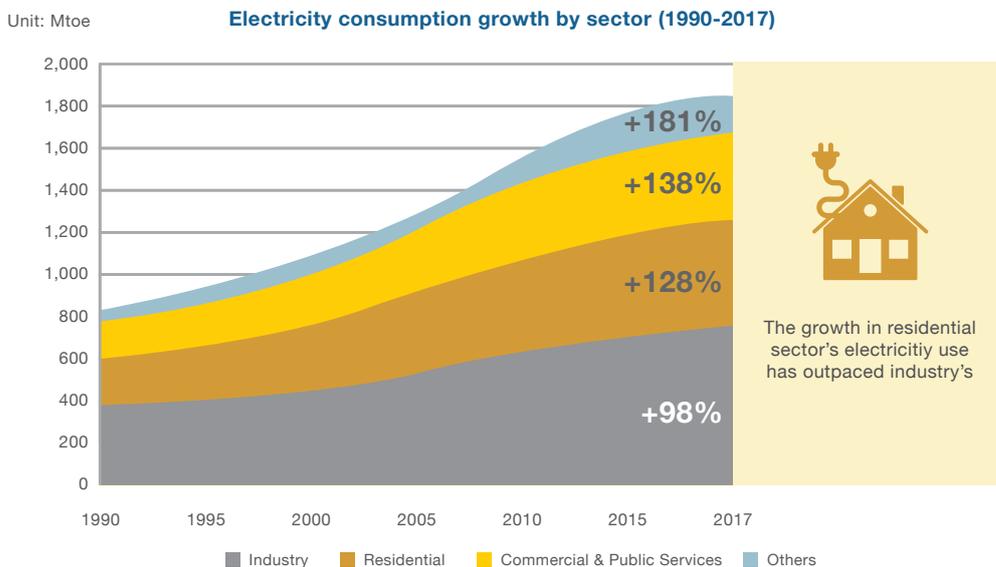
Sources: CWR, IEA Data & Statistics website
 *Others include transport, agriculture, fishing & non-specific purposes
 © CWR, 2022 all rights reserved



Sources: CWR, IEA CO₂ Emissions from Fuel Combustion 2019
 NOTE: electricity and heat allocated to consuming sectors

- What's more, it's still growing – between 2013 and 2017, global residential electricity consumption grew by 9.3%; in fact, the growth in global residential electricity consumption outpaced the growth in industrial electricity use by 7.6%.¹¹⁵

CWR RESIDENTIAL SECTOR IS SET TO USE EVEN MORE ELECTRICITY

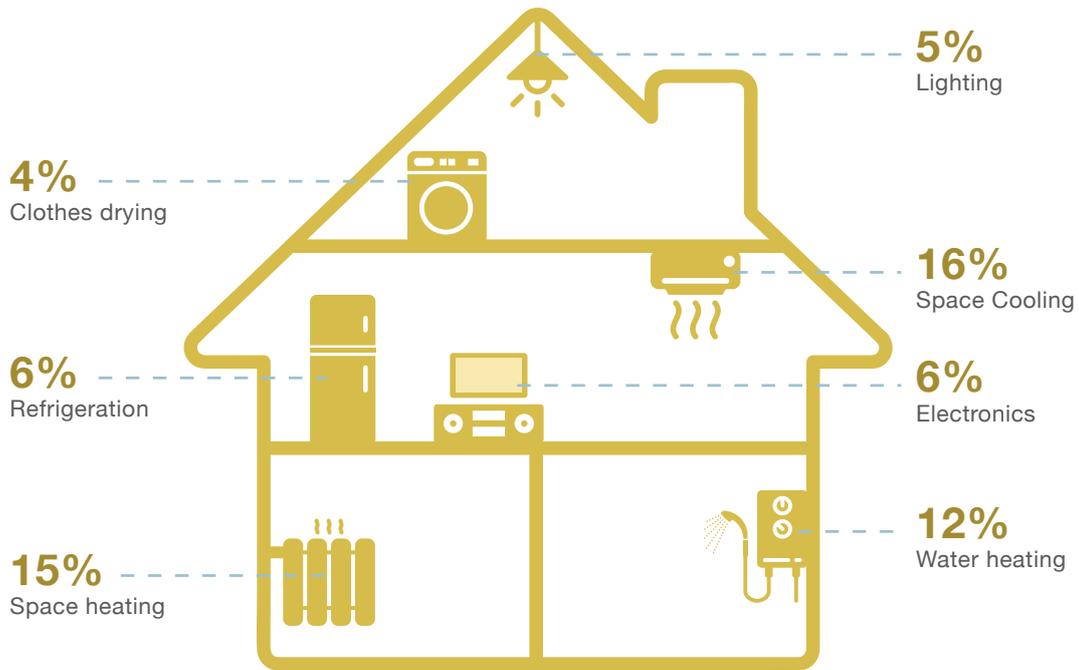


Sources: CWR, IEA Data & Statistics Website
 *Other include transport, agriculture, fishing & non-specified purposes
 © CWR, 2022 all rights reserved

New household habits

So, what can we do? A good place to start is to change household activities that use the most electricity – here, we have selected using air conditioning and taking showers. For instance, in an average US home, cooling your home accounts for 16% of household electricity use while water heating accounts for 12% (see graphic below).

CWR MAIN END USES OF ELECTRICITY IN AN AVERAGE US HOUSEHOLD (2019)

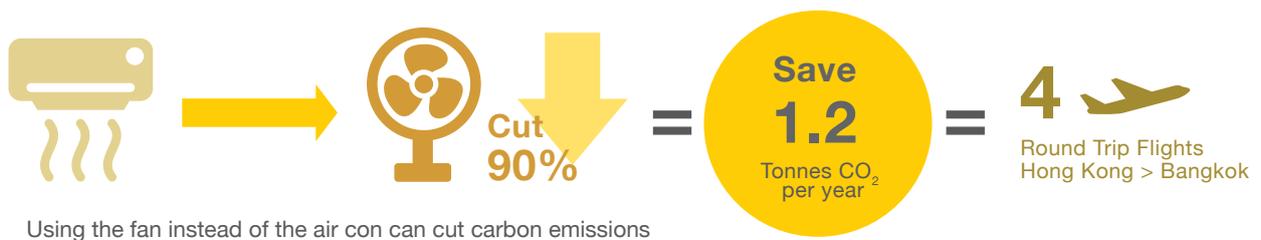


Source: CWR, US Annual Energy Outlook 2020
 NOTE: other end uses account for the outstanding 38%
 © CWR, 2022 all rights reserved

1. Halve air conditioner use by using a fan instead for a year

Climate change brings scary loops – the more we use air conditioning, the more greenhouse gases we emit and the warmer it gets and so the more we want to use air conditioning. Breaking this vicious circle can start with greater use of fans – less energy intensive than cooling systems, the biggest power consumer in average US households.¹¹⁶ In homes powered by coal or gas, using a fan instead of an air conditioner can cut carbon emissions by 90%.

CWR CUTTING GHG EMISSIONS BY USING THE FAN INSTEAD OF AIR CON



Source: CWR, Singapore NCCS “My Guide To Climate Change”, Kumar, Rajesh. (2013). Carbon Emissions from air-Conditioning. American Journal of Engineering Research, Guardian’s emissions calculator
 © CWR, 2022 all rights reserved

2. Take 3 minute instead of 6 minute showers a day for a year

Shorter showers save not only water but also energy, helping to cut GHG emissions. This is because pumping, transporting and heating water uses a large amount of energy. A person who halves the duration of daily showers from six minutes to three minutes for a year could save 135 kg of carbon emissions, equivalent to driving from Rome to Milan and saving almost 30 bathtubs of water. For more on water and energy, see box below.

 **CWR** CUTTING GHG EMISSIONS & WATER USE BY TAKING SHORTER SHOWERS



Source: CWR, UK Environment Agency "Quantifying the energy and carbon effects of water saving full technical report" (2009), US EPA greenhouse gas equivalencies calculator, google maps
 *Indicative action analysed in UK Environment Agency report assumes: 10kW electric shower and showering every day (household of 4 so actions here have been calculated for the individual)
 NOTE: assumes average passenger car; each bathtub = 200 litres
 © CWR, 2022 all rights reserved

These two actions can help a person save up to 1.37 tonnes of emissions a year, depending on the energy mix of the household electricity supply. Together, we can use these simple actions to achieve sizeable cuts equivalent to half of Chile's and all of Sri Lanka's emissions in 2015.

Other ways to cut household electricity consumption are set out in '5 ways you can do more' below. Household heating is estimated to account for 15% of household electricity consumption. In the absence of sufficient data to reliably estimate a collective cut, however, we have not included heating in our collective analysis.¹¹⁶

Saving water = Saving energy | The Water-Energy Nexus

Every litre of water we use at home requires energy. Desalinated water uses a lot of energy and is therefore very carbon intensive (up to four times more intensive than reclaimed water). Saving water at home indirectly reduces energy use and carbon emissions. The other side of the coin is that energy needs water to be produced so the two are inextricably linked.

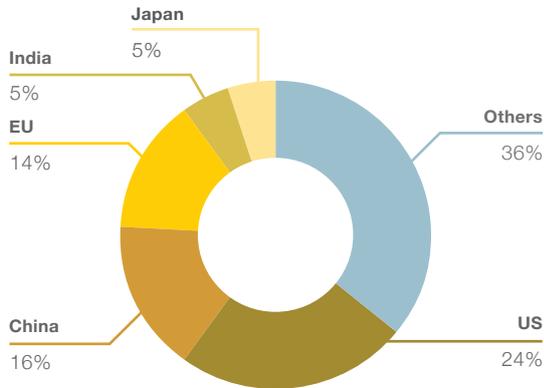


Households which do 7 loads a week in a dishwasher instead of 14 can save 270 kg of carbon dioxide equivalent (kgCO₂e) a year. Washing up in a sink or container instead of under a running tap can save another 666 kgCO₂e a year.

Source: UKEA "Quantifying the energy and carbon effects of water saving full technical report" (2009), CWR Big Picture "Water & Climate Change", US EPA Greenhouse Gas Equivalencies calculator

Together we can... 2 simple actions can cut up to 628 Mt of GHG emissions...

Residential electricity consumption by country (2017)



Some regions use more electricity at home than others. As the chart left shows, households from the US account for almost a quarter (24%) of all residential electricity consumption in the world. Together with China (16%) and the EU (14%), these three regions' residential sectors consumed 3,100TWh of electricity in 2017, which is as much electricity as 590 coal-fired power plants (600MW) running at full capacity all year.¹¹⁵

We estimate that willing individuals from the US, China and the EU who take the two actions outlined above could not only lower electricity bills but also cut emissions by almost 628 million tonnes of carbon dioxide equivalent (MtCO₂e) – comparable to reducing GHG emissions from Australia in 2015.¹⁵ If everybody made these two changes, the collective impact would be even larger.

Source: CWR, IEA Data & Statistics website

1. Halve air conditioner use for a year and use a fan instead

The European Investment Bank Climate Survey found that 70% of Americans, 58% of Europeans and 89% of Chinese intend to use less air conditioning in summer to combat climate change.¹⁰⁰ Using this we estimate that if roughly seven in ten people from the US population (totalling around 230mn people) halve air conditioner use for a year and use a fan instead (assuming 4 months of use a year, so calculating savings from 2 months switch to fan), 47 MtCO₂e can be saved. Similarly, if roughly six in ten of the EU population did this (totalling around 307mn people) 61 MtCO₂e can be saved and if nine in ten from China (totalling around 1.3bn people) did this 260.7 MtCO₂e can be saved.

Through this simple habit change, these people from US, EU and China can together save 368.7 MtCO₂e, comparable to the 2015 GHG emissions of the Philippines and Qatar combined.¹⁵

CWR HOUSEHOLDS FROM THE US, EU & CHINA CAN SAVE ALL GHG EMISSIONS OF THE PHILIPPINES & QATAR COMBINED BY USING THE FAN INSTEAD OF AIR CON FOR 2 MONTHS PER YEAR



Source: CWR, Kumar, Rajesh. (2013). Carbon Emissions from air-Conditioning. American Journal of Engineering Research, Singapore NCCS "My Guide To Climate Change", World-O-meter population statistics, EDGAR emissions database

* only includes indirect emissions from energy consumption of aircons and does not include refrigerant emissions; assumes 1.5 tonne window air con with average use at 8 hours per day for 20 days a month; assumes fans use 1/10 the power of aircons & hence 1/10 of indirect emissions; assumes average air cons operate four months a year thus halving it and so the calculations are for a 2 month period and

** EIB Climate Survey found that 70% from the US, 58% from the EU and 89% from China already do or intend to use less air con during the summer to combat climate change

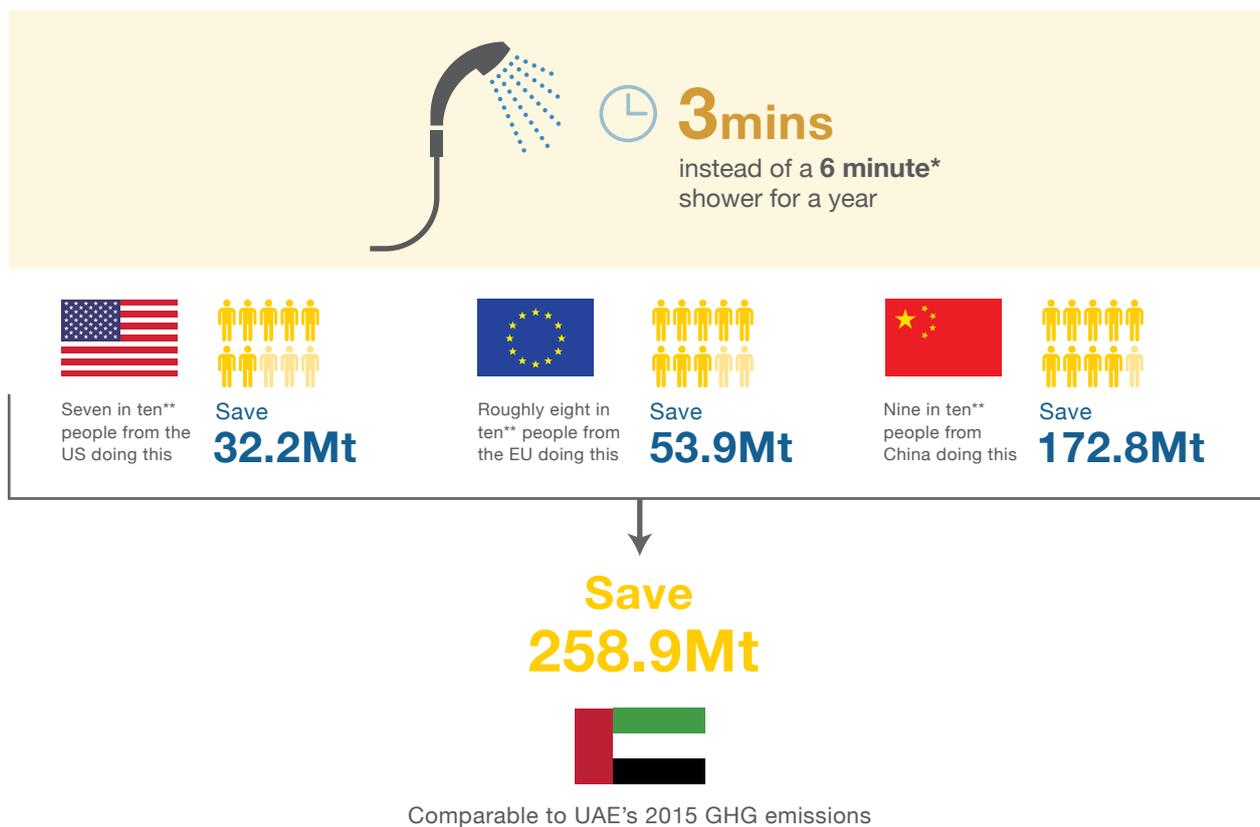
© CWR, 2022 all rights reserved

2. Take 3 minute instead of 6 minute showers a day for a year

The EIB also found that 73% of people in the US, 78% in the EU and 90% in China intend to take some form of household action to combat climate change.¹⁰⁰ Based on these estimates, we calculated the impact of these people taking three-minute instead of six-minute showers for a year. Savings were estimated at more than 32 MtCO₂e for the Americans, almost 54 MtCO₂e for the Europeans and about 173 MtCO₂e for the Chinese.

Together, these people from the US, the EU and China could save 259 MtCO₂e, equivalent to the GHG emissions of the United Arab Emirates in 2015.¹⁵ Water saved would amount to almost 4.5 million Olympic-sized swimming pools.

 **CWR** HOUSEHOLDS FROM THE US, EU & CHINA CAN SAVE ALL GHG EMISSIONS FROM THE UNITED ARAB EMIRATES BY TAKING SHORTER SHOWERS



Source: CWR, UK Environment Agency "Quantifying the energy and carbon effects of water saving full technical report" (2009), EIB Climate Survey, EDGAR emissions database, World-O-meter population statistics

*Indicative action analysed in UK Environment Agency report; assumes 10kW electric shower and showering every day per person in a household of 4 people

**EIB Climate Survey did not have specific data on showering so the average of 4 household related actions to combat climate change has been used

© CWR, 2022 all rights reserved

Ramping up to one billion tonnes if everyone halves air conditioner use

Americans, European and Chinese can clearly make a huge difference. But the impact of collective efforts by all people could be even bigger. Everyone on the planet halving air conditioner use, for example, would save one gigatonne (one billion tonnes) of carbon dioxide equivalent a year.¹¹⁷ That's more than the GHG emissions of Germany in 2015.¹⁵

5 ways you can do more...

1. Better insulation

This one is a significant one-time fix. Heating and cooling homes use between 30% and 50% of household electricity. Much can be wasted if homes are poorly insulated with heat or cool air escaping through windows, ceilings and walls.¹¹⁸

Energy needs can be reduced by 58.5% with wood-framed double glazed windows and 33.4% with organic external wall insulation systems including green roofs.¹¹⁹ Thicker walls with 500 mm insulation can reduce lifetime emissions by 15%.¹²⁰

2. Do clothes need machine drying? Air drying is green and free!

Washing clothes may be carbon intensive but machine drying is even worse. A load of laundry washed at 40°C and dried on a line emits 0.7 kgCO₂e whereas tumble drying emits 2.4 kgCO₂e - more than three times as much. Hanging clothes out to dry instead of using a clothes drier twice a week for a year would save 170 kgCO₂e, equivalent to driving an average passenger car on gasoline from London to Edinburgh.^{100, 121} For more on the climate impact of clothes check, see 'Action 8'.

3. Set devices to go to sleep or shut them down and unplug

Home electronics can use up to 6% of household electricity and that includes powering computers and other devices. One way to cut consumption is setting devices to go to sleep after a period of inactivity so they can run more efficiently. The average energy-efficient laptop burns 15-60 watts when being used but only 2-5 watts while in sleep mode.¹²²

If shutting down a device entirely, unplug chargers that are not in use – they continue to draw at least 0.5 to 2.0 watts of energy known as 'vampire power'.

For more on cutting digital carbon footprints, see 'Action 4'.

4. Use LED light bulbs

Light bulbs made from light-emitting diodes generally use at least 75% less energy and last 25 times longer than incandescent lighting.¹²³ According to one study, the average American can save 170 gCO₂e a year with LED light bulbs.¹²⁴

5. Choose energy-efficient products from your fridge to your kettle

Energy efficiency applies to many household appliances. In some countries such as the US and the UK, energy labels have to be displayed on items like washing machines, air conditioners and refrigerators to help consumers choose more energy-efficient products.

Price tags may be higher but energy-efficient products can save money in the long run and reduce greenhouse gas emissions at the same time. According to the US government, ENERGY STAR products can save about USD575 on household energy bills a year and avoid more than 1,100 kg of greenhouse gas emissions.¹²⁵

Look beyond our own four walls

Green buildings are catching on but commercial buildings still use huge amounts of energy and water. Some of the household actions discussed above such as shutting down devices and using LED light bulbs can be carried out in offices as well. Ensuring that offices are not cooled or heated excessively can also have a big impact. Work practices matter too. Sending an average email with a large attachment uses 50 gCO₂e which is then multiplied by the number of recipients and how many times the email is forwarded (see 'Action 4').

Source: *The Guardian* "What's the carbon footprint of ... email?" by Mike Berners-Lee and Duncan Clark, Oct 2010

4



Action 4

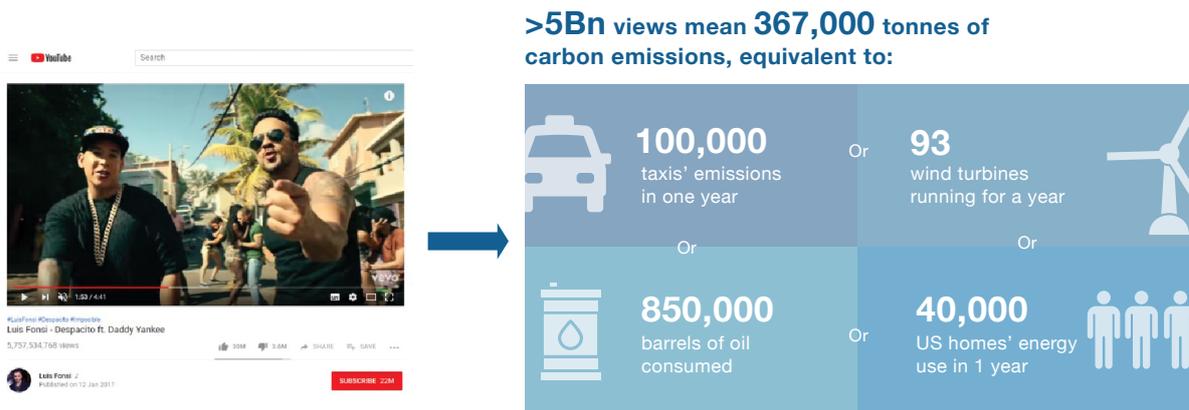
Change online habits

SAY NO TO CARS
FLY LESS
WATCH ELECTRICITY BILLS
CHANGE ONLINE HABITS
RETHINK DIETS
CUT FOOD WASTE
TWEAK ONLINE SHOPPING
SLOW DOWN FAST FASHION

Action 4: Change online habits

Why we chose this...

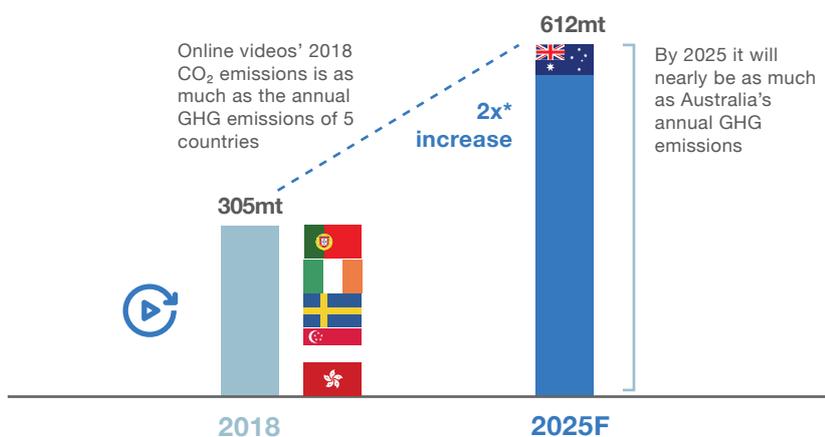
- Every byte of data we use requires energy, from running servers to cooling data centres. Every Instagram post, every YouTube video and every Google search contributes to climate change. Digital technologies, from smartphones to data centres, already represent 3.7% of global carbon emissions – more than international aviation.¹²⁶
- Take the song “Despacito” as an example, which has been played more than 5 billion times globally on YouTube. According to the Financial Times, “Despacito” carbon footprint as of 2018 is more than the annual emissions of 100,000 taxis. This is just one song, on one platform.¹²⁷



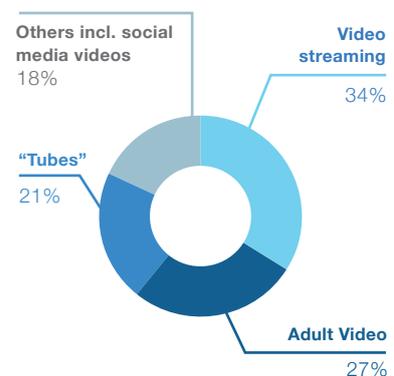
Source: CWR, YouTube, Financial Times, EPA Greenhouse Gas Equivalencies
 NOTE: YouTube views as of 2018
 © CWR, 2022 all rights reserved

- As the world’s data consumption continues to rise, so will its carbon footprint. The carbon emissions of online videos could double from 305 million tonnes of carbon dioxide equivalent to 612 MtCO₂e by 2025 – comparable to nearly all of Australia’s GHG emissions in 2015.^{15, 126} Video streaming accounts for more than a third of these emissions while ‘Tubes’ account for a further 21% (see chart below right).

CWR ONLINE VIDEOS’ SHOCKING CURRENT & FUTURE GHG EMISSIONS



Which videos are the worst emitters?



Source: CWR, the Shift Project (2019) “Climate Crisis: The Unsustainable Use of Online Video”, EDGAR emissions database
 * assumes that data traffic continues to account for 55% of digital tech’s energy consumption & that online videos continue to account for 60% of global data flows
 ©CWR, 2022 all rights reserved

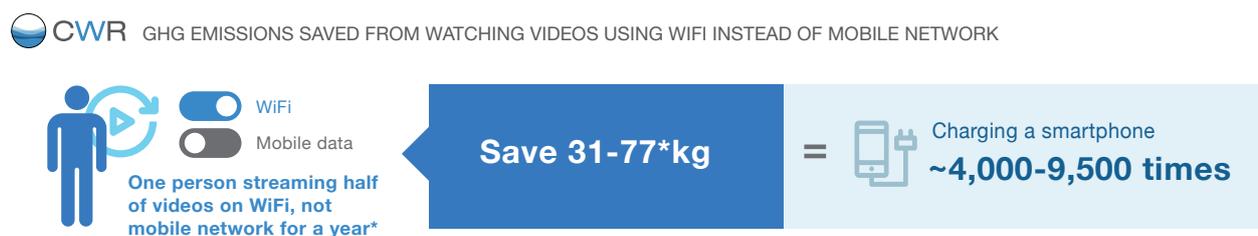
- The internet adult video industry is also a big carbon emitter, accounting for 27% of all online video emissions. If adult videos grow at the same rate as all online videos, the industry could be emitting 165 MtCO₂e by 2025F – equivalent to all the GHG emissions from Columbia in 2015.¹⁵

New online habits...

So, what can we do? A good place to start is to change specific online surfing habits that can make a big climate impact – streaming on WiFi and cutting down social media. We have chosen these because there is sufficient existing research on their impacts, and we believe they are easily achievable.

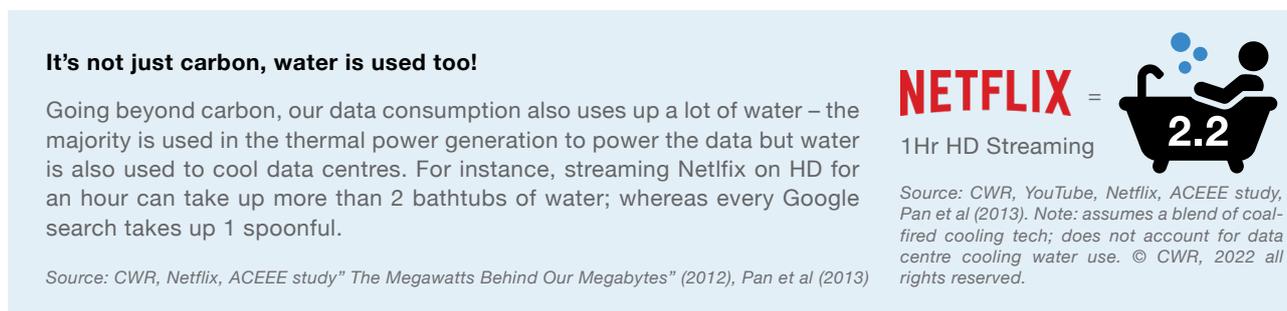
1. Stream half of online videos over WiFi instead of mobile networks for a year

Streaming videos over a mobile network is more than four times more carbon intensive than streaming over WiFi, according to the Shift Project, a French think tank.¹²⁷ We estimate that one person from the US, the EU or China making this switch could each save between 31 kg and 77 kg of carbon emissions – equivalent to charging a smartphone about 4,000 to 9,500 times.



Source: CWR, Cisco Visual Networking Index (2017), Shift Project “Lean ICT – Towards Digital Sobriety” (2018) & supplementary materials, US EPA Greenhouse Gas Equivalencies Calculator
*average person refers to US/EU/China citizen; range of emissions savings due to different energy mixes in these 3 regions
© CWR, 2022 all rights reserved

What is more, changing how we stream can also help save water (see box below).



2. Cut social media activity by one hour a day for a year

Social media is a daily activity for more than half the world’s population.¹³⁰ It can be highly addictive but cutting activity by an hour every day is possible. Assuming that social media uses similar levels of energy as watching online videos, we estimate that one person from the US, the EU or China who cuts activity by one hour a day for a year could save between 9 kg and 21 kg of GHG emissions, equivalent to charging a smartphone about 1,100 to 2,700 times.^{100, 130}



Source: CWR, Shift Project “Lean ICT – Towards Digital Sobriety” (2018) & supplementary materials, US EPA Greenhouse Gas Equivalencies Calculator, Cisco’s online VNI Services Gauge Tool
*assumes mobile network used; also, due to a lack of data, we assume the energy use from watching videos to be similar to that from using social media
© CWR, 2022 all rights reserved

With these two simple actions, an individual from the US, the EU or China could save between 40 kg and 98 kg of emissions – depending on the energy mix of the electricity supply. Together, collective action could save emissions equivalent to the combined emissions of Portugal in 2017 and half those of Cambodia in 2015.¹⁵

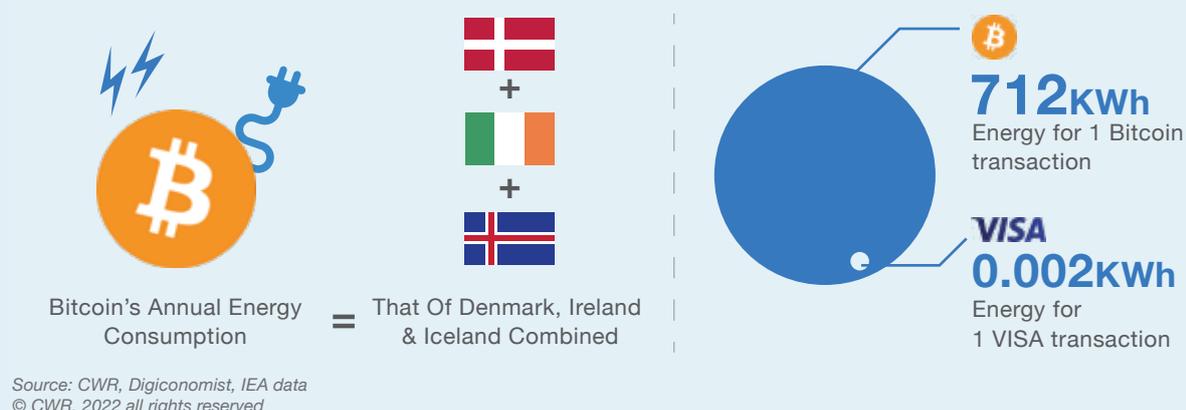
Beyond these changes, there are other ways to modify online activities (see '4 more ways to do more' below). Finally, aside from greening our online surfing habits, we should also pay attention to emerging digital trends such as cryptocurrency, artificial intelligence and so on as they can be energy intensive (see box below).

Waking up to the 'dirty' reality of Cryptocurrencies like Bitcoin

The emergence of blockchain technology more than a decade ago has transformed the way financial transactions are made. Its 'proof-of-work' method is by definition energy intensive. With cryptocurrencies, every coin mined using this method requires more energy to mine than the previous coin. Climate impacts are significant. According to Digiconomist, every Bitcoin transaction requires 712 kilowatt hours – 35,600 times more energy intensive than a Visa card transaction.

On a macro scale, Bitcoin's annual energy consumption already exceeds the combined production of Denmark, Ireland and Iceland. Not all Bitcoins are mined by electricity generated by thermal power. But it was very much the case in China, one of the world's biggest Bitcoin miners until mid-2021 when Beijing clamped down on the sector. The impacts of blockchain technology and cryptocurrencies are starting to emerge.

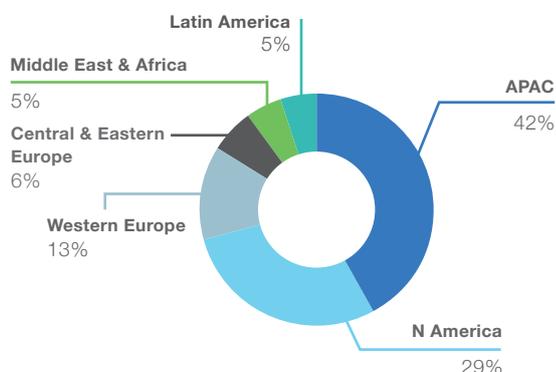
 **CWR** WATCH OUT FOR BITCOIN'S HIGH & STILL RISING ENERGY CONSUMPTION



We must be mindful of these 'pitfalls' and push tech inventors to disclose more and improve their green credentials.

Together we can... 2 simple actions can cut up to 174 Mt of GHG emissions...

Which regions use the most data? (2021F)



Source: CWR, Cisco Visual Networking Index: Forecast and Trends, 2017–2022 White Paper

By 2021, the Asia-Pacific region is expected to account for 42% of all global internet traffic with 136 exabytes a month (one exabyte is equivalent to 119 billion songs lasting 906,000 years).¹³¹ The region may account for around 56% of the world's population but it uses less data per capita than the global average.

North America was set to account for 29% of Internet traffic and Western Europe 19% by 2021. In other words, two regions comprising about 9% of the world's population will account for almost half of all internet traffic.¹³²

People from the Asia-Pacific region, North America and Western Europe can make a bigger difference than others in cutting their online footprints.

We estimate that willing individuals from the US, the EU and China could cut 137 MtCO₂e if they adopted the first new habit outlined above and 37 MtCO₂e if they adopted the second, together equivalent to the combined GHG emissions of Singapore, New Zealand and Cambodia in 2015.¹⁵ If everyone took the same actions, the collective impact would be even larger.

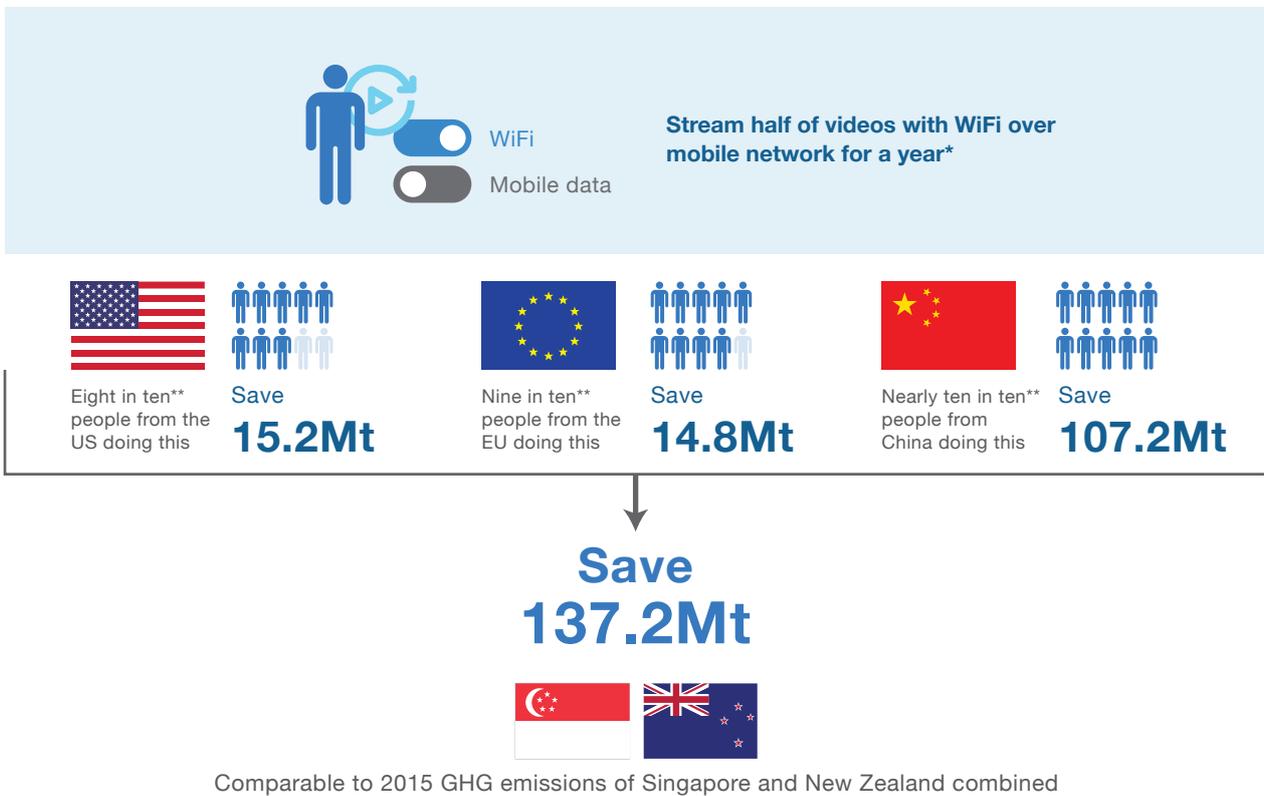
1. Stream half of online videos over WiFi instead of mobile networks for a year

Based on Cisco research, we found that the average online video watcher views 1,890 ten-minute videos a year.¹³³ From this, we estimated that if one person from the US, the EU or China streamed half of these on WiFi instead of mobile networks for a year, annual savings could be between 31 kg and 77 kg of GHG emissions, equivalent to charging a smartphone around 4,000 to 9,500 times.^{100, 133}

The EIB found that 83% of Americans, 92% of Europeans and 97% of Chinese either intend to or already turn off electrical appliances rather than put them on standby from time to time to combat climate change. This is the most relevant consumer survey result we could find on electronic habits so we assume these percentages of populations would also be willing to use WiFi for streaming.¹⁰⁰

Based on these findings, we calculated that eight in ten Americans streaming half their online videos over WiFi instead of mobile networks for a year would save about 15 MtCO₂e. Nine in ten Europeans doing so would save a similar amount and the same change by almost all Chinese would save about 107 MtCO₂e. Together, they could save 137 MtCO₂e, equivalent to the GHG emissions of Singapore and New Zealand combined in 2015.¹⁵

 **ONLINE VIDEO VIEWERS FROM US, EUROPE & CHINA CAN SAVE ALL GHG EMISSIONS FROM SINGAPORE & NEW ZEALAND BY USING WIFI INSTEAD OF MOBILE DATA HALF OF THE TIME**



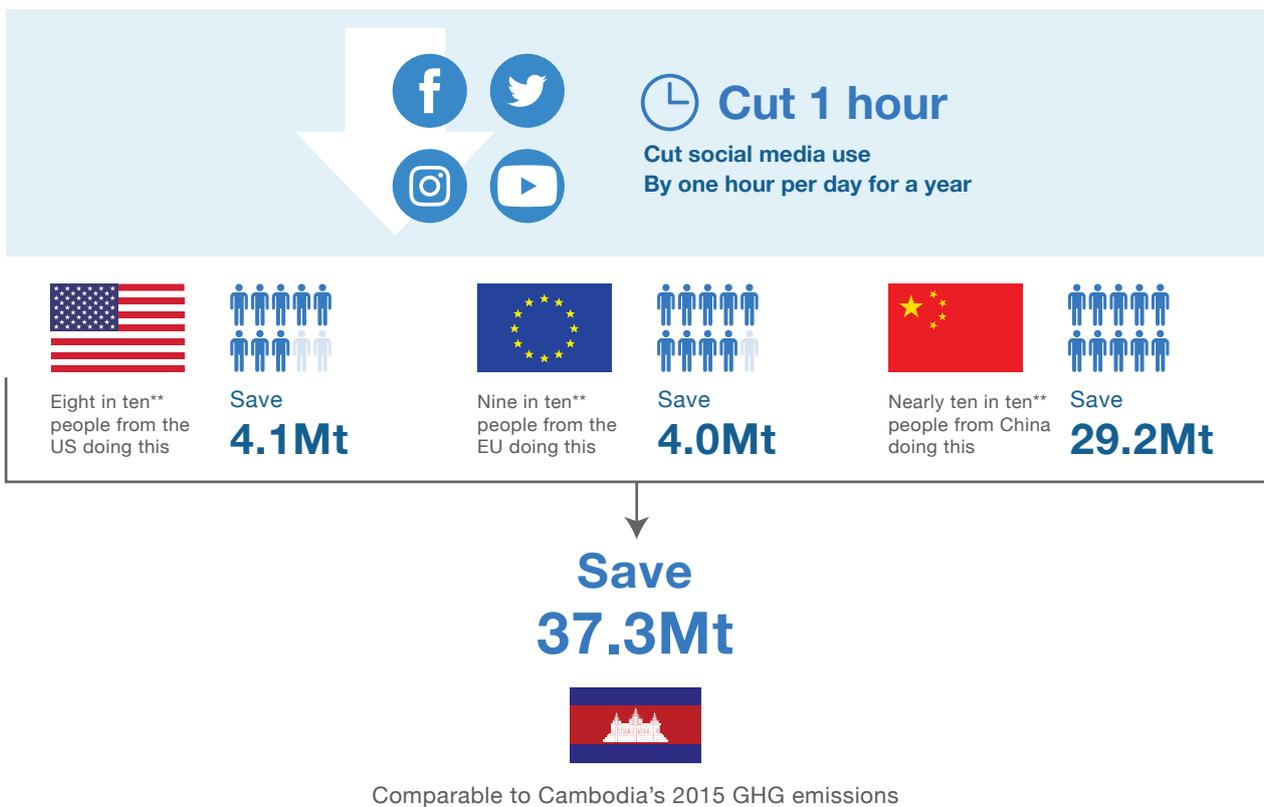
Source: CWR, Cisco Visual Networking Index (2017), Shift Project "Lean ICT – Towards Digital Sobriety" (2018) & supplementary materials, World-O-meter population statistics, EDGAR emissions database, EIB Climate Survey, Worldometer population statistics
 , * Suggested by Shift Project as a way to reduce online carbon footprint
 ** The EIB Climate Survey found that 83% from the US, 92% from the EU and 97% from China either intend to or already turning off electrical appliances rather than put them on standby mode from time to time to combat climate change. This is the most relevant consumer survey result we could find to electronic habits and therefore we assume these population shares to also be willing to switch or wait to use WiFi for streaming
 © CWR, 2022 all rights reserved

2. Cut social media use by one hour a day for a year

The EIB found that 83% of Americans, 92% of Europeans and 97% of Chinese either intend to or already turn off electrical appliances rather than put them on standby from time to time to combat climate change. Again, this is the most relevant consumer survey result we could find so we assume the same shares of population would also be willing to cut social media use by one hour a day for a year.¹⁰⁰

Based on these findings, we calculated that roughly nine in ten Americans who cut social media use by one hour a day for a year could save about 4 MtCO₂e and that eight in ten Europeans doing likewise could save a similar amount. Almost all Chinese adopting the same habits would save about 29 MtCO₂e. Together, these people from the US, the EU and China could save about 37 MtCO₂e, equivalent to the GHG emissions from Cambodia in 2015.¹⁵

 **CWR** INDIVIDUALS FROM THE US, EUROPE & CHINA CAN SAVE CAMBODIA'S GHG EMISSIONS BY SPENDING ONE HOUR LESS PER DAY ON SOCIAL MEDIA



Source: CWR, Shift Project "Lean ICT – Towards Digital Sobriety" (2018) & supplementary materials, World-O-meter population statistics, EDGAR emissions database, EIB Climate Survey, Cisco's online VNI Services Gauge Tool, Worldometer population statistics

*The EIB Climate Survey found that 83% from the US, 92% from the EU and 97% from China either intend to or already turning off electrical appliances rather than put them on standby mode from time to time to combat climate change. This is the most relevant consumer survey result we could find to electronic habits and therefore we assume these population shares to also be willing to switch or wait to use WiFi for streaming

NOTE: assumes mobile network used

© CWR, 2022 all rights reserved

Ramping up to 314 million tonnes

While these two actions by Americans, Europeans and Chinese can make a big difference, the collective impact could be even bigger if others took action as well. All the world's 4.4 billion internet users streaming half their videos with WiFi and cutting social media use by an hour a day for a year could save 314 MtCO₂e (based on average power mixes for the US, the EU and China). That's equivalent to Malaysia's GHG emissions in 2015.¹⁵

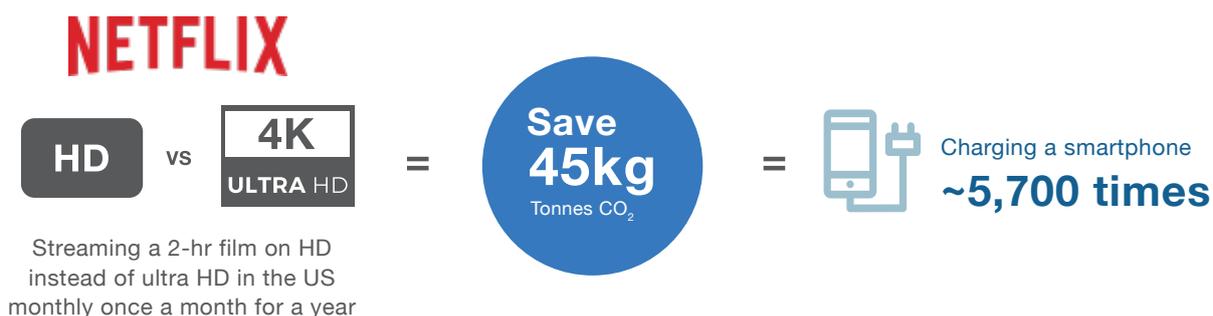
Reducing carbon emissions by changing internet habits requires being careful – even in Africa where internet use is growing fastest.¹³⁴ Even greater care needs to be taken to make savings as technologies like artificial intelligence, blockchain and 5G networks advance. These savings can be significant.

4 ways you can do more...

1. Go without ultra HD once a month

According to Netflix, streaming Ultra HD uses 7 GB an hour whereas regular HD consumes only 3 GB an hour.¹³⁵ A person in the US who switches from Ultra HD to HD for a two-hour film once a month can save 45 kgCO₂e a year, as much as charging a smartphone 5,700 times.

 **CWR** GHG EMISSIONS SAVED FROM STREAMING NETFLIX ON HD INSTEAD OF ULTRA HD



Source: CWR, Shift Project “Lean ICT – Towards Digital Sobriety” (2018) & supplementary materials, Netflix, US EPA Greenhouse Gas Equivalencies Calculator ©CWR, 2022 all rights reserved

The difference between ultra and regular HD applies to all online videos. The COVID-19 pandemic has illustrated the significance of expectations for online video traffic to double by 2025. As people in lockdowns turned to online videos, Netflix, YouTube and Amazon reduced resolutions to meet surging demand, highlighting the importance of green brands (see boxes below).

Pandemic lockdowns boost video streaming and data use

In the early days of the COVID-19 pandemic between January and March in 2020, average daily traffic jumped 15% for YouTube and 16% for Netflix. Demand was so high that companies like these and Amazon reduced the default resolutions of their content to cope with capacity issues.

It is too early to tell how much this spurt in global data consumption has contributed to emissions. But we know streaming at lower resolutions can make a big difference in how much data we use and how much we emit. Irrespective of the pandemic, HD rather than ultra HD helps to reduce emissions.

Source: New York Times article “The Virus Changed the Way We Internet” by Ella Koeze and Nathaniel Popper, Apr 2020; Economic Times India “Streaming in the time of Covid-19: YouTube follows Netflix, limits quality to SD for beating bandwidth stress”, Mar 2020

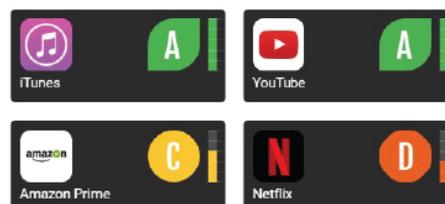
Where are streaming brands on being green?

Greenpeace releases an annual report ranking internet companies and apps in terms of renewable energy. Global brands like Facebook and Google are moving on this, but Chinese brands like Alibaba and Baidu are lagging.

Consumer pressure has shown that even giants like Facebook can change, highlighting the need for further changes to be fully green, cloud and all.

Source: Greenpeace Clicking Clean Report (2017)

A snapshot of results from Greenpeace’s brand ranking



Source: Greenpeace Clicking Clean report (2017)

2. Use electronic devices for longer

The longer we use devices, the more we save. According to the Shift Project, extending lifespans can save significant amounts of carbon. Instead of throwing a laptop away after three years, for instance, using it for another two years can save 68 kgCO₂e. And keeping smartphones for three and a half years instead of two and a half saves another 7 kgCO₂e.¹³⁶ Together, 75 kgCO₂e can save as much carbon as needed to charge a smartphone 10,000 times.

 **CWR** GHG EMISSIONS SAVED FROM USING OUR SMART DEVICES FOR LONGER



Source: CWR, Shift Project "Lean ICT – Towards Digital Sobriety" (2018) & supplementary materials, US EPA Greenhouse Gas Equivalencies Calculator ©CWR, 2022 all rights reserved

3. Cut unnecessary emails

Are attachments necessary? Can they be compressed? According to a study commissioned by UK energy company OVO, British people send more than 64 million unnecessary emails each day. If every adult in the UK sent one fewer 'thank you' email every day, savings could amount to 16,433 tonnes of carbon a year, equivalent to 81,152 flights from London to Madrid or taking 3,334 diesel cars off the road.^{100, 137}

 **CWR** GHG EMISSIONS SAVED FROM SENDING ONE LESS "THANK YOU" EMAIL



Source: CWR, OVO Energy Research "Think Before You Thank": If every Brit sent one less thank you email a day, we would save 16,433 tonnes of carbon a year - the same as 81,152 flights to Madrid" (2019) ©CWR, 2022 all rights reserved

4. Optimise your website

Website hosting companies that use 100% renewable energy include Timpani, Raidboxes and Greenhost.¹³⁸ Kinsta is a managed WordPress hosting provider used by companies like Asos and Ubisoft. It uses the Google Cloud Platform, which runs on data centres that use 50% less energy than average. Other actions include minimising pop-ups, improving search engine optimisation and removing auto-play videos.¹³⁹

5



Action 5

Rethink diets

SAY NO TO CARS

FLY LESS

WATCH ELECTRICITY BILLS

CHANGE ONLINE HABITS

RETHINK DIETS

CUT FOOD WASTE

TWEAK ONLINE SHOPPING

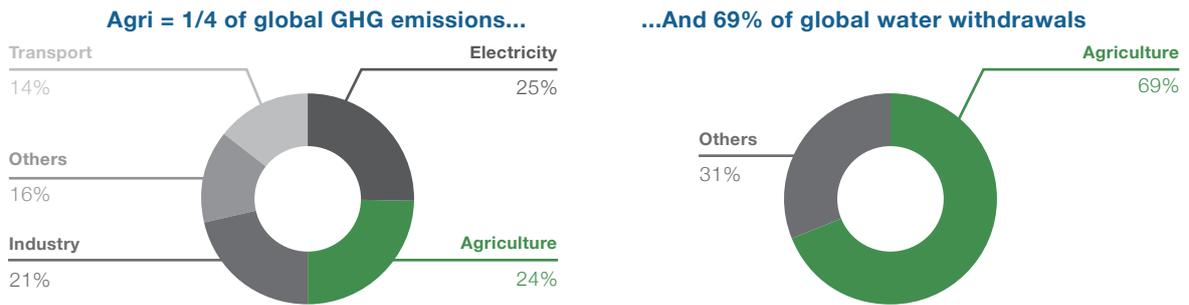
SLOW DOWN FAST FASHION

Action 5: Rethink diets

Why we chose this...

- Agriculture, land use and forestry account for a quarter of GHG emissions. And agriculture is the top water user in most countries, accounting for 69% of water withdrawals worldwide.^{140, 141} Any action to rethink diets could result in huge savings.

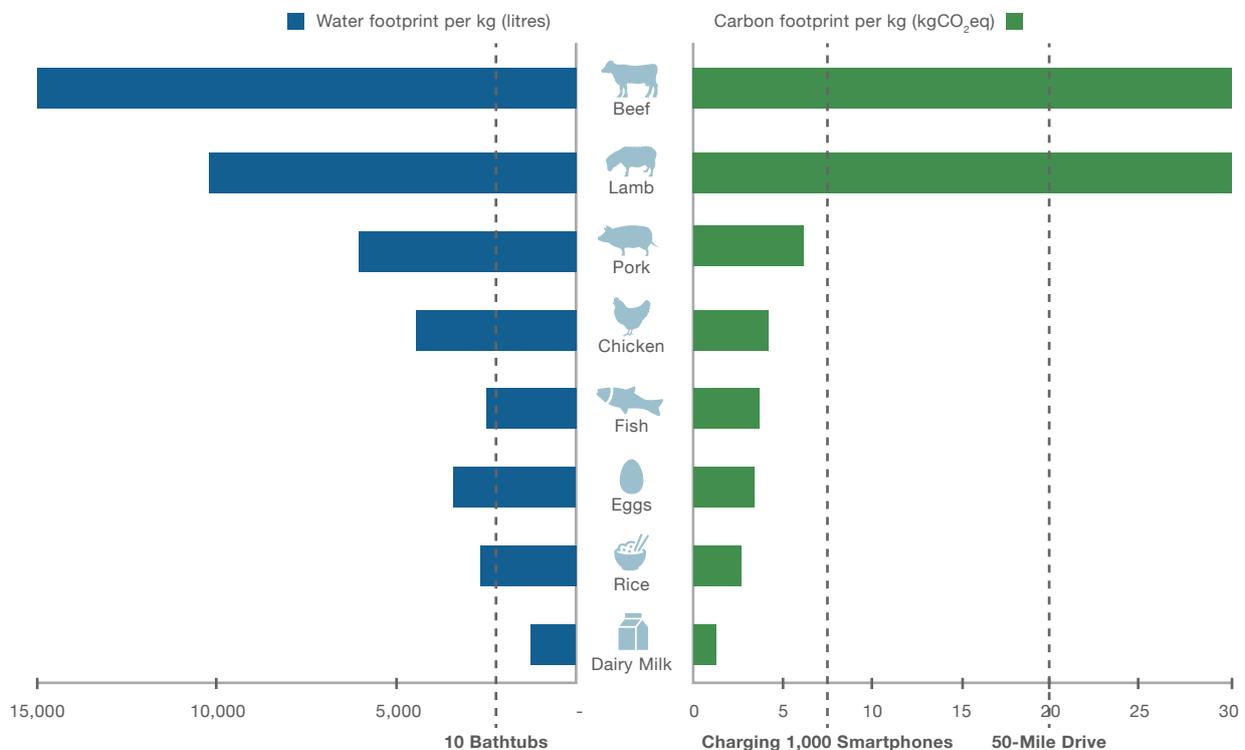
CWR THE CLIMATE & WATER IMPACT OF THE AGRICULTURAL SECTOR



Source: IPCC AR5 report (2014), WRI report "Creating A Sustainable Food Future" (2018), UNFAO AQUASTAT ©CWR, 2022 all rights reserved

- Producing food is carbon and water intensive, as seen in the charts above. As the chart below shows, the most carbon-intensive fresh foods are beef and lamb, mainly because of the methane gas they produce (mostly through burping and farting). Beef and lamb are also the most water-intensive foods. Among animals in the chart, fish have the lowest carbon footprint and farmed fish have the smallest footprint in terms of water.

CWR THE CARBON & WATERFOOTPRINTS OF OUR FRESH FOODS



Source: CWR, Water Footprint Network, Verghese & Clune in "How to reduce your kitchen's impact on global warming" in *The Conversation* (Dec 2016), US EPA *Refers to all fish species for carbon footprint; refers to farmed fish for water footprint 1 bathtub = 200L

NOTE: carbon footprint includes GHG content from farm production through to regional distribution centres © CWR, 2022 all rights reserved

- With 3 billion more mouths to feed by 2050, emissions and water use will keep growing unless people rethink their diets.

New eating habits...

If cutting meat out entirely, going vegan and eating only local foods is too drastic, consuming less meat can still make a difference, especially when it is locally sourced. Here, we look at two actions that can have a big climate impact. We have chosen these because there is sufficient existing research on their impacts, and we believe they are relatively achievable.

1. Eat one less 8 oz (220 gram) steak a week for a year

Eating an 8 oz steak less once a week for a year produces 314 kg of carbon dioxide equivalent, comparable to driving a passenger car from London to Milan (about 1,250 km).¹⁴² The same steak would need 182,000 litres of water to produce, equivalent to more than 910 bathtubs.¹⁴³

 **CWR** THE SIZEABLE GHG EMISSIONS & WATER CONSUMPTION BEHIND OUR STEAKS

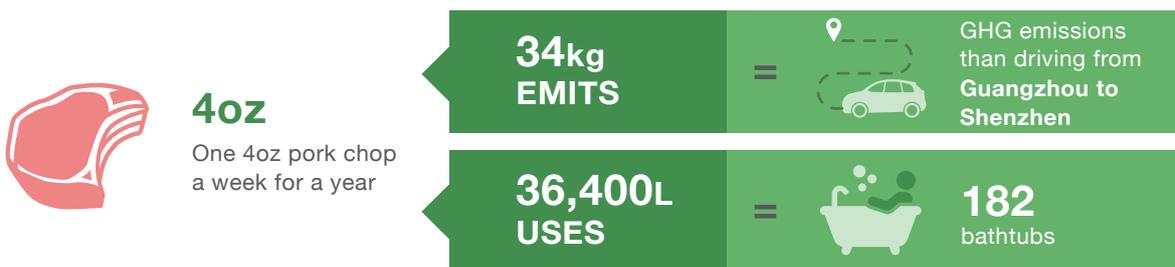


Source: CWR, Verghese & Clune in "How to reduce your kitchen's impact on global warming" in *The Conversation* (Dec 2016), US EPA, US National Health and Nutrition Examination Surveys, Water Footprint Network
NOTE: assumes 1 bathtub = 200L
© CWR, 2022 all rights reserved

2. Eat one less 4 oz (110 gram) serving of pork a week for a year

A 4 oz pork chop accounts for 0.7 kg CO₂e. Cutting one portion a week for a year could save as much as 34 kgCO₂e, equivalent to driving a car from Guangzhou to Shenzhen (about 140 km) and saving 182 bathtubs of water.¹⁴²

 **CWR** THE GHG EMISSIONS & WATER CONSUMPTION BEHIND OUR PORK

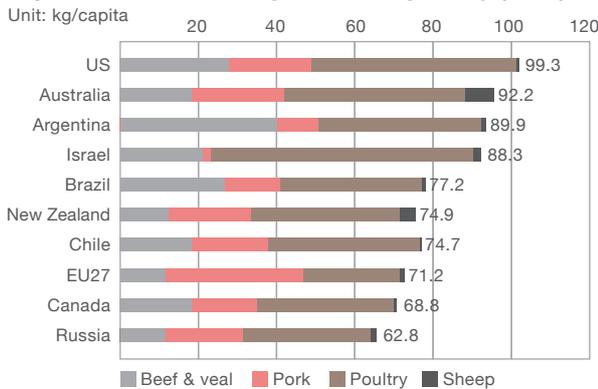


Source: CWR, Verghese & Clune in "How to reduce your kitchen's impact on global warming" in *The Conversation* (Dec 2016), US EPA, US National Health and Nutrition Examination Surveys, Water Footprint Network
NOTE: assumes 1 bathtub = 200L
© CWR, 2022 all rights reserved

Taking these two actions can help save up to 0.35 tonnes of emissions and 182 bathtubs of water. Together, we can achieve sizable cuts in emissions equivalent to the combined GHG emissions of Hong Kong, Denmark and Singapore if more people took these two actions. Other actions – from going flexitarian to rethinking chocolate – are set out in '5 ways you can do' more below.

Together we can... cut up to 158 Mt of GHG emissions...

Top-10 meat consuming countries globally (2018)



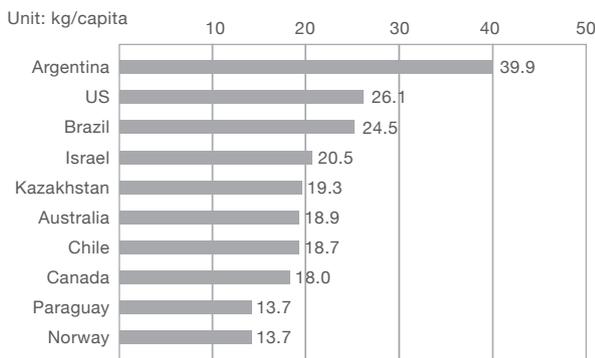
Source: CWR, OECD (2020), Meat consumption (indicator). doi: 10.1787/fa290fd0-en (Accessed on 12 January 2020)

Some nations eat more meat than others. OECD data for 2018 (see left) shows that Americans eat the most meat (about 99 kg per capita a year) followed by Australians (92 kg), Argentinians (90 kg), Israelis (88 kg) and Brazilians (77 kg). Chicken generally dominates among the Top Ten meat consumers followed by beef and pork.

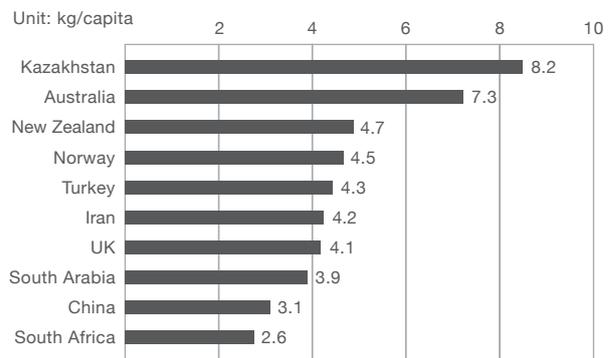
Note that China is not among the Top 10 despite a growing appetite for meat. Chinese eat about 48 kg per capita a year, ranking 22nd. See Rising meat 'consumption in Asia' below.

At almost 40 kg per capita a year, Argentinians are the biggest consumers of beef – the most carbon and water intensive meat – followed by Americans (26 kg) and Brazilians (25 kg). Global consumption is much lower for lamb, also very carbon intensive. Kazakhs eat the most (8 kg) followed by Australians (7 kg). For other meats, Europeans are the biggest consumers of pork (almost 36 kg a year) followed by Chinese and South Koreans (both around 30 kg). Israelis eat the most chicken (65 kg) followed by Americans (50 kg) and Malaysians (49 kg).

Which countries eat the most beef?



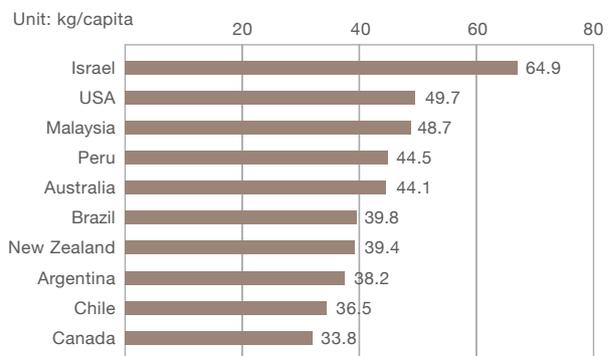
Which countries eat the most lamb?



Which countries eat the most pork?



Which countries eat the most chicken?



Source: CWR, OECD (2020), Meat consumption (indicator). doi: 10.1787/fa290fd0-en (Accessed on 12 January 2020)

We estimate that changes to the habits of willing individuals from Argentina, the US and Brazil (the Top Three beef consumers) plus the EU, China and South Korea (the Top Three consumers of pork) could save almost 158 million tonnes of MtCO₂e, equivalent to the combined GHG emissions of Hong Kong, Denmark and Singapore in 2015.¹⁵

1. Eat one less 8 oz (220 gram) steak a week for a year

According to various surveys, 60% of Argentinians are considering giving up beef and going vegan and 68% of Americans are already reducing or intending to reduce red meat intake to combat climate change. For Brazilians, 29% are moving toward cutting consumption of animal products or are already vegetarian.^{100, 144, 145}

Based on these surveys, we estimate that 27 million Argentinians could save more than 8 MtCO₂e a year while 222 million American could save 70 MtCO₂e and 70 million Brazilians could save 19 MtCO₂e. Together, these people could save almost 98 MtCO₂e, equivalent to the combined emissions of Hong Kong and Denmark in 2015.¹⁵

 **CWR** INDIVIDUALS FROM ARGENTINA, US & BRAZIL CAN SAVE THE COMBINED GHG EMISSIONS OF HONG KONG & DENMARK BY EATING LESS BEEF



Source: CWR, Verghese & Clune in "How to reduce your kitchen's impact on global warming" in *The Conversation* (Dec 2016), Worldometer population statistics, EDGAR emissions database, OECD (2020), Meat consumption (indicator). doi: 10.1787/ta290fd0-en; EIB Climate Survey (2019), Argentina Institute for the Promotion of Beef survey (2019), Good Food Institute survey (2019)

* Assumes an 8oz steak with CO₂ emissions of 26.6kg/kg

** These three countries chosen as they are the top beef eaters in 2018; 60% of Argentinians surveyed considering giving up beef and going vegan; 68% surveyed in the US intending to reduce red meat intake to combat climate change; 29% surveyed in Brazil moving toward reducing their consumption of animal products or are already vegetarian

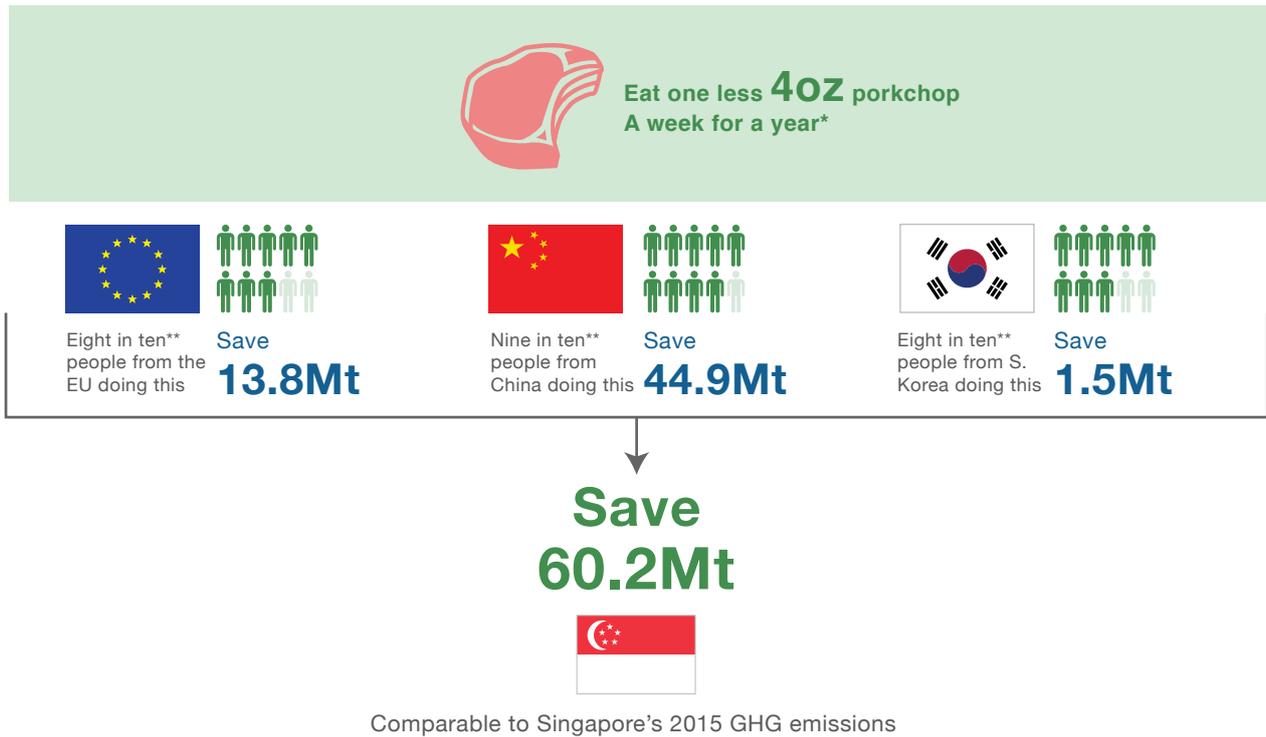
© CWR, 2022 all rights reserved

2. Eat one less 4 oz (110 gram) serving of pork a week for a year

According to the EIB, 79% of Europeans and 92% of Chinese are already reducing or intending to reduce red meat intake to combat climate change. We assume that a willingness to cut consumption of red meat applies to pork as well. In the absence of data for South Korea, we applied the average of the EU and China to estimate a collective reduction.¹⁰⁰

We estimate that eight in ten Europeans eating one less 4 oz pork chop a week for a year would save almost 14 MtCO₂e while the same action by nine in ten Chinese would save almost 45 MtCO₂e. For eight in ten Koreans, savings were estimated at more than 1.5 MtCO₂e. Together, these people from the EU, China and South Korea could save more than 60 MtCO₂e, equivalent to the GHG emissions of Singapore in 2015.¹⁵

 **CWR** INDIVIDUALS FROM THE EU, CHINA & SOUTH KOREA CAN SAVE THE GHG EMISSIONS OF SINGAPORE BY EATING LESS PORK



Source: CWR, Verghese & Clune in "How to reduce your kitchen's impact on global warming" in *The Conversation* (Dec 2016), Worldometer population statistics, EDGAR emissions database, OECD (2020), Meat consumption (indicator). doi: 10.1787/fa290fd0-en; EIB Climate Survey (2019),

* Assumes a 4z pork chop with CO2 emissions of 5.8kg/kg

** These three countries chosen as they are the top pork eaters in 2018; 79% of the EU surveyed intended to reduce red meat intake to combat climate change; this percentage was 92% in China; we assume that willingness to reduce red meat intake applies to pork as well; as there was no such survey found for S Korea we had to take the average of the EU and China shares to estimate a collective cut

© CWR, 2022 all rights reserved

Ramping up to 5.5 billion tonnes if everyone cuts beef/ lamb by 30%

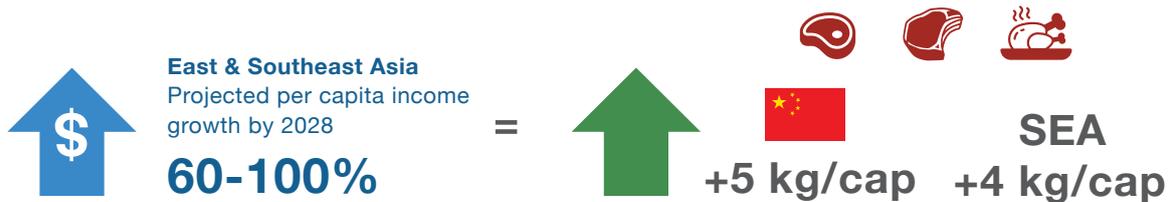
According to the World Resources Institute, all people worldwide shifting 30% of their expected consumption of ruminant meats from cattle and sheep to plant-based proteins by 2050 could cut GHG emissions by 5.5 gigatonnes (billion tonnes) of carbon dioxide equivalent.¹⁶¹ That's comparable to the combined emissions of the EU and Japan in 2015.¹⁵

Rising meat consumption in Asia

As people from Asia become more affluent, their appetite for meat is growing. Could diets from Asia soon mirror those from the West? What would this mean for GHG emissions?

In East and Southeast Asia, income per capita is expected to grow by between 60% and 100% between 2019 and 2028, boosting demand for meat. Annual meat consumption per capita is set to rise by 5 kg in China and 4 kg in Southeast Asia over the same period.

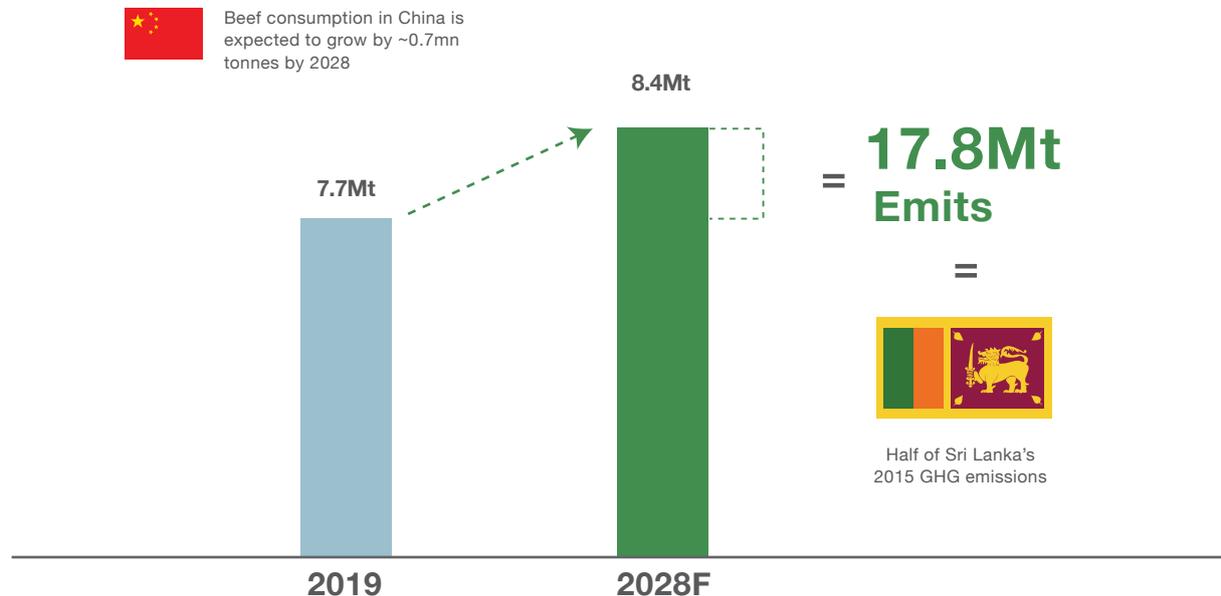
 **CWR** IF EAST "MEATS" WEST – INCREASE MEAT DEMAND



Source: CWR, OECD-FAO report, "Agricultural Outlook 2019-2028"
© CWR, 2022 all rights reserved

Greater meat consumption is expected to be largely concentrated in poultry and pork, the two meats most widely consumed in those regions. Beef consumption, however, is also growing. By 2028, China is expected to be consuming 670,000 tonnes of beef more than it did in 2019, requiring 17.8 Mt of GHG emissions to produce – equivalent to half the annual GHG emissions of Sri Lanka over the decade.

 **CWR** GHG EMISSIONS BEHIND CHINA'S GROWING APPETITE FOR BEEF (2019-2028F)



Source: CWR, Verghese & Clune in "How to reduce your kitchen's impact on global warming" in *The Conversation* (Dec 2016), Crippa, M., Oreggioni, G., Guizzardi, D., Muntean, M., Schaaf, E., Lo Vullo, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J.G.J., Vignati, E., EDGAR emissions database, EUR 29849 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-11100-9, doi:10.2760/687800, JRC117610., OECD-FAO Report "Agricultural Outlook 2019 2028",
© CWR, 2022 all rights reserved

Source: OECD-FAO Report "Agricultural Outlook 2019 2028", Crippa, M., Oreggioni, G., Guizzardi, D., Muntean, M., Schaaf, E., Lo Vullo, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J.G.J., Vignati, E., Fossil CO₂ and GHG emissions of all world countries - 2019 Report, EUR 29849 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-11100-9, doi:10.2760/687800, JRC117610.

5 ways you can do more...

1. Go vegan or flexitarian

Going vegan by eliminating animal-based foods is known as the best way to cut dietary carbon footprints, especially if plant-based foods are bought locally. According to a University of Oxford study, everyone switching to fully plant-based diets could reduce GHG emissions from food production by 49%.¹⁴⁶ A separate report estimated that vegan diets would result in 129,544 fewer heart disease-related deaths in the UK alone every year.¹⁴⁷

Diets that do not completely eliminate animal products such as meat, dairy products and eggs are known as 'flexitarian' diets with most protein derived from nuts and legumes (such as beans and lentils).¹⁴⁸ Such diets are not only more easily to achieve for meat eaters but can have as much impact on carbon emissions as vegetarian diets.¹⁴⁹ According to a UK-focused study published in the journal Nature, the average healthy two-thirds vegan flexitarian diet generates 763 kgCO₂e per person each year compared with 1,265 kg CO₂e for a vegetarian diet that includes dairy products. Such flexitarian diets could prevent about 11 million deaths each year by reducing diseases related to unhealthy diets such as heart attacks, strokes and some cancers.

2. Use plant-based proteins

A traditional recipe for spaghetti bolognese might require 400 grams of premium minced beef and have a carbon footprint of 10.9 kg CO₂e/kg of which 84% would be from the meat. Replacing the beef with kidney beans and lentils, also high in protein, would sharply reduce the footprint to only 2.1 kgCO₂e/kg.¹⁴² Moreover, plant-based protein tends to be healthier.¹⁵⁰

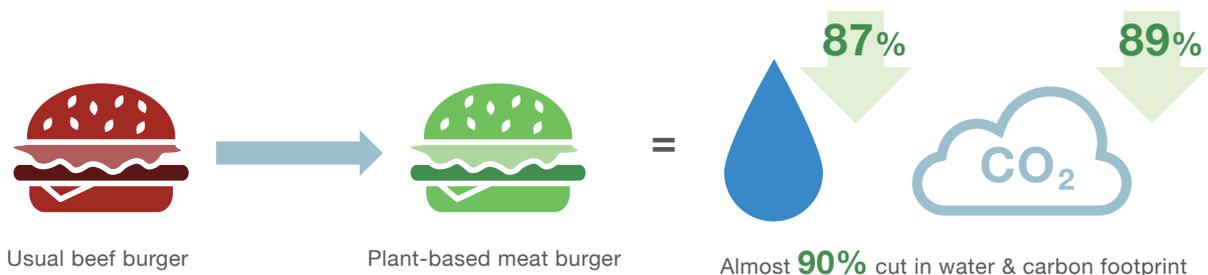
 **CWR** GHG SAVINGS FROM REPLACING MINCE BEEF WITH BEANS & LENTILS IN SPAGHETTI BOLOGNESE



Source: CWR, Verghese & Glune in "How to reduce your kitchen's impact on global warming" in *The Conversation* (Dec 2016), US EPA emissions equivalence calculator, prices" by Patrick Collinson, Jan 2019
© CWR, 2022 all rights reserved

Interest in 'meat' made from plant-based proteins has been growing rapidly in recent years. Companies like Impossible Foods and Beyond Burger have developed plant-based products that mimic the texture and flavour of meat from livestock, and they are already reaching a wide market including several global fast-food chains such as Burger King and McDonald's.¹⁵¹ According to Impossible Foods, plant-based burgers can result in almost 90% savings in carbon and water and still contain many nutrients, albeit not the same ones as a beef burger.^{152,153}

 **CWR** CARBON & WATER SAVINGS OF A PLANT-BASED BURGER



Source: CWR, Quantis, Impossible Foods, Fast Company
© CWR, 2022 all rights reserved

3. If you have meat, opt for chicken instead of beef

As shown in previous pages, not all meat is equally carbon intensive. In terms of carbon footprints, 1 kg of chicken generates less than 4 kgCO₂e compared with more than 26 kgCO₂e for beef.¹⁴³ So choosing chicken instead of beef can have a big climate impact. A survey in 2019 found that individuals swapping beef for poultry once a day for a year could reduce their dietary carbon footprints by about 54%.¹⁶⁰ This did not adversely affect dietary quality as all poultry-based meals had the same calories as meals based on beef.¹⁵⁴

 **CWR** GHG SAVINGS FROM CHOOSING CHICKEN INSTEAD OF BEEF



Source: CWR, Rose, Diego & Willits-Smith, Amelia & Heller, Martin. (2019). Diet and Planetary Health: Single-Item Substitutions Significantly Reduce the Carbon Footprint of Self-Selected Diets Reported in NHANES (OR20-08-19). *Current Developments in Nutrition*. 3. 10.1093/cdn/nzz047.OR20-08-19.
© CWR, 2022 all rights reserved

4. Cut down on chocolate

In addition to meat, chocolate has a high carbon footprint. It also has a high water imprint as cocoa is a very water-intensive crop.¹⁵⁵ Eating a 50 gram dark-chocolate bar three to five times a week for a year emits as much as driving a car from Paris to Madrid (about 1,250 km) and using almost 26 bathtubs of water.¹⁵⁶

 **CWR** THE GHG EMISSIONS & WATER USE BEHIND DARK CHOCOLATE



Source: CWR, BBC climate change food calculator based on Poore & Nemecek (2018)
NOTE: assumes normal petrol car driven; 1 bathtub = 200L
© CWR, 2022 all rights reserved

Protein from insects

Insects are a source of protein that are already part of many people's regular diets. They generate far fewer emissions than other animals such as cattle, for example, which generate 6–13 times more carbon than mealworms in terms of edible protein.

Insect dishes are already being trialled in high-end concept restaurants around the world. According to the Food and Agriculture Organization of the United Nations (FAO), people already consume more than 1,400 species of edible insects as food. Using insects as livestock feed would have further beneficial impacts on the climate.

Source: The Scientist "Why Insects Should Be in Your Diet" by Aaron Dossey, Jan 2013, Huis, Arnold & Oonincx, Dennis. (2017). The environmental sustainability of insects as food and feed. A review. Agronomy for Sustainable Development. 37. 10.1007/s13593-017-0452-8.

5. Eat local and seasonal food

Global food chains offer all kinds of produce from around the world from Mexican tomatoes to bananas from Ecuador essentially all year round. But it has been estimated that transport accounts for 11% of food's carbon footprint.¹⁵⁷ Eating locally sourced food can therefore have a positive impact on the climate – but not always. Heating greenhouses with fossil fuels to grow bananas in Europe is much more carbon intensive than growing bananas in a tropical country and then shipping them to Europe, highlighting the importance of selecting produce grown in its natural climate in the appropriate season.¹⁵⁸

Sometimes saying no to produce from certain markets can help. For instance, Hong Kong was the top importer of beef from Brazil in 2019, accounting for 24% of the world's beef imports from the country – 0.4 million tonnes of carbon dioxide equivalent. Hong Kong was indirectly contributing to Amazon rainforest fires as the forests were being cleared for rearing more cattle.^{159,160}



6



Action 6

Cut food waste

SAY NO TO CARS

FLY LESS

WATCH ELECTRICITY BILLS

CHANGE ONLINE HABITS

RETHINK DIETS

CUT FOOD WASTE

TWEAK ONLINE SHOPPING

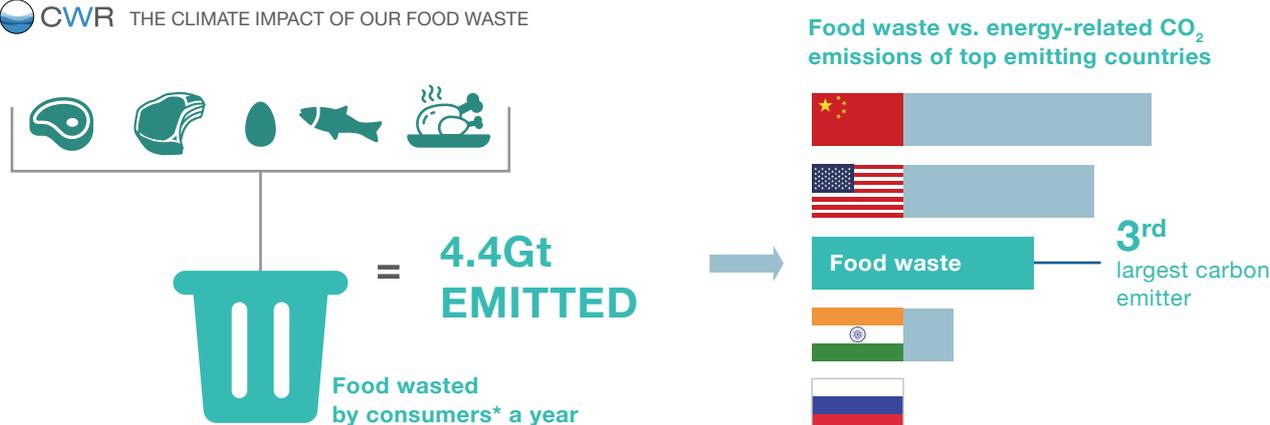
SLOW DOWN FAST FASHION

Action 6: Cut food waste

Why we chose this...

- About a quarter of all food produced for human consumption is wasted worldwide, a third of which is lost when we don't finish our food.¹⁶¹ This is bad as food production accounts for a large share of GHG emissions (see 'Action 5' above). Individuals can help cut food waste.
- Savings can be huge. As the chart below shows, if food waste were a country, it would be the third largest GHG emitter behind the US and China.

 **CWR** THE CLIMATE IMPACT OF OUR FOOD WASTE



Source: CWR, UNFAO Report "Food wastage footprint & Climate Change" (2015), World Resources Institute report "Creating a Sustainable Future" (2018), IEA
 *Food wasted data also includes loss (there is no breakdown so this is the best available data)
 © CWR, 2022 all rights reserved

- What's more, global food waste is set to rise by a third by 2030, highlighting the need to transition food systems and how we consume food to circular models to help tackle waste.¹⁶²
- Cutting food waste can also help save money (see box below).

Cutting food waste = saving money

When we throw edible food into the bin, we are also wasting our money. For instance, the average UK household (with children) spends about GBP60 (USD78) a month on food that is thrown away – that's more than GBP700 (USD913) a year.

Elsewhere in Canada, according to a 2019 study on London, Ontario, wasting food has become a way of life for many who are tossing an average of CAD600 (USD447) into the trash every year. Extrapolated to all of households in London, Ontario, that could translate to a savings of more than CAD75mn (USD56mn).

The study also asked households what motivated them most to change this wastage - the environmental effect, the social impact or the cash they saved - and respondents said the money motivation consistently fed their enthusiasm. Now you know the cost, can you try and reduce your food waste?

Source: BBC article "How to cut food waste and save cash", van der Werf (2019) "Reduce Food Waste, Save Money: Testing a Novel Intervention to Reduce Household Food Waste" *Environment & Behaviour*

New habits to get rid of food waste ...

1. Cut food waste by 10% for a year

The World Resources Institute recommends a 10% reduction in food waste as a realistic 'coordinated effort' to cut emissions. This could save 86 kg of carbon dioxide equivalent (kgCO₂e) in North America and Oceania, 81 kgCO₂e in industrialised Asia and 68 kgCO₂e in Europe every year.

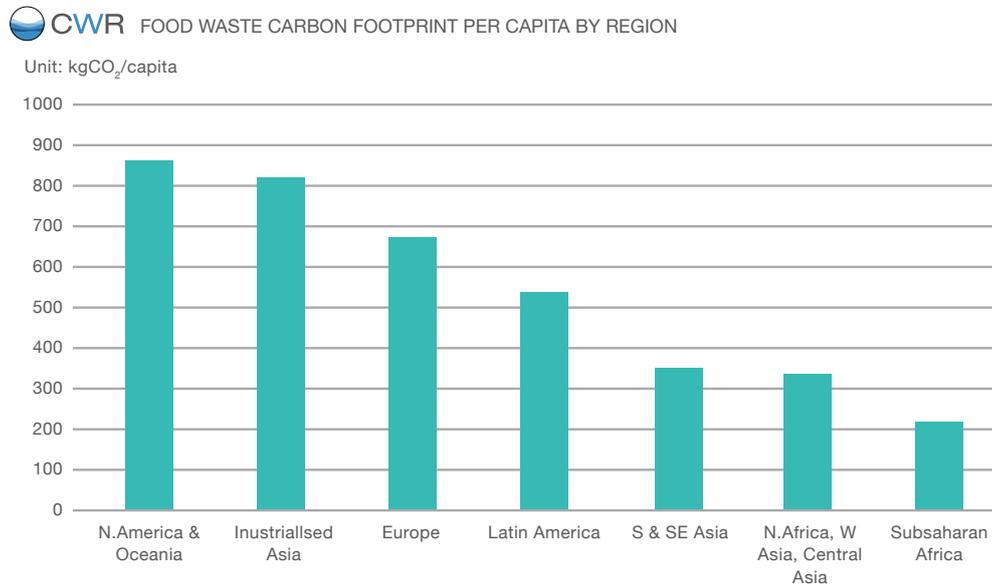
Don't know how to get there? We have set out 5 practical tips below:

- i. **Lick your plate clean** – This is straightforward. The simplest way to not waste food is to finish all the food on our plates. However, if you really have to throw food away try to make sure it's not foods like beef, lamb or chocolate. This is because these types of food are the most carbon intensive to produce. To find out just how much carbon is needed to make them check out 'Action 5 on Rethink diets'.
- ii. **Why not save it for another time?** – We have all been there. Too much food cooked or ordered but everybody is stuffed. Why not store the leftovers or take it away in a box for later? This is becoming a more common practice but remember to actually finish the food and not just leave it in the fridge. And when you are out, make sure to bring your own takeaway box as many restaurants still give out single-use plastic or even polystyrene food containers and cutlery to consumers to pack leftovers – see box in following pages on the negative impacts of single-use plastics.
- iii. **Shop in your fridge first** – Before you go on your next grocery trip, how about a quick 'shop' of your fridge first?¹⁶³ After all, it makes sense to cook or eat what you already have at home before buying more. For example, why not slice leftover roast meat into thin strips and throw it into a stir-fry? There are many such recipes out there waiting to be googled but remember to be mindful about endless browsing, as we show in Action 4, our online habits matter for the climate.
- iv. **Don't throw it away yet: 'Best before' does not mean 'use by'** – Food past its 'best before' date is often still acceptable to eat although it may have lost some of its quality, whereas food past its 'use by' date is unsafe to eat. A study by Johns Hopkins Bloomberg School of Public Health in 2019 found that 84% of those surveyed discarded food on or near the date 'at least occasionally' regardless of the words around the date while 37% 'always' or 'usually' did so.¹⁶⁴
- iv. **Buy only what you need** – Supermarkets and grocery stores often have ploys like discounts or limited offers to entice consumers to buy more products including food. But how much ends up being thrown away? If you get 10 items for \$10 and only eat five before they spoil, that's \$5 wasted. This also applies to ordering food at restaurants – if you are not particularly hungry, why not order a smaller portion? It might even be cheaper.

The above tips are by no means exhaustive and there are other ways to tackle food waste which go beyond average daily consumption routines – from composting to embracing ugly foods – more on this later in '3 ways you can cut food waste'.

Together we can... cut up to 77 Mt of GHG emissions...

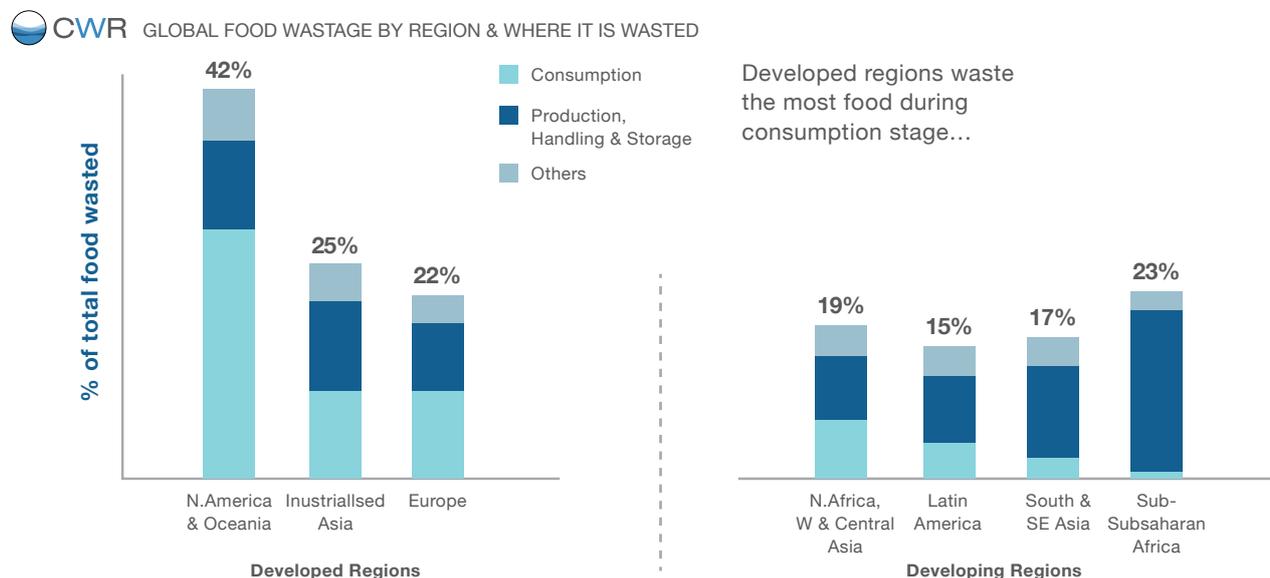
According to the Food and Agricultural Organization of the United Nations (FAO), North America and Oceania have the highest carbon footprint from food waste of 860 kgCO₂e per person every year. Industrialised Asian countries – including Japan, South Korea, Hong Kong and Singapore – come a close second at 810 kgCO₂e followed by Europeans at 680 kgCO₂e (see chart below).



Clearly, people from North America and Oceania along with industrialised Asia and Europe can do more to cut food waste. Yet, aiming for zero food waste is problematic as some parts of food chains – like production, handling and storage – are outside the control of consumers (see charts below).

Indeed, most food losses in South Asia, Southeast Asia and sub-Saharan Africa are in production, handling and storage. On the other hand, North American and Oceania along with industrialised Asia and Europe waste a significant share of food at the consumption stage.

North America and Oceania are by far the most careless, wasting 42% of all food. Industrialised Asia is a distant second at 25% followed closely by Europe at 22%. Compared with the developing world, the three developed countries can clearly do more to cut food waste at the consumer level.

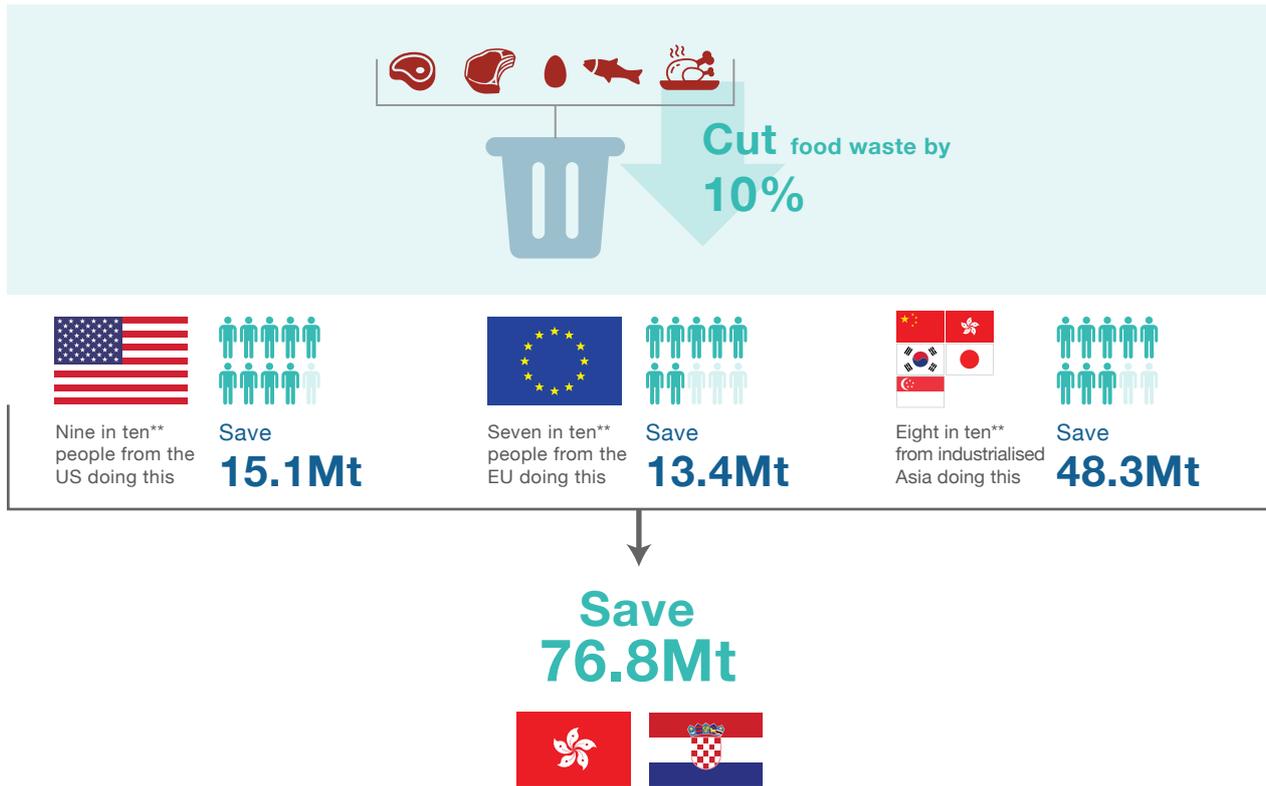


Source: CWR, UNFCCC, WRI report "Creating a Sustainable Food Future" (2018)
© CWR, 2022 all rights reserved

1. Cut food waste by 10% for a year

Based on several region-specific surveys on the willingness to reduce household food waste, we estimated nine in ten Americans could save 15 MtCO₂e and that seven in ten Europeans people could save more than 13 MtCO₂e. We also estimated that about eight in ten people from China, Hong Kong, South Korea, Japan and Singapore could save a further 48 MtCO₂e.^{165, 166, 167} Together, consumers in the US, the EU and industrialised Asia could save almost 77 MtCO₂e if they cut food waste by 10% for a year, equivalent to the combined GHG emissions of Hong Kong and Croatia in 2015.¹⁵

 CONSUMERS FROM US, EUROPE & INDUSTRIALISED ASIA CAN SAVE GHG EMISSIONS FROM HONG KONG & CROATIA BY CUTTING FOOD WASTE BY 10%



Source: CWR, FAO "Climate Change & Food wastage report". Worldometer population statistics, EDGAR emissions database, WRI report "Creating a Sustainable Food Future" (2018), Michigan State University (MSU) Food Literacy and Engagement Poll, Grundig Food Waste Survey (2017), Singapore NEA 2019 Consumer Survey on Food Wastage

* Suggested by the World Resources Institute as a realistic "coordinated effort" to cut

** 88% of surveyed in the US took action to reduce food waste in their homes; 74% of surveyed in 6 European countries trying to reduce food waste; 80% of Singaporeans bothered when throwing away uneaten food (used for Industrialized Asia as this is the best data available)

© CWR, 2022 all rights reserved

Ramping up to almost 2 billion tonnes if everyone cuts food waste by 25%

With sharper cuts in food loss and waste of 25% instead of 10% by 2050, savings would be in the order of 1.6 GtCO₂e, equivalent to the combined GHG emissions of Canada and Germany in 2015.^{14,15}

 **CWR** REDUCING FOOD WASTE GLOBALLY CAN CUT THE COMBINED GHG EMISSIONS OF CANADA & GERMANY



Source: CWR, EDGAR emissions database, WRI report "Creating a Sustainable Food Future" (2018)
© CWR, 2022 all rights reserved

COVID times and the rise of takeaways

COVID-19 stalled or even put into reverse a big global push away from single-use plastics (see box below). Starbucks, for example, stopped letting customers use reusable mugs. And as food takeaways and deliveries soared during the pandemic, so did plastic and other packaging waste. In Singapore, a typical household generated an additional 1,334 tonnes of plastic waste during the country's strictest lockdown period – equivalent in weight to 92 double-decker buses. The pandemic highlighted the need to find new and less wasteful ways to package items.

Source: CNBC article, "Plastic waste surges as coronavirus prompts restaurants to use more disposable packaging" (Jun 28 2020), Today article, "Singapore households generated additional 1,334 tonnes of plastic waste during circuit breaker: Study" (June 5 2020)

Avoid single-use plastic food containers

Takeaway culture plus the popularity of Deliveroo & UberEats has meant that an estimated 2 billion takeaway containers per year are used in the EU alone – if half of these were recycled, we could help reduce as much GHG emissions as 55,000 light-duty vehicles annually. So next time, try to recycle or re-use the containers or bring your own takeaway box to help reduce single-use plastic waste on top of cutting down on food waste!

 **CWR** DON'T FORGET THE PLASTIC BEHIND TACKLING FOOD WASTE



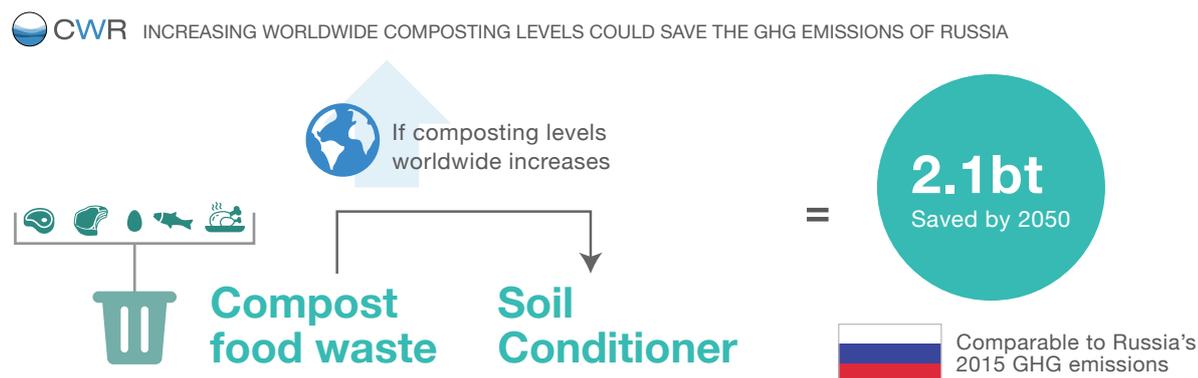
Source: CWR, Science Daily "Takeaway containers -- the environmental cost of packing our favorite fast-foods" (2018)
NOTE: cars in this case also include light-duty vehicles
© CWR, 2022 all rights reserved

3 ways you can do more...

1. Turn food waste into fertiliser by composting

Composting is a recycling process that decomposes organic food waste into a soil conditioner (the compost). Processes range from industrial-scale windrow composting to mounds of green waste decomposing in household gardens.

Project Drawdown, a research group that identifies potential solutions to climate change, estimates that increasing composting worldwide could reduce GHG emissions by 2.1 billion tonnes by 2050.¹⁶⁸ That's comparable to emissions from the whole of Russia in 2015.¹⁵



Source: CWR, BBC "How cutting your food waste can help the climate" (2020), EDGAR emissions database
© CWR, 2022 all rights reserved

2. Buy ugly foods

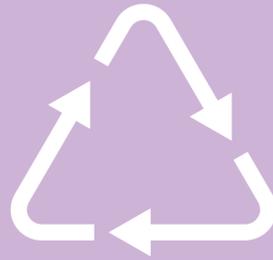
Up to 20% of most fruit and vegetables are too large, too small or otherwise too 'cosmetically compromised' to meet retail standards, according to one study, which said some growers were reporting losses of 30%.¹⁶⁹ A separate study in North Carolina found 42% of crops were left unharvested, mainly to meet appearance quality standards set by buyers.¹⁷⁰

Refusing to reject produce based on how it looks goes beyond cutting food waste at the consumption stage by helping distributors reduce waste in supply chains as well. Denmark already has stores for 'ugly' produce. France has meanwhile emerged as the first country to ban supermarkets from throwing such foods away.¹⁷¹ If ugly foods are not available, social media campaigns may have the potential to cut waste at the supply chain level.

3. Take advantage of food waste apps for bargains

As food waste becomes more of a problem, the tech world is offering some solutions. An app called Too Good to Go connects restaurants and supermarkets with consumers, allowing the former to sell leftover food at lower prices instead of throwing it away.¹⁷² Another app known as Karma takes a similar approach. These two apps serve more than 2.7 million consumers.¹⁷³

7



Action 7

Tweak online shopping

SAY NO TO CARS
FLY LESS
WATCH ELECTRICITY BILLS
CHANGE ONLINE HABITS
RETHINK DIETS
CUT FOOD WASTE
TWEAK ONLINE SHOPPING
SLOW DOWN FAST FASHION

Action 7: Tweak online shopping

Why we chose this...

- Online shopping has a significant carbon footprint – online retailing giant ASOS estimated that its average parcel took 3.8 kg of carbon dioxide equivalent (kgCO₂e) to deliver – about the same as driving a passenger car for 15 km or charging 485 smartphones.^{104,174}

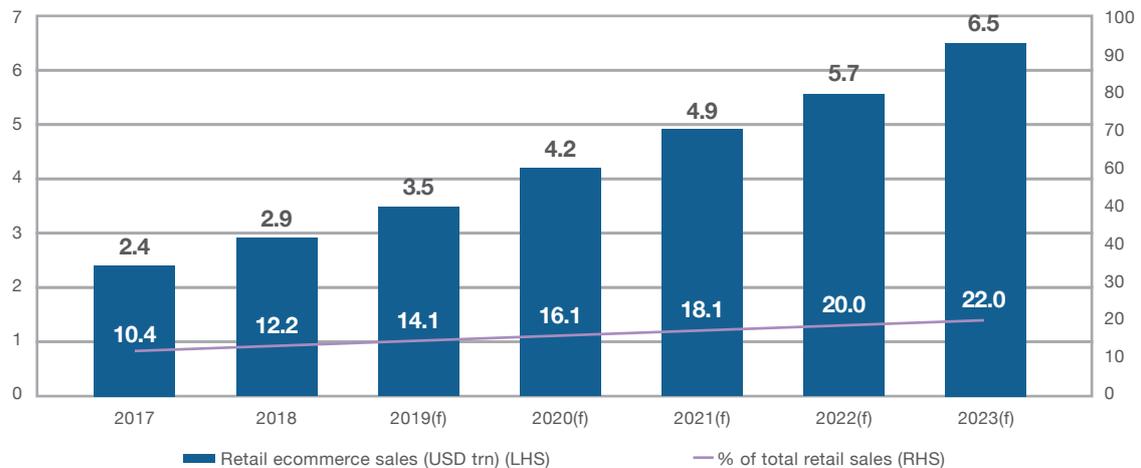
CWR SENDING A PARCEL OF CLOTHES TO AUSTRALIA MEANS...



Source: CWR, ASOS 2017/8 GHG Report, USEPA greenhouse gas equivalencies calculator
 * Refers to ASOS clothing parcel
 © CWR, 2022 all rights reserved

- What's worse, is that the carbon footprint of an online package doubles every time it is returned, and return rates have spiked 95% over the past five years.¹⁷⁵ At brick-and-mortar shops, return rates are only 8% to 10%. That compares with 20% for e-commerce purchases and up to 30% for holiday purchases.^{176, 177, 178} In the US alone, returns generate 15 million tonnes of carbon emissions a year.¹⁷⁹
- We may not realise it but next-day shipping also increase emissions. Deliveries are usually consolidated to ensure maximum deliveries with the fewest journeys. But express deliveries – the next day, for example – make this difficult as more trips mean more emissions. According to the *Australian Financial Review*, up to 55% of carbon emissions could be saved if shoppers chose standard delivery instead of express for online orders.¹⁸⁰
- Online shopping is already popular – even more so with COVID-19 – and is set to grow even further. As the chart below shows, retail e-commerce sales are projected to more than double from USD 2.9 trillion in 2018 to USD 6.5 trillion by 2023.

CWR GLOBAL ECOMMERCE GROWTH 2017-2023(F)



Source: CWR, eMarketer, May 2019

- And then there is the packaging. Packaging used by the e-commerce sector in China alone is set to soar from 9.4 million tonnes in 2018 to an estimated 41.3 million tonnes in 2025.¹⁸¹ Cardboard, styrofoam and bubble wrap are highly polluting, with paper and packaging being one of the dirtiest industries in China.¹⁸²

New online shopping habits

We have selected two online shopping habits that people can change to have a big climate impact. We believe they can be achieved, and there is sufficient existing research showing these habits as key drivers behind online shopping emissions.

1. Cut one online shopping return a month for a year

Given that each return essentially doubles the transport-related emissions of a package, the climate impact of this trend is huge. If we take the 2017/8 ASOS package as an average (which required 3.8 kgCO₂e) to deliver, each person cutting one return a month for a year can save 45.6 kgCO₂e. This is as much GHG emissions as driving a petrol car across the English Channel and back twice.

 **CWR** GHG SAVINGS FROM ONE PERSON CUTTING ONE RETURN A MONTH FOR A YEAR



Source: CWR, ASOS 2017/8 GHG Report, USEPA greenhouse gas equivalencies calculator
 * Refers to average ASOS clothing parcel
 © CWR, 2022 all rights reserved

2. Choose standard instead of express delivery twice a month for a year

Do you really need those new headphones tomorrow? It's understandable that everybody wants their new purchase as soon as possible but that comes at a steep carbon cost. Using the Australian Financial Review estimates as a base and assuming a 2017/8 ASOS package to be a standard delivery, we estimate that one person choosing standard delivery instead of express twice a month for a year can save 50 kgCO₂e. This is as much GHG emissions as driving from Nha Trang to Dalat.

 **CWR** GHG SAVINGS FROM ONE PERSON USING STANDARD INSTEAD OF EXPRESS DELIVERY

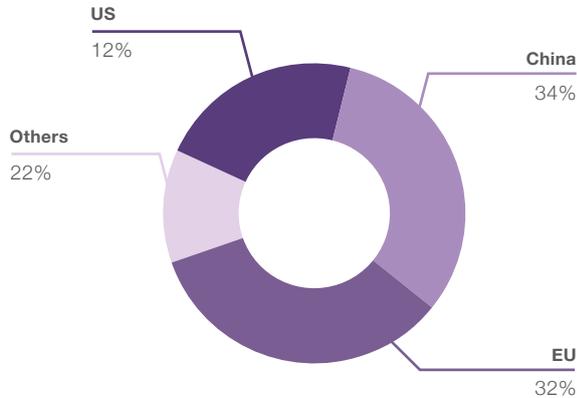


Source: CWR, Australian Financial Review article "The hidden cost of 'free' online shopping returns" by Hannah Wootton, USEPA greenhouse gas equivalencies calculator
 * Refers to average ASOS clothing parcel
 ** assumes average ASOS clothing parcel's carbon emissions to be from standard delivery
 © CWR, 2022 all rights reserved

With these simple actions, a single person can save up to 96 kgCO₂e a year. Beyond these actions, there are many other ways to cut online shopping emissions (see '6 ways to do more' below).

Together we can... cut up to 61 Mt of GHG emissions...

Who are the biggest online shoppers? (2018)



In 2018, the world had an estimated 1.8 billion active online shoppers. As the chart on the left shows, Chinese, Europeans and Americans accounted for almost 80% with 34% of online shoppers in China, 32% in the EU and 12% in the US.^{183, 184, 185, 186}

We estimate that willing individuals from the US, EU and China who adopt the two new shopping habits outlined above could save 61 MtCO₂e which is comparable to the GHG emissions of Singapore in 2015.¹⁵

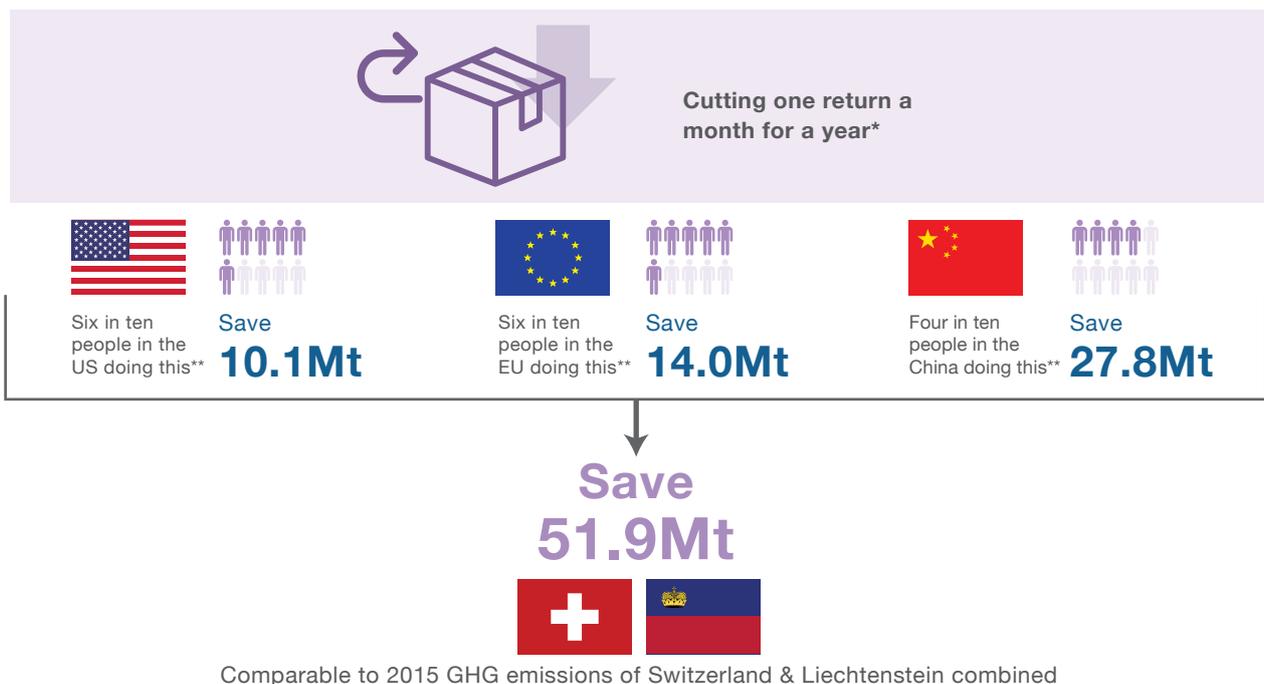
Source: CWR, CNIIC, Statista Digital Market Outlook 2019, Oberlo Statistics

1. Cut one online shopping return a month for a year

An estimated 41% of shoppers in the Top Three online shopping countries are 'serial returners' who buy variations of a product with the intent of returning it.¹⁸⁷ We estimate that roughly six in ten people from the US and the EU and four in ten from China would be willing to reduce the number of returns by one every month for a year. The estimated 221 million Americans who do this could save 10 MtCO₂e while savings by 307 million Europeans would be 14 MtCO₂e and savings by 610 million Chinese would be almost 28 MtCO₂e. Together, these willing Americans, Europeans and Chinese could save almost 52 MtCO₂e, equivalent to the combined GHG emissions of Switzerland and Liechtenstein 2015.¹⁵

Note: no specific data on willing individuals was available so we used the total number of online shoppers per country.

CWR ONLINE SHOPPERS FROM THE US, EU & CHINA CAN SAVE THE GHG EMISSIONS OF SWITZERLAND AND LIECHTENSTEIN COMBINED



Source: CWR, ASOS 2017/8 GHG Report, Return Magic Survey (2017), CNIIC, Statista Digital Market Outlook 2019, Oberlo Statistics, Worldometer population statistics, EDGAR emissions database

*Refers to ASOS clothing parcel; assumes 3.8kgCO₂ per delivery;

**Online shopper numbers were calculated based on statistics and population data = 67.4% of US are online shoppers, 60% for the EU and 42.7% of China; 100% of online shoppers was used

© CWR, 2022 all rights reserved

Young people have a big role to play

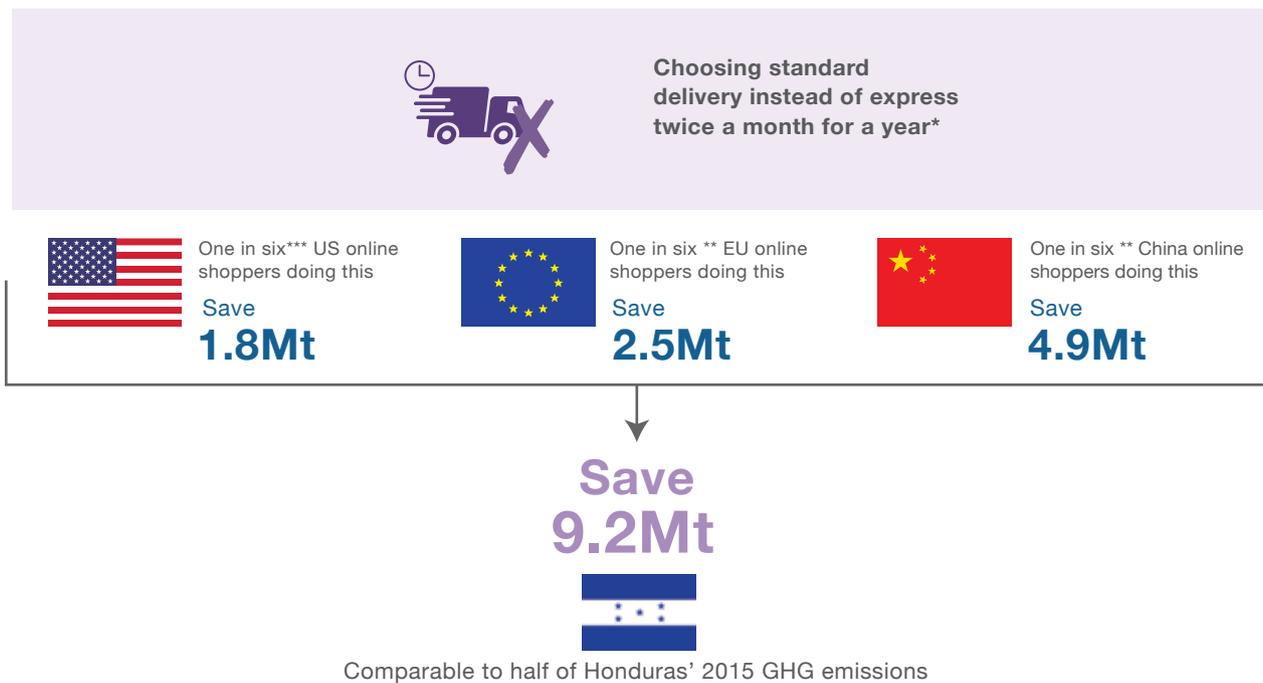
Millennials are big drivers of e-commerce. In the US, millennial spending accounted for an estimated 30% of retail sales in 2020. Globally, millennials make more than 54% of their purchases online. Given this and their reputation for being more environmentally conscious than older generations, millennials have a big part to play in greening online shopping. According to a study of 4,000 online shoppers from the US and the UK, over a third of those aged 18 to 34 confessed to making purchases with the intention of returning some items.

Source: Invesp "Millennial Online Shopping Habits – Statistics and Trends" by Lisa Ross, Forbes "Think Twice Before Returning That Online Purchase: Retailers Are Ready To Ban You From Shopping Again" by Adria Cheng, Oct 2018

2. Choose standard instead of express delivery twice a month for a year

A survey in 2017 found that 16% of online shoppers would be happy to wait six to ten days to receive orders.¹⁸⁸ Assuming one in six to be the share of willing individuals, we estimated that 52 million Americans could save almost 2 MtCO₂e, that 82 million Europeans could save more than 2 MtCO₂e and that 228 million Chinese could save almost 5 MtCO₂e. Together, these people from the US, the EU and China could save more than 9 MtCO₂e, equivalent to half the GHG emissions of Honduras in 2015.¹⁵

 **CWR** ONLINE SHOPPERS FROM THE US, EU & CHINA CAN SAVE HALF THE GHG OF HONDURAS BY SELECTING STANDARD INSTEAD OF EXPRESS DELIVERY



Source: CWR, ASOS 2017/8 GHG Report, Return Magic Survey (2017), CNIIC, Statista Digital Market Outlook 2019, Oberlo Statistics, Worldometer population statistics, EDGAR emissions database

*Refers to ASOS clothing parcel; assumes 3.8kgCO₂ per delivery;

**Online shopper numbers were calculated based on statistics and population data = 67.4% of US are online shoppers, 60% for the EU and 42.7% of China; 100% of online shoppers was used

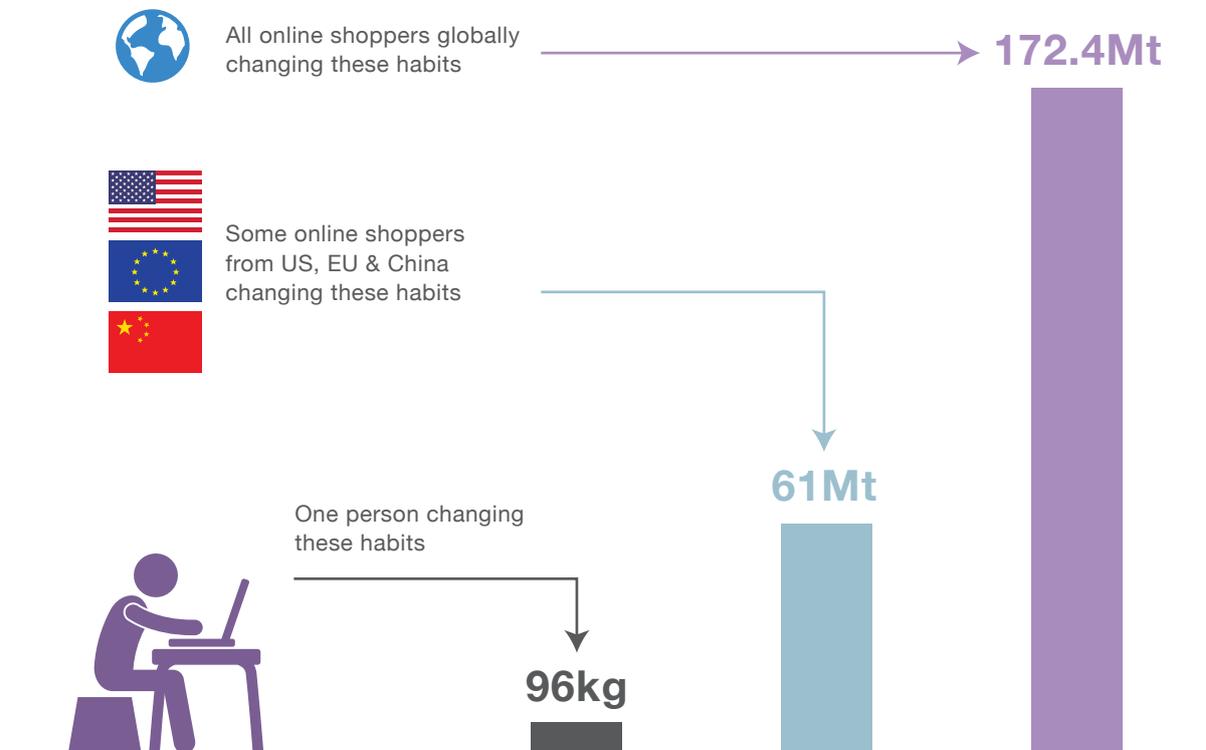
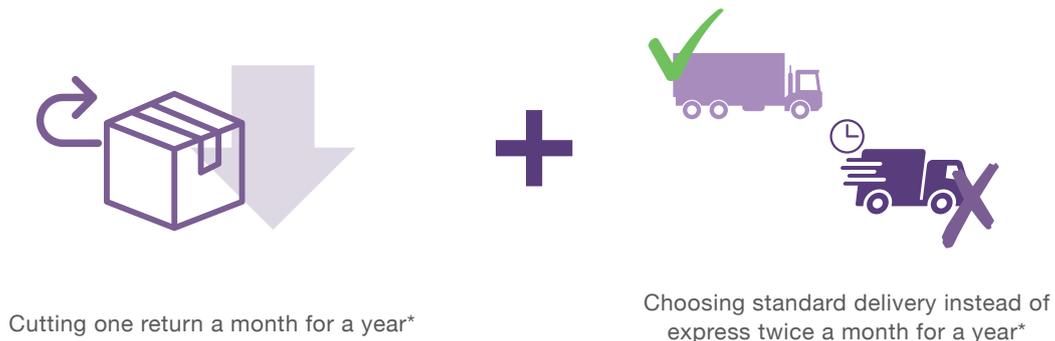
© CWR, 2022 all rights reserved

Ramping up to cut emissions by as much as 172 million tonnes

Clearly changing some of our shopping habits can make a significant climate impact and it can be even bigger if all online shoppers followed suit.

If all of the world's 1.8 billion online shoppers reduced their returns by one every month for a year and used standard instead of express delivery twice a month for a year, the planet could save 172 MtCO₂e, more than the GHG emissions of Qatar in 2015.¹⁵

 **CWR** RAMPING UP – UP TO 172.4MT SAVED IF ALL ONLINE SHOPPERS CUT RETURNS & USE STANDARD DELIVERY



Source: CWR, ASOS 2017/8 GHG Report, CNIIC, Statista Digital Market Outlook 2019, Oberlo Statistics. Internet Retailer and Bizrate Insights survey, Australian Financial Review article "The hidden cost of 'free' online shopping returns" by Hannah Wootton, Dec 2019, Worldometer population statistics, Return Magic Survey (2017)
© CWR, 2022 all rights reserved

6 ways you can do more...

1. Do you really need it?

From athleisure clothing to smartphones and spinning machines to pet accessories, people are buying more and more online. In this section, we have focused on how to minimise online shopping carbon emissions but really and simply the best and easiest way to reduce emissions is not to buy anything, unless you need it.

2. Is it available locally?

Items delivered from the other side of the world may be available locally, either new or second-hand. The less distance packages travel, the lower the emissions.

Re-use or recycle the packaging

Excess packaging is a big challenge for e-commerce. In the US alone, returned items generate almost 2.3 billion kg of landfill waste every year, highlighting the need to reuse or recycle cardboard boxes and other packaging materials. Food delivery companies Foodpanda and Deliveroo have already phased out plastic bags and let people opt out of plastic cutlery and boxes when placing orders. Amazon's Frustration-Free Packaging Program aims to produce less waste and put an end to 'wrap rage'. China e-commerce giant Taobao offers biodegradable packaging to vendors in some locations.

Source: Amazon, foodpanda &, Deliveroo websites, www.ce.cn Dec 6 “菜鸟联合淘宝开设绿色专区快”

3. Go out and shop instead of shopping online

In the US, the average traditional shopper who goes to brick-and-mortar stores (without extensive searching) has a carbon footprint of around 1.6 kgCO₂e for each purchase – lower than the 1.8 kgCO₂e of the average online shopper demanding quick returns.¹⁸⁹ Physically going to shops saves carbon, especially when walking or taking public transport (see 'Action 1').

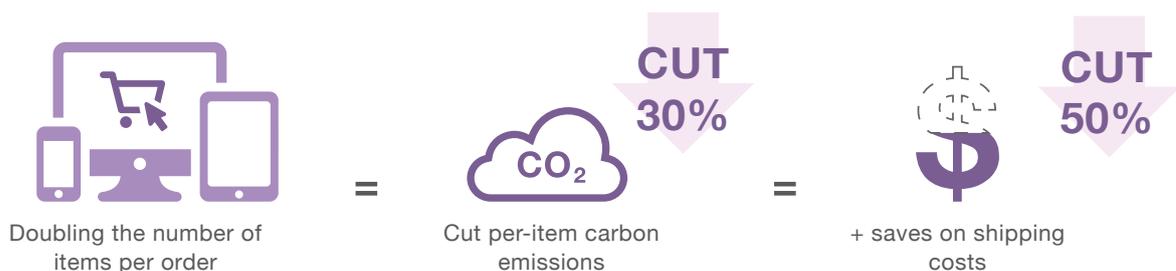
4. Browse for shorter periods and use WiFi

Every byte of data has a carbon and water footprint. Browsing at online stores for 15 minutes instead of two hours for a single clothing item (no returns, normal shipping) reduces the purchase's emissions by 50%.¹⁹⁰ Using WiFi instead of mobile networks can also make a big difference (see 'Action 4').

5. Consolidate shopping

Consolidating several purchases into one delivery instead of buying different goods at different times helps cut transport-related emissions. According to Bain & Co., doubling the average number of items purchased in an e-commerce transaction and eliminating split shipments can reduce average per-item emissions by 30% and cut shipping costs by more than 50%.¹⁹¹

 **CWR** CUT GHG EMISSIONS & COSTS BY BUNDLING YOUR PURCHASES INTO ONE ORDER



Source: CWR, Bain & Co brief "Retailers' Challenge: How to Cut Carbon Emissions as E-Commerce Soars" by Aaron Cheris, Casey Taylor, Jennifer Hayes and Jenny Davis-Peccoud, Apr 2017
© CWR, 2022 all rights reserved

6. Collect it yourself (but don't drive)

The most carbon intensive stage of online shopping is the last stage from the local warehouse or shop to the doorstep.¹⁹² This is made worse as up to 60% of all deliveries are unsuccessful on the first attempt so second or third attempts are needed.¹⁹³ Amazon is trying to tackle this with drones (see box below) but collecting items is also an option. In the UK for instance, department store John Lewis picked up 70% of their click-and-collect orders at a Waitrose market in 2016.¹⁹³ The challenge is that going to pickup locations can sometimes create larger carbon footprints than home delivery or simply walking to a brick-and-mortar shop (see 'Action 1').

Drones to the rescue?

Online retailers are making efforts to reduce 'last-mile' emissions and Amazon may have found a solution – drones. It made the first drone delivery in 2016, although deliveries are limited to short distances in the US (30 minutes or less). Could this be scaled up? And what are the emissions associated with drones?

Source: Amazon Prime Air



8



Action 8

Slow down fast fashion

SAY NO TO CARS

FLY LESS

WATCH ELECTRICITY BILLS

CHANGE ONLINE HABITS

RETHINK DIETS

CUT FOOD WASTE

TWEAK ONLINE SHOPPING

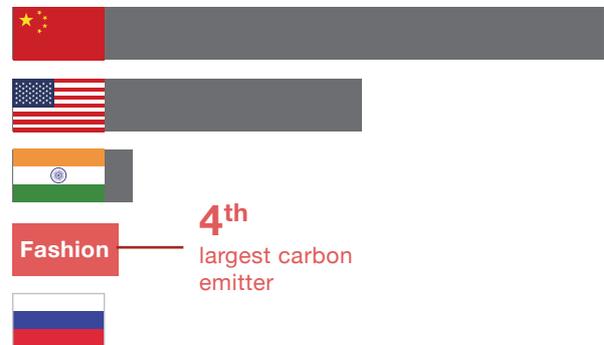
SLOW DOWN FAST FASHION

Action 8: Slow down fast fashion

Why we chose this...

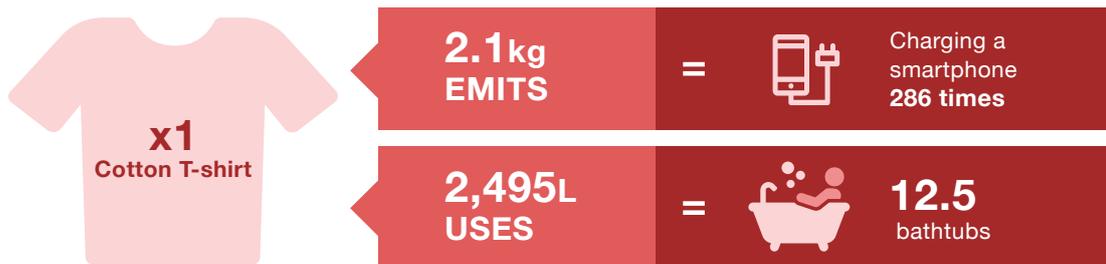
- If the fashion industry were a country, it would be the 4th largest emitter of carbon dioxide behind China, the US and India. And as of 2015, fashion's CO₂ emissions are even more than that of international aviation and shipping's combined. So, while coal, oil, and the energy sector in general have been called out as the bad boys of climate change, fashion has been flying under the radar. But that needs to change.
- The most intensive part of the industry is by far the production and treatment of raw materials like cotton, leather, polyester and cashmere. A 250-gram white t-shirt, for example, emits more than 2 kg of carbon and uses almost 2,500 litres of water during production (see below).

CWR FASHION VS. ENERGY-RELATED CO₂ EMISSIONS OF COUNTRIES IN THE WORLD



Source: CWR, Pulse Of The Fashion Industry 2017 Report, IEA © CWR, 2022 all rights reserved

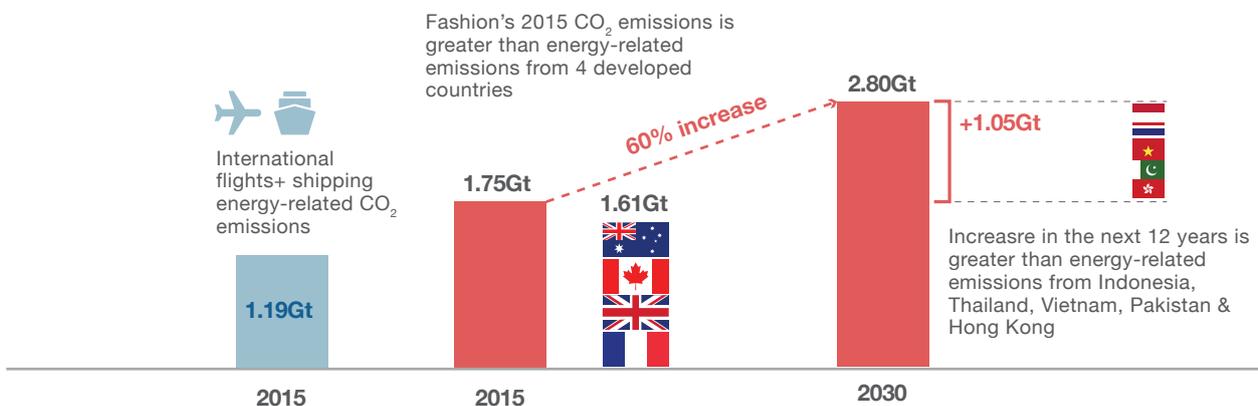
CWR THE EMISSIONS & WATER USED FROM 1 COTTON T-SHIRT



Source: CWR, BBC article "Can fashion ever be sustainable?" Mar 2020, Water Footprint Network, USEPA greenhouse gas equivalencies calculator
*Whiter cotton t-shirt with a weight of 250g
© CWR, 2022 all rights reserved

- Worryingly, fast fashion – which is exacerbating the problem by stepping up the pace of design and production - is still growing rapidly and therefore, so are the emissions from the sector. By 2030, the industry's carbon emissions are set to grow by 60% to 2.8 MtCO₂e (from 2015 baseline).¹⁹⁴ That's the equivalent of adding the combined emissions from Indonesia, Thailand, Vietnam, Pakistan and Hong Kong in 2015, highlighting the need for deep cuts.

CWR FASHION'S SHOCKING CURRENT & FUTURE EMISSIONS



Source: CWR, Pulse Of The Fashion Industry 2017 Report, IEA © CWR, 2022 all rights reserved

- The fashion industry is also thirsty, dirty, extremely wasteful and addicted to plastics and oil. Globally, an estimated 92 million tonnes of textile waste is generated each year and this is expected to jump 50% over the next 15 years¹⁹⁵ (see boxes below).

Fashion is very thirsty

It's not just about carbon, the fashion industry, especially fast fashion, is very thirsty. The industry currently uses around 79 billion m³ of water per year, which is 2% of all freshwater extraction globally, and is more than one tenth of the water used by all types of industry.

The fashion industry relies on water throughout the production process for textiles and garments. The raw materials phase is particularly water intensive. Cotton, a key fashion staple, uses 12.5 bathtubs of water (as shown on the previous page) but then there is also the water pollution issues from the pesticides and fertiliser used to grow the cotton. As for a pair of jeans, they take 50 bathtubs of water to be produced. The Aral Sea in Central Asia has shrunk to just 10% of its former volume, largely due to irrigation for cotton farming.

As for some of the other natural fibres like leather, cashmere and wool, since they come from livestock, they are also very water and carbon intensive.

Source: Common Objective – Water Issue, Water Footprint Network, BBC article, “Can fashion ever be sustainable?” Mar 2020

Fashion is also very dirty

Fashion is also highly polluting. According to WWF, cotton accounts for 24% and 11% of the global sales of insecticides and pesticides respectively. Not only this, untreated wastewater is still often dumped into water sources near textile factories. While those in Europe and US wear their brand new garments, the dirty byproducts are left in already water-scarce countries like China, India and Pakistan.

What's more, fashion can even affect our health. As uncovered by the Greenpeace Detox campaign across the 2010s, fashion products can actually contain high levels of toxic and hazardous chemicals. These include alkylphenols, which is toxic to aquatic life and an endocrine disruptor; azo dyes which can be carcinogenic; and even heavy metals like mercury and lead.

Given all this on top of the carbon and water impacts, it is more than time to end fast fashion and to change the entire fashion industry into a circular and more sustainable model.

Source: CWR article “Dirty Thirsty Wars – Fashion Blindsided” by Debra Tan, Sept 2014, WWF-HK Ecological Footprint Report “Reduce, Rethink: Change the Way We Live” (2019), Greenpeace Report “Destination Zero: seven years of Detoxing the clothing industry” (2019)

Is your t-shirt exploiting cheap labour?

And if fashion's carbon intensive, thirsty and dirty ways were not bad enough, there is more bad news on the social front. As fast fashion is built upon cheap prices for consumers, it essentially operates a “race to the bottom” to find the cheapest labour. This has an obvious negative impact on worker welfare and a spotlight was shone on this in 2013 when 1,134 workers died in an overcrowded garment factory collapse in Dhaka, Bangladesh. Many organisations are working to increase transparency with the ultimate aim to eradicate exploitive labour, but recent reports show progress is slow.

Source: BBC article “Dhaka building collapse: Factories and buyers” May 2013

New fashion habits

We have selected two habits that people can adopt to have a big climate impact – buy less clothes and wear them longer. We have chosen these because they are impactful and easily achievable and there is sufficient scientific research available to calculate emission cuts. Commentator and comedian Hasan Minhaj highlighted these two actions in a segment of the award-winning Netflix show Patriot Act in 2019 ('The ugly truth about fast fashion').

We have made these two actions more specific by identifying the number of clothing items and the length of time before buying another item so we can calculate emissions saved. We have set these levels as we believe they are relatively achievable.

1. Buy 1 fewer pairs of jeans and 3 fewer t-shirts a year. While a t-shirt is carbon intensive (2.1 kgCO₂e), a pair of jeans is even more so, emitting 33.4 kg of CO₂e (low end as this is from efficient production).¹⁹⁶ So, if you bought one fewer pair of jeans and 3 fewer t-shirts, you can save 39.7 kgCO₂e. This is as much GHG emissions as driving a passenger car from Sapporo to Hokkaido.

 **CWR** GHG EMISSIONS SAVED PER PERSON FROM BUYING FEWER CLOTHES A YEAR



Source: CWR, BBC article "Can fashion ever be sustainable?" Mar 2020
© CWR, 2022 all rights reserved

2. Extend the life of a pair of jeans and 3 t-shirts by 9 months. It's not just about buying less clothes, wearing your clothes for longer – instead of discarding or replacing them – can also help the climate. By just wearing one item of clothing for 9 months longer, a person can reduce their carbon footprint by up to 30%.¹⁹⁷ If you do this for one pair of jeans and 3 t-shirts, you can save 11.9 kgCO₂. This is as much GHG emissions as charging a smartphone 1,530 times. It should be noted that the data source does not specify about washing during the 9 month period, which would obviously impact this.

 **CWR** GHG EMISSIONS SAVED PER PERSON FROM WEARING CLOTHES FOR LONGER



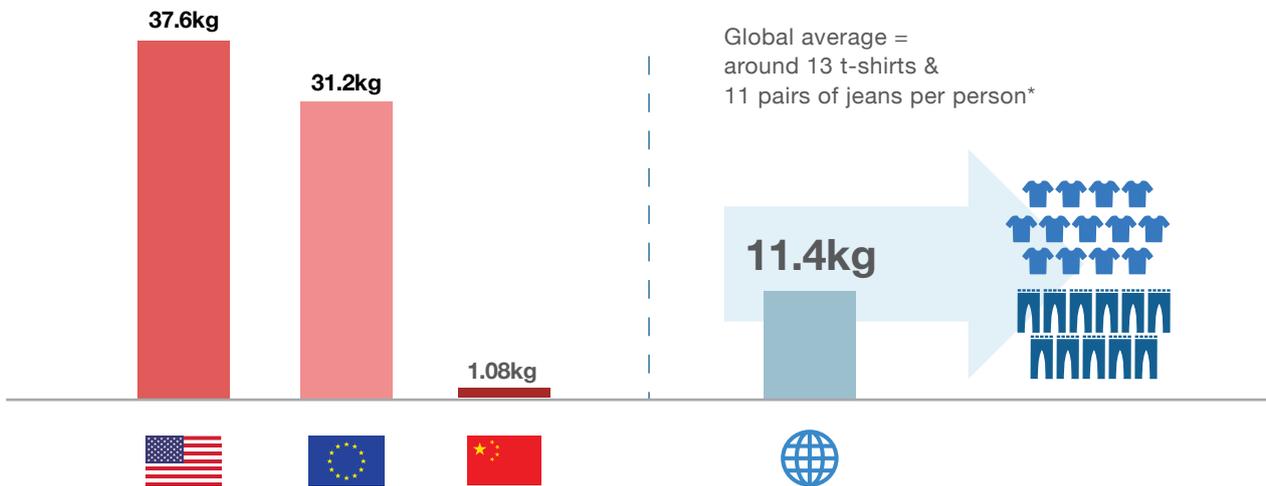
Source: CWR, BBC article "Can fashion ever be sustainable?" Mar 2020, WRAP report "Extending the life of clothes" Dec 2015, US EPA emissions calculator
© CWR, 2022 all rights reserved

These two simple actions can help a person save about 52 kg of emissions. Beyond these actions are many more ways to do more to cut fashion emissions (see '4 ways to do more' below) and emissions from online shopping (see 'Action 7').

Together we can... cut up to 15 Mt of GHG emissions...

Europeans and Americans consume about three times more apparel than the average person each year, according to a report by consulting group Quantis in 2018.¹⁹⁸

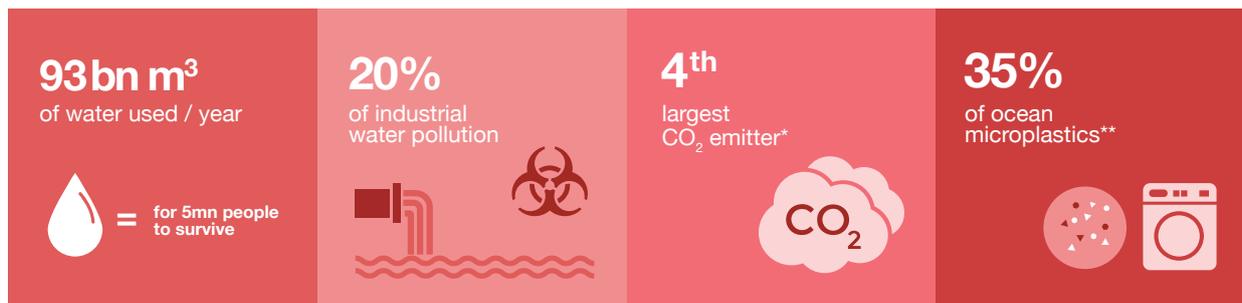
CWR ANNUAL APPAREL CONSUMPTION PER PERSON IN US, EU & CHINA COMPARED TO GLOBAL AVERAGE (2016)



Source: CWR, Quantis report "Measuring Fashion: Environmental Impact of the Global Apparel and Footwear Industries Study" (2018)
 * assuming that a pair of jeans weighs about 850g and a t-shirt about 150g
 © CWR, 2022 all rights reserved

The growth in American consumption has been particularly astounding: in 1980, the average American bought about 12 new pieces of clothing every year and now they buy 68 new pieces a year.¹⁹⁹

CWR FASHION'S THIRSTY & DIRTY IMPACT



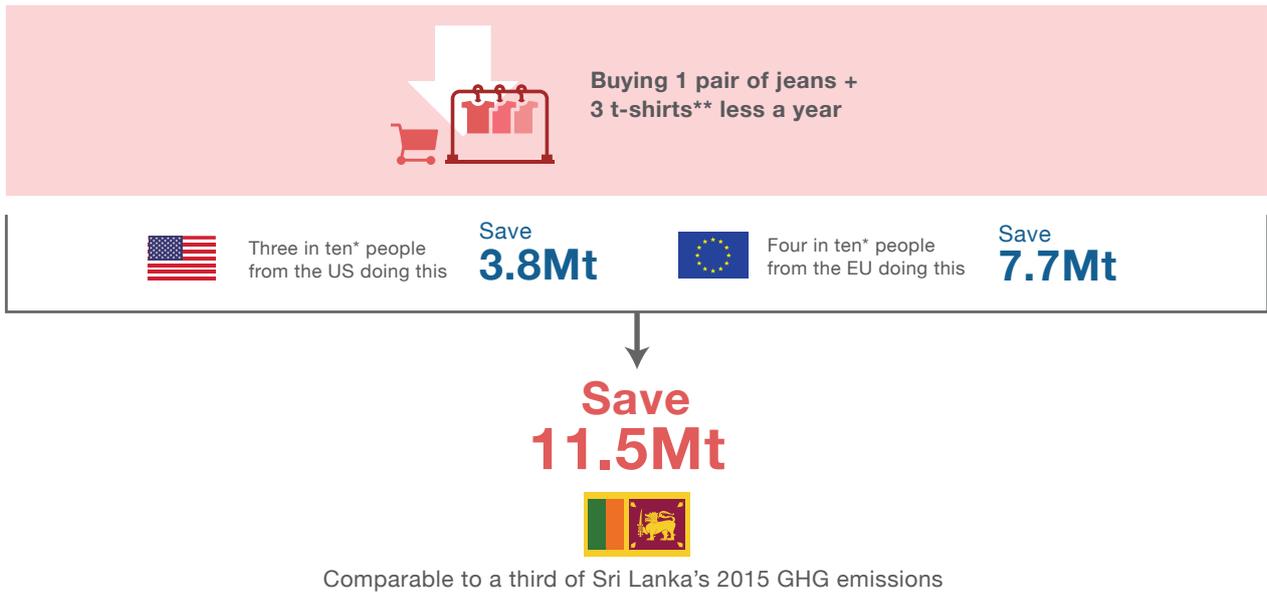
*If a country, fashion would be the 4th largest carbon emitter
 **Microplastics released from the laundering of synthetic fibres like polyester.
 Source: World Bank, UNEP, OECD, IUCN - various years.
 © CWR, 2022 all rights reserved

We estimate that willing individuals from the US and the EU who adopt the two new habits could save 14.9 MtCO₂e which is comparable to a third of Hong Kong's GHG emissions in 2015.¹⁵

1. Buy one fewer pairs of jeans and three fewer t-shirts a year

Various surveys have found that 29% of shoppers in the US are willing to pay more for sustainable fashion products. In the EU's Top Five fashion markets, 38% of shoppers take the fashion industry's social and environmental impacts into account when shopping.^{200, 201} In the absence of other data, we assume these respondents are willing to buy fewer clothes to tackle climate change. If this was done by roughly a third of Americans, amounting to 95 million people, almost 4 MtCO₂e could be saved. And if this was replicated by four in ten people in the EU, or 195 million people, almost 8 MtCO₂e could be saved. The combined impact of almost 12 MtCO₂e is equivalent to a third of Sri Lanka's greenhouse gas emissions in 2015 (see graphic on next page.)¹⁵

CWR CONSUMERS FROM US & EU CAN SAVE 1/3 OF SRI LANKA'S EMISSION BY BUYING FEWER CLOTHES A YEAR



Source: CWR, BBC article "Can fashion ever be sustainable?" Mar2020, Fashion United article "1 in 3 consumers in Europe's largest markets consider sustainability when shopping" Nov 2018, Forbes article "Report Shows Customers Want Responsible Fashion, But Don't Want To Pay For It. What Should Brands Do?" Jun 2019, Worldmeter population statistics, EDGAR emissions database
 * For the US, 29% of shoppers were willing to pay more for sustainable fashion products. For EU's top 5 fashion markets, 38% of shoppers take fashion's social and environmental impact into account when shopping. We assume these responders to be willing to buy fewer clothes for the climate.
 NOTE: US & EU chosen as they are the top consumers of fast fashion (see Quantis report)
 ©CWR, 2022 all rights reserved

2. Extend the life of a pair of jeans and 3 t-shirts by 9 months

Currently in the US, clothes are only worn three times or less; and compared to 20 years ago, every garment bought is kept buy half as long.²⁰² Based on the surveys referred to above, we estimate that if roughly a third of the US population (totalling around 95mn people) did this, 1.1 MtCO₂e can be saved and if four in ten people in the EU did this (totalling around 195mn people) 2.3 MtCO₂e can be saved. The combined emissions of more than 3 MtCO₂e saved are equivalent to more than the GHG emissions of the Bahamas in 2015.¹⁵

CWR CONSUMERS FROM US & EU CAN SAVE MORE THAN THE EMISSIONS OF THE BAHAMAS BY WEARING CLOTHES FOR LONGER



Source: CWR, BBC article "Can fashion ever be sustainable?" Mar 2020, Fashion United article, "1 in 3 consumers in Europe's largest markets consider sustainability when shopping" Nov 2018, Forbes article "Report Shows Customers Want Responsible Fashion, But Don't Want To Pay For It. What Should Brands Do?" Jun 2019, Worldometer population statistics, EDGAR emissions database
 * For the US, 29% of shoppers were willing to pay more for sustainable fashion products. For EU's top 5 fashion markets, 38% of shoppers take fashion's social and environmental impact into account when shopping. We assume these responders to be willing to also buy fewer clothes for the climate.
 NOTE: US & EU chosen as they are the top consumers of fast fashion (see Quantis report)
 © CWR, 2021 all rights reserved

Ramping up to cut more carbon and water by washing clothes more efficiently

While fashion is highly carbon and water intensive to produce, its emissions and water use do not end there. Because the more we wash clothes the more we are adding to the clothes' carbon and water footprints.

A load of laundry washed at 60°C and dried in a combined washer-dryer emits 3.3 kg of CO₂, comparable to a 13km drive in a passenger car.^{100, 121} As for water, University of Michigan research has shown that the average washing machine uses more than 50m³ of water a year – as much as an average person drinks in a lifetime.²⁰³

So, what can we do? Washing full loads instead of half loads saves 50% of a washing machine's carbon and water footprint. Washing less often reduces the footprint further (the Levi's CEO has not washed his jeans in ten years).²⁰⁴ It can also make clothes last longer, reduce microplastic release (see below) and save on electricity (see 'Action 3').

Fast fashion's plastic problem

Oil and plastic don't come to mind when you're putting on your clothes, but they should! Polyester and other synthetic fibres, which are in your yoga pants, sports tops, pretty much everything fast fashion and athleisure are kinds of plastic derived from oil. And if we continue business-as-usual, 98% of all future fibre growth is expected in synthetic fibres.

Every time a polyester garment is washed, it releases 700,000 plastic microfibrils. Many of these microplastics pass through sewage treatment and end up in rivers and oceans and then in our food chain, and increasingly in the air. And FYI, microplastics never degrade.

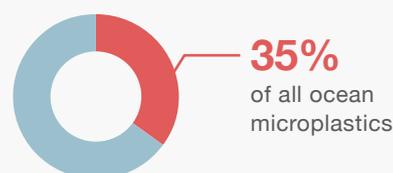
Overall, in a year, it is estimated that 500,000 tonnes – the equivalent of 50 billion plastic bottles – of microfibrils enter the ocean. 35% of all microplastics in the ocean came from the laundering of synthetic textiles like polyester.

And, yes, there is more plastic issues and pollution in fashion, now thanks to clothes hangers – “plastic straw” of the fashion industry, jewellery & sunglasses. Cheap sunglasses and fast fashion jewellery at basement prices mean an exponential increase in plastic waste ending in landfills.

With the amount of polyester produced annually expected to triple between 2007 and 2025, surely it's time to say no to fast fashion and wash our clothes less?

Source: CWR article, "Fashion Frolicking In Oil", by Dawn McGregor (17 Jul 2020), UNEP article, "Fashion's tiny hidden secret (13 Mar 2019)

CWR FASHION'S PLASTIC POLLUTION TRAIL



Source: CWR, Plymouth University study, UN Environment, IUCN

4 ways you can do more...

1. Wear all your clothes for longer

What we need is a mindset change. Instead of buying new clothes, we can wear all our clothes for longer and not just a pair of jeans and three t-shirts for nine more months. This is the most impactful way we can say no to and stop fast fashion (see more in box below) because even donating our clothes and buying from seemingly sustainable brands has pitfalls (see boxes on following page).

Say no to fast fashion

One of the biggest ways we can slow down fast fashion is simply not buying from them. These include brands like Cotton On, H&M, Zara, Topshop, Fashion Nova and others. After all, even if we are wearing clothes from these brands longer or buying fewer clothes from them, we are still perpetuating the cycle of fast fashion.

The good news is fast fashion brands are not infallible – just look at the rapid collapse of Forever 21 in the last few years due to “cookie-cutter” styles and poor sales performances at its rapidly expanding stores. But still consumers need to act and one way to show your support or lack of support is by where you spend your money, so think twice.

Source: Business Insider “At its peak, Forever 21 made \$4.4 billion in revenue. Here’s what led to the brand’s downfall and bankruptcy.” by Kaitlyn Wang & Irene Kim, Sept 2019

2. Buy and wear second-hand clothes

Many people aren’t so keen and some even squeamish about the idea of second hand clothes but the truth is, with the rapid rise of fast fashion, second-hand clothes now are barely and sometimes not even worn. Despite this, buying and wearing second hand clothes can have a big climate impact. If everybody in the US bought one used item instead of new in 2019, it would save the carbon emissions equivalent to taking over half a million cars off the road for a year.²⁰⁵ On top of this, second hand clothes are cheaper so perhaps you could get that dream dress at a bargain? And yes, there are more places to get second hand lux and high fashion items, so that is not an excuse. And remember, buying second hand clothes are better but it’s no excuse to buy too many – even if you have just done a spring cleaning (see more in box below); just buy what you need.

Donating for recycling fuels consumption & adds to fashion waste

What happens to the pile of unwanted old clothes cleared out during spring cleaning? For some people, donating to charities or brand collection boxes is the answer but in reality, this is often only a feel-good solution only and gives consumers an excuse to buy even more clothes.

Why is donating clothes feel-good only? Because a lot of donated clothes often get dumped. What charities can’t sell or give away are sold to buyers in the developing world and still end up in mountains of waste or landfills in those countries, where up to 87% of landfill is incinerated.

Perhaps you’ve seen in-store recycling bins with retailers like H&M implying that the old clothes you bring in will be recycled to make new clothing. But less than 1% of their clothing is actually recycled to make new clothing. That is because the blend of fibres that make their clothes don’t break down easily. So, don’t get too caught up in that ‘do gooder’ feel after donating clothes and definitely don’t use it as an excuse to go on a shopping spree.

Source: Big Think article “Fashion contributes to 10 percent of humanity’s carbon emissions” by Molly Hanson, 9 Dec 2019, Patriot Act with Hasan Minhaj episode “The Ugly Truth Of Fast Fashion” (2019)

3. Rent your clothes instead of buying

A trend worth highlighting is ‘ownership’ which is increasingly popular, especially among millennials – moving away from owning clothes to renting them instead. Businesses are catching on. The company Rent the Runway was valued at USD 1 billion in 2019 and established brands like Urban Outfitters and American Eagle have launched clothing rentals.²⁰⁶ As the State of Fashion 2019 report remarked: ‘If millennials aren’t buying houses, cars, or the latest movie, why would they keep buying clothes?’²⁰⁷

One note of caution though – given all the deliveries required in a rental service, could all the transport-related emissions mean they are doing more harm than good? Check out ‘Action 7’ for more on the impact of online shopping.

4. Buy from brands that are not greenwashing

Who you buy from matters. Some brands, for example, are better for the climate and water as they sell recycled or sustainably sourced materials. However, certain fast fashion brands have caught on and claim to be more sustainable than they really are. Take Zara’s Join Life campaign. Their annual report claims that Zara reuses or recycles 88% of their waste but in reality it’s written in small print 254 pages later that this leaves out the thousands of factories from around the world where nearly all of their waste comes from. Even waste from their stores is not included, as found later in the report.²⁰⁸

So, knowing and buying more from a sustainable brand is rewarding but increasingly difficult given greenwashing like the case described above (see more on this in box below).

Greenwashing: fake eco-creds from fast fashion brands

Despite efforts by fast fashion brands to be more sustainable, their efforts have often been found to be false, with many of them greenwashing. For example, some brands have added sustainable clothing lines to their product range. H&M’s “Conscious Collection” makes up a minority of their overall stock but takes up a large proportion of the brands marketing campaigns. Another example is Zara’s target of 80% of energy at HQ will come from renewable sources but what about the rest of the supply chain – which happens to be the monster portion of energy use? While brands are making efforts, it is clear that they are leading consumers to believe they are doing more good than they actually are. So, consumers get informed and support brands that really are acting for the climate.

Source: Sense & Sustainability article, “How Fast Fashion is Greenwashing” (3 Dec 2019)

METHODOLOGY

The aim of this report is to use science-based evidence to show how easy changes to habits can have a significant climate impact. Individual actions matter, collective action can make big climate impacts. Accordingly, we have estimated impacts for each action area at the individual level, those willing to make change ('willing individuals'), and at the collective level.

Note: The number of "people/ willing individuals" is based on data available for the action, or as close to, where people expressed willingness to do that action (change their habit).

We analysed 8 action areas from everyday life across key GHG emission sources (transport, energy etc.), where the impact of individuals and the collective can be significant and the habit change is relatively achievable, according to the latest data. These 8 action areas are listed in the table below.

Action area		Emission source
1	Say no to cars	Transport
2	Fly less	Transport
3	Watch electricity bills	Energy
4	Change online habits	Energy
5	Rethink diets	Agriculture & Food
6	Cut food waste	Agriculture & Food
7	Tweak online shopping	Consumer-related
8	Slow down fast fashion	Consumer-related

For each of the 8 action areas, the below process was used to estimate impacts (individual, highest consumers/willing individuals & collective). The data sources for each estimation are listed at the relevant place in the report and included in all infographics.

• Why we choose this

In this section, we provide background information on why this action was selected and its significant impact on the climate (GHG emissions, water etc.), with the latest available scientific data.

• New habits

In this section, 1-3 habit changes were selected per action area for which there was sufficient scientific data (especially for carbon emissions) and statistics. Then the impact at the individual level is given.

- **Together we can**

In this section, the impact from the same 1-3 habits as above, is scaled to those consuming the most, as they can have the biggest impact (e.g. Top 3 meat consuming countries). Also in this section, the willing individuals data is factored. This helps make the impact data more relevant to current consumer behaviour and trends, rather than taking a blanket population of a country (e.g. a survey found that 69% of Americans are either already or intending to fly less to combat climate change).

Note: When there was no specific data on willing individuals available (only a few instances) we extrapolated based on the next best data available and this is detailed at relevant places in the report.

Note: The action specific data varies according to the best available data. Thus, in some cases Life Cycle Assessment (environmental impacts associated with all the stages of a product's life, from raw material extraction through materials processing, manufacture, distribution, and use) data has been used and this is detailed at relevant places in the report.

- **Ways you can do more**

This section includes a list of actions that go beyond the impacts examined in the section and that can yield further impact but given they can require more commitment from consumers, they are there as information points and guides.

DISCLAIMER

This document (“Document”) has been prepared by China Water Risk (CWR) for general introduction, overview and discussion purposes only and does not constitute a comprehensive statement of any matter and it should not be relied upon as such. The Document should not be regarded by recipients as a substitute for the exercise of their own judgment. Information contained on this document has been obtained from, or is based upon, third party sources believed to be reliable, but has not been independently verified and no guarantee, representation or warranty is made as to its accuracy or completeness. All statements contained herein are made as of the date of this Document. CWR makes no representation or warranty, expressed or implied, with respect to the accuracy or completeness of any of the information in the Document, and accepts no liability for any errors, omissions or misstatements therein or for any action taken or not taken in reliance on this Document. None of China Water Risk, its sponsors, affiliates, officers or agents provide any warranty or representation in respect of information in this Document. In no event will China Water Risk be liable to any person for any direct, indirect, special or consequential damages arising out of any use of the information contained on this Document. This Document, graphics and illustrations must not be copied, in whole or in part or redistributed without the written consent of China Water Risk (copyright © China Water Risk, 2022, all rights reserved).

© China Water Risk. All rights reserved, 2022

REFERENCES

1. BBC News “Australia fires: A visual guide to the bushfire crisis”, Jan 2020. at <<https://www.bbc.com/news/world-australia-50951043>>
2. Al Jazeera “Australia in the grip of flash floods and bushfires” Jan, 2020. at <<https://www.aljazeera.com/news/2020/01/australia-grip-flash-floods-bushfires-200128102429008.html>>
3. The Guardian “Antarctic temperature rises above 20C for first time on record” by Jonathan Watts, Feb 2020. at <<https://www.theguardian.com/world/2020/feb/13/antarctic-temperature-rises-above-20c-first-time-record>>
4. The Guardian “Sea level rise accelerating along US coastline, scientists warn” by Oliver Milman, Feb 2020. at <<https://www.theguardian.com/environment/2020/feb/03/sea-level-rise-accelerating-us-coastline-scientists-warn>>
5. NBC News “There’s no more typical California wildfire season. It may be year-round, experts warn.” by Erik Ortiz, Nov 2018. at <<https://www.nbcnews.com/news/us-news/there-s-no-more-typical-wildfire-season-california-it-may-n934521>>
6. China Water Risk Report “No Water, No Growth – Does Asia have enough water to develop?” (2018).
7. BBC News “Climate change: Water shortages in England ‘within 25 years’” Mar 2019. at <<https://www.bbc.com/news/uk-47620228>>
8. UN Environment Programme Press Release, 8 Oct 2018 – “Rapid and unprecedented action required to stay within 1.5°C says UN’s Intergovernmental Panel on Climate Change”. at <<https://www.unenvironment.org/news-and-stories/press-release/rapid-and-unprecedented-action-required-stay-within-15oc-says-uns>>
9. Wester, Philippus & Mishra, Arabinda & Mukherji, Aditi & Shrestha, Arun. (2019). The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People. 10.1007/978-3-319-92288-1.
10. Sci DevNet article “Study counts lives saved with push for 1.5°C climate target” by Inga Vesper, Apr 2018. at <<https://www.scidev.net/global/climate-change/news/lives-saved-with-climate-target.html>>
11. UN Environment Programme Report “Emissions Gap Report 2019” (2019)
12. Scientific American article, “U.S. Officially Rejoins Paris Climate Agreement, Feb 2021 <<https://www.scientificamerican.com/article/u-s-officially-rejoins-paris-climate-agreement/>>
13. Le Quéré, C., Jackson, R.B., Jones, M.W. et al. Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nat. Clim. Chang. 10, 647–653 (2020). <https://doi.org/10.1038/s41558-020-0797-x>
14. World Resources Institute Report “Creating a Sustainable Food Future” (2018)
15. EDGAR - Emissions Database for Global Atmospheric Research EU Commission
16. Wynes, Seth & Nicholas, Kimberly. (2017). The climate mitigation gap: Education and government recommendations miss the most effective individual actions. Environmental Research Letters. 12. 074024. 10.1088/1748-9326/aa7541.
17. Carbon Disclosure Project Report “The Carbon Majors Database: CDP Carbon Majors Report 2017” (2017)
18. Crippa, M., Oreggioni, G., Guizzardi, D., Muntean, M., Schaaf, E., Lo Vullo, E., Solazzo, E., Monforti-Ferrario, F., Olivier, J.G.J., Vignati, E., Fossil CO2 and GHG emissions of all world countries - 2019 Report, EUR 29849 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-11100-9, doi:10.2760/687800, JRC117610.
19. Climate Analytics, Potsdam Institute for Climate Impact Research Report “Historical Responsibility for Climate Change – from countries emissions to contribution to climate change” (2015)
20. OPEC website (https://www.opec.org/opec_web/en/about_us/169.htm)
21. China Power article, “How Is China’s Energy Footprint Changing?” <<https://chinapower.csis.org/energy-footprint/#:~:text=In%202017%2C%20the%20industrial%20sector,%20of%20the%20country's%20coal.&text=China's%20dependence%20on%20coal%20for,contributed%20to%20urban%20air%20pollution.>>
22. David Wallace-Wells (2019) The Uninhabitable Earth: Life After Warming, 1st Edition, Tim Duggan Books, New York
23. UN News article “Climate change: An ‘existential threat’ to humanity, UN chief warns global summit”, May 2018. at <<https://news.un.org/en/story/2018/05/1009782>>
24. China Water Risk article “Cape Town’s ‘Day Zero’: Where Are We Now?” by Ahmed Khan, Jan 2019. at <<http://www.chinawaterrisk.org/opinions/cape-towns-day-zero-where-are-we-now/>>
25. The Mercury News “California Drought: Northern California having driest February since 1864” by Paul Rogers, Feb 2020. at <<https://www.mercurynews.com/california-drought-nearly-a-quarter-of-california-now-in-drought-feds-say>>
26. USA Today “Mediterranean climate’: California drought ends after more than 7 years, but dry conditions will return” by Kristin Lam, Mar 2019. at <<https://www.usatoday.com/story/news/nation/2019/03/15/california-drought-free-after-7-years-dry-conditions-remain/3168753002/>>

REFERENCES

27. Sky Hi News “Snowpack has declined by an average of 41% in the Rocky Mountains over past 3 decades” by Deepan Dutta, Dec 2018. at < <https://www.skyhinews.com/news/snowpack-has-declined-by-an-average-of-41-%-in-the-rocky-mountains-over-past-3-decades/>>
28. Wobus, Cameron & Small, Eric & Hostermann, Heather & Mills, David & Stein, Justin & Rissing, Matthew & Jones, Russell & Duckworth, Michael & Hall, Ronald & Kolian, Michael & Creason, Jared & Martinich, Jeremy. (2017). Projected climate change impacts on skiing and snowmobiling: A case study of the United States. *Global Environmental Change*. 45. 10.1016/j.gloenvcha.2017.04.006.
29. Oppenheimer, M., B.C. Glavovic , J. Hinkel, R. van de Wal, A.K. Magnan, A. Abd-Elgawad, R. Cai, M. CifuentesJara, R.M. DeConto, T. Ghosh, J. Hay, F. Isla, B. Marzeion, B. Meysignac, and Z. Sebesvari, 2019: Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.
30. Lehmann, Jascha & Mempel, Finn & Coumou, Dim. (2018). Increased Occurrence of Record-Wet and Record- Dry Months Reflect Changes in Mean Rainfall. *Geophysical Research Letters*. 10.1029/2018GL079439.
31. Bulletin of the American Meteorological Society Special Report (2019) “Explaining Extreme Events in 2018 from a Climate Perspective”
32. Salinger, M. & Renwick, James & Behrens, Erik & Mullan, Brett & Diamond, Howard & Sirguy, Pascal & Smith, Robert & Trought, Mike & Alexander, Lisa & Cullen, Nicolas & Fitzharris, Brian & Hepburn, Chris & Parker, Amber & Sutton, Phil. (2019). The unprecedented coupled ocean-atmosphere summer heatwave in the New Zealand region 2017/18: drivers, mechanisms and impacts. *Environmental Research Letters*. 10.1088/1748- 9326/ab012a.
33. NASA Global Climate Change “Satellite Data Record Shows Climate Change’s Impact on Fires” by Ellen Gray, Sep 2019. at < <https://www.nasa.gov/feature/goddard/2019/satellite-data-record-shows-climate-changes-impact- on-fires>>
34. Reuters “Death toll in massive California wildfire revised down by one”, Feb 2019. at < <https://www.reuters.com/article/us-california-wildfire/death-toll-in-massive-california-wildfire-revised-down-by-one-idUSKCN1PX08>> 35 CNN
35. CNN “Australia’s deadly wildfires are showing no signs of stopping. Here’s what you need to know” by Jessie Yeung, Jan 2020. at < <https://edition.cnn.com/2020/01/01/australia/australia-fires-explainer-intl-hnk- scli/index.html>>
36. The Guardian article, “Record-breaking 4.9m hectares of land burned in NSW this bushfire season” <<https://www.theguardian.com/australia-news/2020/jan/07/record-breaking-49m-hectares-of-land-burned-in-nsw- this-bushfire-season>>
37. Towards Data Science “An Analysis of Amazonian Forest Fires” by Matthew Stewart, Nov 2019. at < <https://towardsdatascience.com/an-analysis-of-amazonian-forest-fires-8facca63ba69>>
38. The Straits Times “California’s new normal: Wildfires, ash and power outages could last a decade” by Faiz Siddiqui, Oct 2019. at < <https://www.straitstimes.com/world/united-states/californias-new-normal-wildfires-ash- and-power-outages-could-last-a-decade>>
39. Dahl, Kristina & Licker, Rachel & Abatzoglou, John & Declet-Barreto, Juan. (2019). Increased frequency of and population exposure to extreme heat index days in the United States during the 21st century. *Environmental Research Communications*. 1. 075002. 10.1088/2515-7620/ab27cf.
40. Carbon Brief “Climate change made Europe’s 2019 record heatwave up to ‘100 times more likely’” by Daisy Dunne, Aug 2019. at < <https://www.carbonbrief.org/climate-change-made-europes-2019-record-heatwave-up-to- hundred-times-more-likely>>
41. The Independent “Human body ‘close to thermal limits’ due to extreme heatwaves caused by climate change, scientist says” by Phoebe Weston, Jul 2019. at < <https://www.independent.co.uk/environment/exteme-global-temperatures-heatwave-human-body-limits-a9023421.html>>
42. The Guardian “Climate change to cause humid heatwaves that will kill even healthy people” by Damian Carrington, Aug 2017. at < <https://www.theguardian.com/environment/2017/aug/02/climate-change-to-cause- humid-heatwaves-that-will-kill-even-healthy-people>>
43. MIT News “China could face deadly heat waves due to climate change” by David Chandler, Jul 2018. at < <http://news.mit.edu/2018/china-could-face-deadly-heat-waves-due-climate-change-0731>>
44. The Lancet webpage “Climate change and health: Infographic”. at <<https://www.thelancet.com/infographics/>>
45. State of the Planet (Columbia University) “How Climate Change Is Exacerbating the Spread of Disease” by Renee Cho, Sep 2014. at <<https://blogs.ei.columbia.edu/2014/09/04/how-climate-change-is-exacerbating-the- spread-of-disease/>>
46. Watts et al (2019) “The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate” *The Lancet* Vol 394, Iss 10211, P1836-1878
47. Newsweek “Melting glaciers and thawing permafrost could release ancient viruses locked away for thousands of years” by Rosie Mccall, Feb 2020. at <<https://www.newsweek.com/melting-glaciers-thawing-permafrost- ancient-viruses-1486037>>

REFERENCES

48. Boscarino, J., Hoffman, S., Adams, R., Figley, C., & Solkhkha, R. (2014). Mental health outcomes among vulnerable residents after Hurricane Sandy. *American Journal of Disaster Medicine*, 9, 107–120.
49. Bryant, R. et al (2014). Psychological outcomes following the Victorian Black Saturday bushfires. *Australian and New Zealand Journal of Psychiatry*, 48, 634–643.
50. BBC News “The harm from worrying about climate change” by Christine Ro, Oct 2019. at < <https://www.bbc.com/future/article/20191010-how-to-beat-anxiety-about-climate-change-and-eco-awareness>>
51. American Psychological Association, *ecoAmerica Report “Mental Health and Our Changing Climate: Impacts, Implications, and Guidance”* (2017)
52. Time magazine “Terrified of Climate Change? You Might Have Eco-Anxiety” by Ciara Nugent, Nov 2019. at < <https://time.com/5735388/climate-change-eco-anxiety/>>
53. Live Science “Antarctica just saw its all-time hottest day ever” by Brandon Spektor, Feb 2020. at < <https://www.livescience.com/antarctica-record-high-temperature.html>>
54. USA Today “Warm water discovered beneath Antarctica’s ‘doomsday’ glacier, scientists say” by Doyle Rice, Jan 2020. at < <https://www.usatoday.com/story/news/nation/2020/01/31/thwaites-glacier-warm-water-discovered-below-doomsday-glacier/4621838002/>>
55. CWR report, “Avoiding Atlantis: The CWR APACCT 20 Index – Benchmarking coastal threats for 20 APAC sectors with finance sector input”, November 2020 < https://www.chinawaterrisk.org/wp-content/uploads/2020/11/CWR_2020_Avoiding-Atlantis_The-CWR-APACCT-20-Index.pdf>
56. New York Times “As Sea Levels Rise, Scientists Offer a Bold Idea: Dam the North Sea” by Claire Moses, Feb 2020. at < <https://www.nytimes.com/2020/02/14/world/europe/north-sea-dams.html>>
57. VICE “Climate Change Will Create 1.5 Billion Migrants by 2050 and We Have No Idea Where They’ll Go” by Izzie Ramirez, Sep 2019. at < https://www.vice.com/en_us/article/59h9qa/climate-change-will-create-15-billion-migrants-by-2050-and-we-have-no-idea-where-theyll-go>
58. Asia Development Bank Report “A Region At Risk - The Human Dimensions Of Climate Change In Asia And The Pacific” (2017)
59. Missirian, A & Schelinker, W (2017) “Asylum applications respond to temperature fluctuations”, *Science*, Vol. 358, Issue 6370, pp. 1610-1614
60. The Guardian “Climate refugees can’t be returned home, says landmark UN human rights ruling” by Kate Lyons, Jan 2020. at < <https://www.theguardian.com/world/2020/jan/20/climate-refugees-cant-be-returned-home-says-landmark-un-human-rights-ruling>>
61. Insider “Celebrities who have evacuated or lost their homes as wildfires spread across California” by Olivia Singh, Oct 2019. at < <https://www.insider.com/california-wildfires-celebrities-who-have-evacuated-their-homes-2018-11>>
62. IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press.
63. Agriculture and climate change, European Environmental Agency, Published 30 Jun 2015, Last modified 11 May 2021.
64. IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany. 1148 pages. <https://doi.org/10.5281/zenodo.3831673>
65. National Geographic “Bumblebees are going extinct in a time of ‘climate chaos’” by Douglas Main, Feb 2020. at < <https://www.nationalgeographic.com/animals/2020/02/bumblebees-going-extinct-climate-change-pesticides/>>
66. Ekor, Martins. (2014). The Growing Use of Herbal Medicines: Issues Relating to Adverse Reactions and Challenges in Monitoring Safety. *Frontiers in pharmacology*. 4. 177. 10.3389/fphar.2013.00177.
67. The Guardian “What is biodiversity and why does it matter to us?” by Damian Carrington, Mar 2018. at < <https://www.theguardian.com/news/2018/mar/12/what-is-biodiversity-and-why-does-it-matter-to-us>>
68. O. Hoegh-Guldberg, D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K. Ebi, F. Engelbrecht, J. Guiot, Y. Hijioka, S. Mehrotra, A. Payne, S. I. Seneviratne, A. Thomas, R. Warren, G. Zhou, 2018, Impacts of 1.5oC global warming on natural and human systems. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.

REFERENCES

69. Ter Steege, H et al (2015) "Estimating the global conservation status of more than 15,000 Amazonian tree species" in *Science Advances*, Vol. 1, no. 10, e1500936
70. The Washington Post "The Brazilian Amazon is still burning. Who is responsible?" by Meg Kelly and Sarah Cahlan, Oct 2019. at <<https://www.washingtonpost.com/politics/2019/10/07/brazilian-amazon-is-still-burning-who-is-responsible/>>
71. National Geographic "Save the Plankton, Breathe Freely". at <<https://www.nationalgeographic.org/activity/save-the-plankton-breathe-freely/>>
72. Sims R., R. Schaeffer, F. Creutzig, X. Cruz-Núñez, M. D'Agosto, D. Dimitriu, M.J. Figueroa Meza, L. Fulton, S. Kobayashi, O. Lah, A. McKinnon, P. Newman, M. Ouyang, J.J. Schauer, D. Sperling, and G. Tiwari, 2014: Transport. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
73. Greenpeace International Press Release "Car industry's 2018 carbon footprint exceeds EU greenhouse gas emissions – Greenpeace", Sep 2019. at <<https://www.greenpeace.org/international/press-release/24131/car-industrys-2018-carbon-footprint-exceeds-eu-greenhouse-gas-emissions-greenpeace/>>
74. The Guardian "Greenhouse gas emissions from diesel vehicles cancelled out cuts from renewable energy" by Adam Morton, Nov 2019. at <<https://www.theguardian.com/environment/2019/nov/02/greenhouse-gas-emissions-from-diesel-vehicles-cancelled-out-cuts-from-renewable-energy>>
75. Eco News "BNEF suggests global petrol and diesel car sales have already peaked" by David Twomey, May 2019. at <<http://econews.com.au/61070/bnef-suggests-global-petrol-and-diesel-car-sales-have-already-peaked/>>
76. Eurostat "Passenger cars in the EU". at <https://ec.europa.eu/eurostat/statistics-explained/index.php/Passenger_cars_in_the_EU#Overview>
77. Gasgoo "China's automobile population totals 250 million units by June 2019" by Monika, Jul 2019. at <http://autonews.gasgoo.com/china_news/70016117.html>
78. US Policy and Governmental Affairs Office of Highway Policy Information "Highway Statistics 2017". at <<https://www.fhwa.dot.gov/policyinformation/statistics/2017/mv1.cfm>>
79. JASPA "都道府県別・車種別自動車保有台数(軽自動車含む)" at <<https://www.jaspa.or.jp/Portals/0/resources/jaspahp/member/data/pdf/tiiki-hoyuu2018.pdf>>
80. Brazil Ministério da Infraestrutura statistics. at <<https://www.denatran.gov.br/component/content/article/115-portal-denatran/8558-frota-de-veiculos-2018.html>>
81. Independent article "Can Uber and Lyft help combat climate change? Green investors are not convinced" by Ross Kerber, Apr 2019. at <<https://www.independent.co.uk/news/business/analysis-and-features/uber-lyft-climate-change-ipo-environment-global-warming-a8852396.html>>
82. Clewlow & Mishra (2017) "Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States" UC Davis Institute of Transportation Studies, UCD-ITS-RR-17-07
83. ITDP Report "A Global High Shift Cycling Scenario" (2015)
84. Forbes "Bicycling Could Help Save The Planet, Says IPCC Climate Report" by Carlton Reid, Oct 2018. at <<https://www.forbes.com/sites/carltonreid/2018/10/08/bicycling-could-help-save-the-planet-says-ippc-climate-report/#50c31eef2795>>
85. Rojas-Rueda, David & Nazelle, Audrey & Tainio, Marko & Nieuwenhuijsen, Mark. (2011). The Health Risks and Benefits of Cycling in Urban Environments Compared with Car Use: Health Impact Assessment Study. *BMJ (Clinical research ed.)*. 343. d4521. 10.1136/bmj.d4521.
86. World Economic Forum "The first city running its vehicles on waste cooking oil" by David Thorpe, Feb 2015. at <<https://www.weforum.org/agenda/2015/02/the-first-city-running-its-vehicles-on-waste-cooking-oil/>>
87. Transport & Environment "Biodiesel 80% worse for climate than fossil diesel" by Eoin Bannon, Apr 2016. at <<https://www.transportenvironment.org/news/biodiesel-80-worse-climate-fossil-diesel>>
88. WWF-HK report "No Middle Road: The Growth of Electric Vehicles and their Impact on Oil" (2016)
89. WWF blog post "Electric Vehicle Growth in China set to shrink oil demand, devalue oil companies", Dec 2016. at <<https://www.wwf.org.hk/en/?17280/>>
90. Martin, Elliot & Shaheen, Susan. (2012). Greenhouse Gas Emission Impacts of Carsharing in North America. *Intelligent Transportation Systems*. IEEE Transactions on. 12. 1074 - 1086. 10.1109/TITS.2011.2158539.
91. Martin, Elliot & Shaheen, Susan & Lidicker, Jeffrey. (2010). Carsharing's Impact On Household Vehicle Holdings: Results From A North American Shared-Use Vehicle Survey. Institute of Transportation Studies, UC Davis, Institute of Transportation Studies, Working Paper Series.
92. Centre for Climate & Energy Solutions "Reducing Your Transportation Footprint". at <<https://www.c2es.org/content/reducing-your-transportation-footprint/>>
93. Wynes, Seth & Nicholas, Kimberly. (2017). The climate mitigation gap: Education and government recommendations miss the most effective individual actions. *Environmental Research Letters*. 12. 074024. 10.1088/1748-9326/aa7541.

REFERENCES

94. European Commission Climate Action page “Reducing emissions from aviation”. at <https://ec.europa.eu/clima/policies/transport/aviation_en>
95. Transport & Environment Report “Aviation emissions and the Paris Agreement” (2016)
96. BBC Worklife 101 “Flygskam” by Miriam Quick, Jul 2019. at <<https://www.bbc.com/worklife/article/20190718-flygskam>>
97. BBC news “‘Flight shame’ could halve growth in air traffic”, Oct 2019. at <<https://www.bbc.com/news/business-49890057>>
98. International Air Transport Association “62nd Annual Report” (2018)
99. CNN Travel “Chinese air passengers to rule skies by 2040, ACI forecasts” by Barry Neild, Nov 2018. at <<https://edition.cnn.com/travel/article/china-air-passengers/index.html>>
100. European Investment Bank Report “2nd EIB Climate Survey: Citizens’ commitment to fight climate change in 2020” (2019)
101. BBC News, “Should we give up flying for the sake of the climate?”, Feb 2020 at <<https://www.bbc.com/future/article/20200218-climate-change-how-to-cut-your-carbon-emissions-when-flying>>
102. Business class: Luxury in the sky, Quartz Obsession Podcast, Nov 2021
103. Investopedia “How Much of Airlines’ Revenue Comes From Business Travelers?”, Jul 2019. at <<https://www.investopedia.com/ask/answers/041315/how-much-revenue-airline-industry-comes-business-travelers-compared-leisure-travelers.asp>>
104. Nevins, Joseph. (2014). Academic Jet-Setting in a Time of Climate Destabilization: Ecological Privilege and Professional Geographic Travel. *The Professional Geographer*. 66. 10.1080/00330124.2013.784954.
105. United States Environmental Protection Agency Greenhouse Gas Equivalencies Calculator. at <<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>>
106. BBC News “Eurostar launches London-Amsterdam route” Feb 2018. at <<https://www.bbc.com/news/business-43002908>>
107. World Economic Forum “China is building a floating train that could be faster than air travel” by Rosamund Hutt, Jun 2019. at <<https://www.weforum.org/agenda/2019/06/china-floating-train-faster-than-air-travel/>>
108. Atmosfair “Atmosfair Airline Index” (2018)
109. Cathay Pacific webpage: “Calculate and offset your carbon emissions”: at <https://www.cathaypacific.com/cx/en_HK/about-us/environment/fly-carbon-neutral-fly-greener/calculate-and-offset-your-carbon-emissions.html>
110. British Airways, Leapfrog webpage. at <https://www.pureleapfrog.org/ba/carbon_neutral/>
111. New York Times “Flying Is Bad for the Planet. You Can Help Make It Better.” By Tatiana Schlossberg, Jul 2017. at <<https://www.nytimes.com/2017/07/27/climate/airplane-pollution-global-warming.html>>
112. Debbage, K. G., & Debbage, N. (2019). Aviation carbon emissions, route choice and tourist destinations: Are non-stop routes a remedy? *Annals of Tourism Research*, 79, 102765. doi:10.1016/j.annals.2019.102765
113. Nejat, Payam & Jomehzadeh, Fatemeh & Taheri, Mohammad & Gohari, Mohammad & Abd Majid, Muhd.Zaimi. (2015). A global review of energy consumption, CO2 emissions and policy in the residential sector. *Renewable and Sustainable Energy Reviews*. 10.1016/j.rser.2014.11.066.
114. European Environment Agency News “Homes responsible for one quarter of European greenhouse emissions from energy”, Dec 2011. at <<https://www.eea.europa.eu/highlights/homes-responsible-for-one-quarter>>
115. International Energy Agency Data & Statistics. at <<https://www.iea.org/data-and-statistics>>
116. US EIA “Annual Energy Outlook 2020” (2020)
117. International Energy Agency Report “The Future of Cooling” (2019)
118. Visual Capitalist “What Uses the Most Energy in Your Home?” by Jeff Desjardins, Nov 2016. at <<https://www.visualcapitalist.com/what-uses-the-most-energy-home/>>
119. Sinha, Arijit & Kutnar, Andreja. (2012). Carbon Footprint versus Performance of Aluminum, Plastic, and Wood Window Frames from Cradle to Gate. *Buildings*. 2. 542-553. 10.3390/buildings2040542.
120. Totland, M & Kvande, Tore & Bohne, Rolf André. (2019). The effect of insulation thickness on lifetime CO2 emissions. *IOP Conference Series: Earth and Environmental Science*. 323. 012033. 10.1088/1755-1315/323/1/012033.
121. The Guardian “What’s the carbon footprint of ... a load of laundry?” by Mike Berners-Lee and Duncan Clark. Nov 2010 at <<https://www.theguardian.com/environment/green-living-blog/2010/nov/25/carbon-footprint-load-laundry>>
122. Climate Care infographics “The Carbon Footprint of the Internet”. at <<https://climatecare.org/infographic-the-carbon-footprint-of-the-internet/>>
123. US Energy Gov webpage “LED Lighting”. at <<https://www.energy.gov/energysaver/save-electricity-and-fuel/lighting-choices-save-you-money/led-lighting>>
124. Murtaugh, Paul & Schlax, Michael. (2009). Reproduction and the carbon legacies of individuals. *Global Environmental Change-human and Policy Dimensions - GLOBAL ENVIRON CHANGE*. 19. 10.1016/j.gloenvcha.2008.10.007.

REFERENCES

125. US Energy Star webpage “About ENERGY STAR”. at < https://www.energystar.gov/about/about_energy_efficiency/>
126. The Shift Project Report “Climate Crisis: The Unsustainable Use Of Online Video The Practical Case For Digital Sobriety” (2019)
127. China Water Risk article “YouTube: The Dark Side Of Going Viral” by Woody Chan, Dec 2018. at < <http://www.chinawaterrisk.org/resources/analysis-reviews/youtube-the-dark-side-of-going-viral/>>
128. The Shift Project Report “ Climate Crisis: The Unsustainable Use of Online Video” (2019)
129. BBC Smart Guide to Climate Change “Why your internet habits are not as clean as you think” by Sarah Griffiths, Mar 2020. at < <https://www.bbc.com/future/article/20200305-why-your-internet-habits-are-not-as-clean-as-you-think>>
130. We Are Social, Hootsuite Report “Digital In 2020” (2020)
131. Scality “100 Exabytes And Big Data”. at <<https://www.scality.com/100-exabytes-big-data/>>
132. Cisco Report, “Visual Networking Index: Forecast and Trends, 2017–2022 White Paper” (2016)
133. Cisco News Release “Cisco Visual Networking Index Predicts Global Annual IP Traffic to Exceed Three Zettabytes by 2021”, June 2017. at <<https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1853168>>
134. We Are Social, Hootsuite Report “Digital In 2019” (2019)
135. Netflix Help Centre “How can I control how much data Netflix uses?”. at <https://help.netflix.com/en/node/87>
136. The Shift Project Report “Lean ICT – Materials” (2019). at < <https://theshiftproject.org/wp-content/uploads/2018/10/Lean-ICT-Materials-Quantilev-2018.xlsx>>
137. The Guardian “Pointless emails: they’re not just irritating – they have a massive carbon footprint” by Stephen Moss, Nov 2019. at < <https://www.theguardian.com/technology/shortcuts/2019/nov/26/pointless-emails-theyre-not-just-irritating-they-have-a-massive-carbon-footprint>>
138. Ethical.net “How to Reduce Your Internet Carbon Footprint” by Caoilainn Scouler, Jun 2019. at <<https://ethical.net/technology/how-to-reduce-your-internet-carbon-footprint/>>
139. Mozilla Firefox blog “Eight ways to reduce your digital carbon footprint”, Jul 2019. at <<https://blog.mozilla.org/firefox/digital-carbon-footprint/>>
140. UNFAO – AQUASTAT (FAO’s Global Information System on Water and Agriculture). at <<http://www.fao.org/aquastat/en/overview/methodology/water-use>>
141. IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
142. The Conversation “How to reduce your kitchen’s impact on global warming” by Karli Verghese & Stephen Clune, Dec 2016. at <<http://theconversation.com/how-to-reduce-your-kitchens-impact-on-global-warming-68484>> 143
143. Hong Kong Free Press “A steak’s contribution to global warming” by Emily Botsford, Nov 2015. at <<https://www.hongkongfp.com/2015/11/27/a-steaks-contribution-to-global-warming/>>
144. OZY “Could The Economic Disaster Turn Meat-Loving Argentines Vegan?” by Josephina Salomon, Jan 2020. at <<https://www.ozy.com/the-new-and-the-next/could-the-economic-crisis-turning-meat-loving-argentinians-vegan/252699/>>
145. Good Food Initiative “South America’s Largest Egg Producer Debuts Plant-Based Egg” by Mary Allen, Mar 2019. at <<https://www.gfi.org/mantiqueira-plant-based-egg>>
146. Poore, Joseph & Nemecek, Thomas. (2018). Reducing food’s environmental impacts through producers and consumers. *Science* (New York, N.Y.). 360. 987–992. 10.1126/science.aag0216.
147. Energy Live News “Vegan diet ‘could cut global emissions by ten billion tonnes’” by Jonny Bairstow, Jul 2019. at <<https://www.energylivenews.com/2019/07/01/vegan-diet-could-cut-global-emissions-by-ten-billion-tonnes/>>
148. BBC News “A bit of meat, a lot of veg - the flexitarian diet to feed 10bn” by James Gallagher, Jan 2019. at <<https://www.bbc.com/news/health-46865204>>
149. The Telegraph “Eating some meat is better for the environment than going vegetarian, new study finds” by Josh Wilson, Sep 2019. at <<https://www.telegraph.co.uk/global-health/climate-and-people/eating-meat-better-environment-going-vegetarian-finds-new-study/>>
150. Krajcovicova-Kudlackova, M & Babinska, Katarina & Valachovicova, M. (2005). Health benefits and risks of plant proteins. *Bratislavské lekárske listy*. 106. 231–4.
151. Spoon University article, <<https://spoonuniversity.com/lifestyle/5-fast-food-restaurants-serving-plant-based-meat-items>>
152. Green Queen “Impossible Foods Vegan Burger Made From Plants Launches in Hong Kong, First City Outside of USA” by Sonalie Figueiras, Apr 2019. at <<https://www.greenqueen.com.hk/impossible-foods-vegan-burger-made-from-plants-launches-in-hong-kong-first-city-outside-of-usa/>>
153. Healthline article, May 2020, “What Is the Impossible Burger, and Is It Healthy?” <<https://www.healthline.com/nutrition/impossible-burger#benefits>>

REFERENCES

154. Donald Rose, Martin C Heller, Amelia M Willits-Smith, Robert J Meyer, Carbon footprint of self-selected US diets: nutritional, demographic, and behavioral correlates, *The American Journal of Clinical Nutrition*, Volume 109, Issue 3, March 2019, pp 526–534
155. China Water Risk article “Water In: Beer, Crisps & Chocolate” by Woody Chan, Dec 2016. at <<http://www.chinawaterisk.org/resources/analysis-reviews/water-in-beer-crisps-chocolate/>>
156. BBC News “Climate change food calculator: What’s your diet’s carbon footprint?” by Nassos Stylianou, Clara Guibourg and Helen Briggs, Aug 2019. at <<https://www.bbc.com/news/science-environment-46459714>>
157. The Guardian “How the myth of food miles hurts the planet” by Robin McKie, Mar 2008. at <<https://www.theguardian.com/environment/2008/mar/23/food.ethicalliving>>
158. Independent “Everything you thought about the carbon footprint of imported food is wrong, says top professor” by Phoebe Weston, Aug 2019. at <<https://www.independent.co.uk/news/food-miles-carbon-footprints-climate-change-sustainability-a9050406.html>>
159. China Water Risk article “Why Hong Kong Needs A Meat Tax” by Sally Ho, Nov 2019. at <<http://www.chinawaterisk.org/opinions/why-hong-kong-needs-a-meat-tax/>>
160. CNN “The Amazon is burning because the world eats so much meat” by Eliza Mackintosh, Aug 2019. at <<https://edition.cnn.com/2019/08/23/americas/brazil-beef-amazon-rainforest-fire-intl/index.html>>
161. World Resources Institute blog post “How to Sustainably Feed 10 Billion People by 2050, in 21 Charts” by Janet Ranganathan, Richard Waite, Tim Searchinger and Craig Hanson, Dec 2018. at <<https://www.wri.org/blog/2018/12/how-sustainably-feed-10-billion-people-2050-21-charts>>
162. Goldman Sachs report, “Carbonomics – 10 key themes from the inaugural conference” Nov 2020
163. BBC Food “How to cut food waste and save cash”. at <https://www.bbc.co.uk/food/articles/!_food_waste_recipes>
164. Neff, Roni & Spiker, Marie & Rice, Christina & Schklair, Alexandra & Greenberg, Sally & Leib, Emily. (2019). Misunderstood food date labels and reported food discards: A survey of U.S. consumer attitudes and behaviors. *Waste Management*. 86. 10.1016/j.wasman.2019.01.023.
165. Consumer Affairs “Consumers are focusing on reducing food waste, new study finds” by Kristen Dalli. at <<https://www.consumeraffairs.com/news/consumers-are-focusing-on-reducing-food-waste-new-study-finds-021519.html>>
166. Market Insider “Grundig: Consumers Want to Reduce Food Waste But Lack Time and Means”, Sep 2017. at <<https://markets.businessinsider.com/news/stocks/grundig-consumers-want-to-reduce-food-waste-but-lack-time-and-means-1002302094>>
167. Singapore National Energy Agency “2019 Consumer Survey on Food Wastage” (2019)
168. BBC Smart Guide of Climate Change “How cutting your food waste can help the climate” by Kelly Oakes, Feb 2020. at <<https://www.bbc.com/future/article/20200224-how-cutting-your-food-waste-can-help-the-climate>>
169. Tomorrow’s Table, A Real Food Challenge Report “Beyond Beauty: Opportunities & Challenges for Cosmetically Imperfect Produce” (2015)
170. Johnson, Lisa & Dunning, Rebecca & Gunter, Chris & Bloom, J & Boyette, Michael & Creamer, Nancy. (2018). Field measurement in vegetable crops indicates need for reevaluation of on-farm food loss estimates in North America. *Agricultural Systems*. 167. 136-142. 10.1016/j.agsy.2018.09.008.
171. Business Insider article, “France was the first country to ban supermarkets from throwing away unused food — and the world is taking notice”, Jan 7 2018 <<https://www.businessinsider.com/how-france-became-a-global-leader-in-curbing-food-waste-2018-1>>
172. Aim2Flourish “How to Efficiently Cut Food Waste” by Lucie Lalanne. at <https://aim2flourish.com/innovations/!_how-to-efficiently-cut-food-waste>
173. SCMP “How to reduce food waste: the food-sharing apps offering cheap leftover meals for eco-conscious eaters”, Feb 2020. at <<https://www.scmp.com/lifestyle/gadgets/article/3050192/how-reduce-food-waste-food-sharing-apps-offering-cheap-leftover>>
174. ASOS “2017/8 Greenhouse Gas Report” (2019)
175. Payments Journal “What Country Has the Highest Online Shopping Return Rate?” by Fran Whittaker-Wood, Feb 2019. at <<https://www.paymentsjournal.com/highest-online-shopping-return-rate/>>
176. eMarketer “Retailers Brace for Returns This Holiday Season” by Krista Garcia, Dec 2018. at <<https://www.emarketer.com/content/retailers-brace-for-returns-this-holiday-season>>
177. The Wall Street Journal “How Online Retailers Predict Your Perfect Outfit” by Erin Geiger Smith, Aug 2015. at <<https://www.wsj.com/articles/how-online-retailers-predict-your-perfect-outfit-1438794462>>
178. The Star “Online shopping drives surge in holiday returns, and what happens next may surprise you” by Francine Kopun, Jan 2017. at <<https://www.thestar.com/business/2017/01/15/online-shopping-drives-surge-in-holiday-returns-and-what-happens-next-may-surprise-you.html>>
179. Vogue Business “The unsustainable cost of free returns” by Jessica Schiffer, Jul 2019. at <<https://www.voguebusiness.com/consumers/returns-rising-costs-retail-environmental>>
180. Australian Financial Review “The hidden cost of ‘free’ online shopping returns” by Hanna Wootton, Dec 2019. at <<https://www.afr.com/companies/retail/the-hidden-cost-of-free-online-shopping-returns-20191226-p53mx8>>

REFERENCES

181. Reuters "On Singles' Day, green groups warn of China's surge in packaging waste" by David Stanway, Nov 2019. at <<https://www.reuters.com/article/us-singles-day-pollution/on-singles-day-green-groups-warn-of-chinas-surge-in-packaging-waste-idUSKBN1XL0A4>>
182. China Water Risk article "Dirty & Thirsty – Not Just A Paper Tiger" by Yuanchao Xu, Feb 2020. at <<http://www.chinawaterrisk.org/resources/analysis-reviews/dirty-thirsty-not-just-a-paper-tiger/>>
183. Oberlo "10 Online Shopping Statistics You Need to Know in 2020" by Maryam Mohsin, Mar 2020. at <<https://www.oberlo.com/blog/online-shopping-statistics>>
184. Statista Digital Markets Outlook (2019) by Ksenia Striapunina, Mar 2020 at <<https://www.statista.com/statistics/715683/e-commerce-users-in-europe/>>
185. CNIIC Report "43rd Statistical Report on Internet Development in China" (2019)
186. Oberlo "How Many People Shop Online in 2020?" at <<https://www.oberlo.com/statistics/how-many-people-shop-online>>
187. Return Magic "The State of Online Returns in 2018". at <<https://www.returnmagic.com/online-returns/>>
188. Digital Commerce 360 "Consumers want free shipping, and they're not willing to wait very long for delivery", Mar 2017. at <<https://www.digitalcommerce360.com/2017/03/27/consumers-want-free-shipping-and-theyre-not-willing-to-wait-very-long-for-delivery/>>
189. Weideli, D. (2013). Environmental Analysis of US Online Shopping MIT Center for Transportation & Logistics. MIT Center for Transportation & Logistics
190. Hirschler, Roland. (2018). Car vs. Packaging—A First, Simple (Environmental) Sustainability Assessment of Our Changing Shopping Behaviour. Sustainability. 10. 3061. 10.3390/su10093061.
191. Bain & Co "Retailers' Challenge: How to Cut Carbon Emissions as E-Commerce Soars" by Aaron Chervis, Casey Taylor, Jennifer Hayes and Jenny Davis-Peccoud, Apr 2017. at <<https://www.bain.com/insights/how-to-cut-carbon-emissions-as-ecommerce-soars/>>
192. Brown, Jay & Guifrida, Alfred. (2014). Carbon emissions comparison of last mile delivery versus customer pickup. International Journal of Logistics. 17. 10.1080/13675567.2014.907397.
193. Inhabitat "The pros and cons of online versus in-store shopping" by Lucienne Cross, Jun 2019. at <<https://inhabitat.com/the-pros-and-cons-of-online-versus-in-store-shopping/>>
194. UN Climate Change News "Fashion Industry, UN Pursue Climate Action for Sustainable Development", Jan 2018. at <<https://unfccc.int/news/fashion-industry-un-pursue-climate-action-for-sustainable-development>>
195. China Water Risk article "Waste To Fashion In Hong Kong" by Anneleise Smillie, Feb 2019. at <<http://www.chinawaterrisk.org/interviews/waste-to-fashion-in-hong-kong/>>
196. Periyasamy, Aravin Prince and Gopalakrishnan Duraisamy. "Carbon Footprint on Denim Manufacturing." (2018)
197. Wrap "Extending the Life of Clothes", Dec 2015. at <<https://www.wrap.org.uk/content/extending-life-clothes>>
198. Quantis Report "Measuring Fashion: Environmental Impact of the Global Apparel and Footwear Industries Study" (2018)
199. Wall Street Journal "The High Price of Fast Fashion" by Dana Thomas, Aug 2019. at <<https://www.wsj.com/articles/the-high-price-of-fast-fashion-11567096637>>
200. BBC article, "Can fashion ever be sustainable?" Mar 2020 < <https://www.bbc.com/future/article/20200310-sustainable-fashion-how-to-buy-clothes-good-for-the-climate>>
201. Fashion Revolution "Consumer Survey Report" (2018)
202. Salon "Fast fashion lies: Will they really change their ways in a climate crisis?" by Anika Kozlowski, Aug 2019. at <https://www.salon.com/2019/08/04/fast-fashion-lies-will-they-really-change-their-ways-in-a-climate-crisis_partner/>
203. Planet Blue, University of Michigan "The average washing machine uses 13,500 gallons of water per year. That is as much water as you will drink in your lifetime". at <<http://sustainability.umich.edu/pba/resources/water/! laundry-water-use>>
204. CNN Business "Levi's CEO: Don't put your jeans in the freezer" by David Goldman, Mar 2019. at < <https://edition.cnn.com/2019/03/21/investing/levis-jeans-freezer/index.html>>
205. Thred Up webpage. at <https://www.thredup.com/chooseused?tswc_redir=true>
206. The New York Times "Rent the Runway Now Valued at \$1 Billion With New Funding" by Sapna Maheshwari, Mar 2019. at <<https://www.nytimes.com/2019/03/21/business/rent-the-runway-unicorn.html>>
207. McKinsey & The Business of Fashion Report "The State of Fashion 2019" (2019)
208. Inditex Annual Report (2018)

NOTES



chinawaterrisk.org

Suite 2405, 24/F, 9 Queens Road Central, Hong Kong