



2019

Generation Investment Management
Sustainability Trends Report

generation

Important information

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The information presented herein is intended to reflect Generation's present thoughts regarding trends and opportunities towards a more sustainable economy and should not be construed as investment research, advice or the making of any recommendation. References to any companies must not be construed as a recommendation to buy securities of such companies.

The information presented herein is based on Generation’s analysis of publicly available data and is intended to present a global perspective on different areas that Generation believes represent a sustainable economy. The jurisdictions and time periods presented herein may vary, as the data shown is what Generation used in its own assessment and believes to be the most complete view to support each identified area of sustainability and associated trends. 2019 and other historic estimates made throughout the report were extrapolated from cited research and based on previous trends and known current data. While the data is from sources Generation believes to be reliable, Generation makes no representation as to the completeness or accuracy of the data.

Insights into the transition to a sustainable economy

Since we were founded 15 years ago, Generation has been a pure play sustainable investment manager. We see long-term investing as best practice and sustainability as the organising construct of the global economy. We use Environment, Social and Governance (ESG) factors as tools to evaluate the quality of business and management. We believe this approach leads to important and relevant insights which other investment frameworks may miss, and ultimately to superior, risk adjusted results for investment managers. In other words, we are not trading value for values.

Sustainability Trends 2019 is our chance to share some of the insights gained from our fully integrated approach to sustainable investment. Drawn from more than 250 sources, we believe that there is no report which provides a more comprehensive survey of these trends.

We start with a look at the future of finance and economics. The type of economy we choose will make or break whether we move to a sustainable future. The report then moves on to other themes, such as energy and industrial systems. We show that the sustainability revolution, coupled with the accelerating technology revolution, is transforming whole swathes of the economy—from energy and mobility to food systems and the built environment. Consumers are playing an ever more active role, from concern around plastics and disposable fashion to growing scrutiny of supply chains. The business case for sustainability has become more robust and more nuanced as these shifts play out.

But while we are encouraged by the gathering momentum, we are keenly aware of the nature of the challenge. The IPCC's *Global Warming of 1.5°C* report, released in October 2018, confirms that time is running out. We will also fail to meet many of the 2030 Sustainable Development Goals without a step change. The scale of the needed transformation is unprecedented. It means transitioning away from an incumbent energy system we have relied upon for more than 150 years, a revolution in global food systems—and much more.

Sustainability Trends 2019 also focuses on what an inclusive, just transition could look like. We look at the exciting opportunities to bring hundreds of millions of people access to financial services such as banking and mobile money. We explore innovations in healthcare that promise to contain escalating costs and expand access. We find a growing number of companies embracing models that improve the wellbeing and security of their employees. Finally, we acknowledge the rise of new social movements and their demands for a just, sustainable future.

We look forward to receiving your feedback on this year's report.

Contact: sustainabilitytrends@generationim.com

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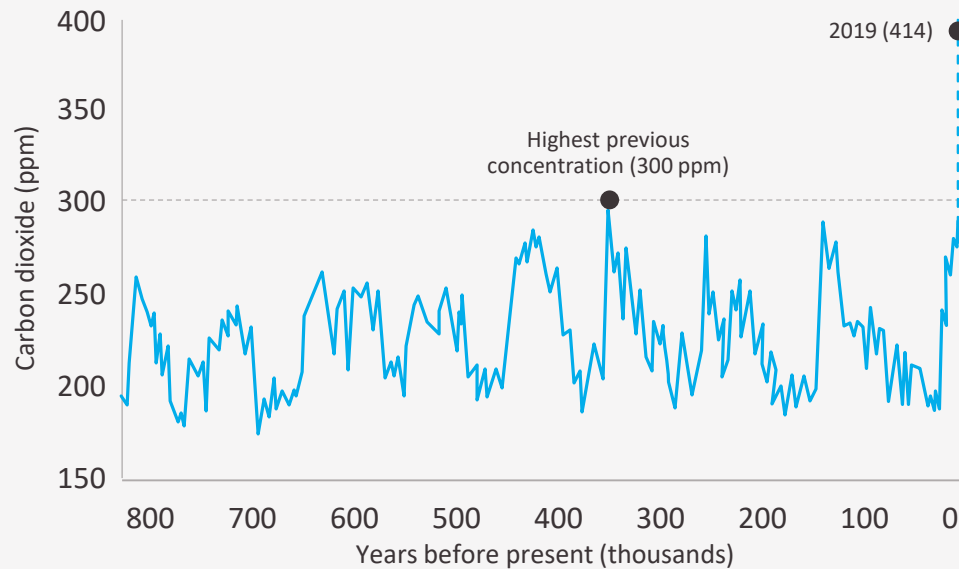
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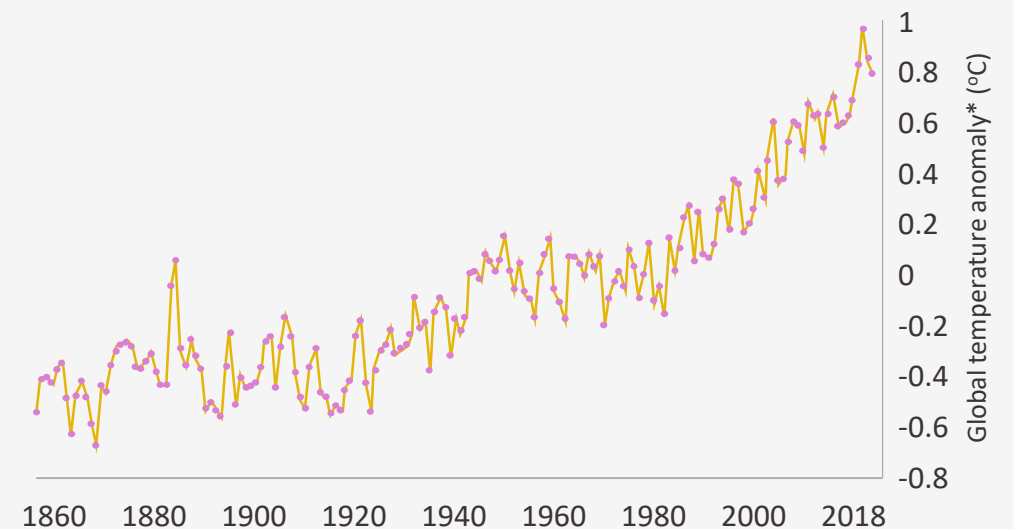
We have entered an age of environmental breakdown and the social and economic fabric is fraying

Global greenhouse-gas emissions and average global temperatures continue to rise. In 2019 CO₂ concentration levels are at 414 parts per million, far beyond previous highs

CO₂ during ice ages and warm periods for past 800,000 years



Global average temperature, 1850-2018

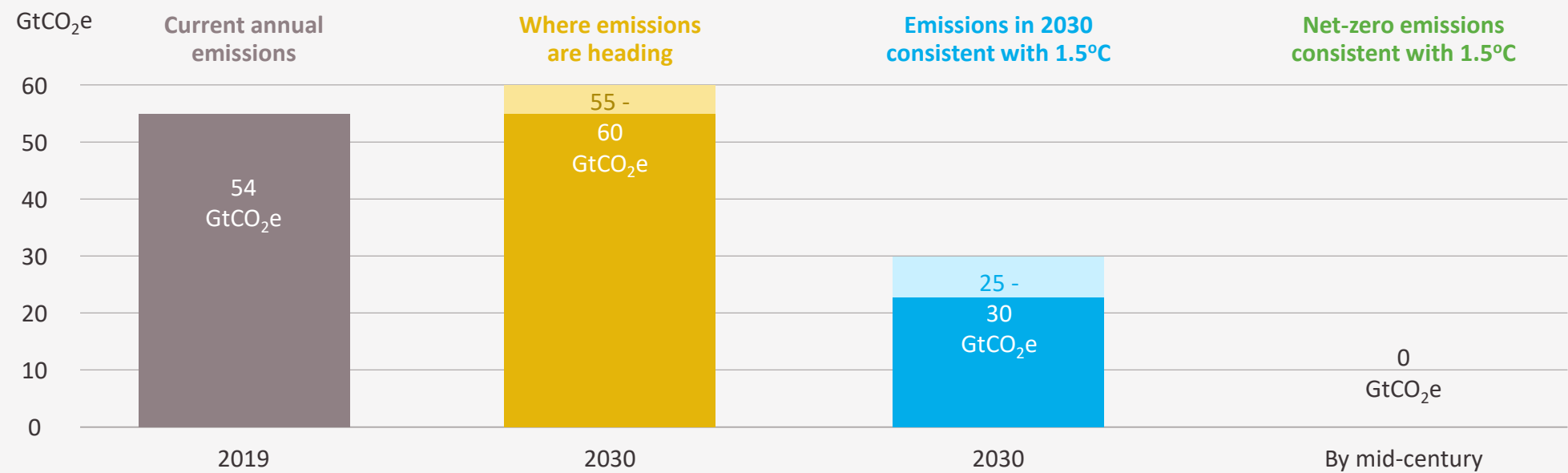


Source: NOAA; Berkeley Earth; Mauna Loa Observatory, Hawaii

* Relative to 1951-1980 average

We have entered an age of environmental breakdown and the social and economic fabric is fraying

The world is not on track to limit temperature increase to 1.5°C above pre-industrial levels. Reductions in carbon emissions to net zero by 2050 are absolutely necessary to achieve this

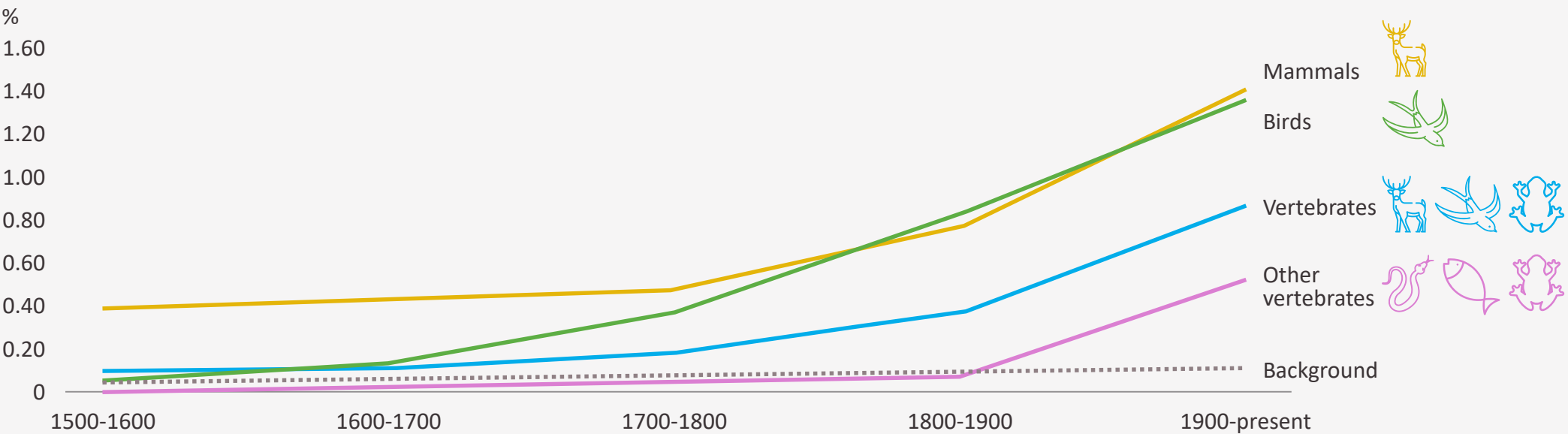


Source: World Resources Institute; IPCC; Generation

We have entered an age of environmental breakdown and the social and economic fabric is fraying

The period of the anthropocene* has also generated an extinction crisis

Cumulative extinctions as % of IUCN-evaluated species**



Source: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), May 2019; International Union for Conservation of Nature; Living Planet Report 2018; Ceballos, Gerardo, Paul R. Ehrlich, Anthony D. Barnosky, Andrés García, Robert M. Pringle, and Todd M. Palmer. “Accelerated modern human–induced species losses: Entering the sixth mass extinction.” *Science Advances* 1, no. 5 (2015); Generation

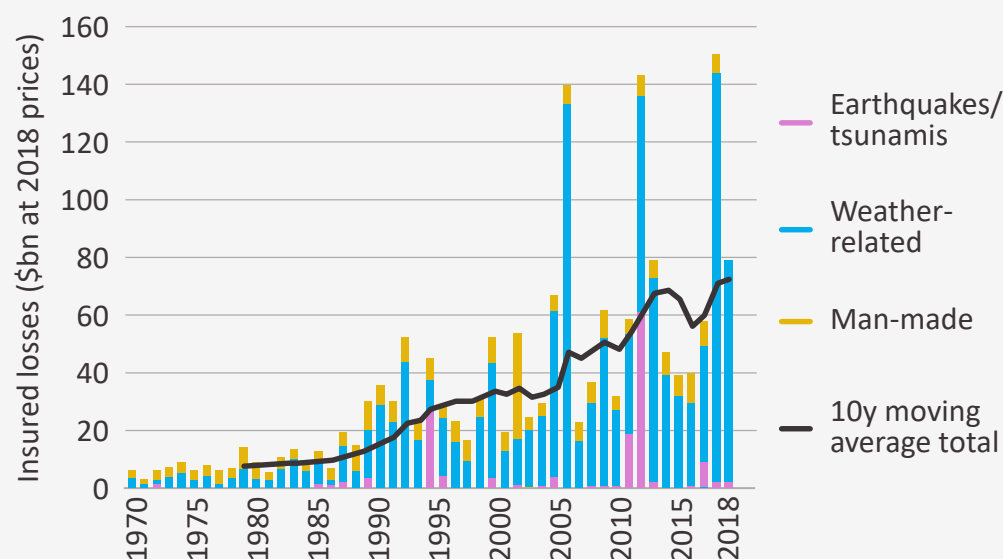
* The anthropocene is the idea that the earth is entering a new epoch in its geological history, in which human beings have for the first time become the primary agents of change on a planetary scale (definition from the National Trust).

** IUCN: The International Union for Conservation of Nature

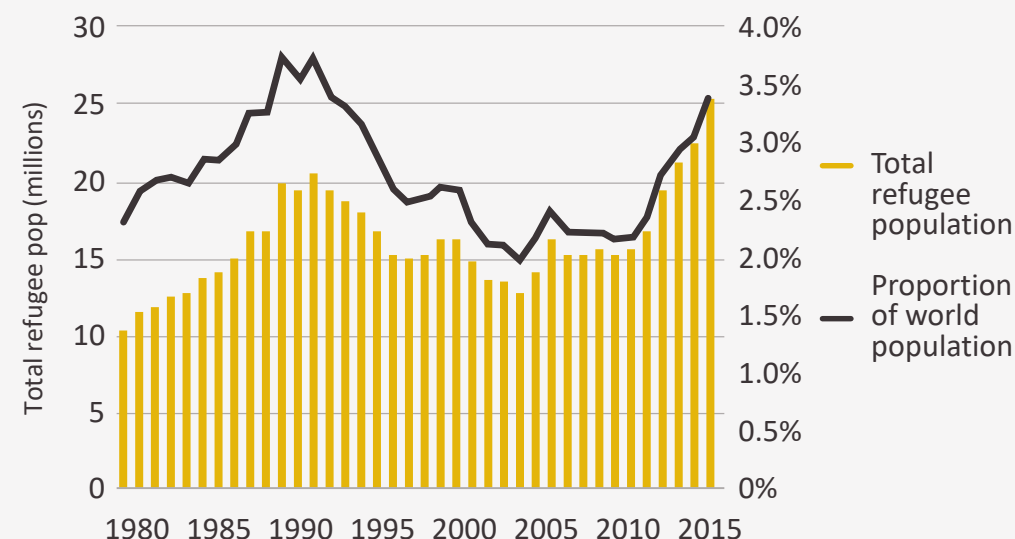
We have entered an age of environmental breakdown and the social and economic fabric is fraying

The environmental crisis is having clear economic and social impacts, with global insured losses from catastrophes in 2018 at \$79bn and a probable rise in climate refugees*

Global catastrophe-related insured losses, 1970-2018



Global refugee population, 1980-2018



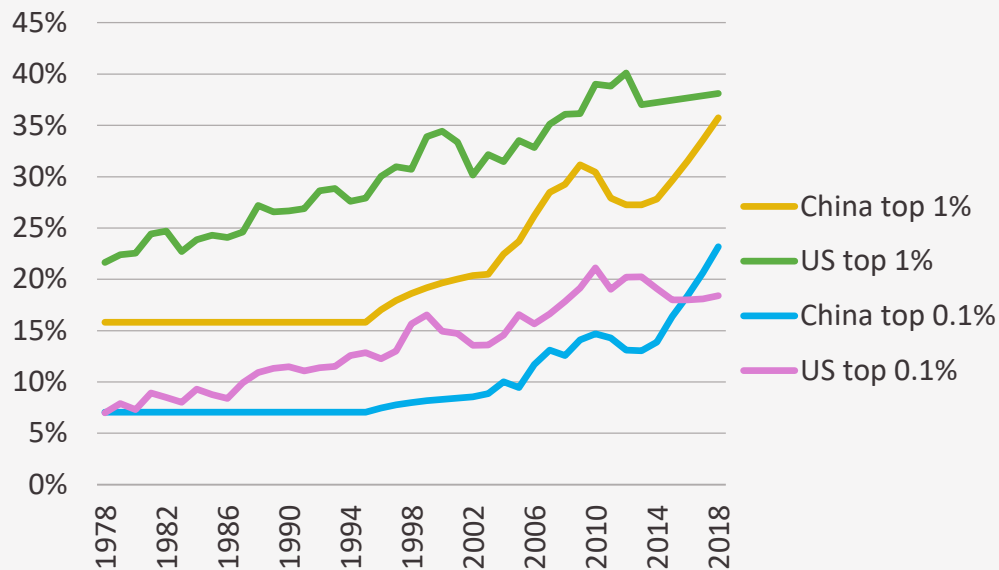
Source: Swiss Re; UNCHR

* According to the European Parliament, climate refugees are “migrants who move due to natural disasters and climate change”

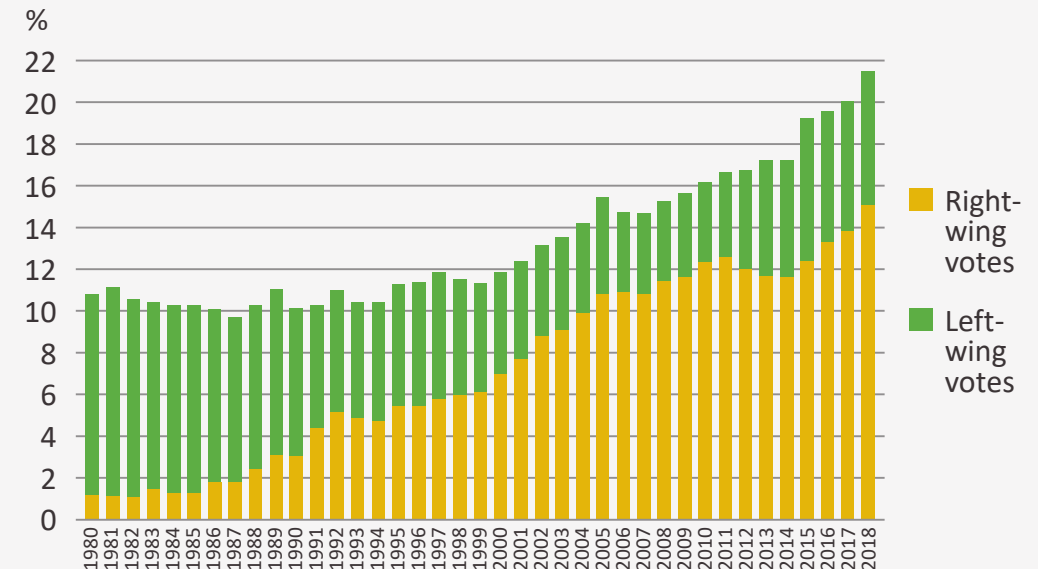
We have entered an age of environmental breakdown and the social and economic fabric is fraying

Many countries have become more unequal, which is one factor behind the rise of populism

Wealth shares, China and US, 1978-2018

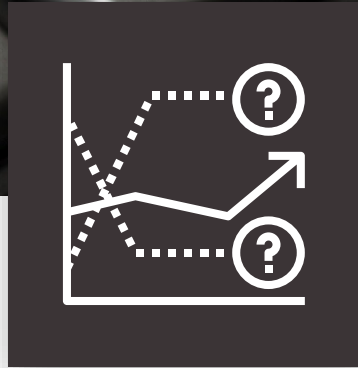


Aggregated populist* vote, Europe, 1980-2018



Source: World Wealth and Income Database; Timbro; Generation

* The basic populist tenet is that the conflict between the “people” and the “elite” is more important than all other conflicts. There are other drivers of populism, including social media.



Finance & Economics

Section summary

There is a growing sense across the world that the economy no longer works in the interests of the average person. In many countries income and wealth inequality have reached historic highs.

However, many companies are embracing innovations that can help to improve these trends. 2018-19 has seen plenty of innovation in measures to boost the wealth and income of middle-class families, and to reduce poverty. More companies are embracing the idea that happy, fulfilled workers are also more productive. And there has been rapid growth in companies that offer people more inclusive finance.

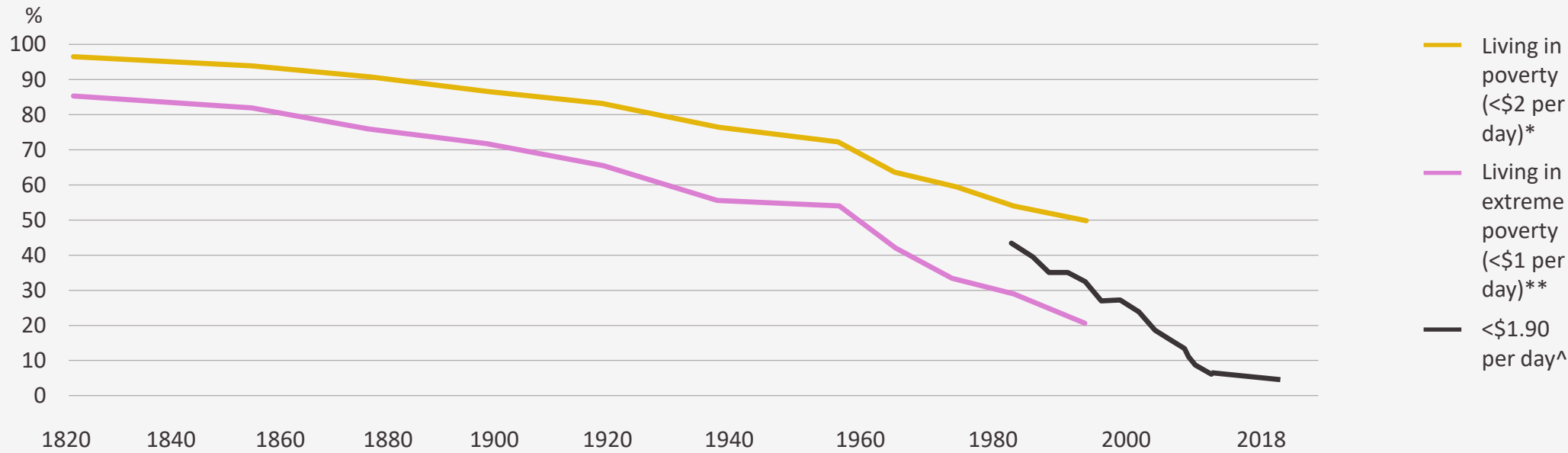


Though extreme poverty is falling, growing inequality in many countries is fuelling a sense of unfairness



At the global level there is progress in reducing poverty. Since 1980 extreme poverty has fallen from nearly half the world’s population to less than 10%

Share of world population living in extreme poverty, 1820-2018



Source: Our World in Data; World Bank 2018; Bourguignon, François, and Christian Morrisson. "Inequality among world citizens: 1820-1992." *American Economic Review* 92, no. 4 (2002): 727-744; Generation

* In constant 1985 PPP dollars

** In constant 1990 PPP dollars

^ At 2011 purchasing power parity

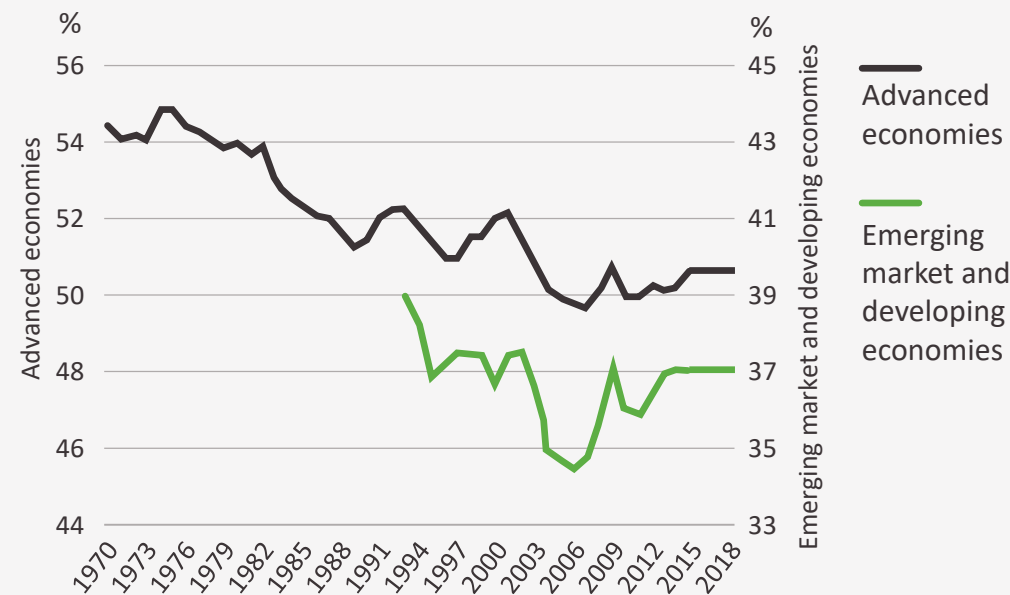


Though extreme poverty is falling, growing inequality in many countries is fuelling a sense of unfairness

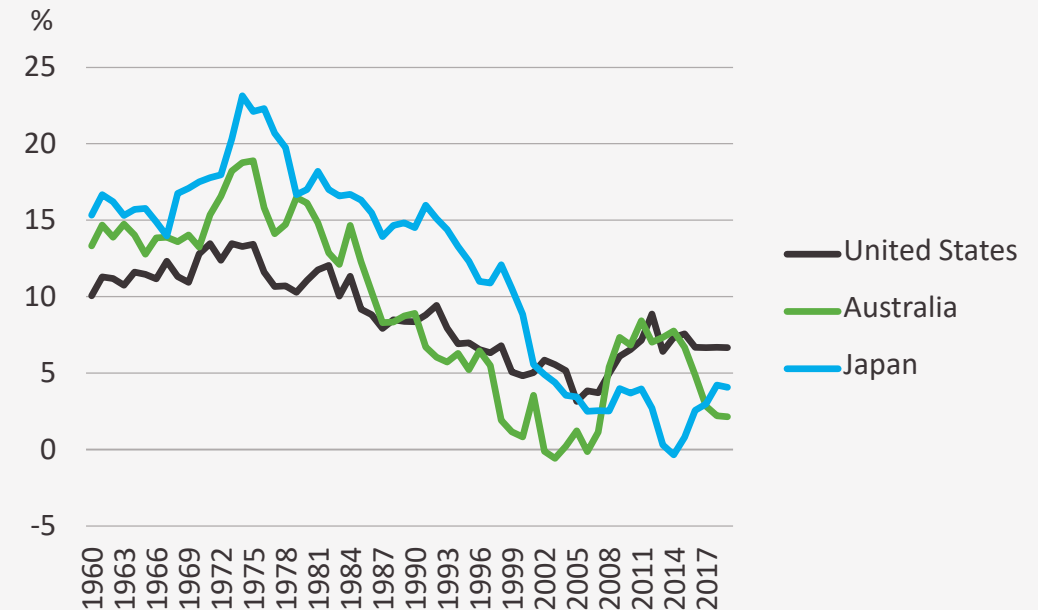


But the benefits of economic growth are less likely to accrue to workers than they once were, which in turn makes workers financially more precarious

Labour share of national income, global, 1970-2018



Household savings rate, select countries, 1960-2018



Source: OECD; IMF; Generation

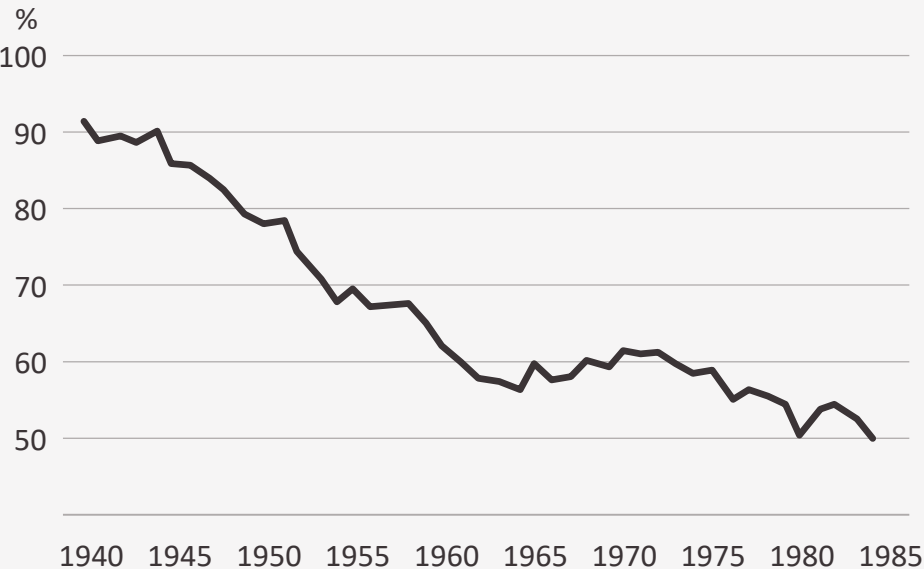


Though extreme poverty is falling, growing inequality in many countries is fuelling a sense of unfairness

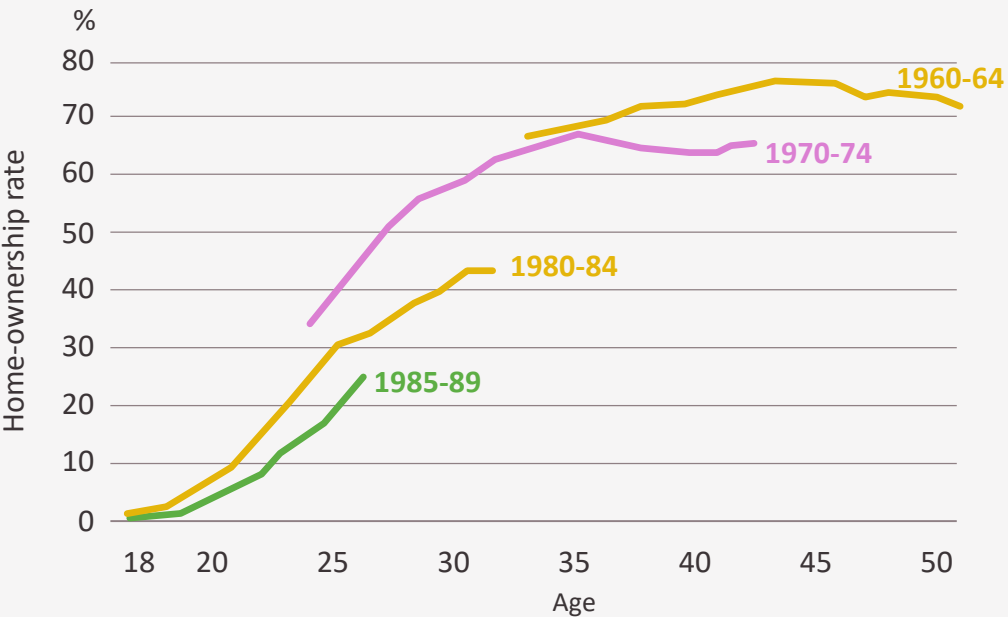


For young people, upward mobility is falling and home-ownership is increasingly out of reach

Share of American children earning more than their parents, by birth year, 2017 estimate



Home-ownership by age, by birth year, UK



Source: Chetty, Raj, David Grusky, Maximilian Hell, Nathaniel Hendren, Robert Manduca, and Jimmy Narang. “The fading American dream: Trends in absolute income mobility since 1940.” *Science* 356, no. 6336 (2017): 398-406; Institute for Fiscal Studies; *The Economist*

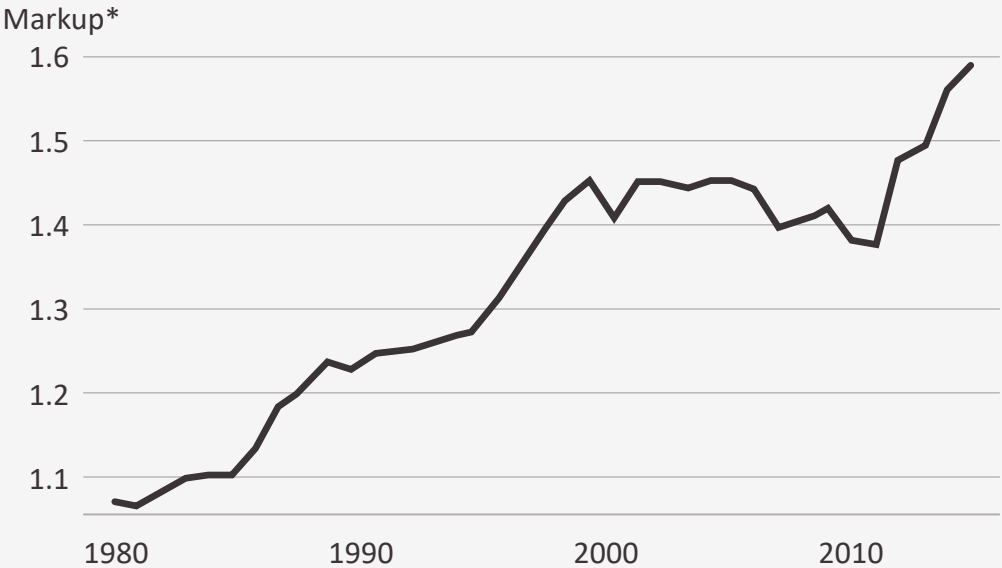


Though extreme poverty is falling, growing inequality in many countries is fuelling a sense of unfairness

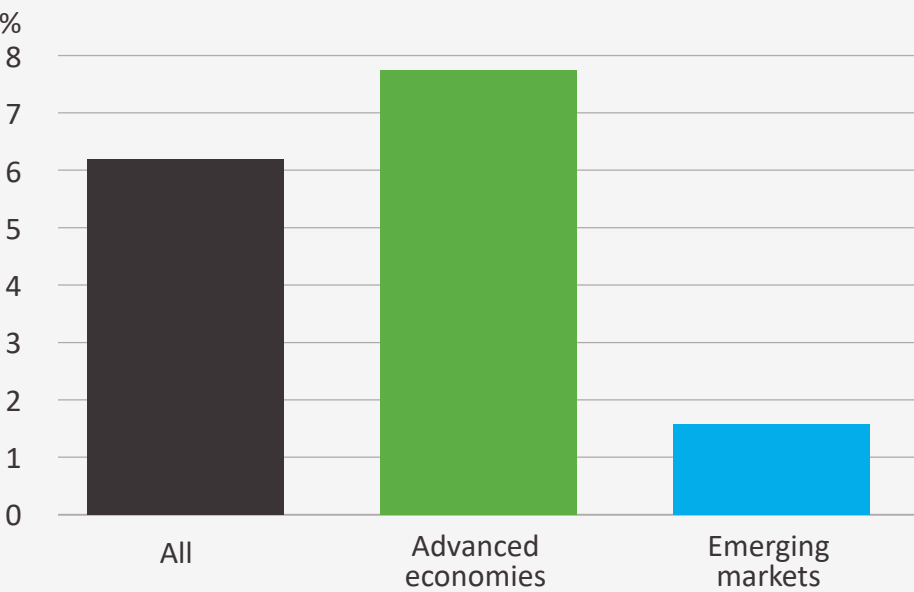


The market power of big corporations is rising, which may contribute to rising inequality and populism

Corporate market power, global, as measured by markups*, 2018 estimate



Increases in corporate market power** since 2000, by country income group, 2019 estimate



Source: IMF World Economic Outlook, April 2019; De Loecker, Jan, and Jan Eeckhout. *Global market power*. National Bureau of Economic Research, 2018; Generation

* The ratio of the price of a good/service to the marginal cost of production

** As measured by percentage change in markups

A sustainable financial & economic system is characterised by:



More capital
being allocated
for sustainable
ends



Improved
technology and
governance to
boost workers'
income and wealth



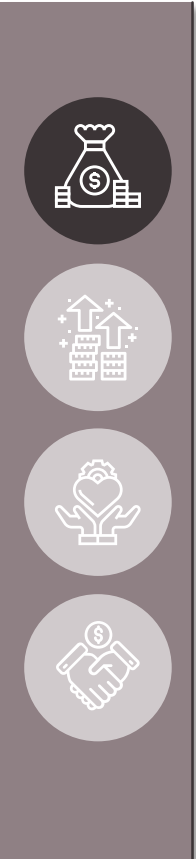
Moves to increase
worker
engagement and
job quality



Technology
unlocking new
opportunities for
financial inclusion

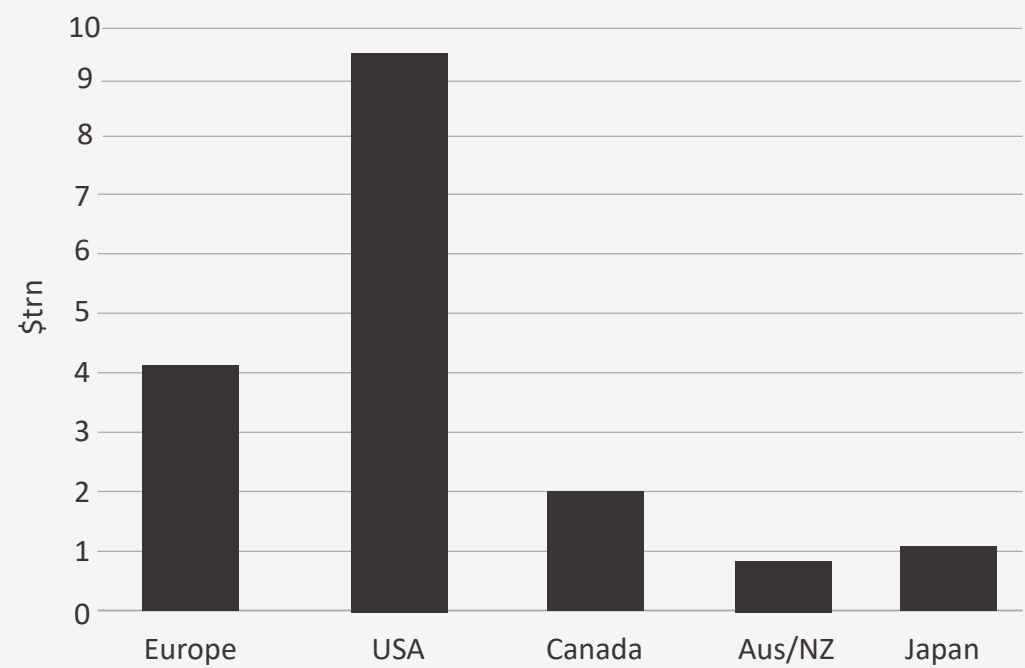


Capital is moving towards sustainable investments

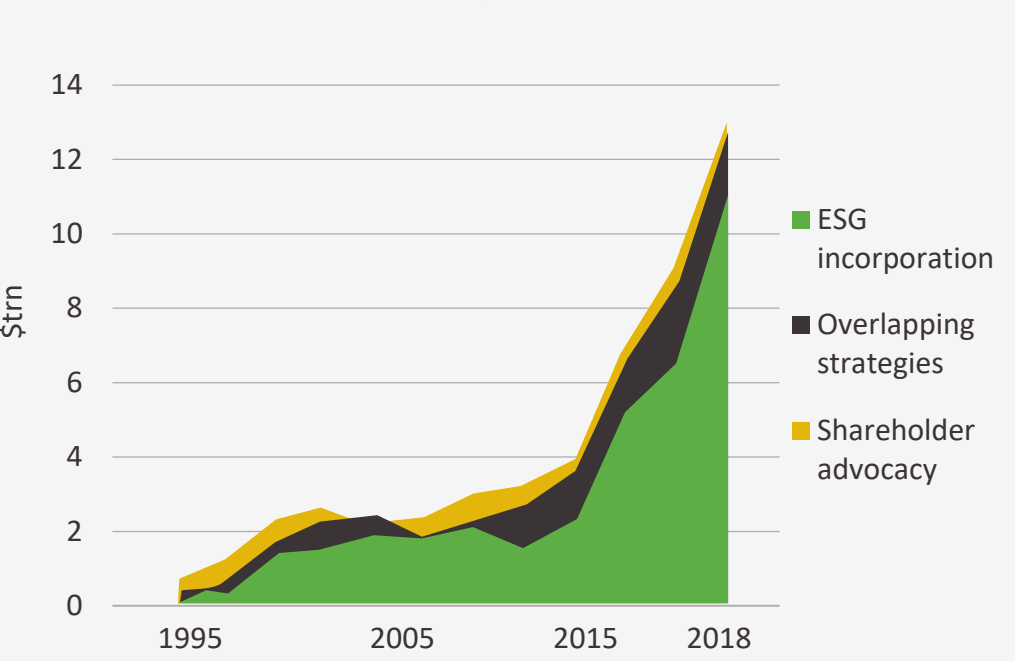


Share of assets under sustainability-oriented investment management have reached a tipping point in becoming mainstream, with \$17.5trn of ESG-integrated assets under management globally*

ESG investing assets, by country, 2018



Assets under sustainable management, US, 1995-2018*



Source: US SIF Foundation; XE; Global Sustainable Investment Review; Generation
* Definition of “ESG” varies between sources.

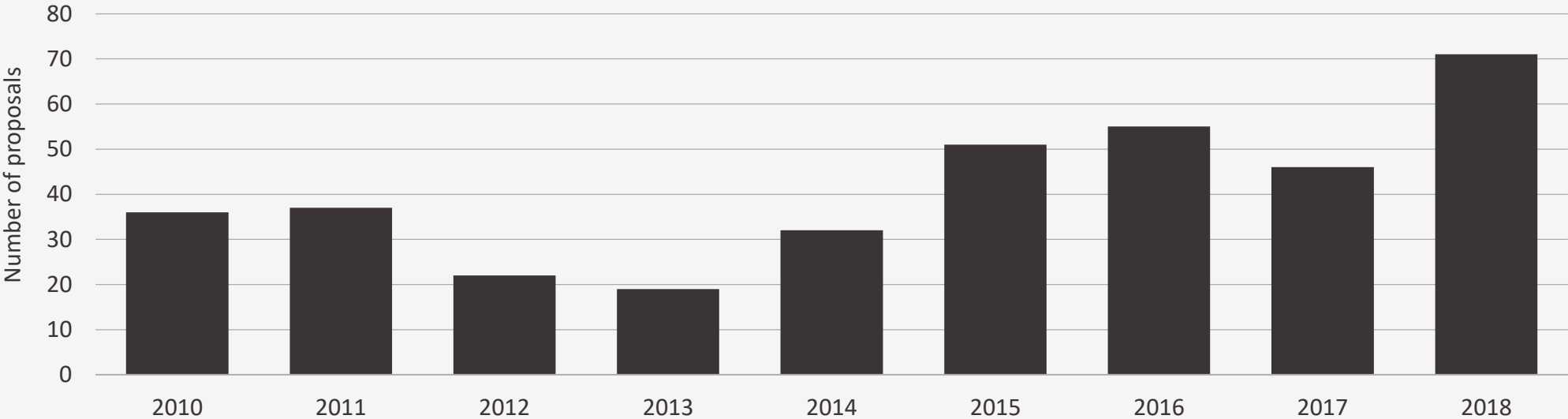


Capital is moving towards sustainable investments



Investors are pressurising companies to act more sustainably

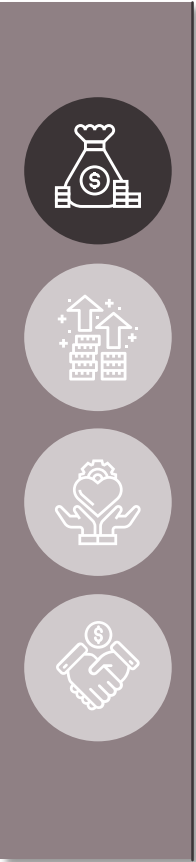
Shareholder climate-crisis resolutions*, US, 2010-18



Source: Bloomberg New Energy Finance; Proxy Preview; InsideClimate
* Voted on or pending

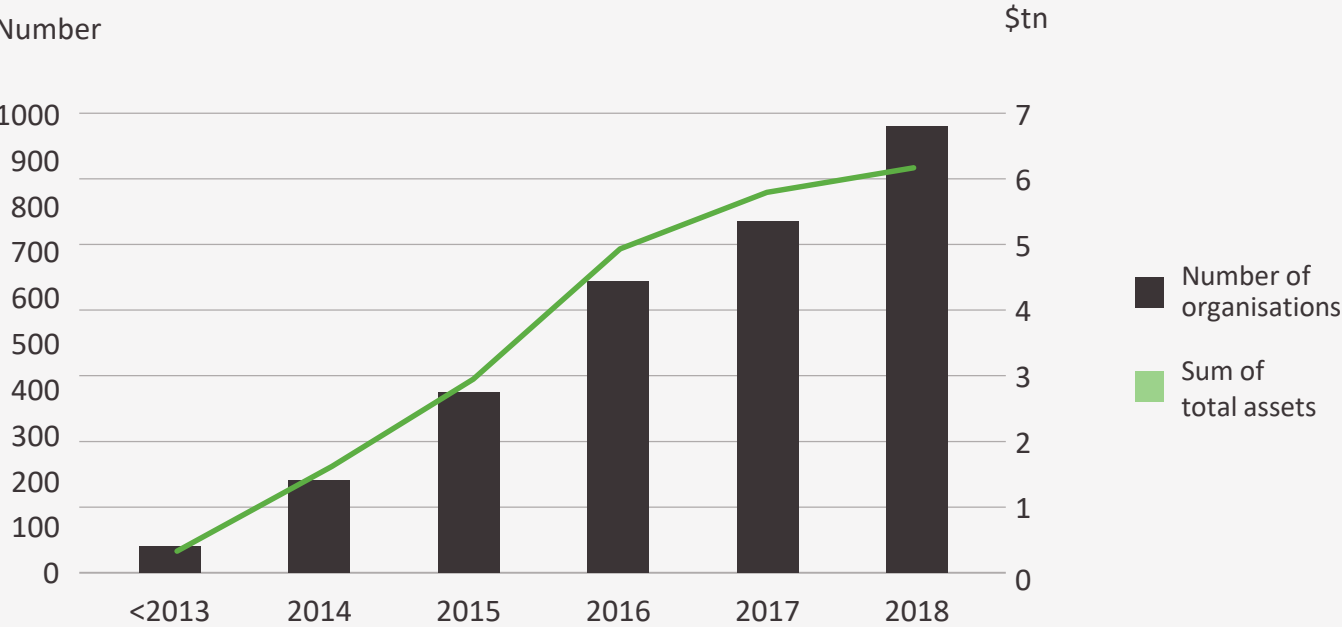


Capital is moving towards sustainable investments



Large institutional investors are divesting unsustainable assets

Growth in divestment commitments, 2013-18



IRELAND
In January 2019 the Ireland Strategic Investment Fund (ISIF), a state body controlled by the National Treasury Management Agency, divested from dozens of fossil-fuel firms



NORWAY
In March 2019 Norway’s \$1tn sovereign-wealth fund decided to divest from a range of oil and gas companies



AMERICA
In 2018 New York’s Mayor Bill de Blasio announced plans to divest the City’s \$189bn pension funds of fossil-fuel assets

Source: Arabella Investment; Generation

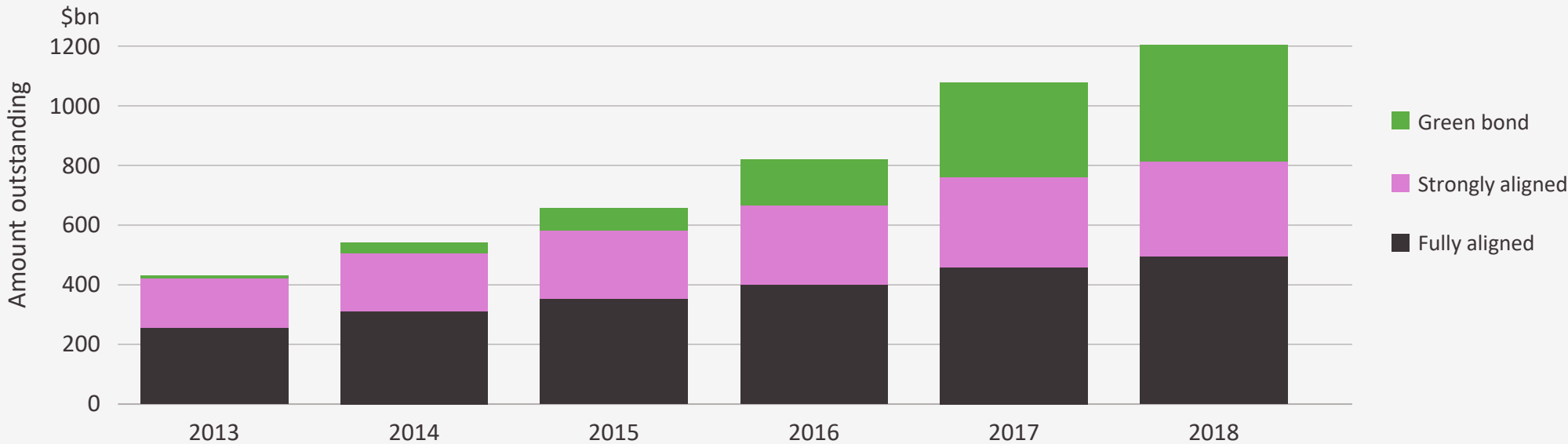


Capital is moving towards sustainable investments

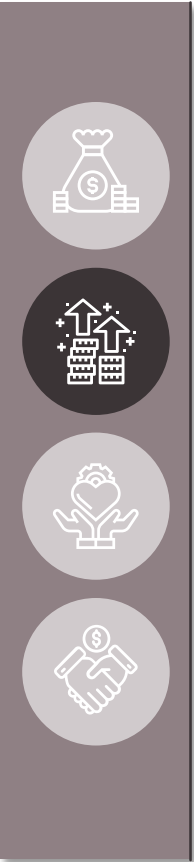


The global market for green bonds is growing. It is also maturing in terms of the definition and measurement of green bonds. However, it remains small relative to the overall bond market

Outstanding climate-aligned bonds, global, 2013-18



Source: Climate Bonds Initiative

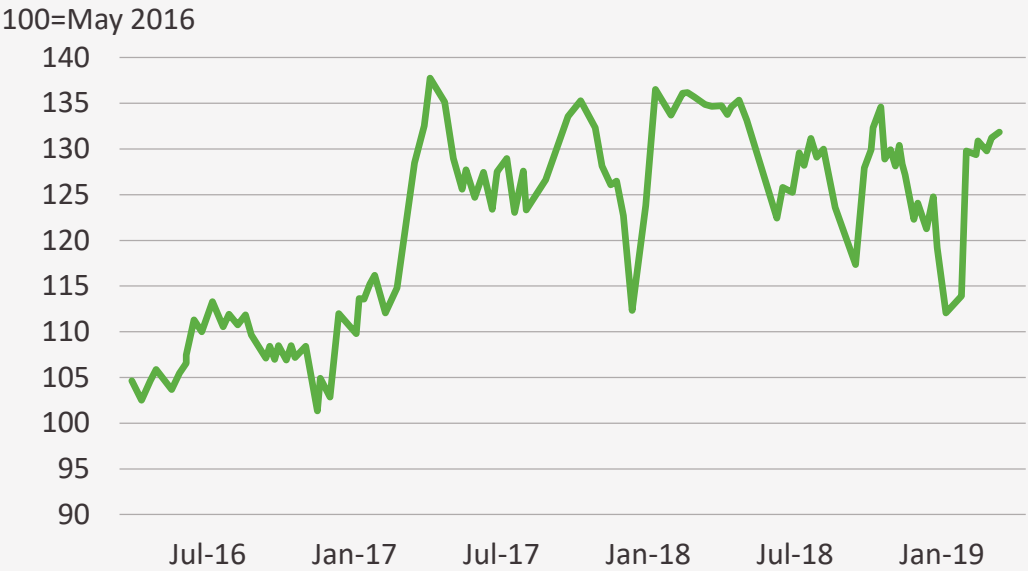


Innovations in technology and governance are needed to boost workers’ income and wealth

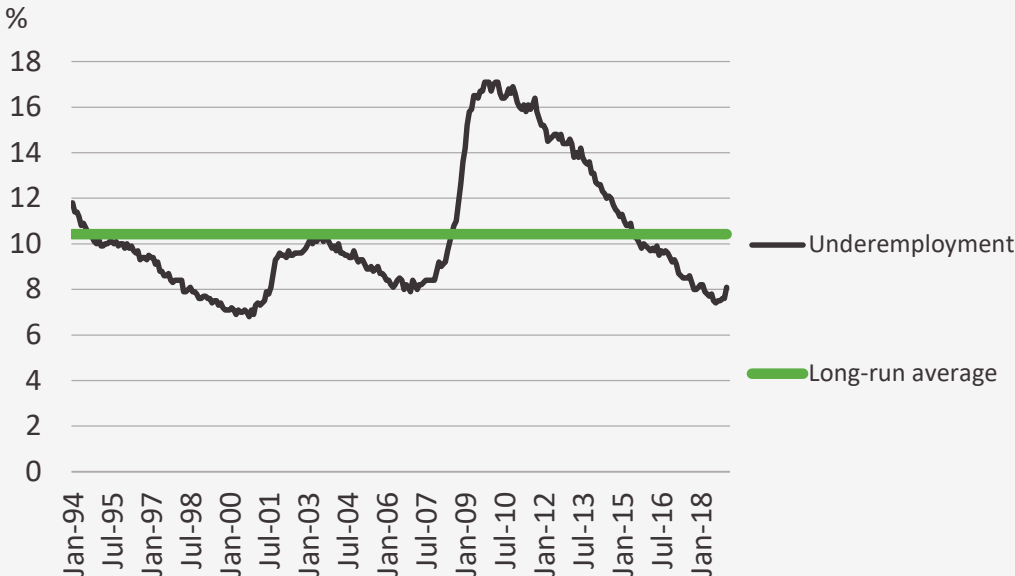


Improved “matching” of workers with job opportunities helps reduce underemployment

Online Labour Index*, global



Underemployment rate**, US, 1994-2019



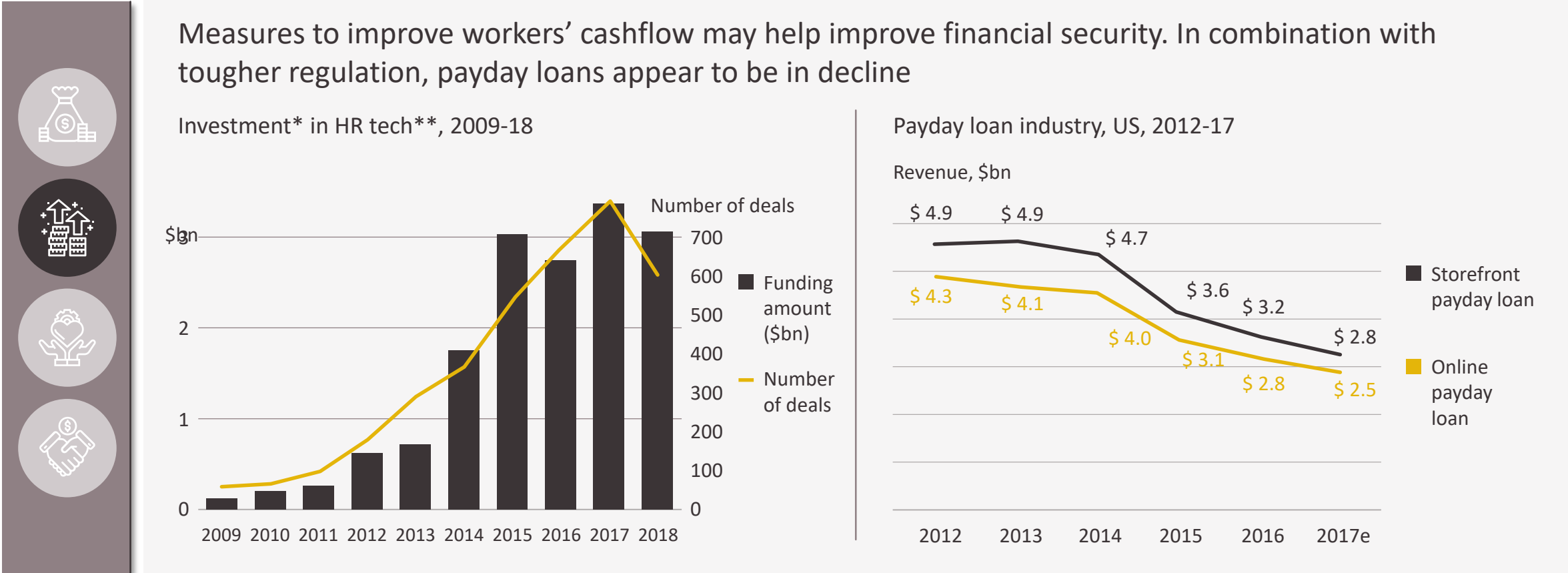
Source: Bureau of Labour Statistics; Oxford Online Labour Index; “Who Counts as Employed? Informal Work, Employment Status, and Labor Market Slack”, Federal Reserve Bank of Boston, 2016; Kässi, Otto, and Vili Lehdonvirta. “Online labour index: Measuring the online gig economy for policy and research.” *Technological forecasting and social change* 137 (2018): 241-248.

* The Online Labour Index (OLI) is the first economic indicator that provides an online gig-economy equivalent of conventional labour-market statistics.

** U6 is the broadest measure of official unemployment. It represents total unemployed, plus all persons marginally attached to the labor force, plus total employed part-time for economic reasons, as a percent of the civilian labour force plus all persons marginally attached to the labour force



Innovations in technology and governance are needed to boost workers’ income and wealth



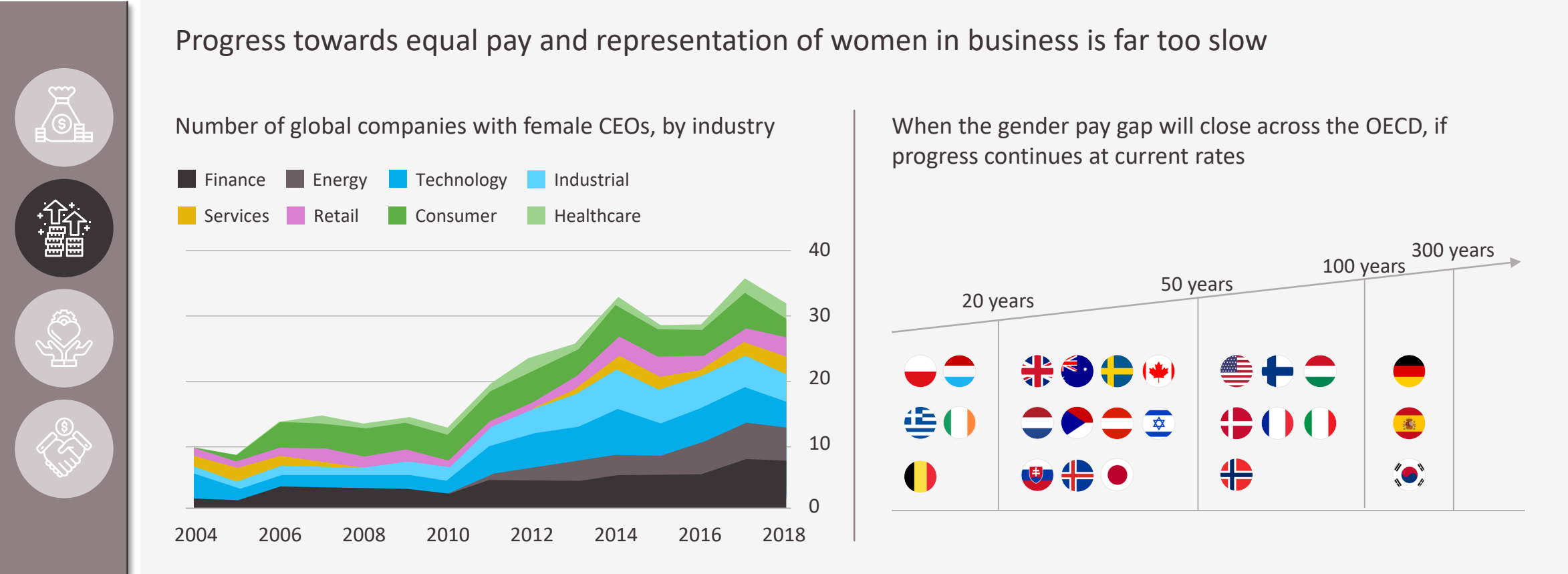
Source: CB Insights; Centre for Financial Services Innovation

* According to CB Insights, “investment activity...in privately funded HR tech companies”

** CB Insights defines HR tech “to include workforce management, payroll administration, and benefits administration software (Human Resource Information Services); software including employee development and workforce optimisation (Human Capital Management); and tech-enabled platforms that help manage recruiting and staffing”.



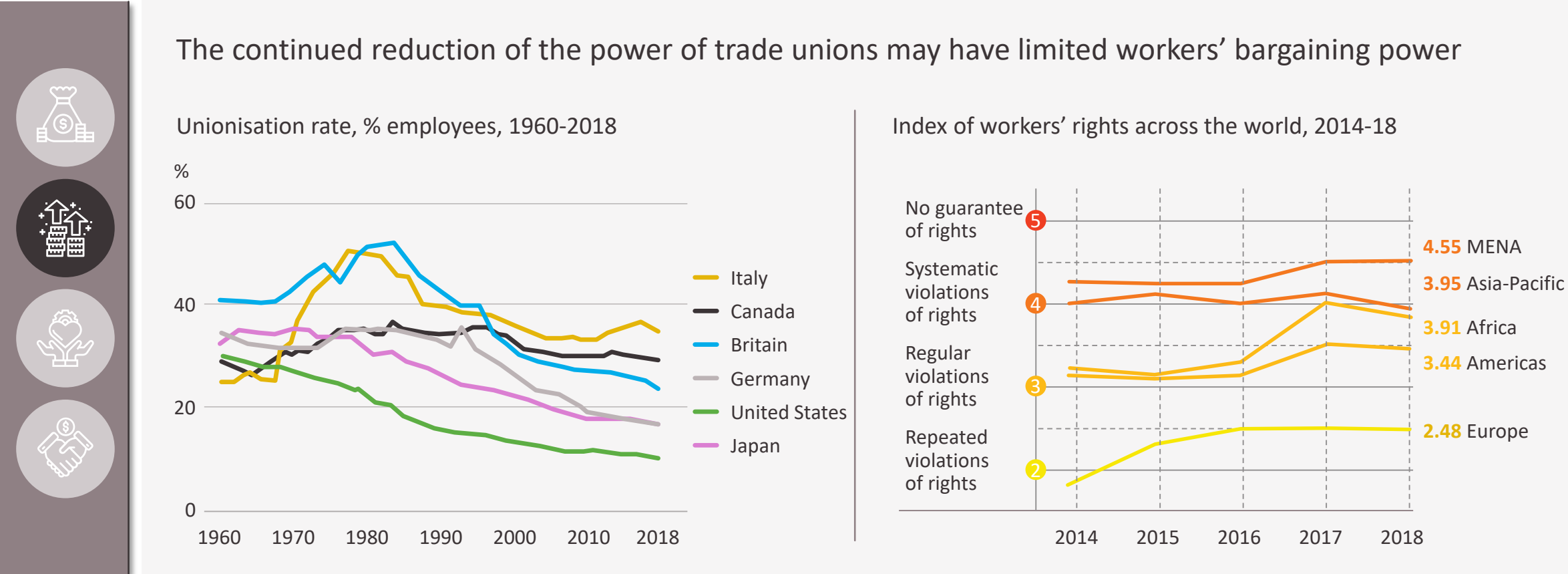
Innovations in technology and governance are needed to boost workers’ income and wealth



Source: Crist Kolder Associates; OECD; Eurostat; PwC; Generation. Data for left-hand chart refers to Fortune 500 and S&P 500 companies as of August 2018.



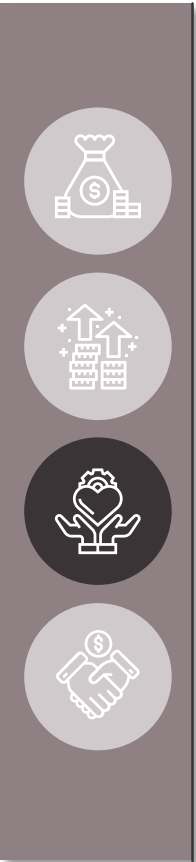
Innovations in technology and governance are needed to boost workers’ income and wealth



Source: OECD; ITUC Global Rights Index; Haldane, Andrew. "Pay power." In *Speech at ACAS Future of Work Conference, London*, vol. 10. 2018; Generation

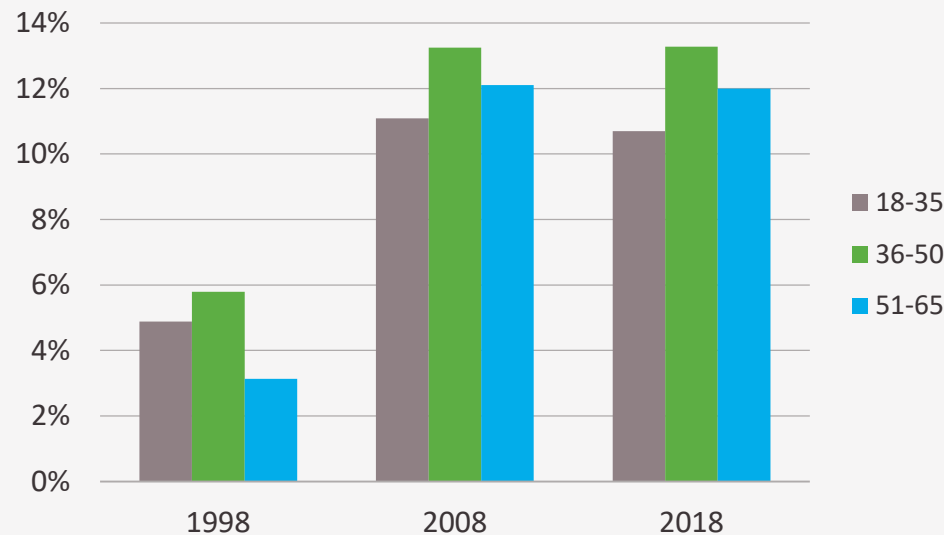


More effort is required to improve worker engagement and job quality

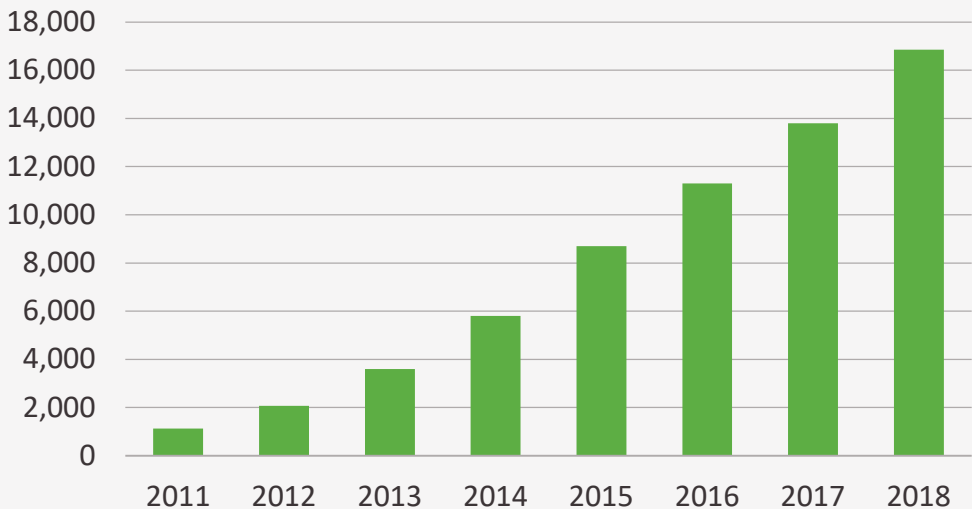


Over the long run more workers have been given more opportunity to work flexibly, though more recently progress may have stalled

Share of workers with self-chosen flexible hours*, by age group, 1998-2018



Number of co-working spaces**, global



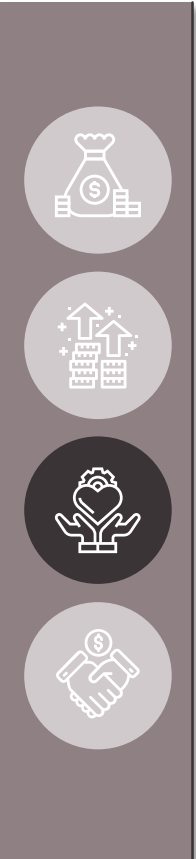
Source: Office for National Statistics; fitzsmallbusiness.com; Generation

* Meaning schedules that allow workers to alter workday start and finish times

** An office where people from a range of different companies, or self-employed people, can come together to work individually or collaboratively

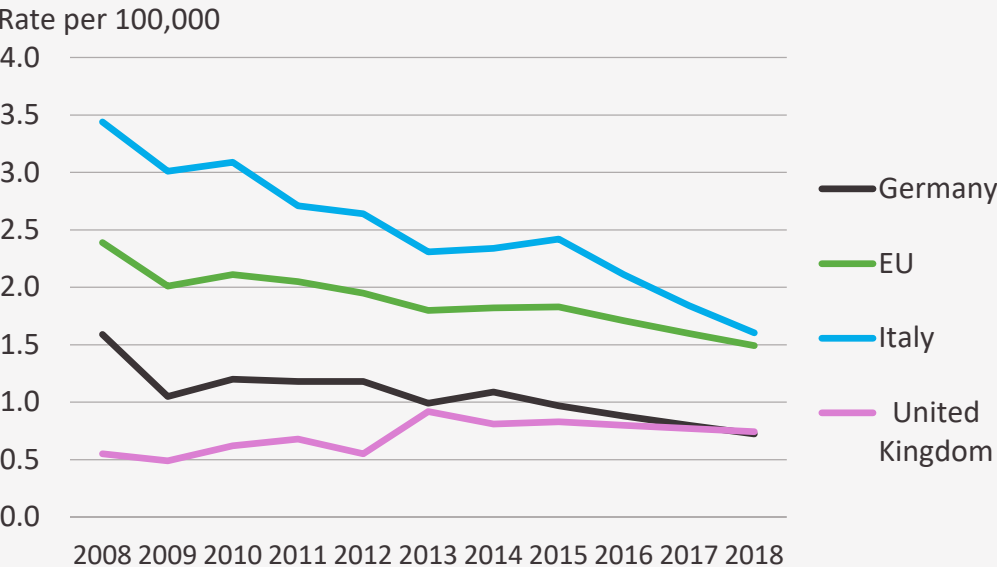


More effort is required to improve worker engagement and job quality

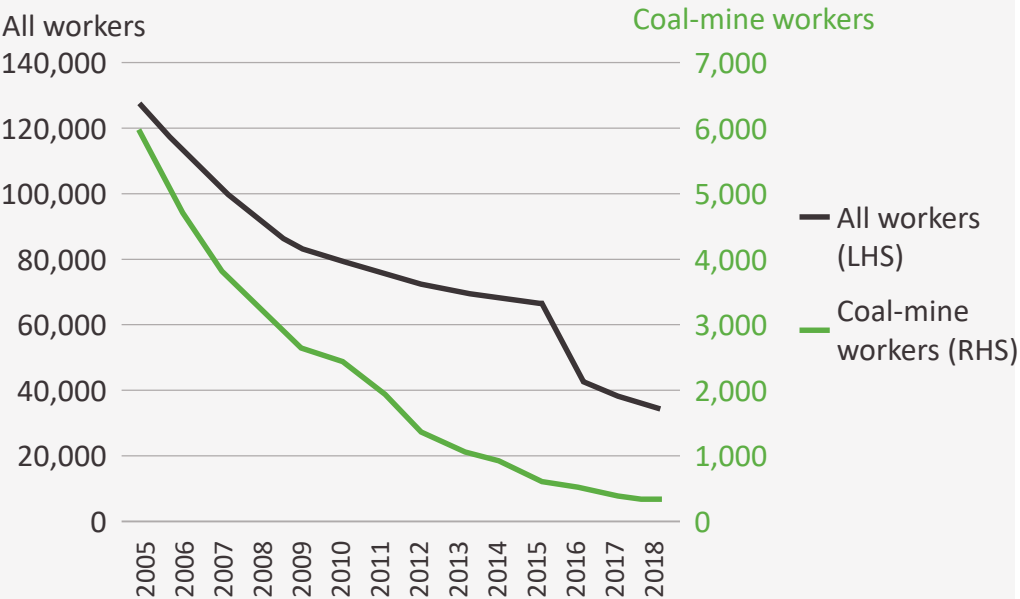


Workplaces are generally becoming safer places to be

Fatal accidents at workplaces, per 100,000 employed, select countries, 2008-18



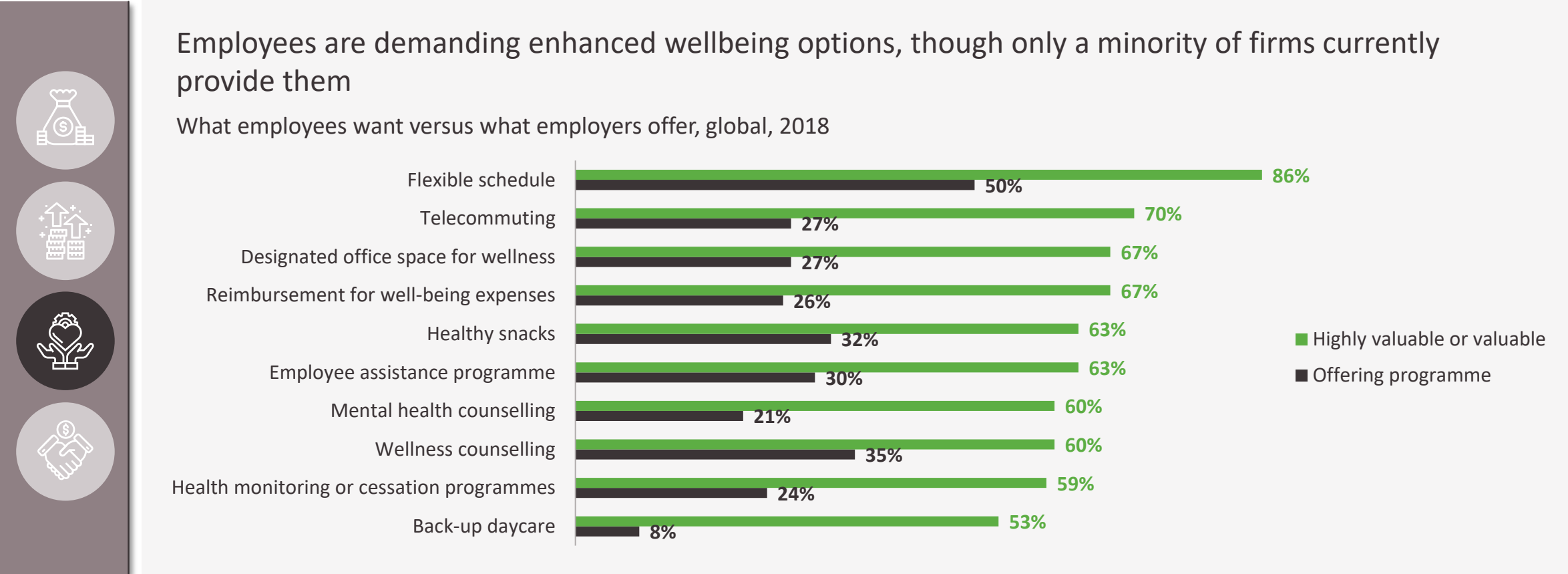
Worker deaths, China, 2005-18



Source: Eurostat; China Labour Bulletin; Generation



More effort is required to improve worker engagement and job quality



Source: Deloitte Global Human Capital Trends survey, 2018

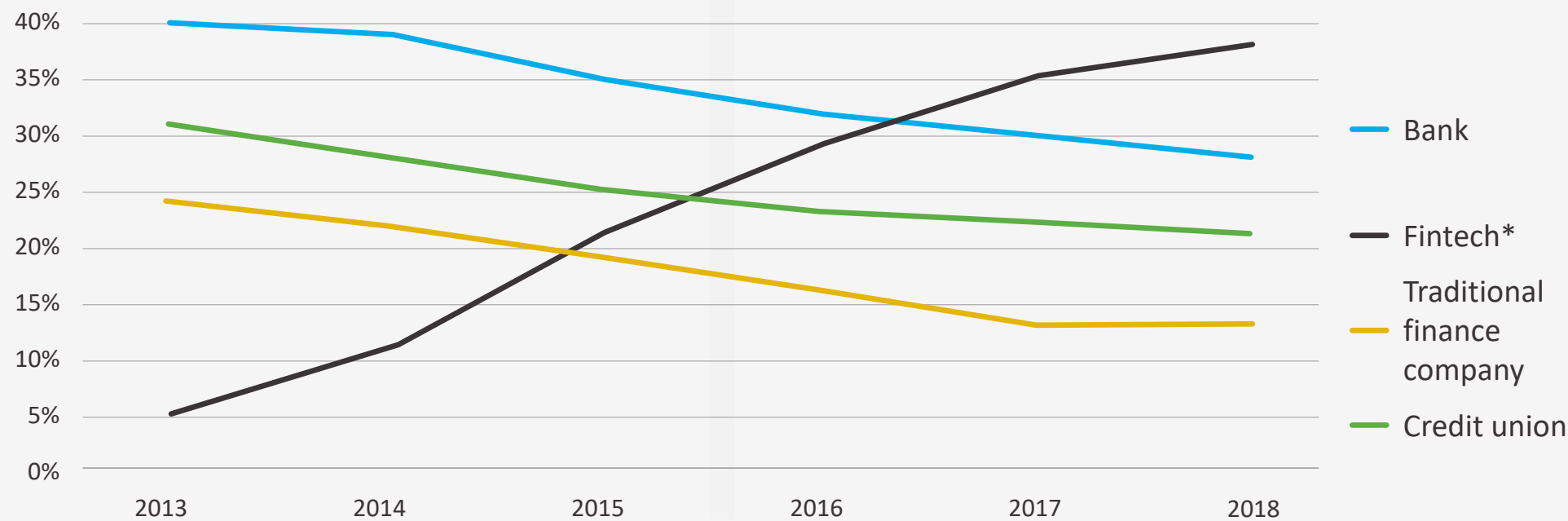


Innovation is unlocking new opportunities for financial inclusion



Technological innovation can help to improve financial inclusion

Personal-loan balances by delivery method, 2013-18, US



Source: Medici; TransUnion

* According to the Bank for International Settlements, fintech includes “all credit activity facilitated by electronic (online) platforms that are not operated by commercial banks”

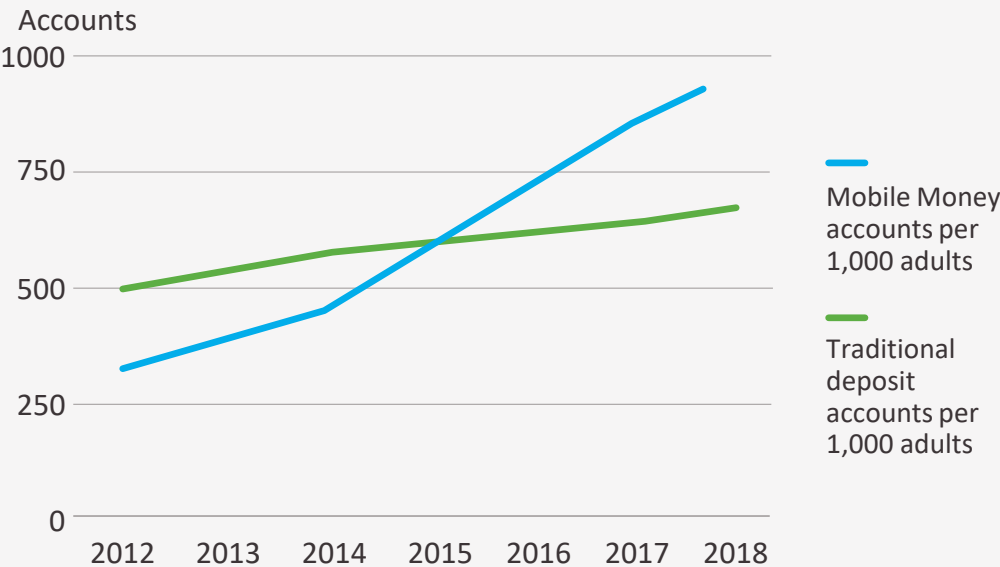


Innovation is unlocking new opportunities for financial inclusion

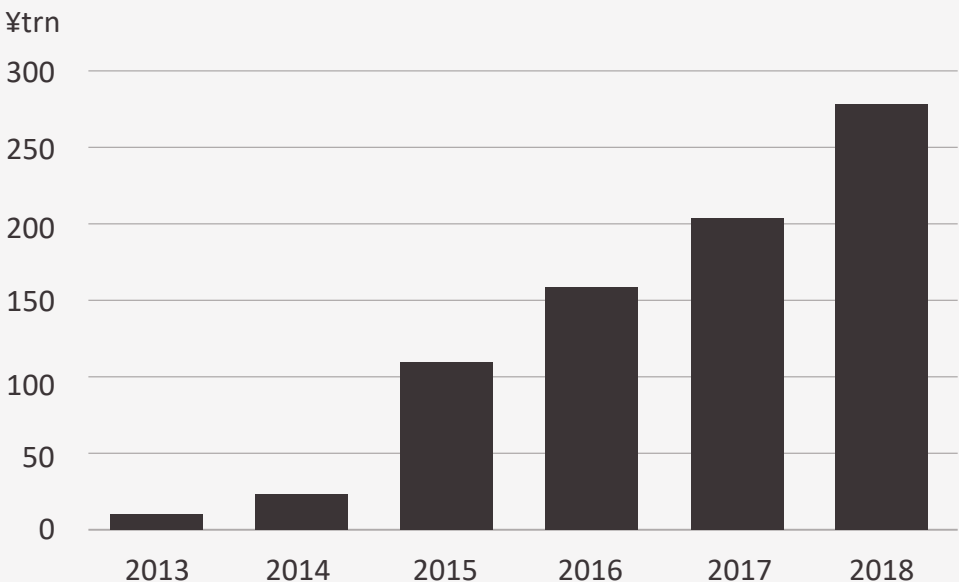


The shift to mobile banking is a global phenomenon

Mobile-money and traditional bank accounts, sub-Saharan Africa, 2012-18*



Mobile-payment transaction volume, China, 2013-18



Source: Bank for International Settlements; World Bank; Maino, Rodolfo, Alexander Massara, Hector Perez Saiz, Preya Sharma, and Amadou N. Sy. *FinTech in Sub-Saharan African Countries: A Game Changer?*. International Monetary Fund, 2019; People’s Bank of China; Caixin Data; CEIC; Generation

*Two-thirds of unbanked adults have a mobile phone.



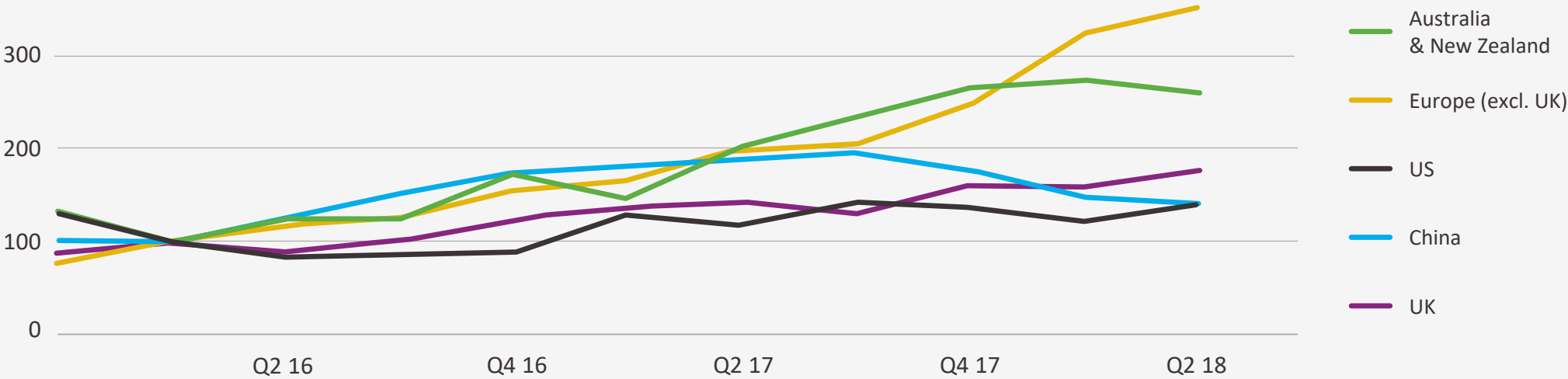
Innovation is unlocking new opportunities for financial inclusion



Growth of fintech lending may help fund SMEs who had previously struggled to find finance

Fintech credit volumes, selected countries, 2016-18

Q1 2016 = 100



Source: Bank for International Settlements

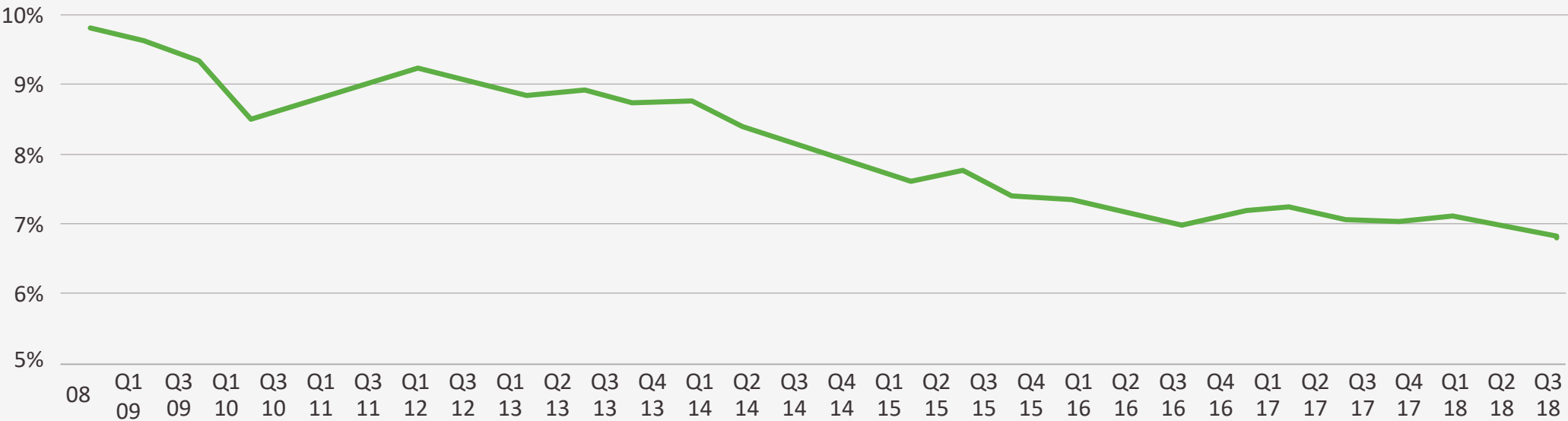


Innovation is unlocking new opportunities for financial inclusion



Improvements in remittances also help boost people’s incomes, with less taken away as commission

Average commission for remitting money, global average, 2008-18



Source: World Bank; Generation

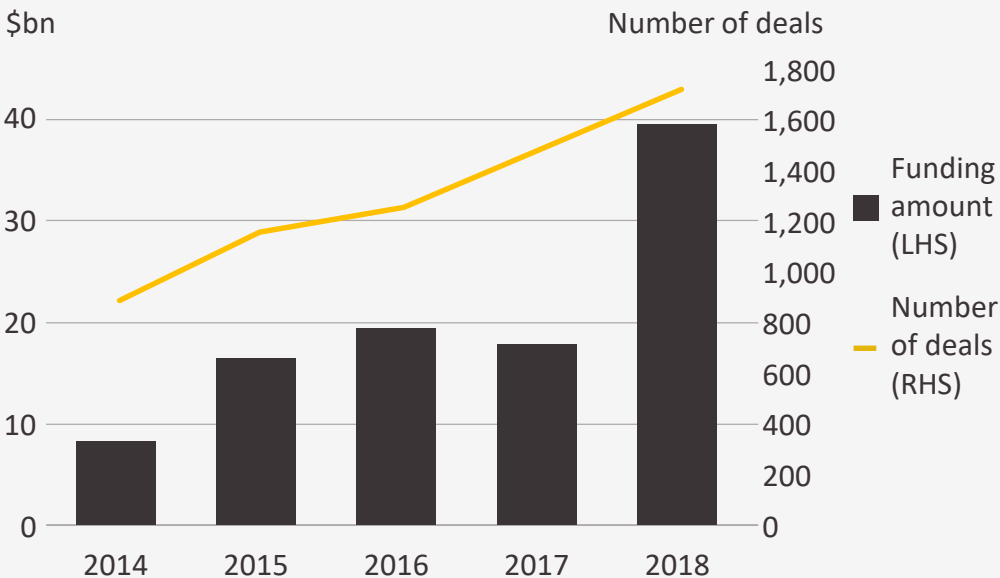


Innovation is unlocking new opportunities for financial inclusion

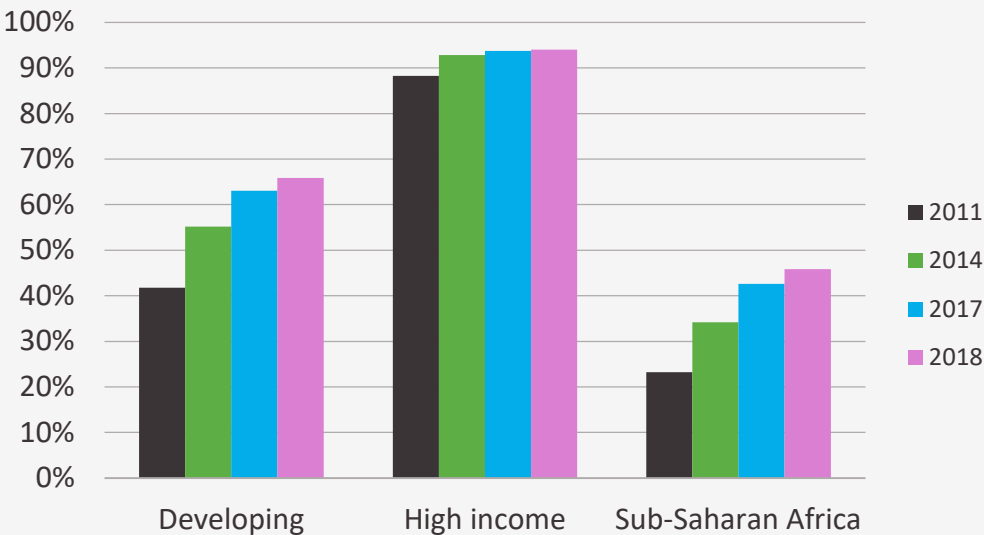


Trends towards more financial inclusion are likely to continue

Annual global fintech deals and venture financing*, 2014-18



Share of population with bank account**, by region, 2011-18



Source: CB Insights; World Bank; Generation

* Equity financings into emerging fintech companies. Fundings must be put into VC-backed companies, which are defined as companies who have received funding at any point from venture capital firms, corporate venture groups, or super angel investors.

** Account ownership at a financial institution or with a mobile-money-service provider

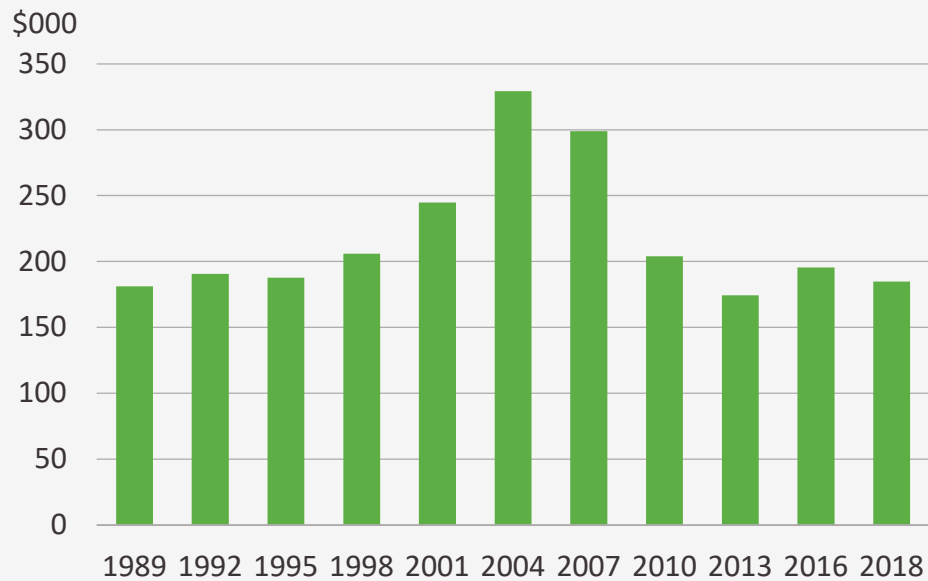


Innovation is unlocking new opportunities for financial inclusion

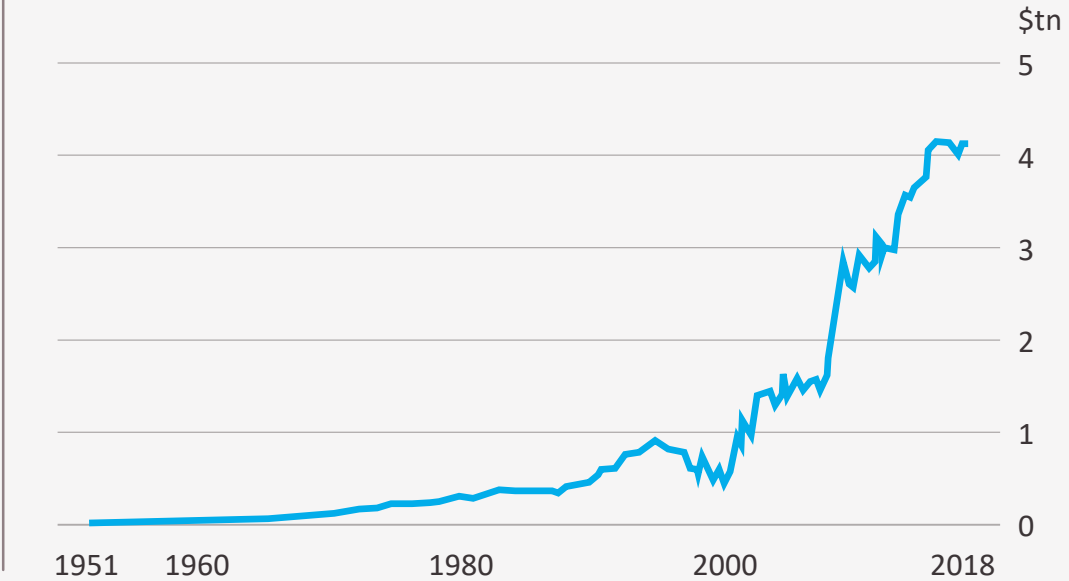


However, many elderly people have worryingly low levels of savings and income. Many pension schemes are also underfunded

Net wealth for near-retirees*, US 1989-2018, 2016\$



Unfunded pension liabilities, US state and local, 1951-2018



Source: Board of Governors of the Federal Reserve System; Survey of Consumer Finances; Centre for Economic and Policy Research; Generation
* Figures refer to middle quintile in each year, ages 55-64.



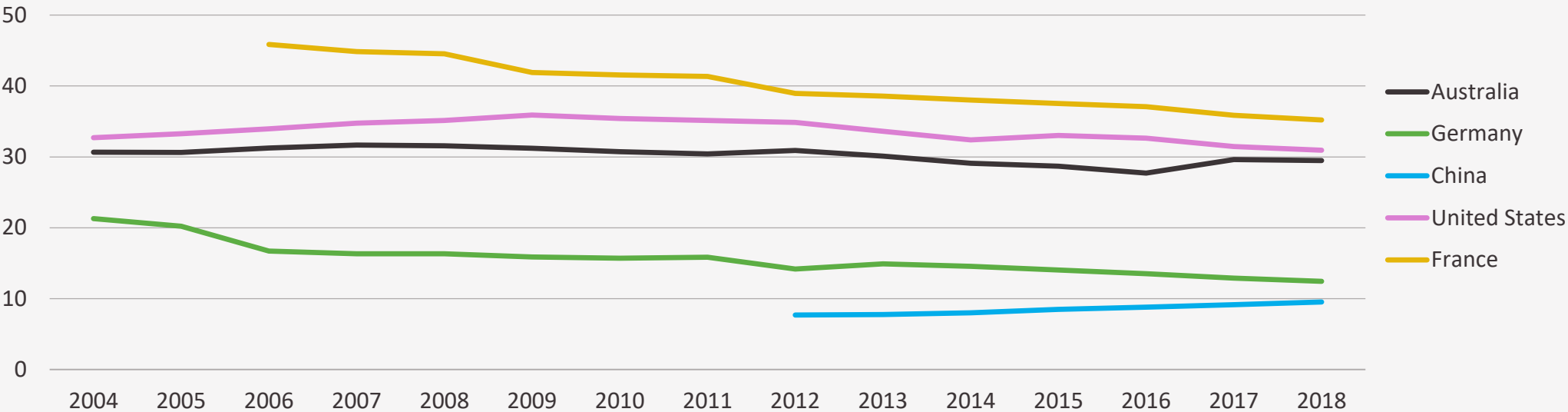
Innovation is unlocking new opportunities for financial inclusion



The declining number of physical bank branches may also lead to financial exclusion for some groups, in particular the elderly

Commercial bank branches per 100,000 people, select countries, 2004-18

Branches per 100,000 people



Source: World Bank; Generation



Health

Section summary

Healthcare is the single-biggest expense for many governments. Costs are rising, as lifestyle and chronic diseases become more common.

But it is possible to mitigate these trends. Companies and governments are devising innovative ways of keeping healthcare costs down—from reducing waste and error to emphasising prevention over cure. That, in turn, will continue to facilitate the global boom in medical innovation in 2019 and beyond.

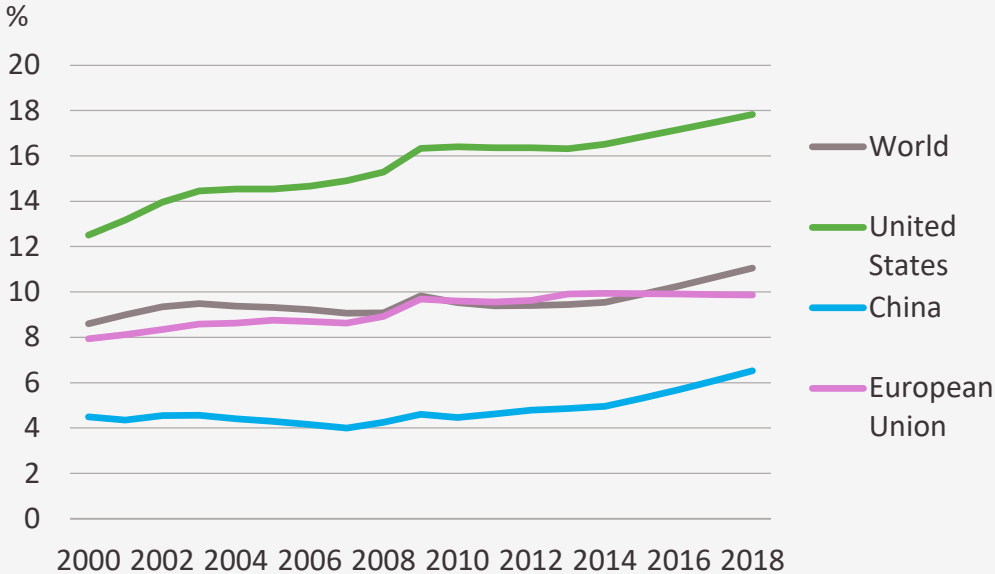


Healthcare costs continue to rise, while the system is inefficient and access is unequal



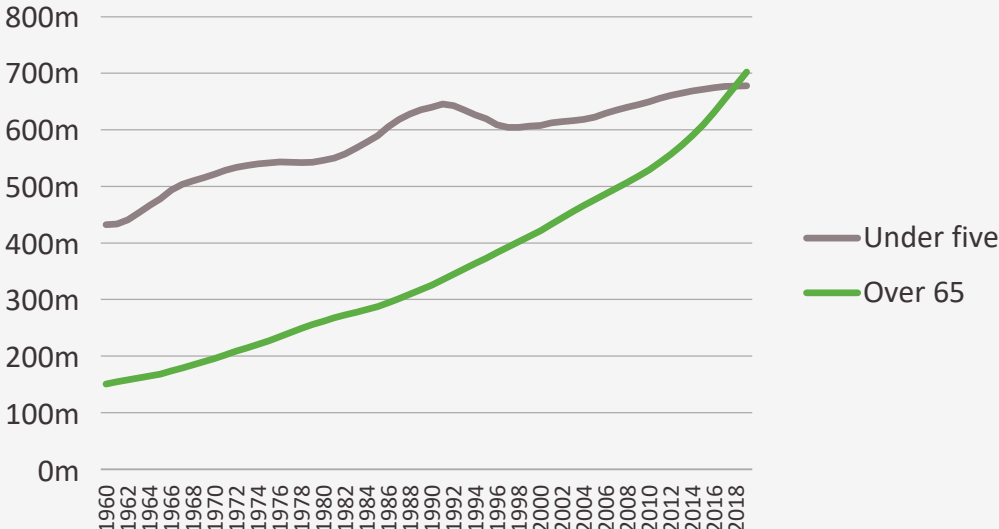
Rising healthcare expenditures are an economic and fiscal risk in many countries

Healthcare spending as a share of GDP, 2000-18



An ageing population puts welfare states and healthcare systems under increasing strain

Global population by age group 1960-2018



Source: World Bank; OECD; Generation

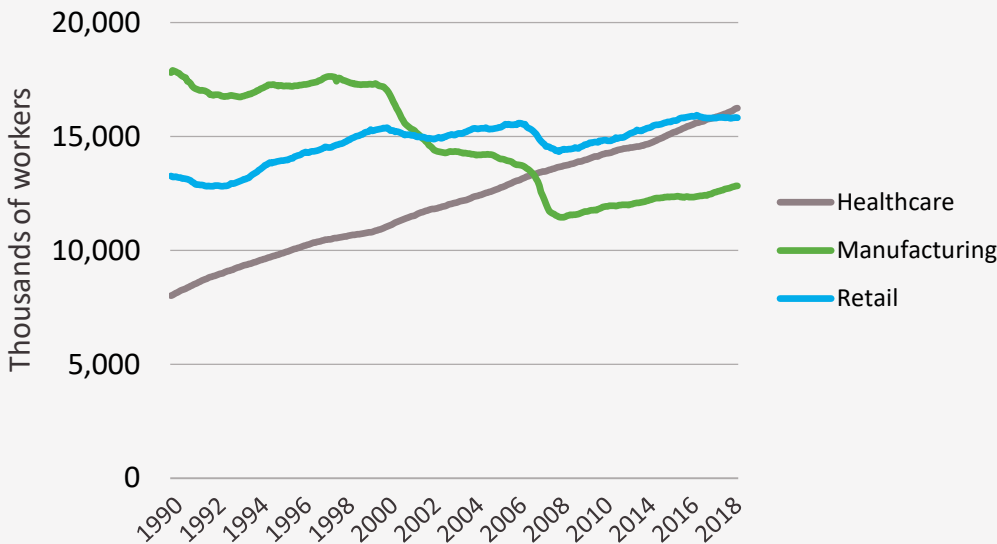


Healthcare costs continue to rise, while the system is inefficient and access is unequal

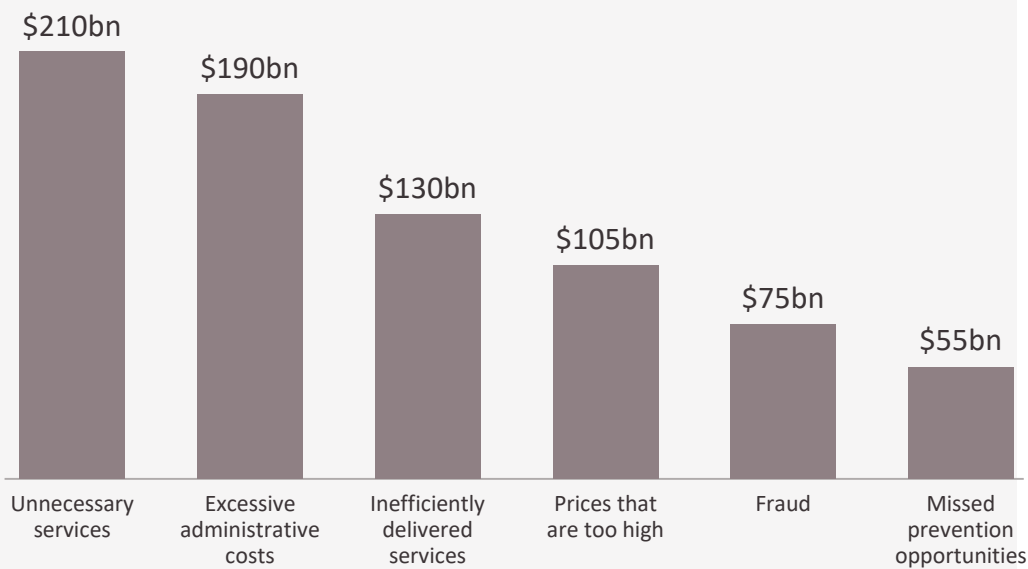


Unfortunately, healthcare systems continue to be inefficient and there is little productivity improvement

Number of Americans working in healthcare, 1990-2019



Annual wastage in the US healthcare system, 2018 estimate



Source: Bureau of Labour Statistics; The Institute of Medicine; Generation

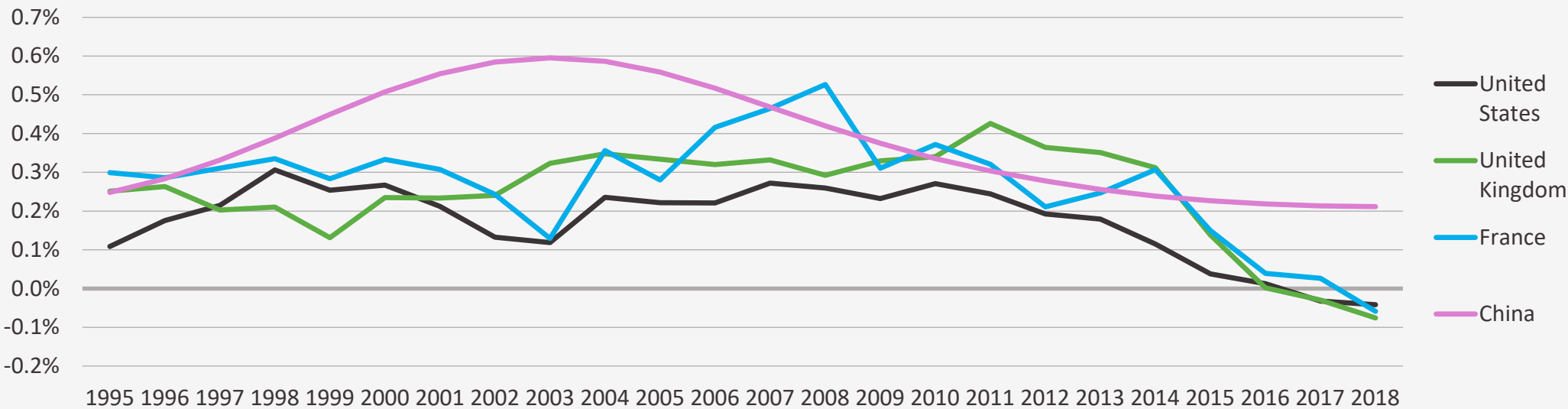


Healthcare costs continue to rise, while the system is inefficient and access is unequal



Gains in life expectancy in many countries have either slowed or gone into reverse

Year-on-year change in life expectancy, 1995-2018*



Source: World Bank; Generation
* Five-year moving average

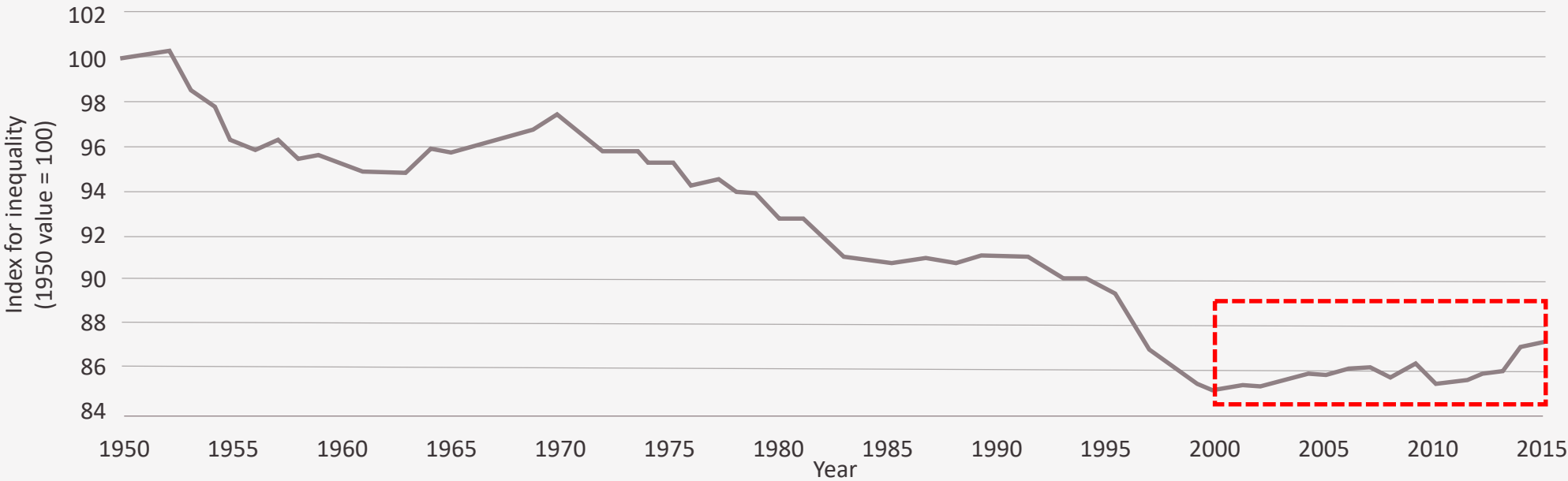


Healthcare costs continue to rise, while the system is inefficient and access is unequal



After decades of progress the gap in life expectancy between different social classes has grown since the 2000s, a sign of growing inequality

Index of absolute inequality in life expectancy at birth, and life expectancy at birth, 2018 estimates



Source: Stanford Institute for Economic Policy Research (2018), “Life Expectancy and Inequality in Life Expectancy in the United States”
* Absolute life expectancy is measured by the 80-20 index, which is the difference between life expectancy of 80th and 20th percentiles

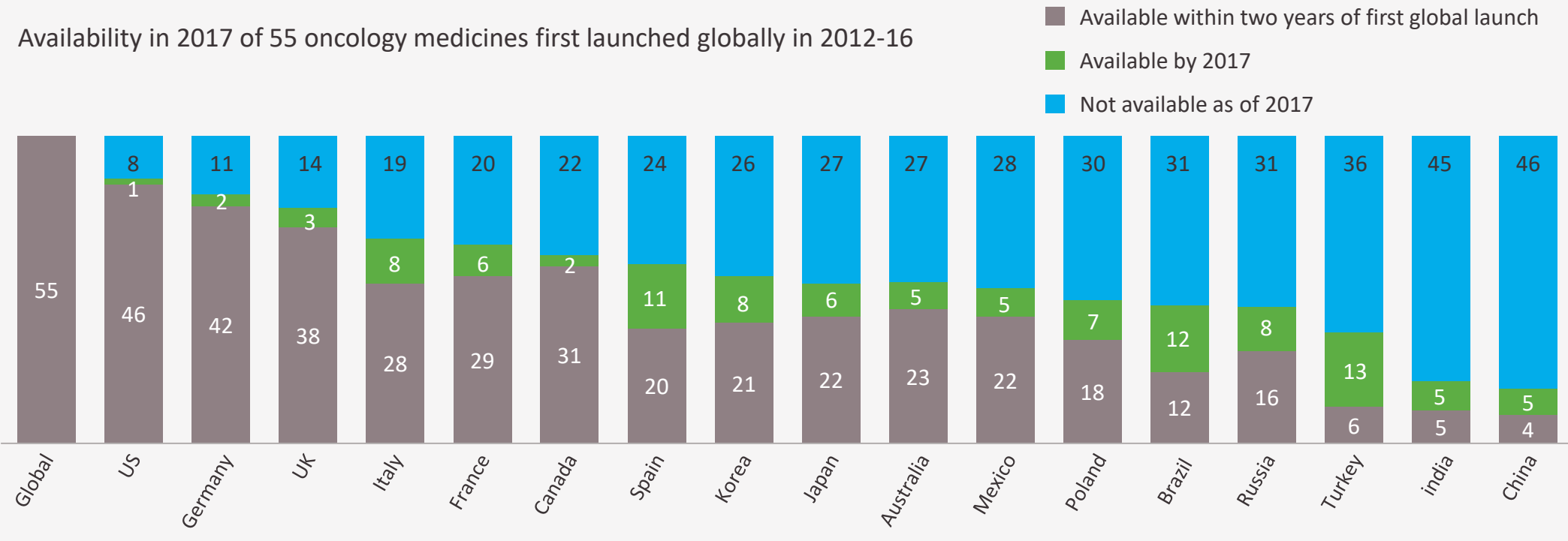


Healthcare costs continue to rise, while the system is inefficient and access is unequal



Even in the richest countries, access to innovative cancer treatments can lag by several years

Availability in 2017 of 55 oncology medicines first launched globally in 2012-16



Source: IQVIA MIDAS, December 2017

A sustainable health system is characterised by:



Improved ability
to tackle chronic
and lifestyle
diseases



More affordable
and accessible
health care for all



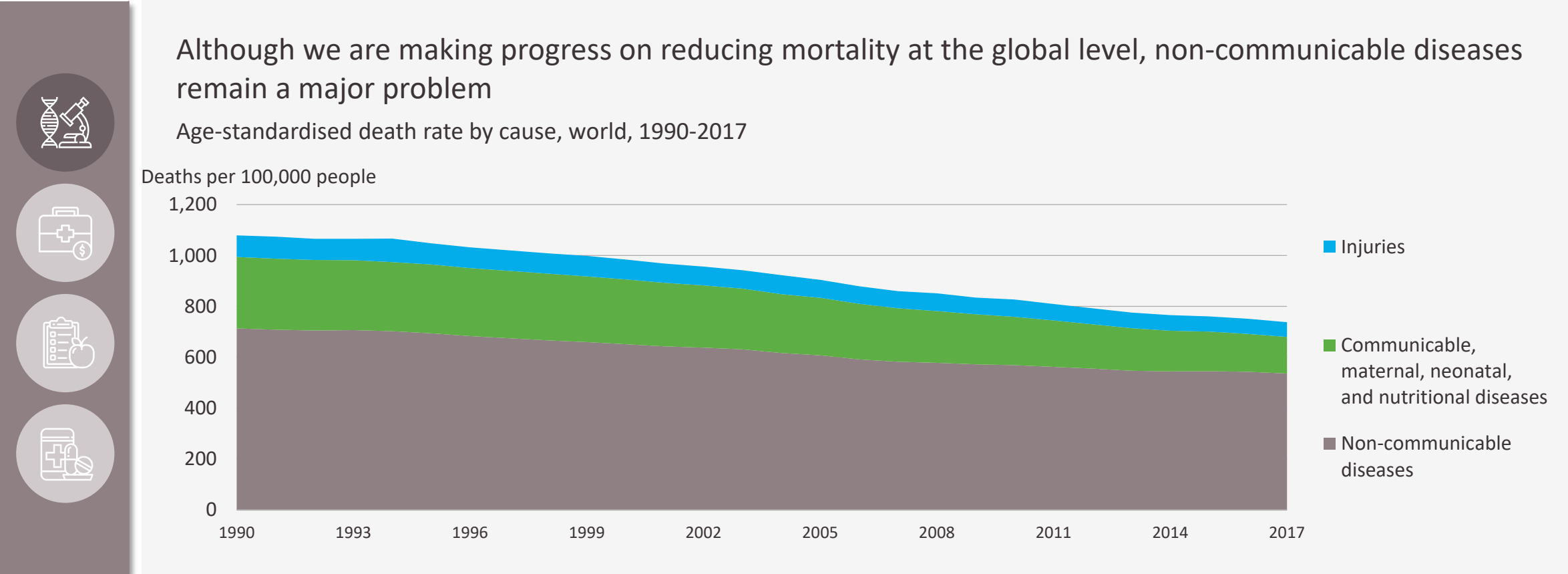
An emphasis on
preventative
strategies



A focus on
genuine
innovation



Chronic and lifestyle diseases are a growing burden



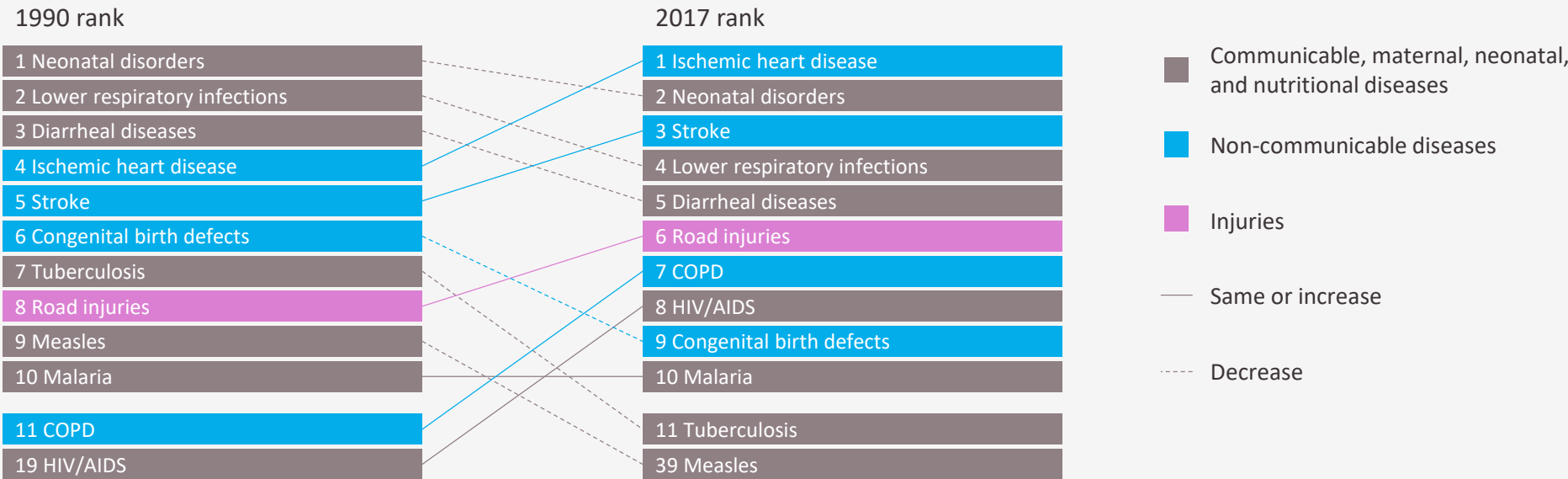
Source: IHME, Global Burden of Disease



Chronic and lifestyle diseases are a growing burden



Cardiovascular disease is now the leading cause of death globally. There are significant regional differences however - in the developed world cancer is among the leading causes of death.
Most common causes of death, global, 2018 estimate



Source: Institute for Health Metrics and Evaluation, 2018

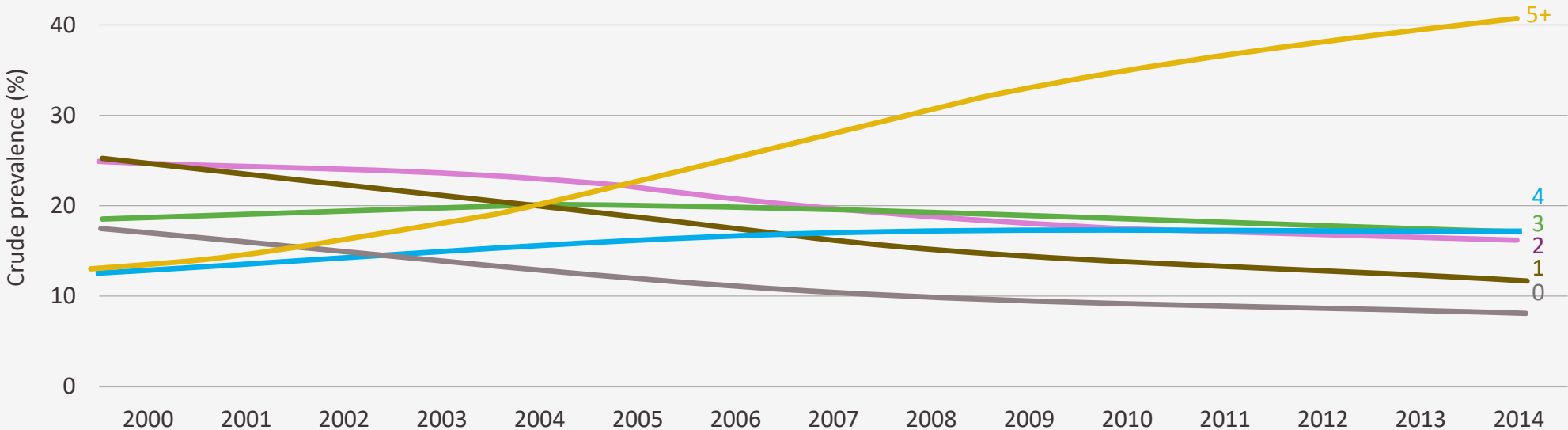


Chronic and lifestyle diseases are a growing burden



Healthcare systems need to deal with people suffering from increasingly complex conditions

Prevalence of comorbidities* in incident cardiovascular disease patients, UK, 2018 estimate



Source: *PLoS Medicine* (2018) "Patterns and temporal trends of comorbidity among adult patients with incident cardiovascular disease in the UK between 2000 and 2014: A population-based cohort study."

* The presence of one or more additional conditions occurring with a primary condition

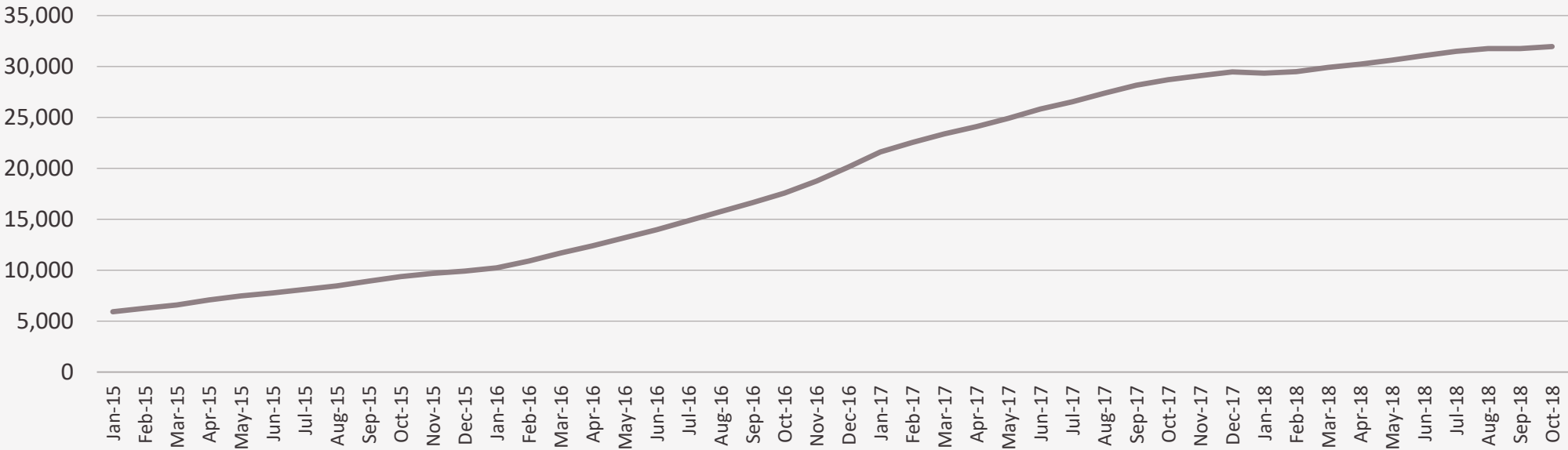


New public threats are emerging



The synthetic opioids crisis in the United States continues to grow

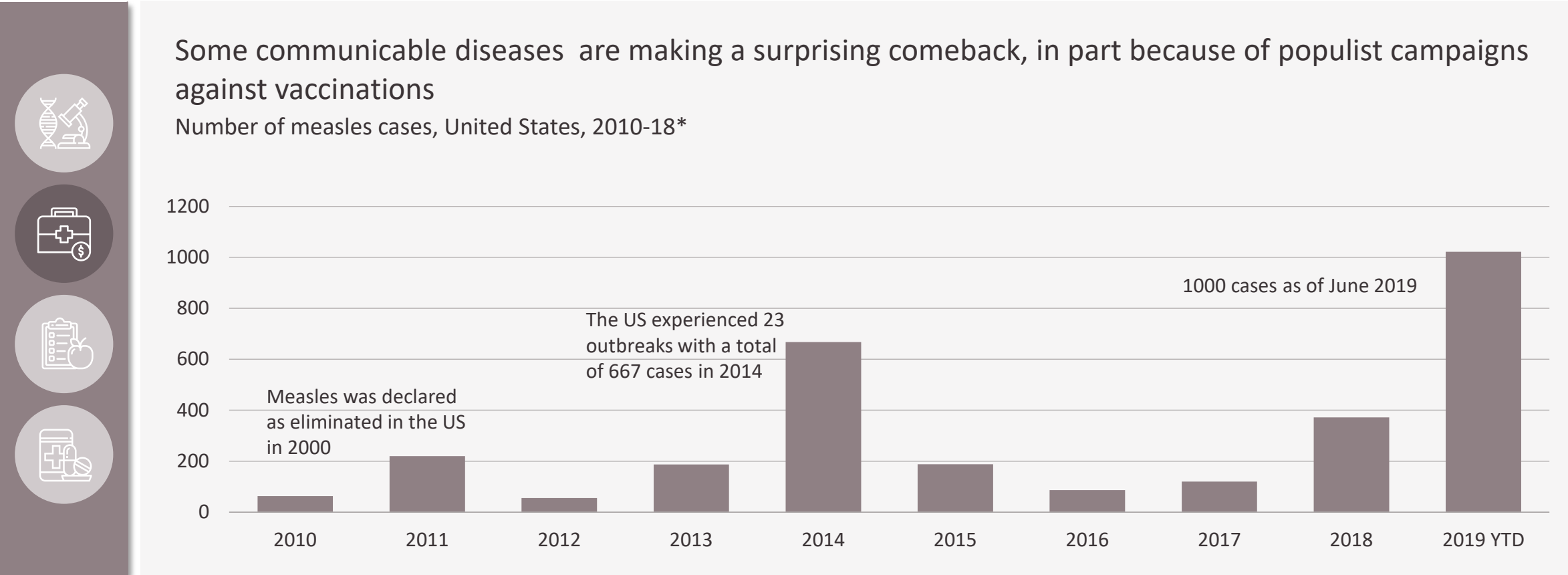
Rolling 12-month counts of deaths related to synthetic opioids*, US, 2014-18



Source: Centers for Disease Control and Prevention; Institute for Fiscal Studies, May 2019; Angus Deaton and Anne Case; Generation
* Excluding methadone



New public threats are emerging



Source: Centers for Disease Control and Prevention (2019)

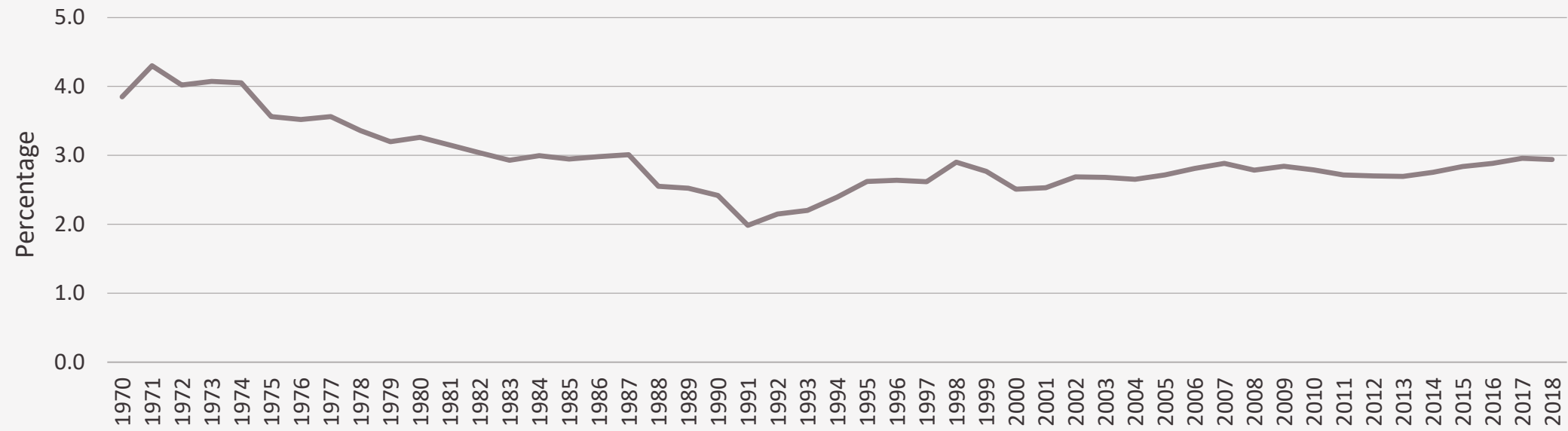


There are increasing efforts to improve prevention



Government strategies have called for a shift to preventative care, yet it currently represents only 3% of total healthcare expenditure

Share of current health expenditure devoted to prevention, average of OECD countries, 1970-2018



Source: OECD; Generation

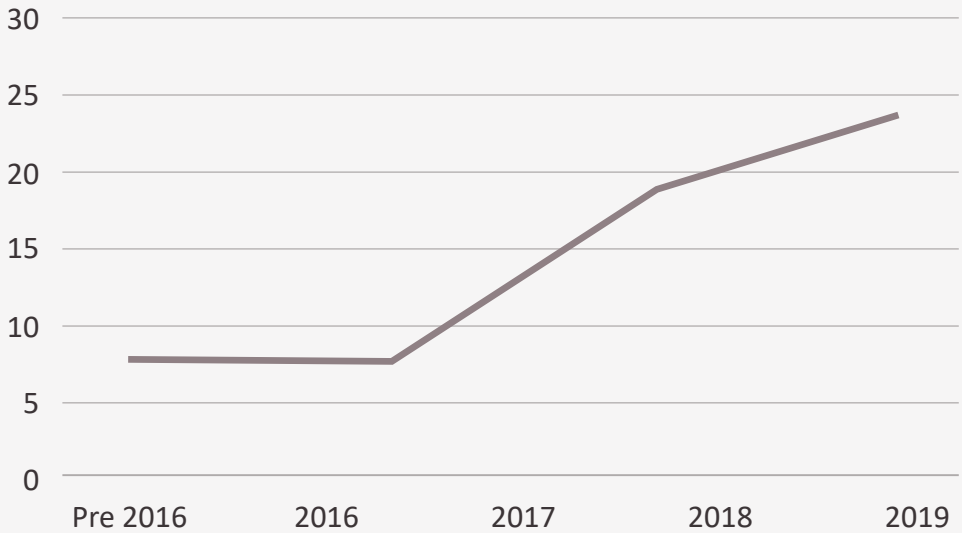


There are increasing efforts to improve prevention

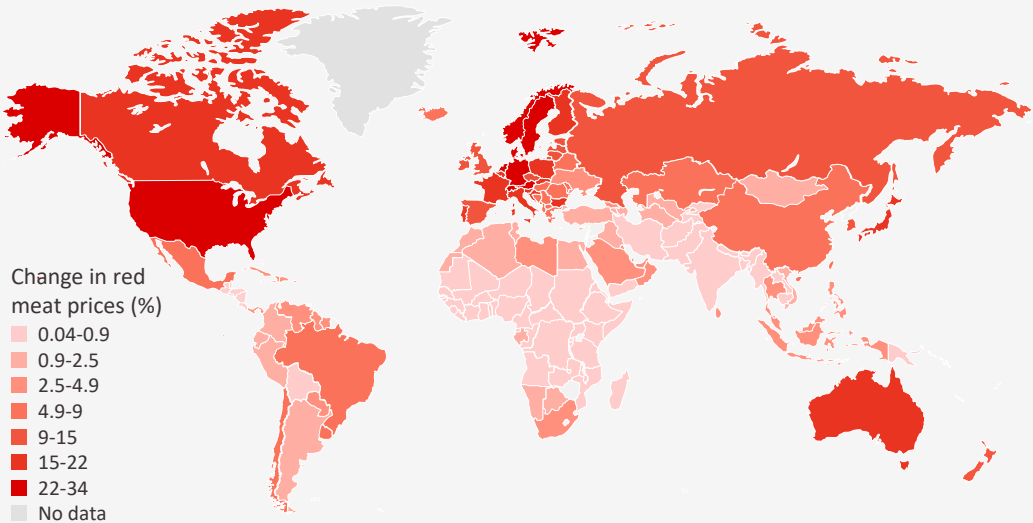


However, policy innovation is emerging beyond the traditional healthcare system. More jurisdictions are introducing sugar taxes; there are also calls for taxes on meat due to the health and environmental impacts

Number of jurisdictions worldwide with a sugar tax*



Required increase in red-meat prices to fully reflect health costs**



Source: Springmann, Marco, Daniel Mason-D’Croze, Sherman Robinson, Keith Wiebe, H. Charles J. Godfray, Mike Rayner, and Peter Scarborough. "Health-motivated taxes on red and processed meat: A modelling study on optimal tax levels and associated health impacts." *PloS One* 13, no. 11 (2018); *The Economist*; Generation

* Where the sugar contained within food or drink is taxed. In Britain, drinks with over 5 grams of sugar per 100ml are taxed 18p per litre and those with more than 8 grams 24p per litre.

** For instance, in America, meat prices must rise by 22-34% in order to fully reflect health costs associated with meat consumption. "In high income countries...red meat would need to be 20% more expensive and processed meat, like bacon, sausages and jerky, would need to be more than double its current price to account for the health costs associated with their consumption."

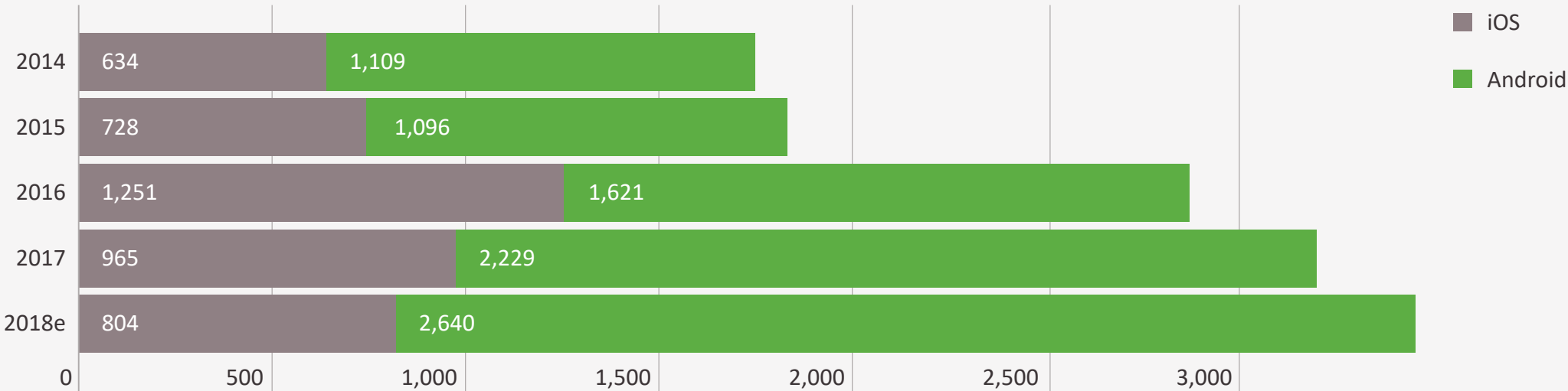


There are increasing efforts to improve prevention



New technology solutions are emerging which aim to help people manage their own health

Number of self-care apps added to app stores, 2014-18



Source: The Braff Group; Aptopia

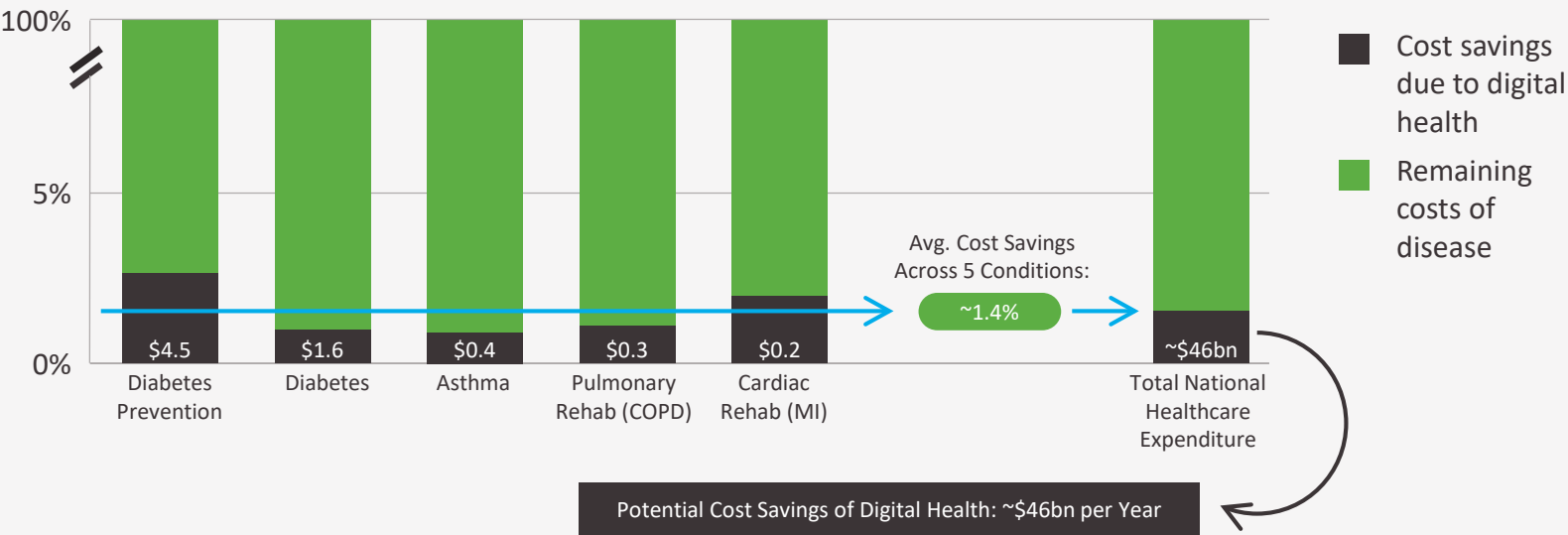


There are increasing efforts to improve prevention



Digital innovation could have a decisive impact in reducing costs. It is estimated that \$46bn could be saved through digital innovation

Estimated annual cost savings of digital health in various use cases, US, 2017 estimates



Source: IQVIA AppScript Essentials Value Model

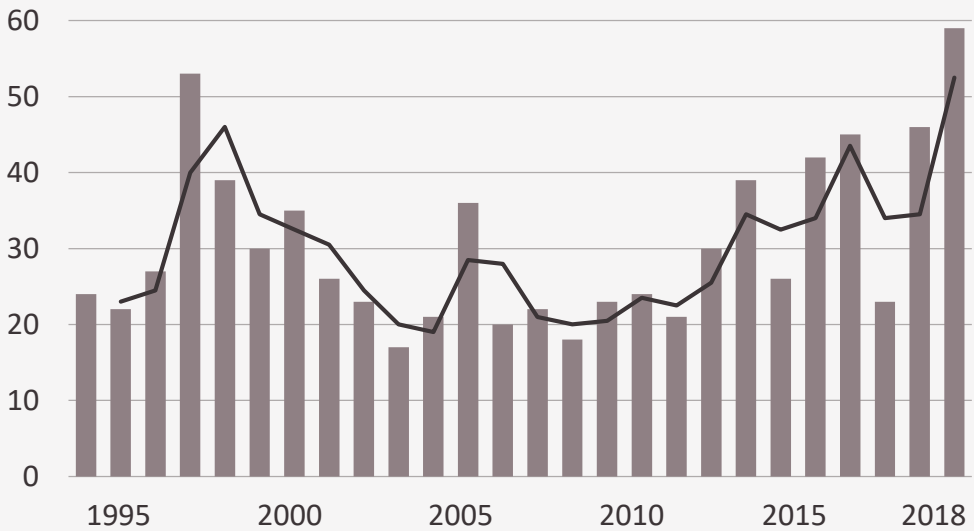


Healthcare is experiencing a period of rapid innovation

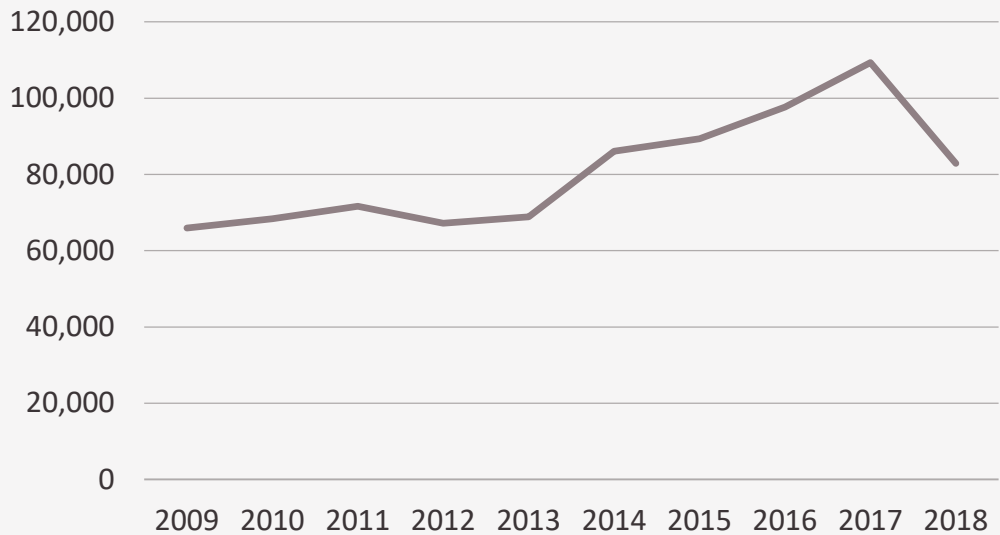


Healthcare innovation is rising, with a steady increase in drugs coming to market

US FDA drug approvals, 1993-2018, with moving average



Number of patents granted related to health, global, 2009-18*



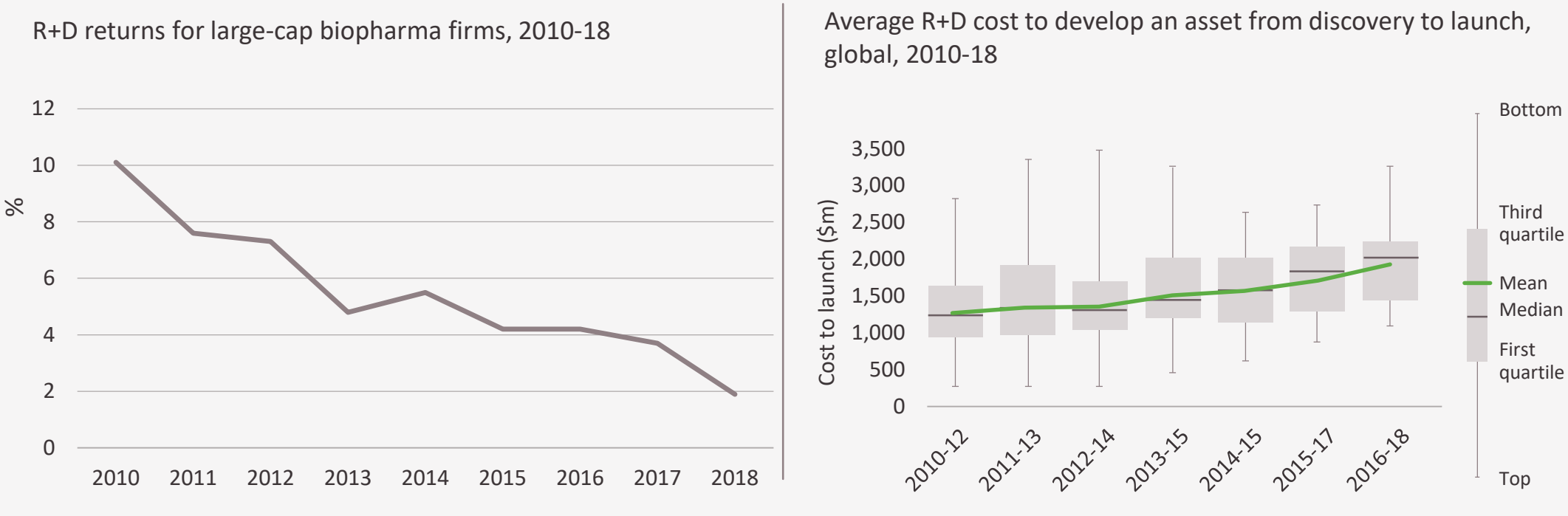
Source: US FDA; WIPO database; Generation
* Figures for 2018 may seem artificially low because of delays in registration of patents



Healthcare is experiencing a period of rapid innovation



However the efficiency of R&D spending remains in question



Source: Deloitte Centre for Health Solutions (December 2018): “Measuring the return from pharmaceutical innovation, 2018”; Generation

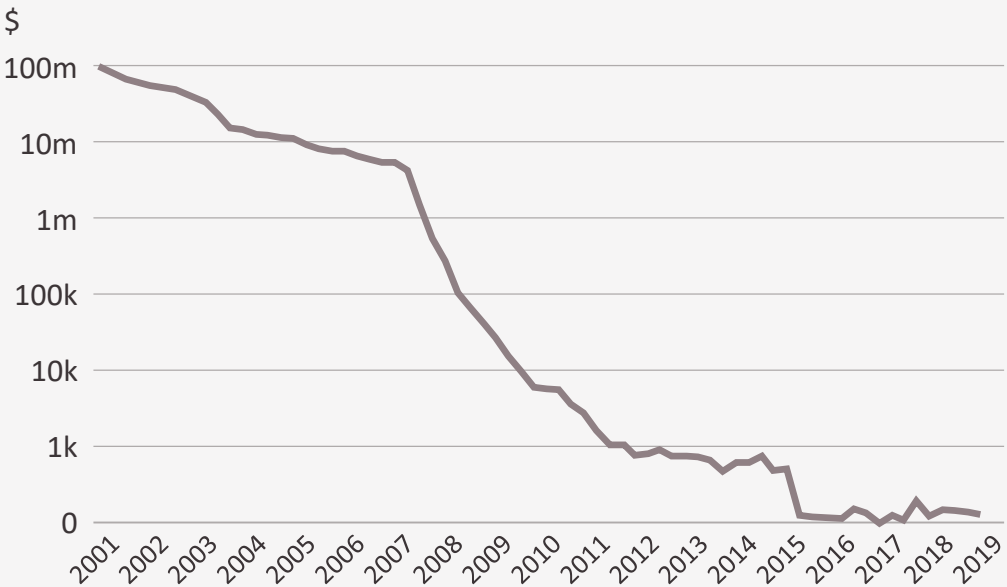


Healthcare is experiencing a period of rapid innovation

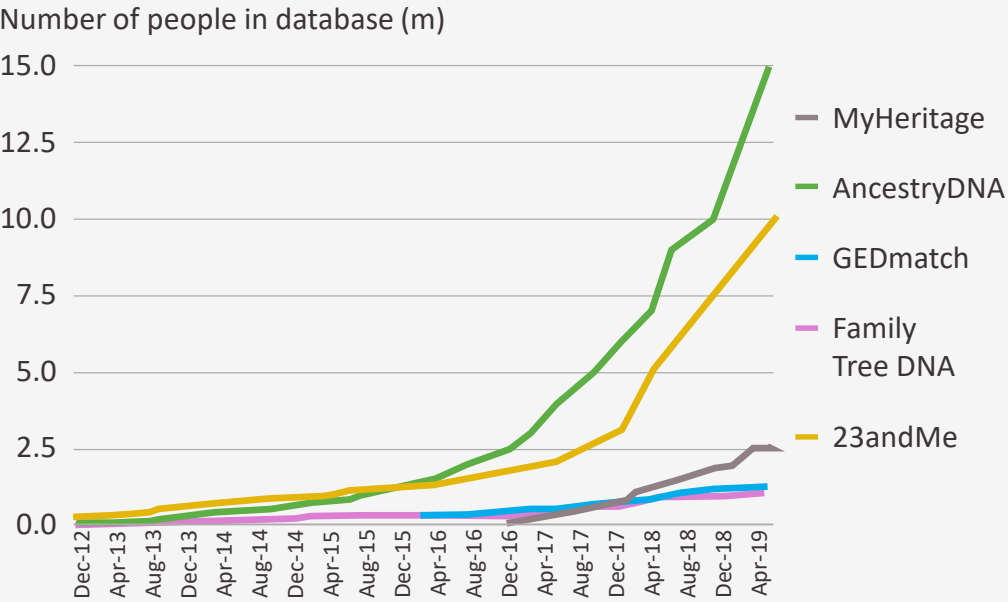


Falling genome costs are driving innovation in consumer genomics and other areas

Genome costs



DNA testing



Sources: NIC, Leah Larkin

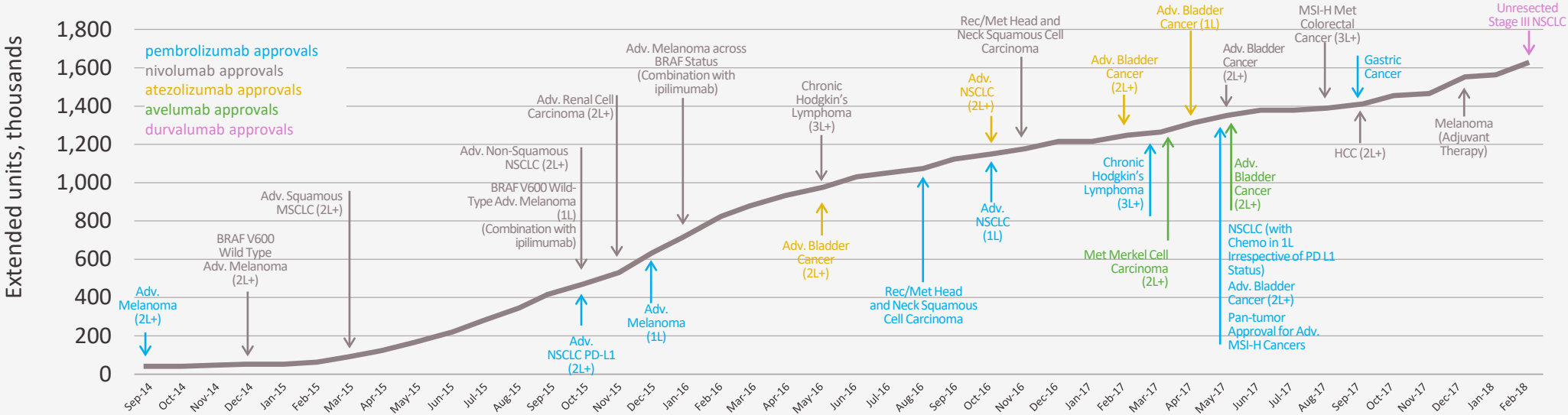


Healthcare is experiencing a period of rapid innovation



Immunotherapy has revolutionised cancer treatment

Growth in immunotherapy drugs, US, 2014-18



Source: US FDA; National Sales Perspectives, February 2018; IQVIA Institute, April 2018; WIPO database; PubMed

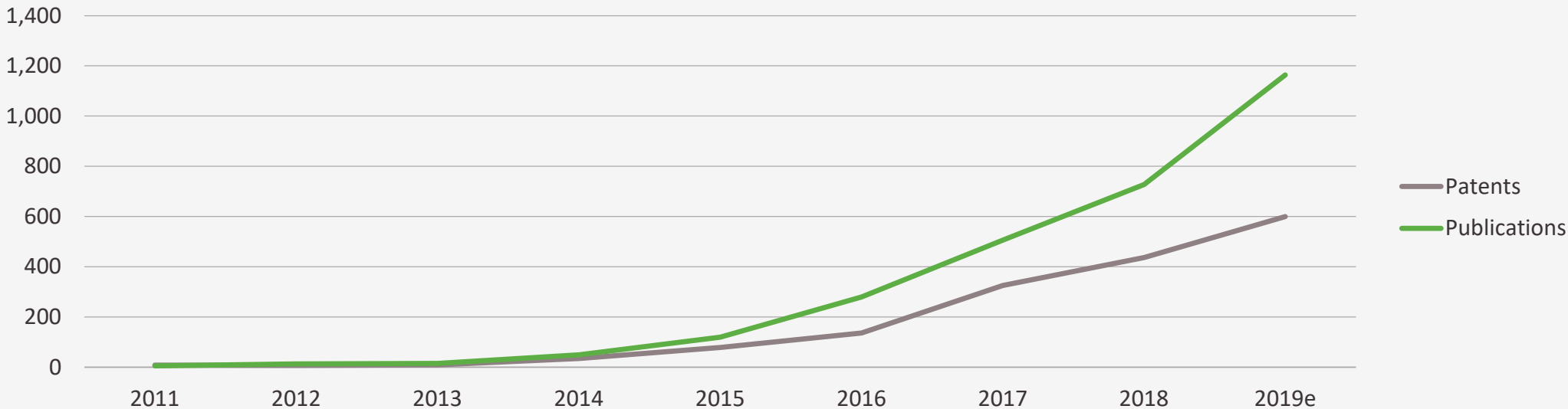


Healthcare is experiencing a period of rapid innovation



There has been a sharp rise in innovative activity in cancer diagnostics

Number of patents and publications which refer to liquid biopsies*, 2011-19e



Source: PubMed; Generation
* These provide the ability to diagnose cancer via a blood test

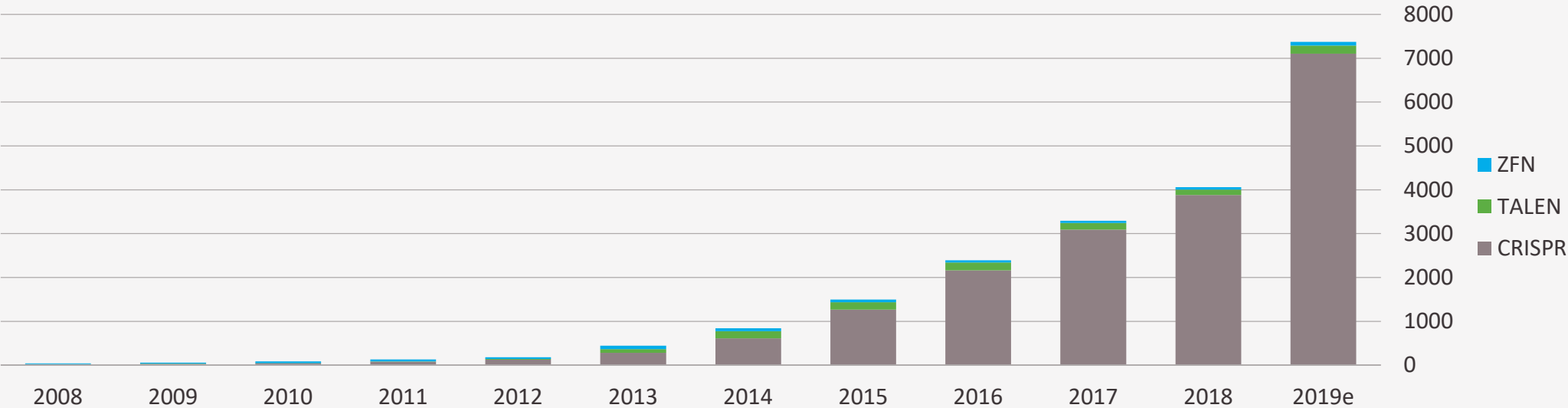


Healthcare is experiencing a period of rapid innovation



Research in gene editing is expanding rapidly, adding to the urgency of addressing ethical issues

Scientific publications which refer to gene editing, 2008-19



Source: PubMed; Generation



Consumption

Section summary

Consumption spending forms the majority of global GDP. At present many consumer habits are not sustainable. Finite resources are being exhausted; production of waste continues to rise.

Yet data clearly show that we are at the beginning of a consumer sustainability revolution. 2018-19 was a turning point in terms of demands for alternative diets; others want “asset-light” lives. Some companies are responding to these emergent demands. But there is a long way to go.

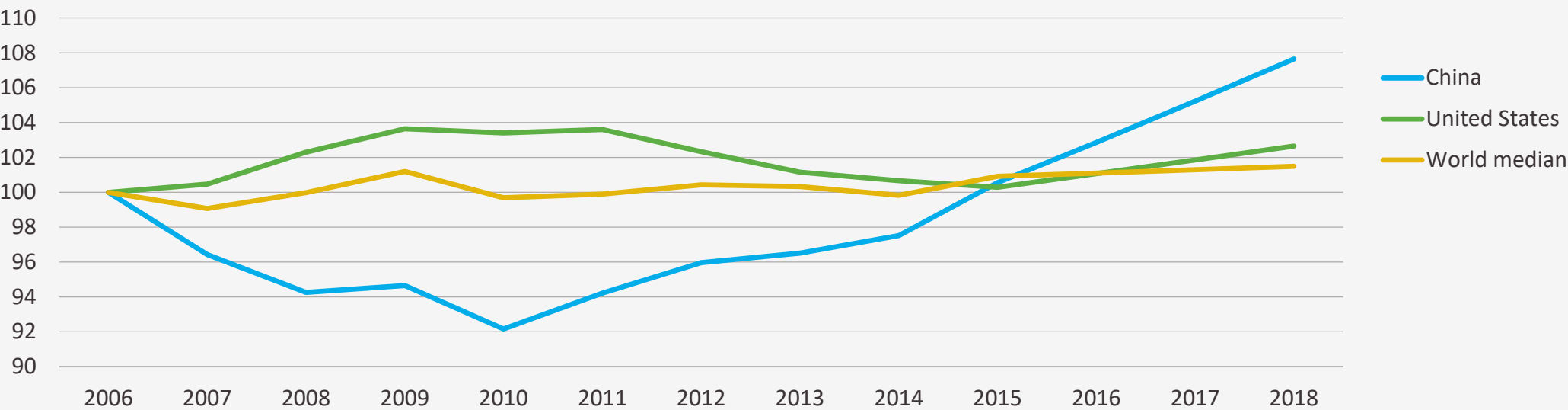


Consumer choices will have a decisive impact on sustainability



Consumers’ collective purchasing power is increasing as their share of GDP rises, especially in China

Consumption spending to GDP, 2006=100, 2006-18



Source: World Bank; Generation

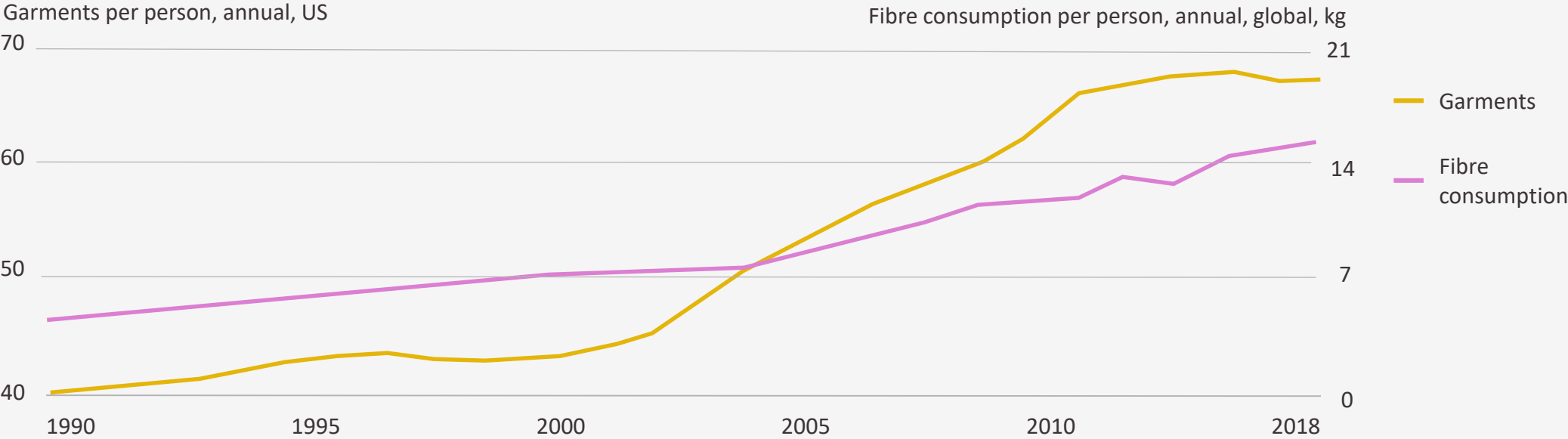


Consumer choices will have a decisive impact on sustainability



“Fast” fashion and other resource-intensive spending patterns have large sustainability impacts. A kilogram of cotton takes about 10,000 litres of water to produce, for example

Clothing use around the world, 1990-2018



Source: Food and Agricultural Organisation; World Fibre Reports; American Apparel and Footwear Association; Generation

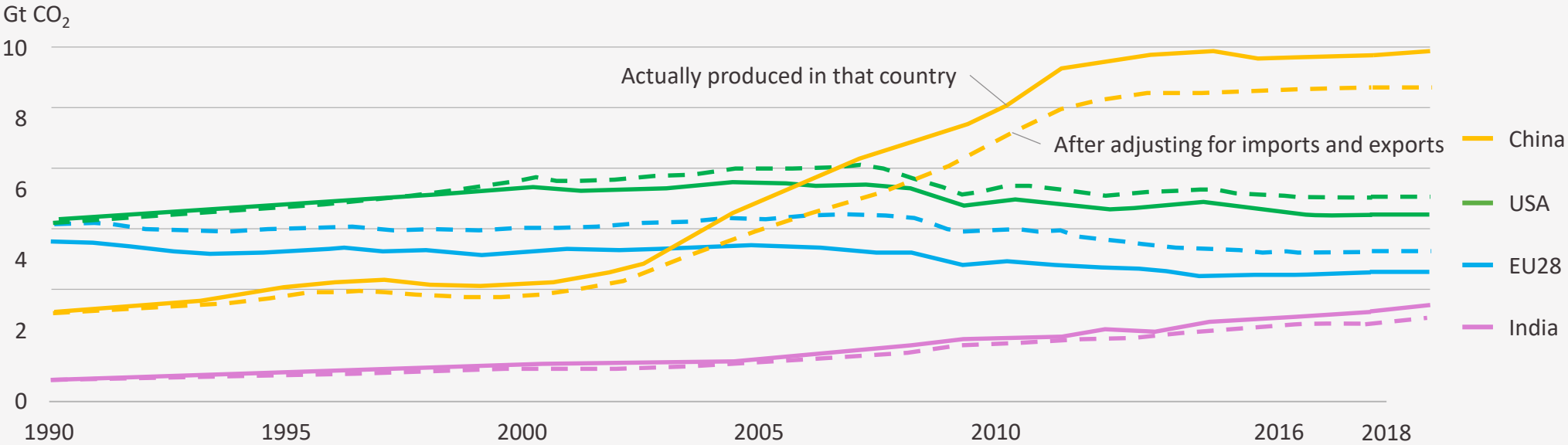


Consumer choices will have a decisive impact on sustainability



Rich countries consume huge quantities of goods and services produced in other countries, meaning that they are, in effect, responsible for the associated emissions and resource extraction

Annual territorial and consumption emissions, 1990-2018



Source: Earth System Science Data (2018): “Global carbon budget 2018”; Peters et al 2011; Global Carbon Project 2018; Generation

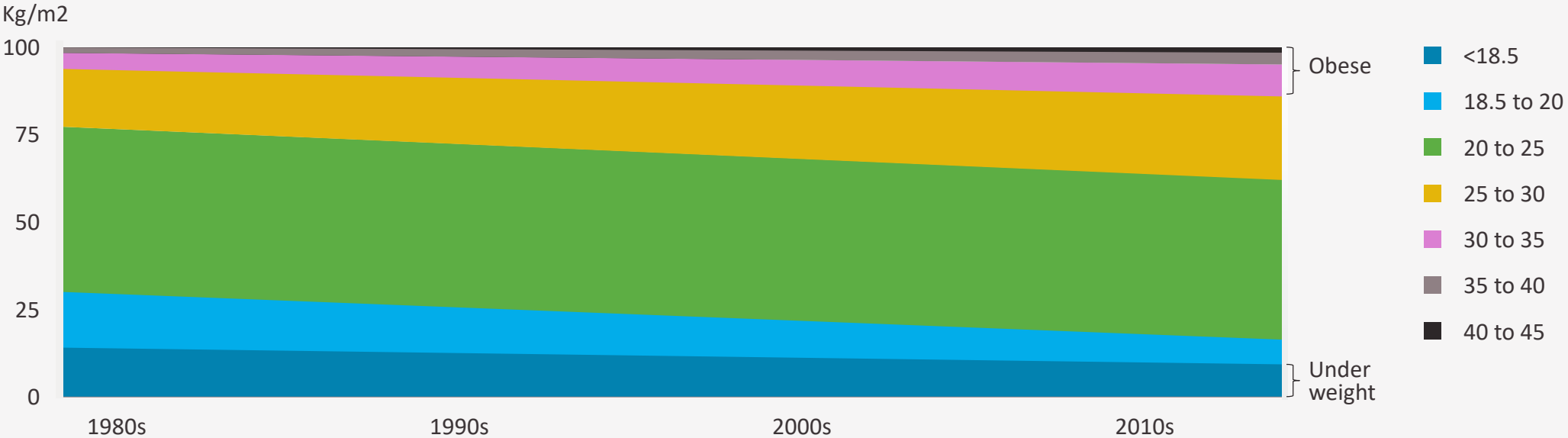


Consumer choices will have a decisive impact on sustainability



The global food system is not optimised for human health. For the first time ever there are more obese people than underweight people

Global distribution of BMI, 2017 estimate



Source: Lancet (2017) “Worldwide trends in children’s and adolescents’ body mass index, underweight, overweight and obesity, in comparison with adults, from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies with 128.9 million participants”; Generation

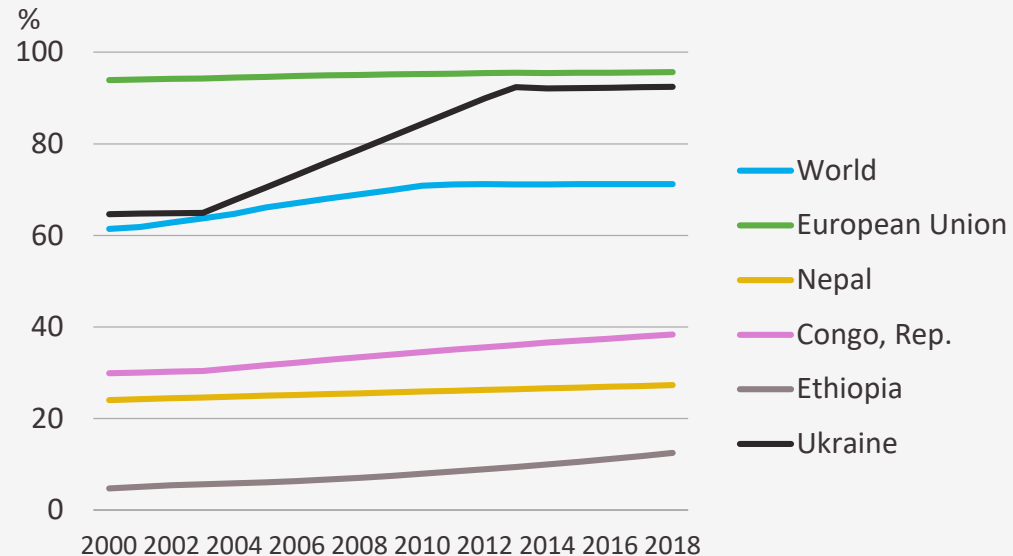


Consumer choices will have a decisive impact on sustainability

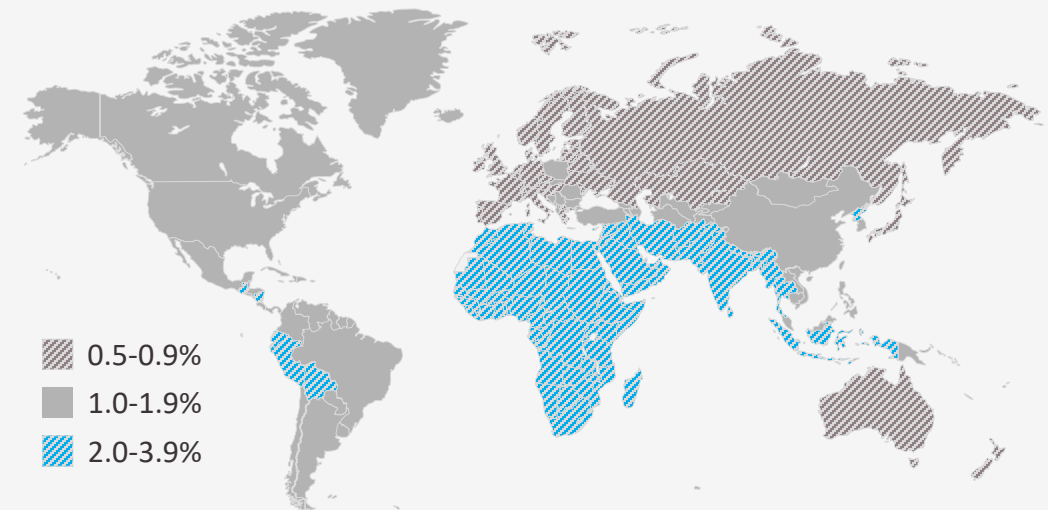


For many people, basic nutritional needs are still unmet

People using safely managed drinking water services (% of population), selected countries, 2000-18



Impact of iron deficiency on disability-adjusted life-years (DALYs)*, global



Source: World Bank; WHO; Generation

* One DALY can be thought of as one lost year of “healthy” life

A sustainable consumption system is characterised by:



Consumer demand for sustainably produced food



Easier access to sustainable household goods



A sustainability-focused approach to e-commerce

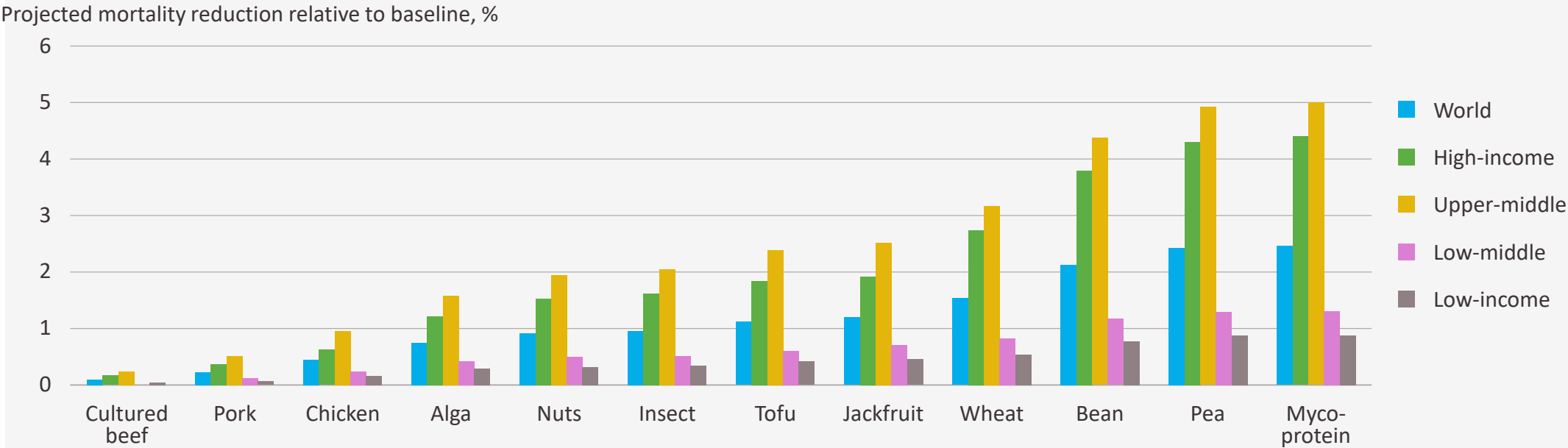


Consumer interest in healthier, sustainable food is growing



Shifting away from meat may have considerable benefits for human health, potentially reducing mortality by up to 5%

Projected mortality reduction by shifting from beef to different food types, 2019 estimates, global, by country income group



Source: Oxford Martin School, 2019: “Meat: the Future series: Alternative Proteins”. The most positive effects are found in wealthier countries, where beef consumption is high and where there is a particular benefit of consuming more fibre.

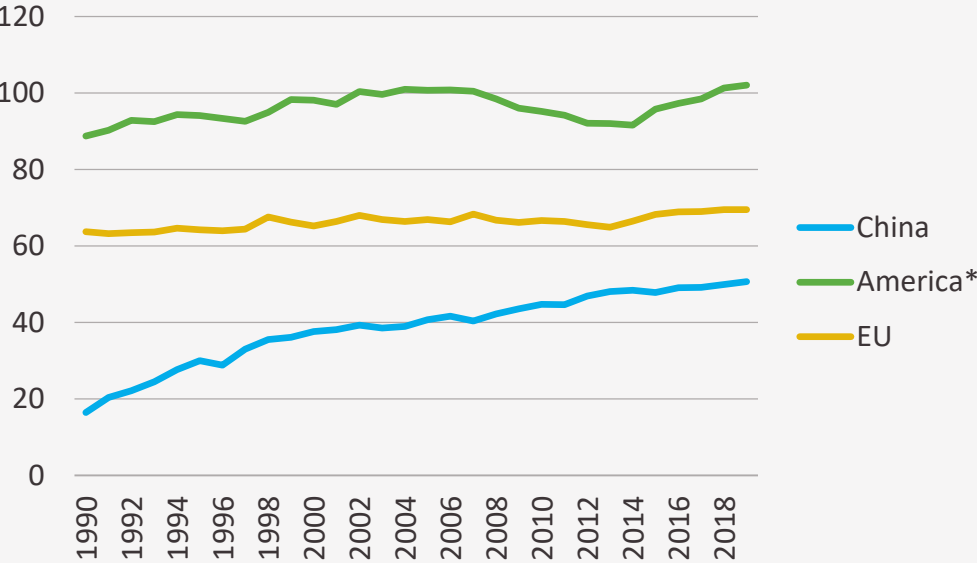


Consumer interest in healthier, sustainable food is growing

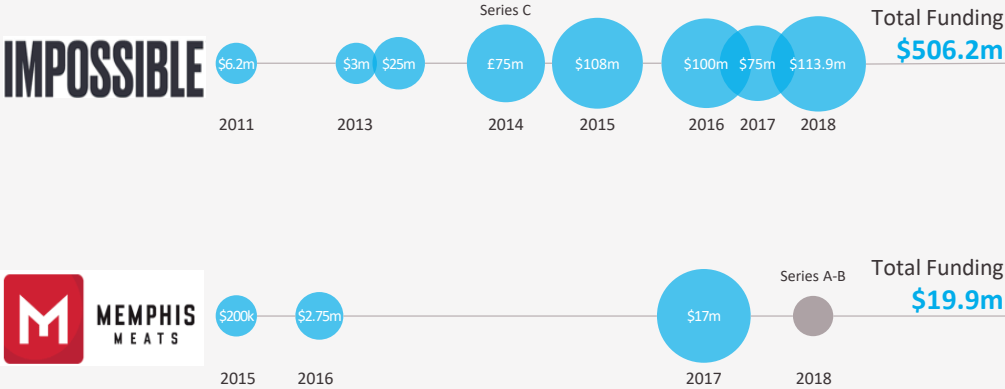


Meat consumption continues to rise across the world, though many alternatives are emerging

Per-capita annual meat consumption, kg, by world region, 1990-2018



Example investment in meat substitutes, 2013-19



Source: OECD; FAO; Pitchbook; Hayek, Matthew N., and Rachael D. Garrett. "Nationwide shift to grass-fed beef requires larger cattle population." *Environmental Research Letters* 13, no. 8 (2018); "Grazed and Confused Ruminating on cattle, grazing systems, methane, nitrous oxide, the soil carbon sequestration question – and what it all means for greenhouse gas emissions", Oxford University, 2017; Generation.

* In many countries, including America, consumption of grass-fed beef is rising. Grass-fed beef is often believed to be sustainable. However, a study from Oxford University in 2017 finds that while grazing of grass-fed animals can boost the sequestration of carbon, that "effect is time-limited, reversible, and at the global level, substantially outweighed by the greenhouse gas emissions they generate."



Consumer interest in healthier, sustainable food is growing



Alternative meats put far less strain on the natural world

Environmental impact of an Impossible Burger versus a regular beef burger

Impact category	Unit	Impossible Burger	Beef burger	Difference
Aquatic pollutants	g P04-eq	1.3	15.1	-92%
Global warming potential	kg C02-eq	3.5	30.6	-89%
Land occupation	m2.y	2.5	62.0	-96%
Water consumption	litres	106.8	850.1	-87%

Source: Impossible Foods; *Frontiers in Sustainable Food Systems* (2019): “Climate impacts of cultured meat and beef cattle”.

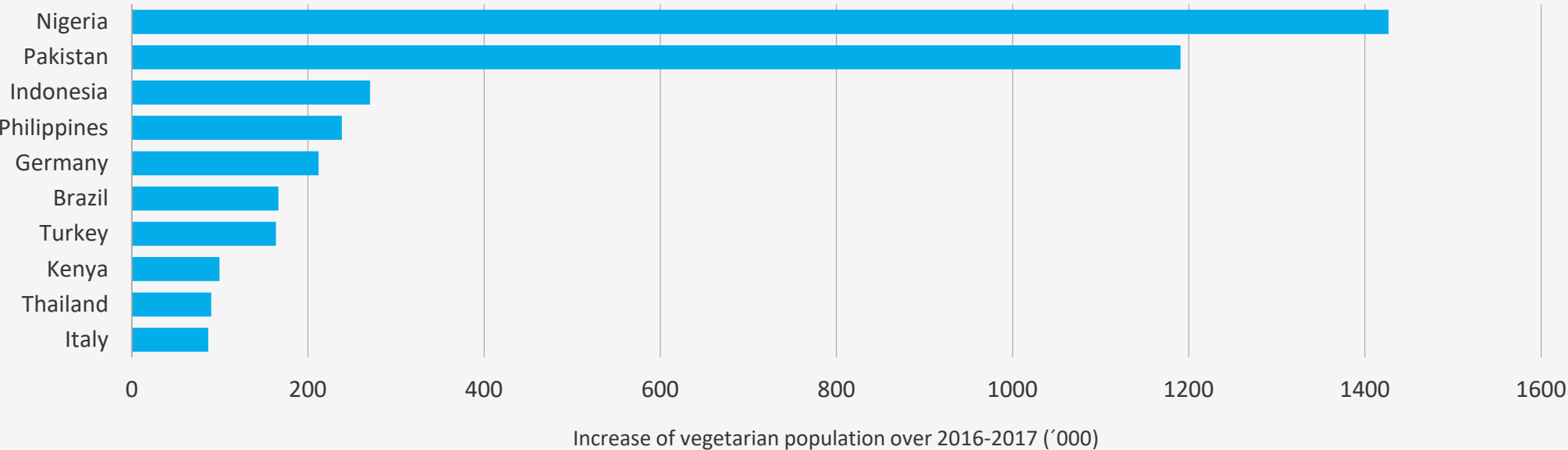


Consumer interest in healthier, sustainable food is growing



Social and religious factors may also play a role behind the rise of vegetarianism* globally

10 countries with the biggest increase in vegetarian population, 2016-17



Source: Euromonitor International
* Not eating meat or fish

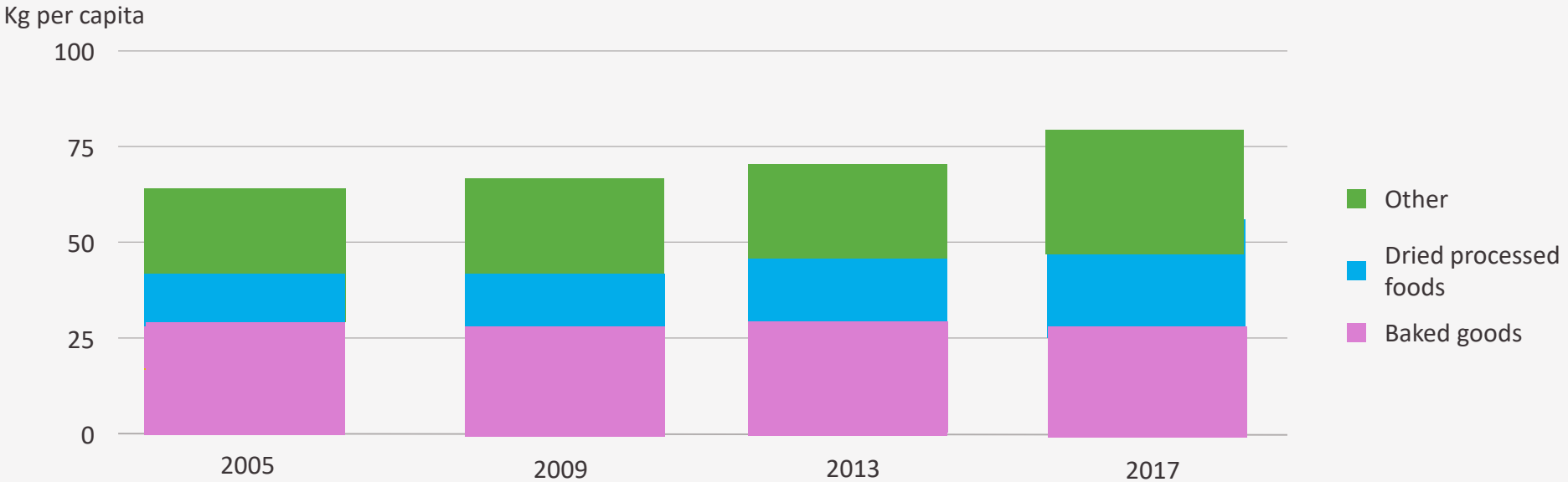


Consumer interest in healthier, sustainable food is growing



Growing global demand for packaged food is a concern. Over two-thirds of packaged food is not aligned with healthy diets

Packaged food sales, global, per person, 2005-2017



Source: Global Nutrition Report



Consumer interest in sustainable products and household goods is growing



Sustainability is becoming a mainstream consumer option

Share of global consumers* in 2018 who prefer buying from brands which...



76%
are committed to
using good-quality
ingredients

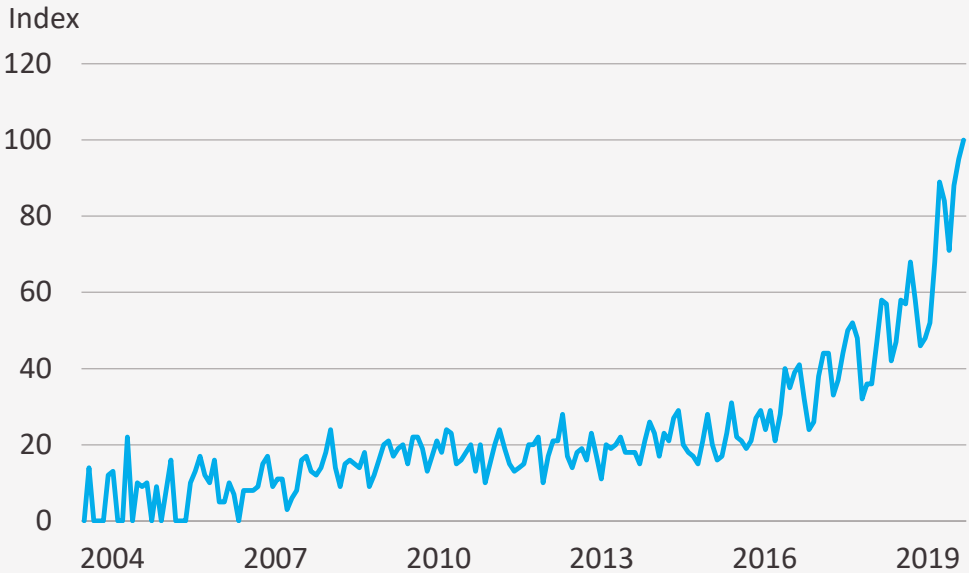


63%
stand for a shared
purpose



65%
treat employees well

Global interest** in “sustainable fashion”, 2004-19



Source: Accenture Strategy; Google Trends
* Survey of around 30,000 consumers globally
** Search volume

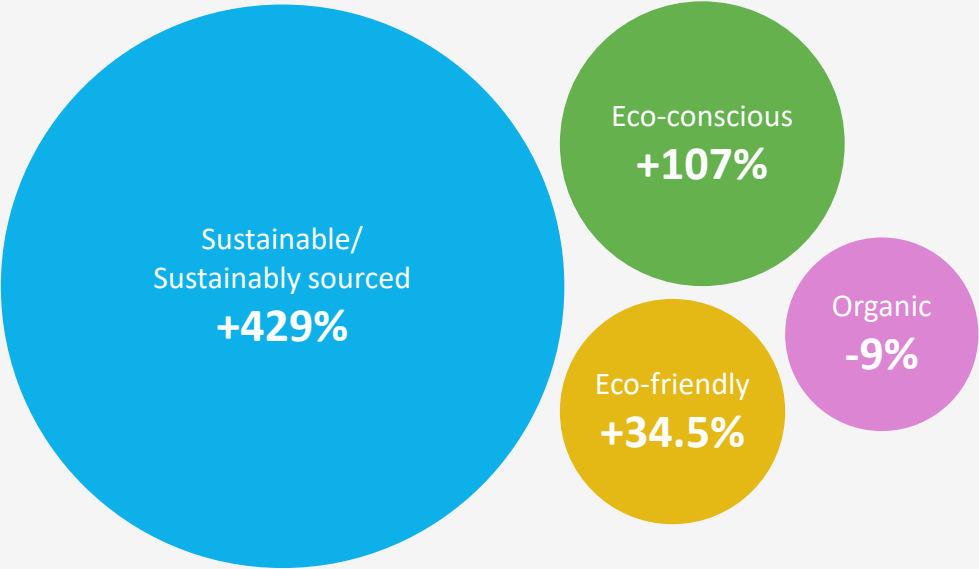


Consumer interest in sustainable products and household goods is growing



And people are increasingly looking for more sustainably sourced fashion

In stock apparel product descriptions, 2018 vs 2015, more than 52,000 brands, global



Source: edited.com

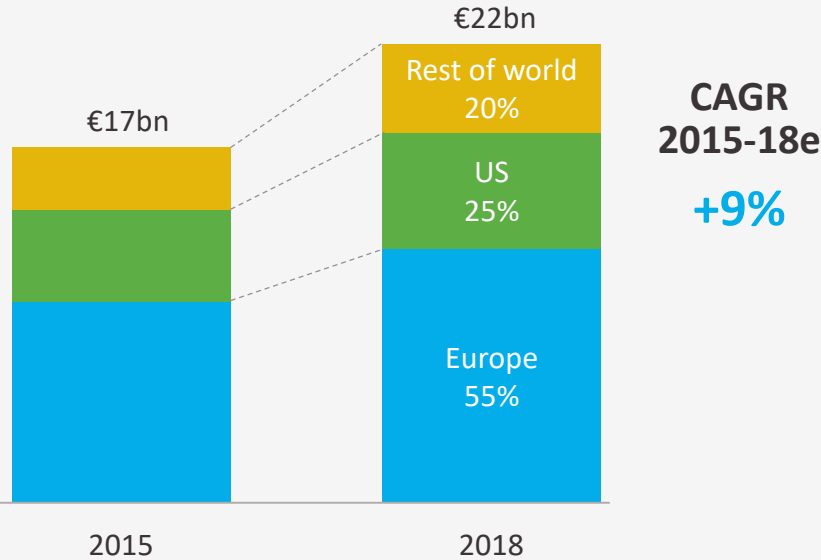


Consumer interest in sustainable products and household goods is growing

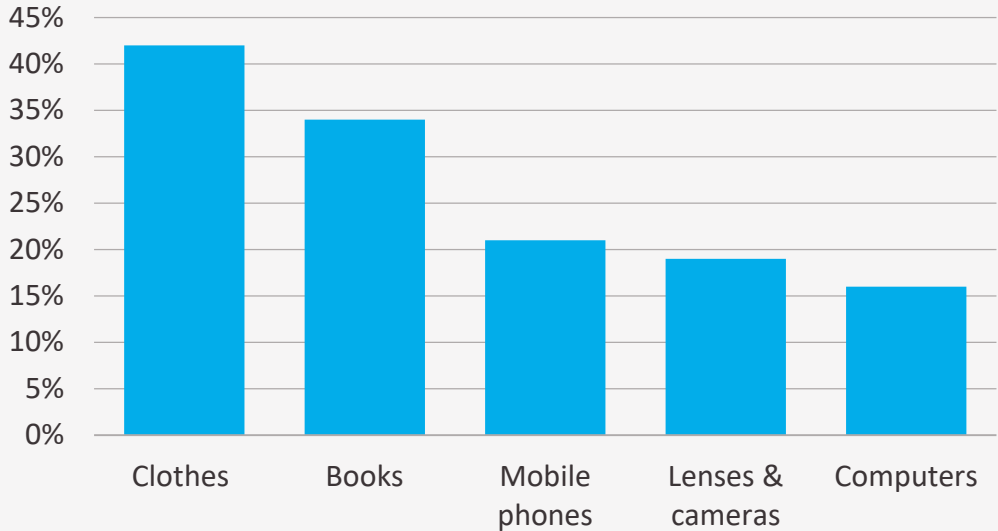


Some consumers are becoming more interested in buying used goods or renting them. Sharing assets puts less strain on scarce resources

Global market in second-hand luxury goods, 2015 and 2018



Share of Chinese people born after 1990 who have rented goods, 2018 estimate



Source: Bain & Company; China Internet Watch; CBN; Vogue Business

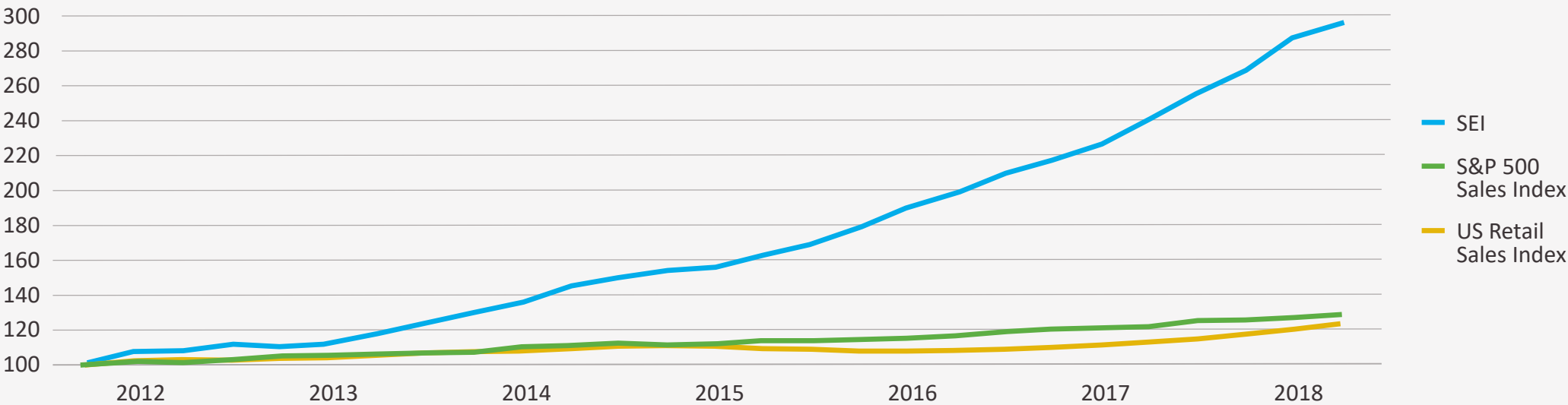


Consumer interest in sustainable products and household goods is growing



Subscription models are gaining traction globally.

Subscription Economy Index* versus stockmarket and retail sales, North America, Europe and APAC, 2012-18, 2012=100



Source: Zuora; Generation

* The Subscription Economy Index is based on anonymised, aggregated, system-generated activity on the Zuora service. It reflects the growth metrics of hundreds of companies around the world, and spans a number of industries including SaaS, media, telecommunications and corporate services.

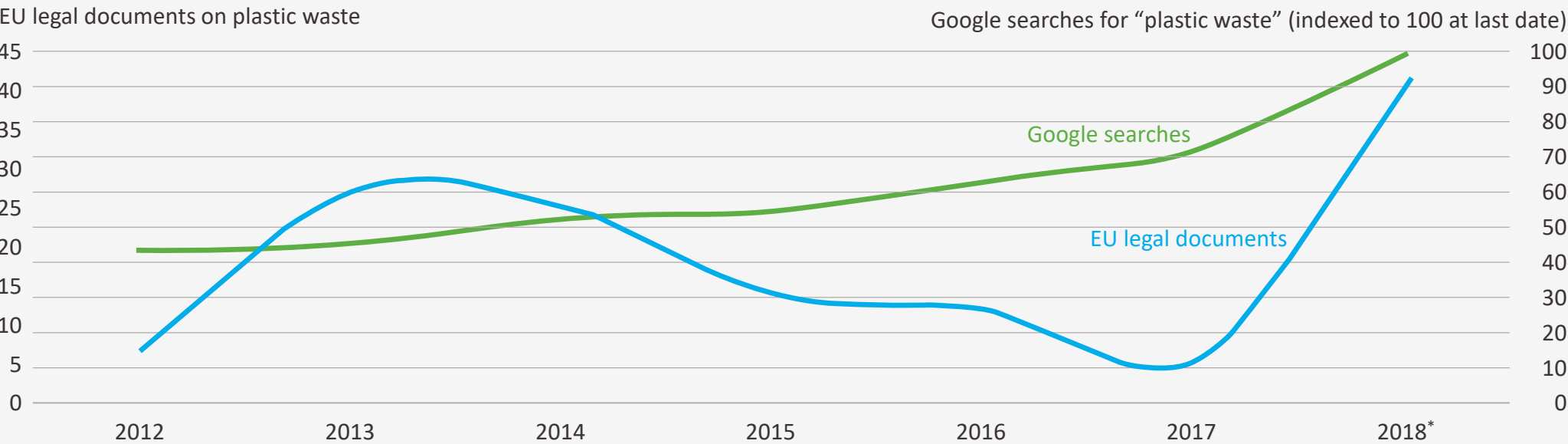


Consumer interest in sustainable products and household goods is growing



More and more consumers are expecting goods with less plastic packaging

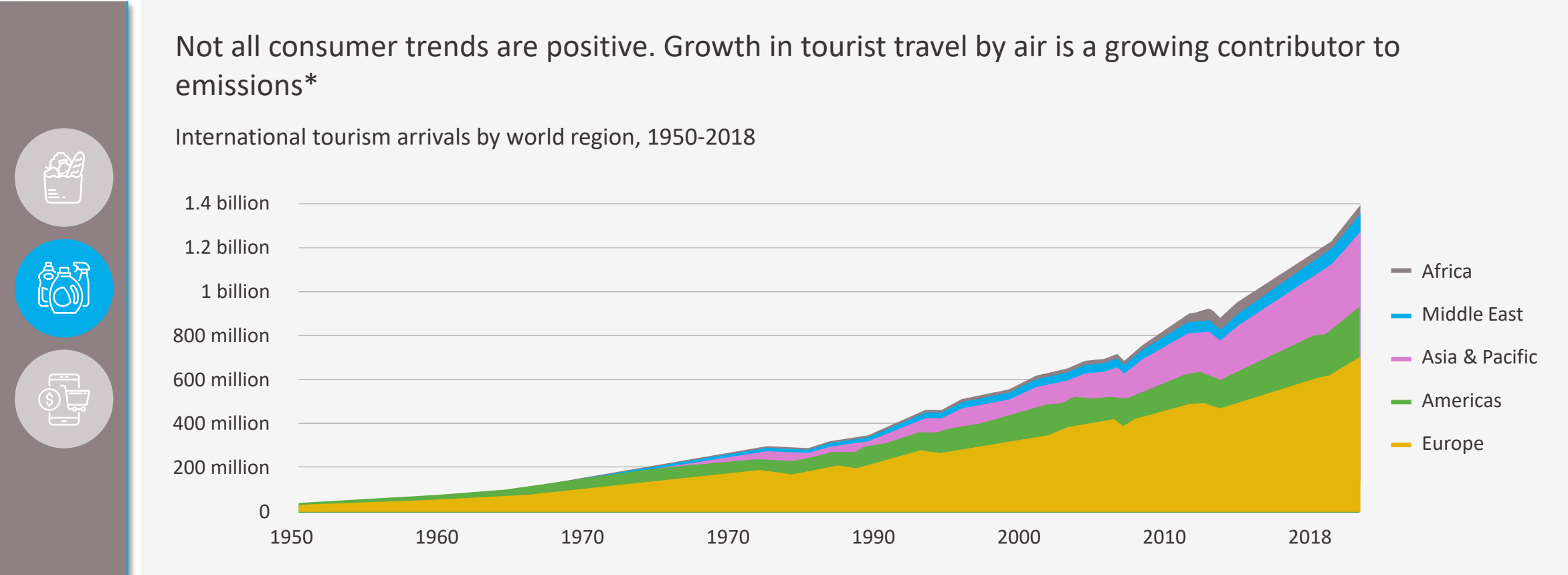
Public and policymaker interest in plastic waste



Source: Schroders; Generation
* 2018 is annualised value based on Q1 values.



Consumer interest in sustainable products and household goods is growing



Source: United Nations World Travel Organisation; Our World in Data; World Tourism Barometer; Statista; Generation
*Air travel still represents only a small share of overall greenhouse-gas emissions, yet does represent low-hanging fruit in terms of personal behaviour change



Households are embracing new, sustainable models of consumption



Some research suggests that the environmental impacts of e-commerce are lower than traditional commerce

Carbon footprint of buying a toy in an urban area, by mode of purchase and behaviour



Behaviour	Search	Purchase	Return
Traditional Shopper	In stores (multiple trips)	In store	In store
Modern Shopper (Impatient)	Online - In store	Online (air delivery)	Online
Cybernaut (Impatient)	Online	Online (air delivery)	Online

Source: MIT Centre for Transportation and Logistics (2013): “Environmental Analysis of US Online Shopping”.

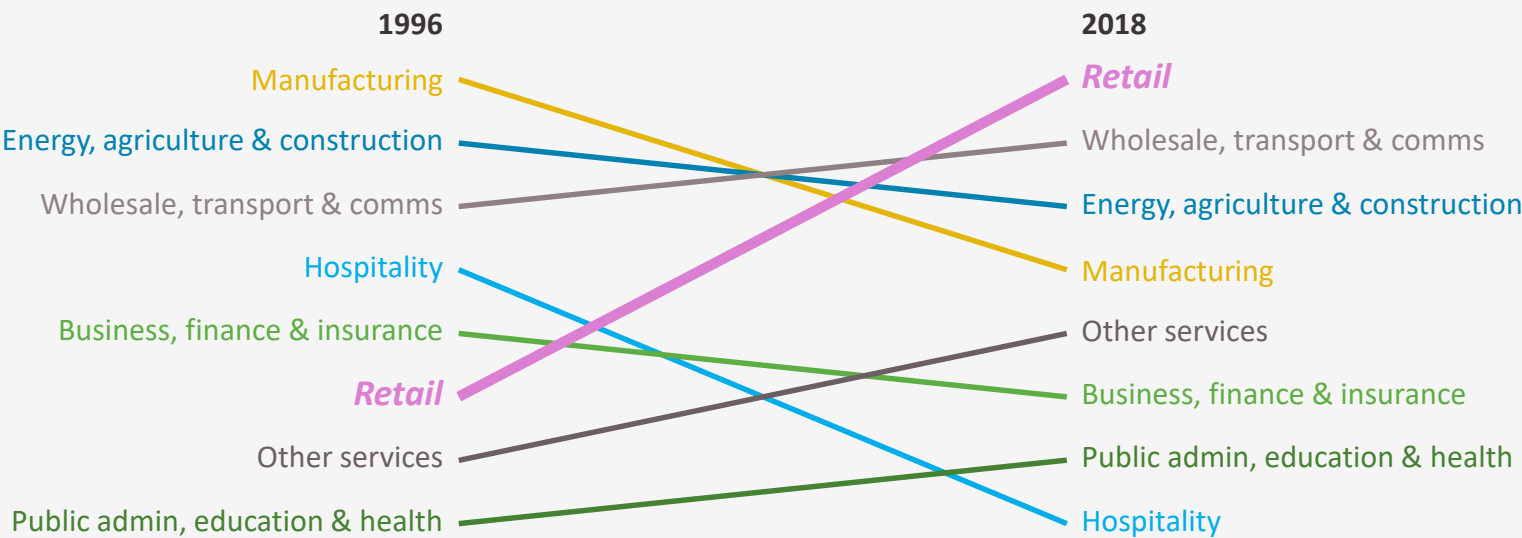


Households are embracing new, sustainable models of consumption

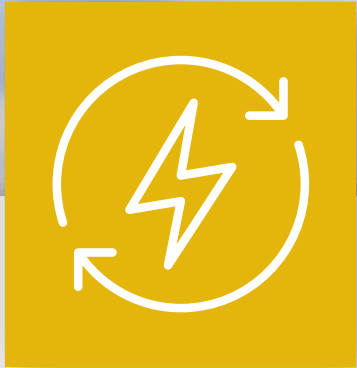


Retailing’s shift online is already hitting jobs, with retail recently becoming the sector where the highest share of people are moving into unemployment

Rank of sectors by redundancy outflow rates*, UK



Source: Resolution Foundation
* Measured on a quarterly basis



Energy

Section summary

The energy sector is the world's leading source of greenhouse-gas emissions. Major advances are required in the production, distribution and consumption of energy in order to make it sustainable.

There is increasing evidence, however, of progress. Clean energy is now clearly and broadly competitive with fossil fuels. The technology behind batteries is improving. Households are embracing methods of reducing their energy consumption—and so are companies. Some policy choices are spurring change, though others prevent a sustainable energy system from reaching its full potential.



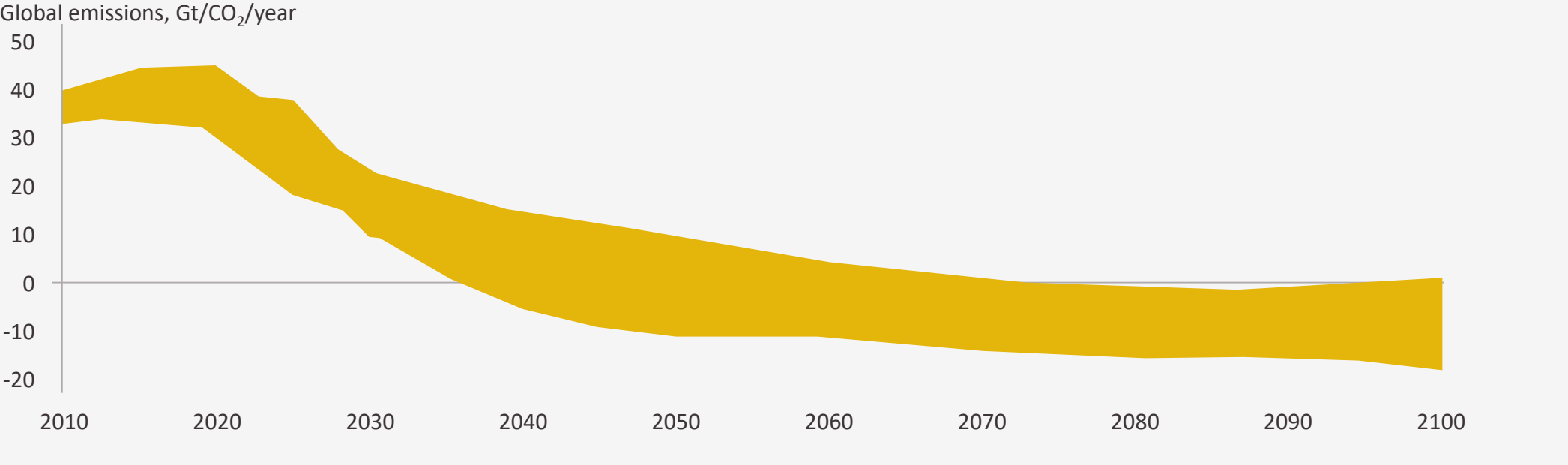


The global energy system remains deeply unsustainable



A rapid transition in energy systems is essential to meet global climate-crisis goals

In pathways which limit global warming to 1.5°C, CO₂ emissions fall to net zero globally around 2050. This includes the full decarbonisation of the electricity sector



Source: Carbon Brief; European Climate; IPCC; Generation

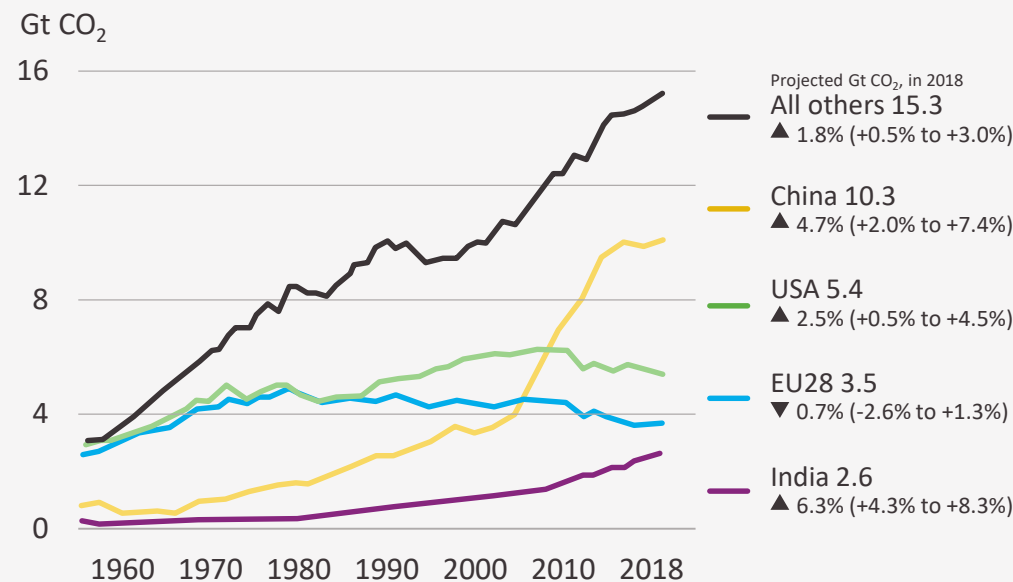


The global energy system remains deeply unsustainable

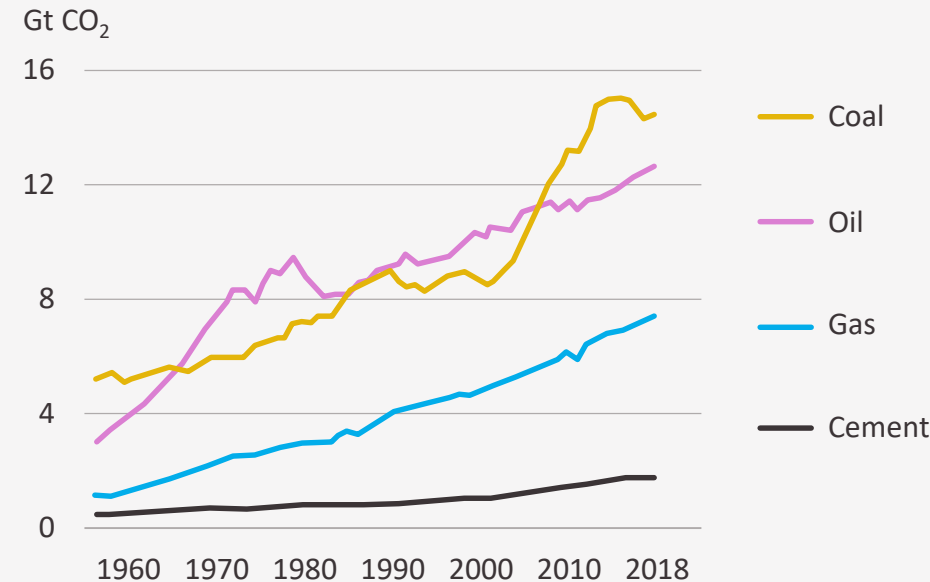


We are not on track. Global greenhouse-gas emissions continue to rise, with record emissions in 2018. In 2018 coal consumption rose by 1.4%

Fossil CO₂ emissions, 1960-2018



Global CO₂ emissions by energy, 1960-2018



Source: CDIAC; GCP; UNFCCC; BP; USGS; Generation

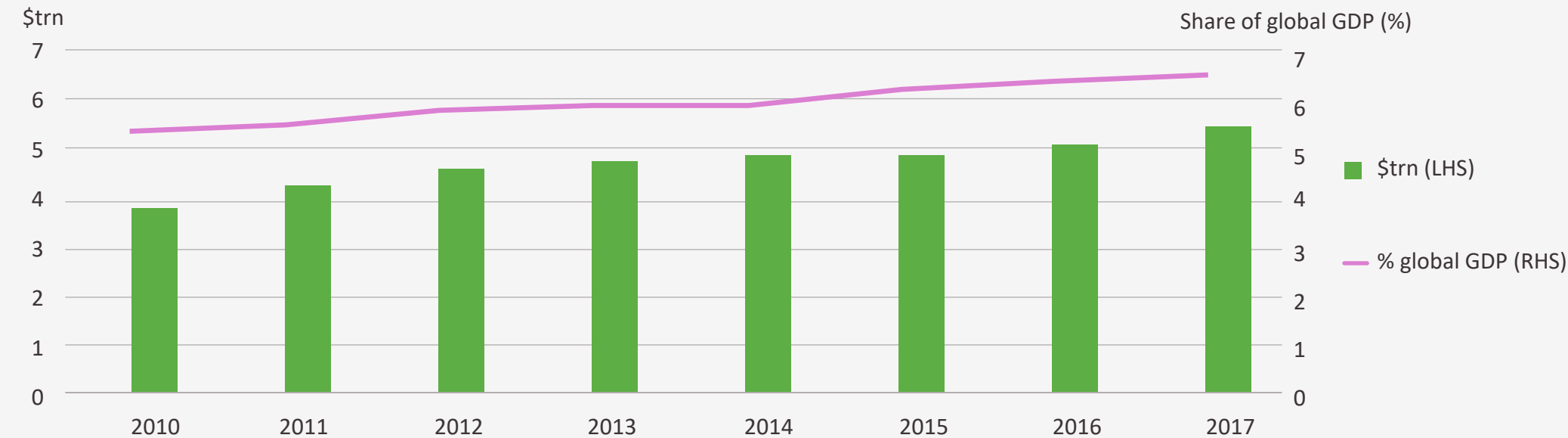


The global energy system remains deeply unsustainable



Government support for fossil fuels is still rising. These subsidies are worth about 7% of global GDP. Subsidies to renewables are small in comparison

Fossil-fuel subsidies*, global, 2010-17



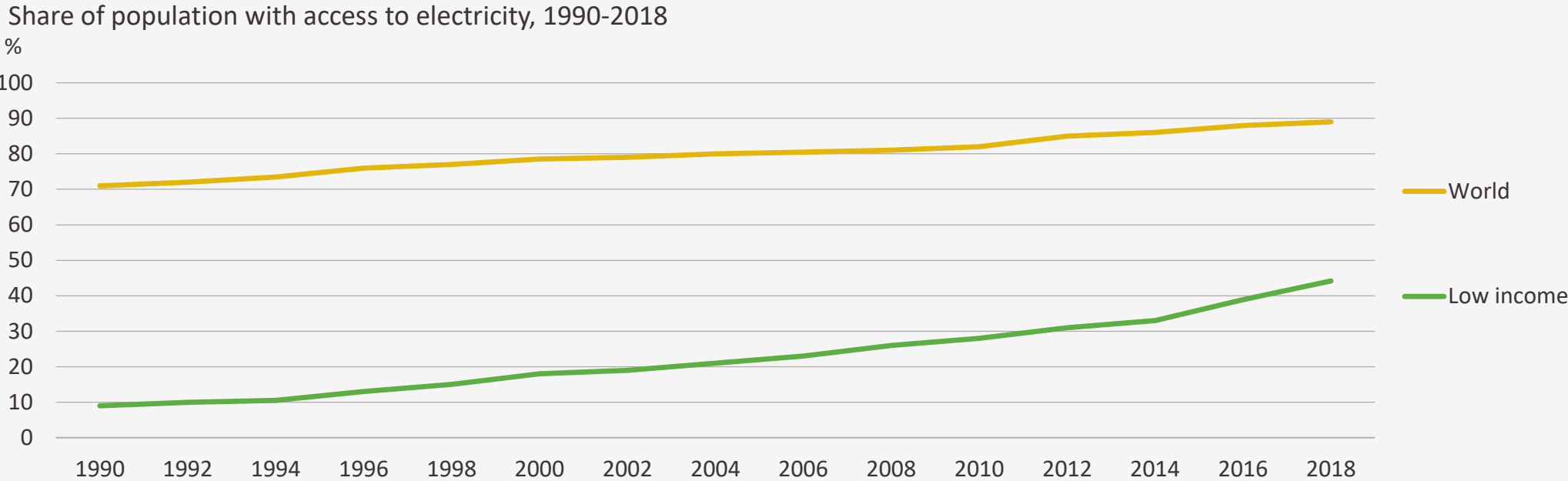
Source: Coady, David, Ian Parry, Nghia-Piotr Le, and Baoping Shang. *Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates*. No. 19/89. International Monetary Fund, May 2019; IEA; Generation.
* Measured on a “post-tax” basis. According to the IMF, post-tax subsidies “reflect[...] differences between actual consumer fuel prices and how much consumers would pay if prices fully reflected supply costs plus the taxes needed to reflect environmental costs and revenue requirements.”



The global energy system remains deeply unsustainable



Access to modern energy services is improving quickly but there is a long way to go



Source: World Bank; Generation

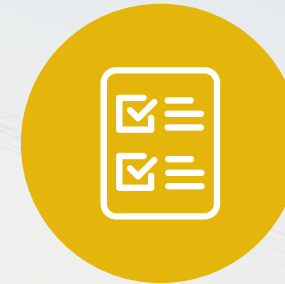
A sustainable energy system is characterised by:



Clean energy that
is cheaper than
fossil energy



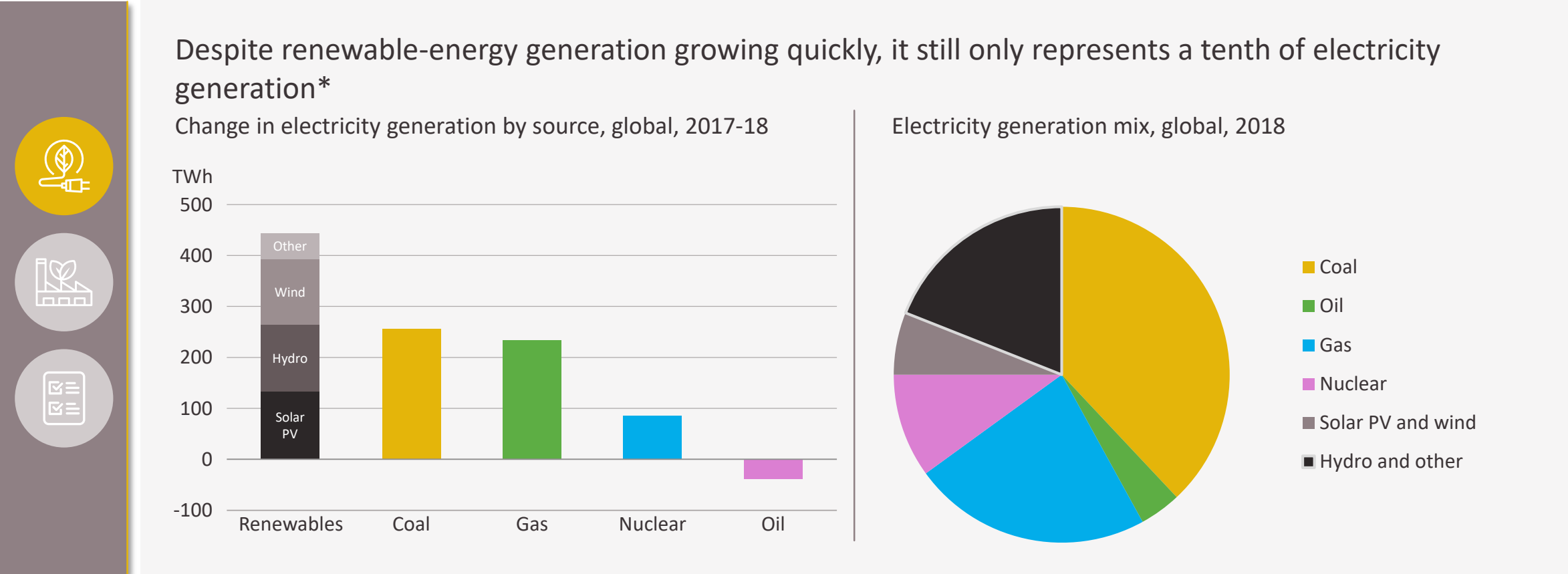
Net carbon-
negative buildings



Adoption of
natural carbon
sinks at scale



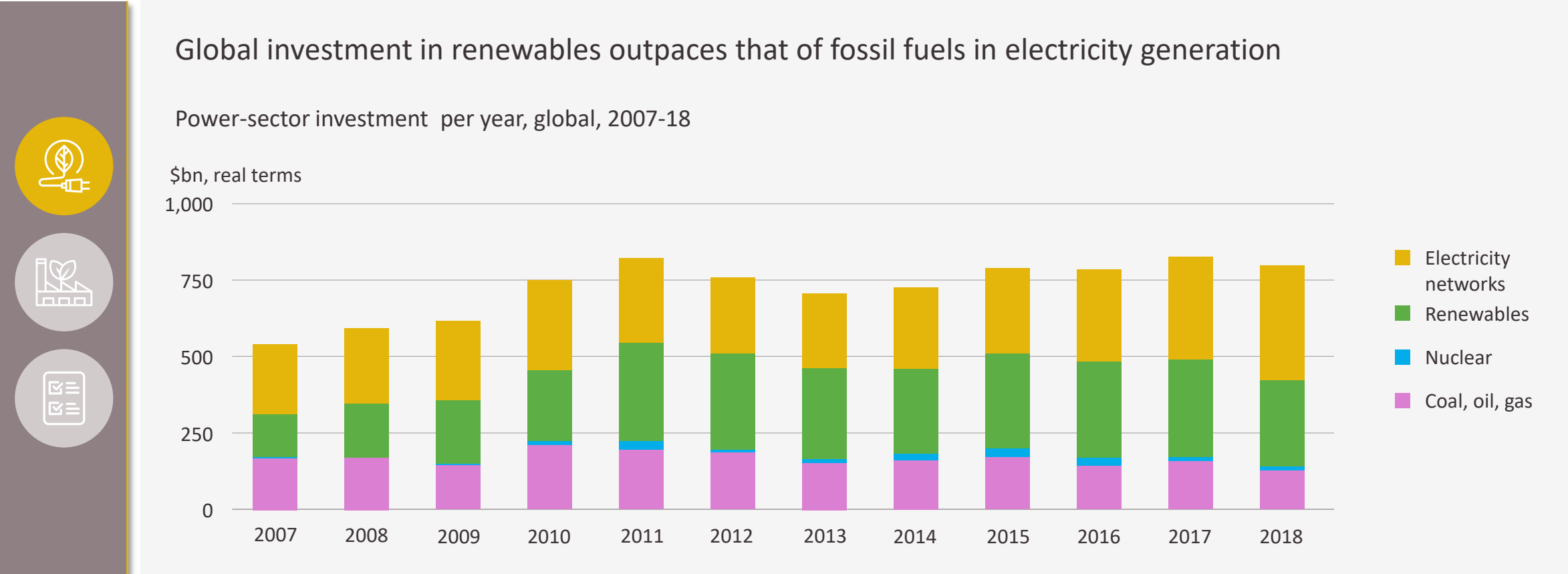
Renewable energy is highly competitive and continues to scale



Source: International Energy Agency
* Excluding hydro, where there is debate about whether it is a renewable energy or not



Renewable energy is highly competitive and continues to scale



Source: IEA; Generation



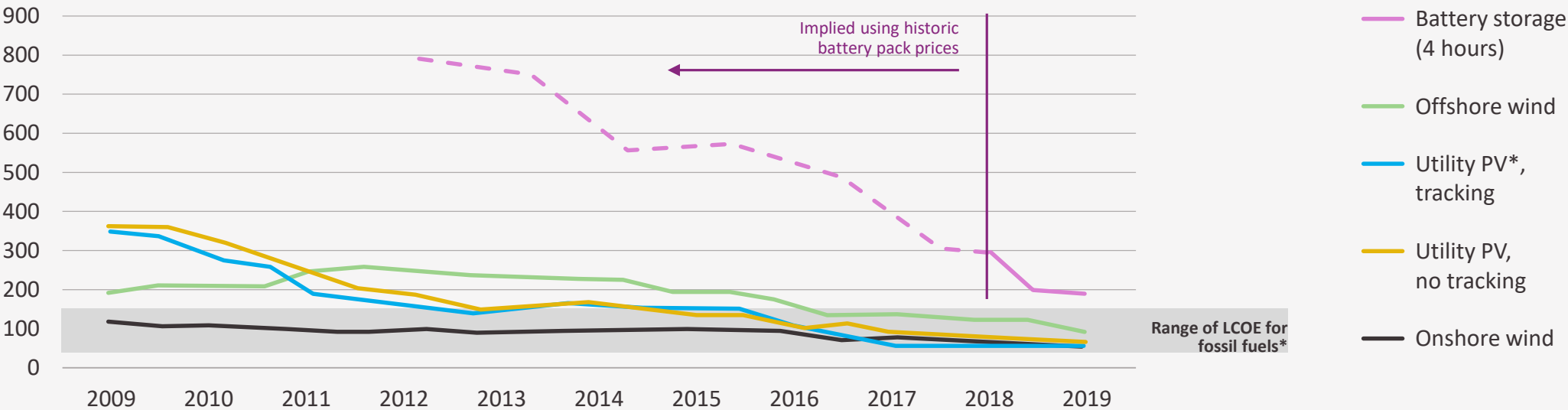
Renewable energy is highly competitive and continues to scale



The cost of many renewable energies is falling rapidly, and is competitive with fossil-fuel generation

Levelised cost of energy, by energy technology, 2009-19

LCOE (\$/MWh, 2018 real)



Source: Bloomberg New Energy Finance; IRENA; Generation
* Photovoltaic

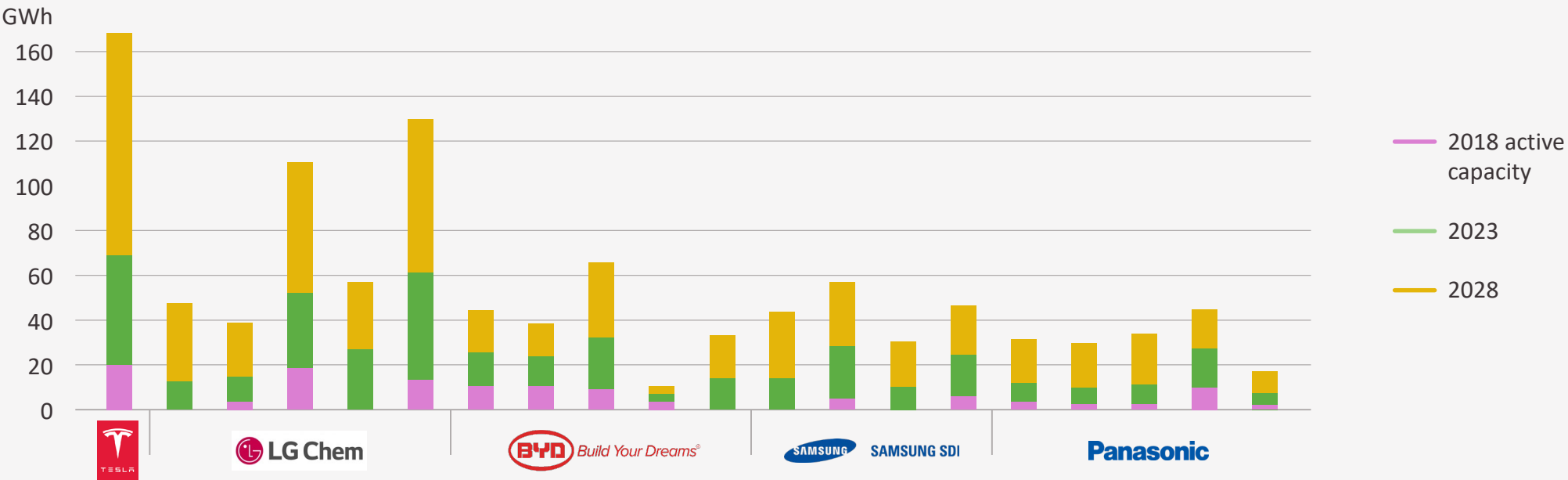


Renewable energy is highly competitive and continues to scale



Energy-storage technology is improving rapidly, with massive battery capacity additions planned. By 2028 it is estimated that 1.54TWh of capacity will be active

Build-out of lithium-ion battery capacity from 2018-28, plant by plant, by company, 2018 estimate



Source: Benchmark Mineral Intelligence
Bloomberg New Energy Finance forecasts that the global energy storage market will grow to a cumulative 942GW/2,857GWh by 2040, attracting \$620 billion in investment over the next 22 years.

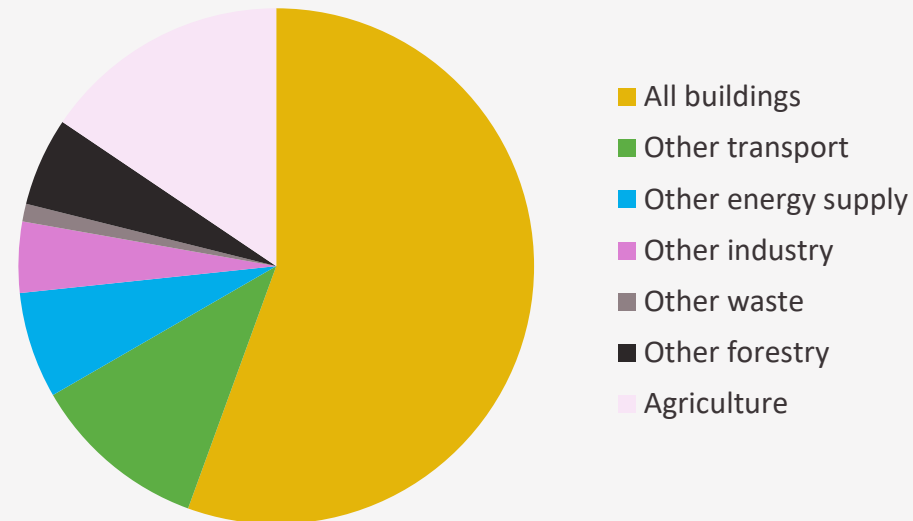


More efficient and smarter buildings can save significant amounts of energy



Either directly or indirectly, buildings contribute roughly half of total greenhouse gas emissions

Share of global CO2 emissions attributed to buildings*, 2018 estimate



Source: Meggers, Forrest, Hansjürg Leibundgut, Sheila Kennedy, Menghao Qin, Mike Schlaich, Werner Sobek, and Masanori Shukuya. "Reduce CO2 from buildings with technology to zero emissions." Sustainable Cities and Society 2, no. 1 (2012); Architecture 2030; Generation

* Once sectors that are partially results of building sector demand are accounted for.

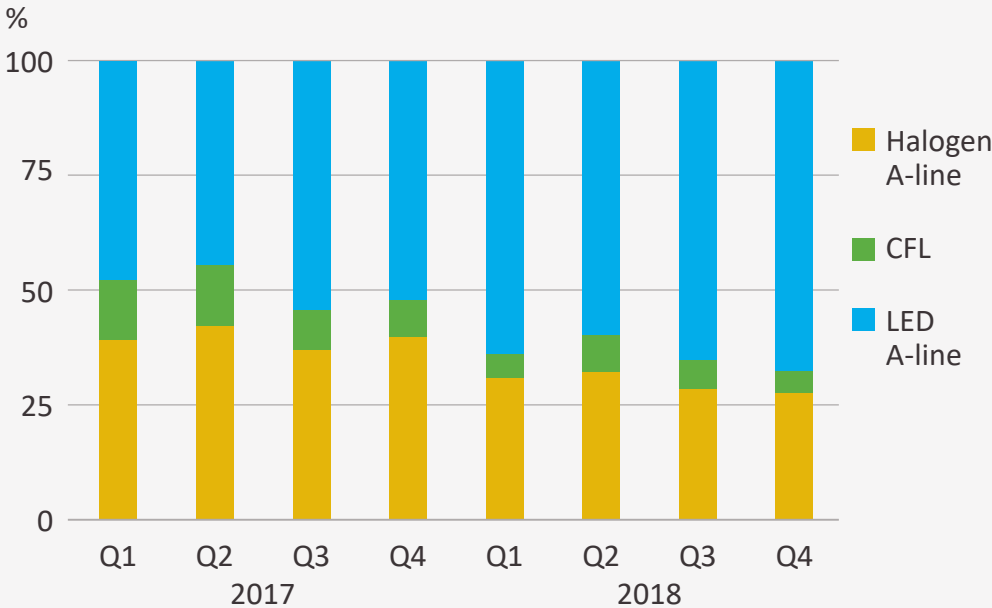


More efficient and smarter buildings can save significant amounts of energy

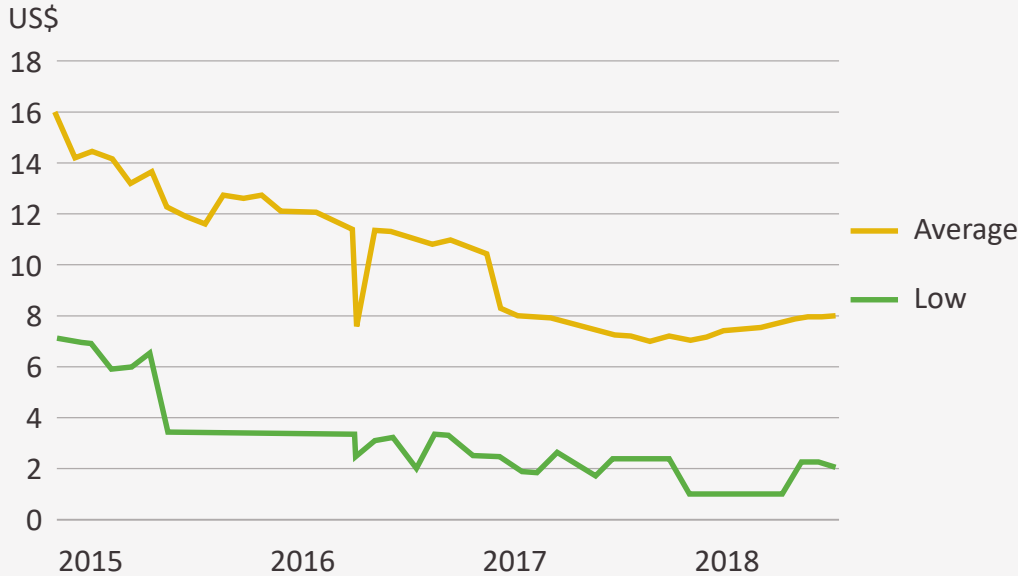


There are improvements in building design, especially lighting. LEDs now represent two-thirds of the US market and their costs have dropped by half since 2015

Market penetration of LED A-line lightbulbs, US, 2017-18



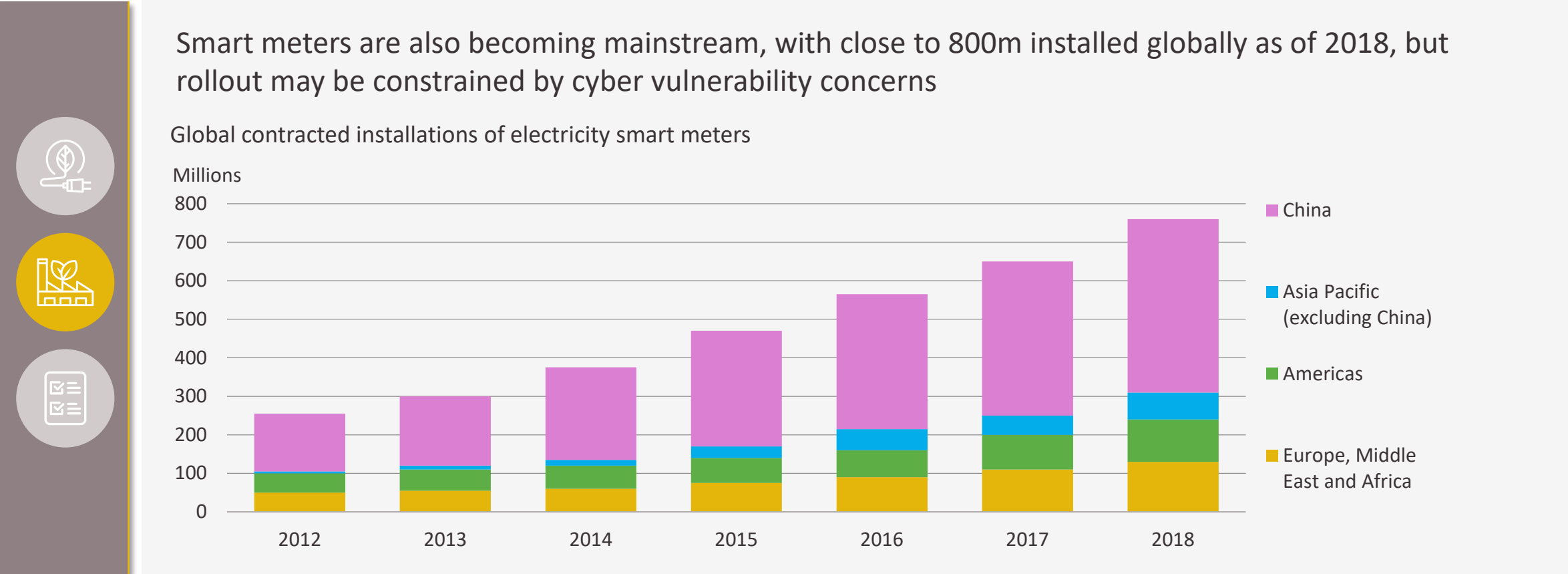
Retail price of LED lamps, US, 2015-18



Source: National Electrical Manufacturers Association; LEDinside



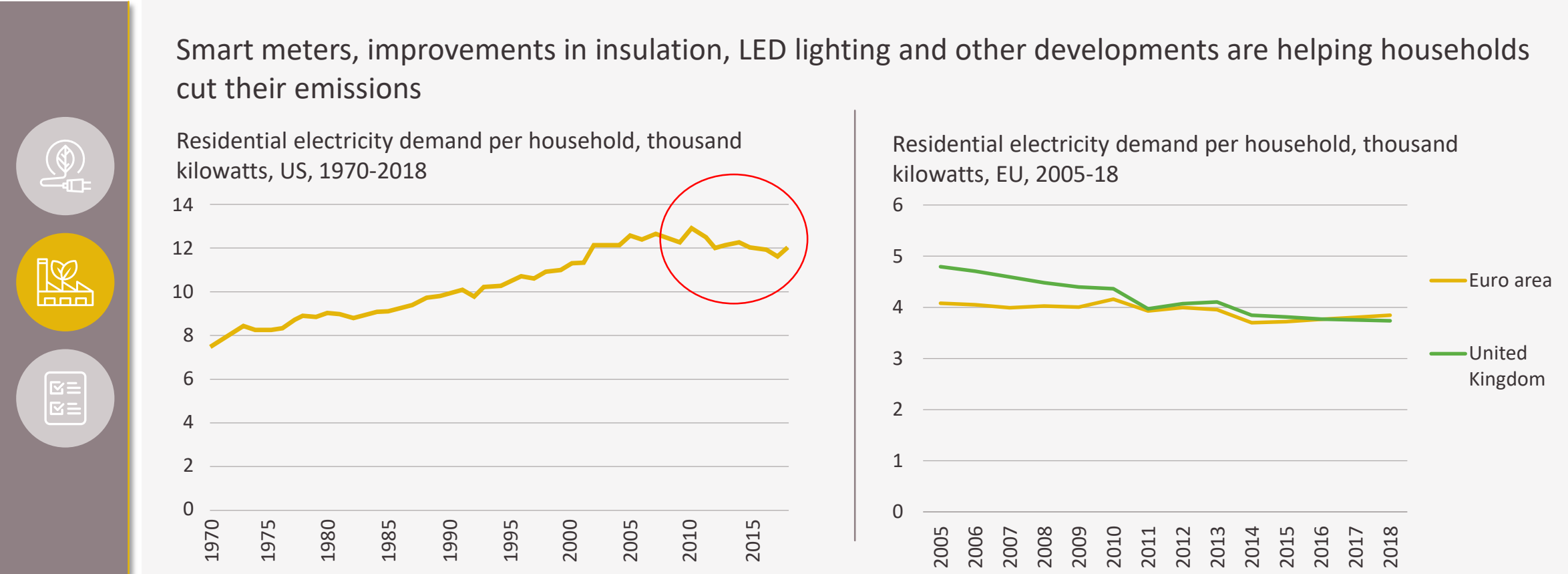
More efficient and smarter buildings can save significant amounts of energy



Source: IEA; GlobalData; Generation



More efficient and smarter buildings can save significant amounts of energy



Source: US Energy Information Administration; US Census Bureau; Eurostat; Generation

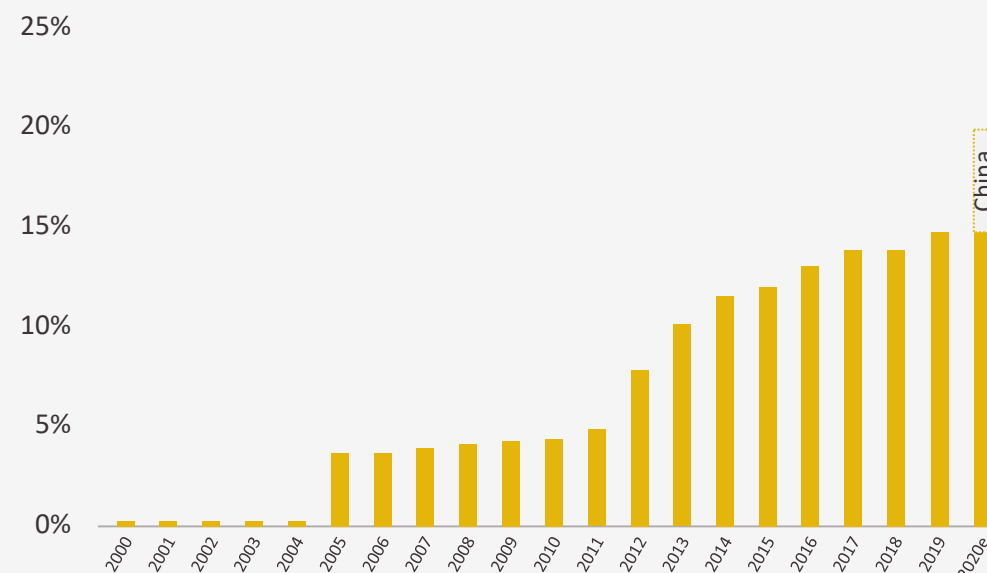


Policy is key to accelerating the transition to a sustainable energy system

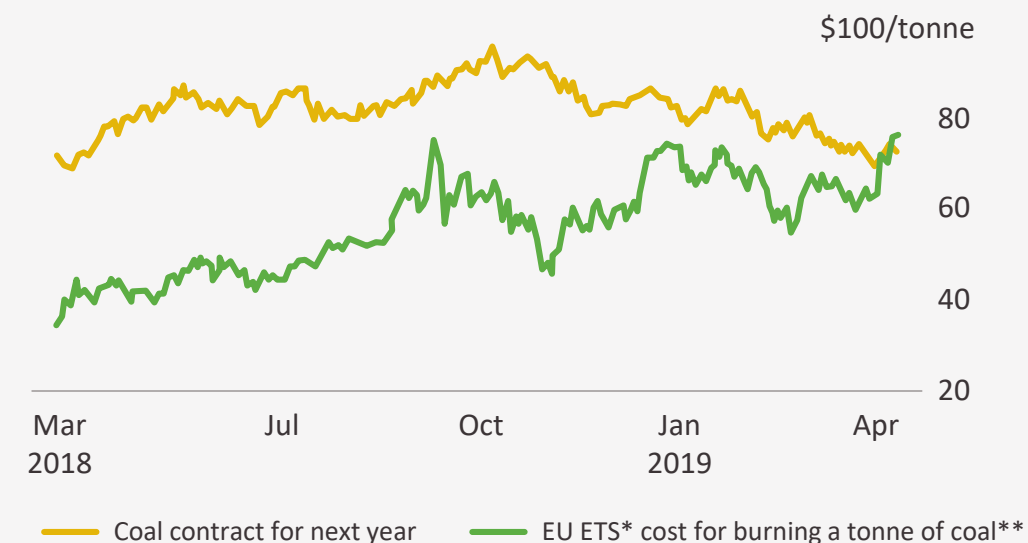


Around 20% of global CO₂ emissions are now priced, though often at too low a price to incentivise widespread behavioural change.

Share of global CO₂ emissions which are priced, 2000-2020e



Cost of burning a tonne of coal vs carbon price in EU, 2018-19*



Source: World Bank; Bloomberg

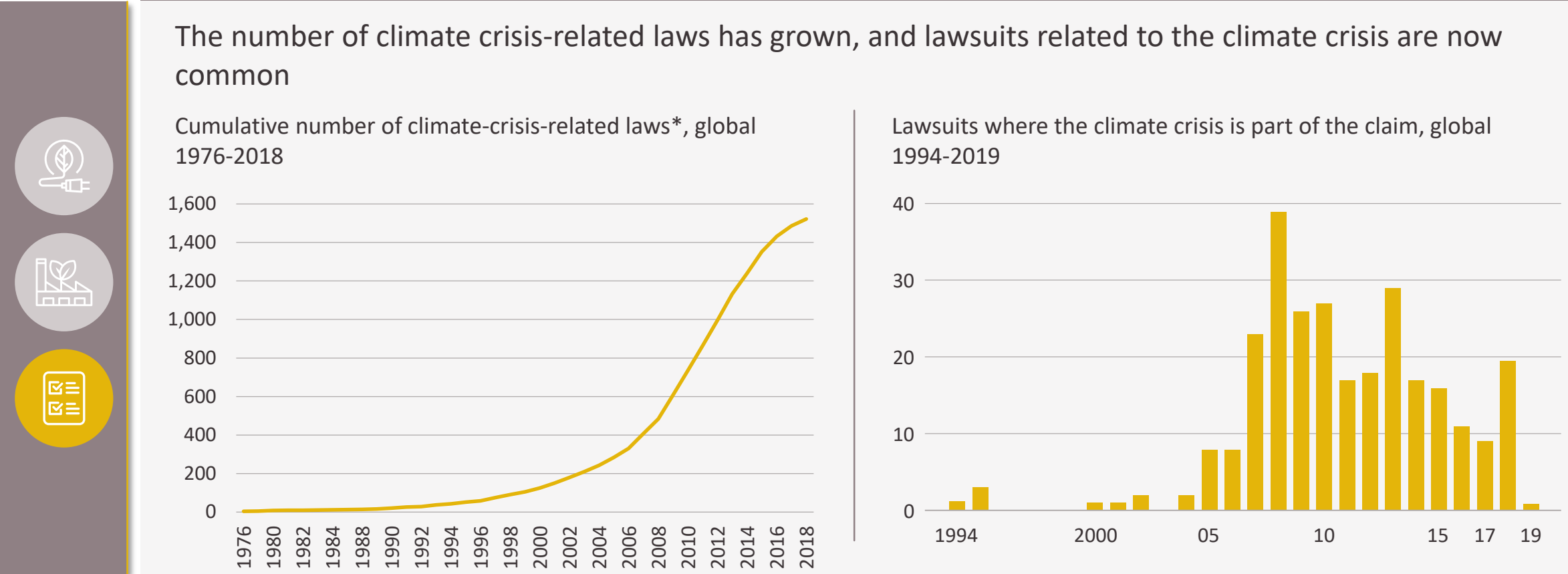
When burned, a tonne of coal will release about 2.6 tonnes of carbon dioxide

* EU emissions-trading system

** In other words, the economic value earned from burning a tonne of coal is now the same as the price you have to pay to have the right to do so.



Policy is key to accelerating the transition to a sustainable energy system



Source: Climate Change Laws of the World; Joana Setzer and Sabin Centre for Climate Change Law; Generation

* These are defined as: “national-level climate change legislation and policies globally. The database covers climate and climate-related laws, as well as laws and policies promoting low carbon transitions, which reflects the relevance of climate policy in areas including energy, transport, land use, and climate resilience.”

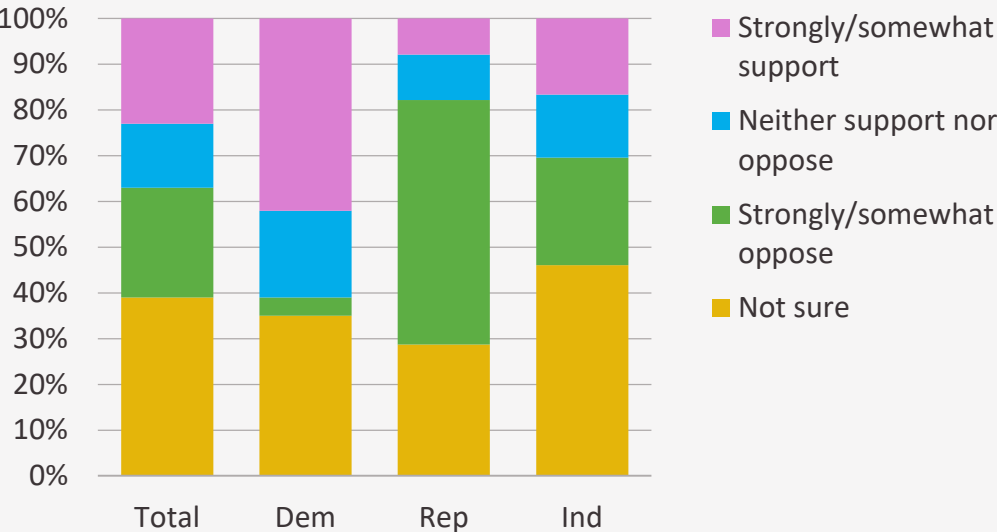


Policy is key to accelerating the transition to a sustainable energy system

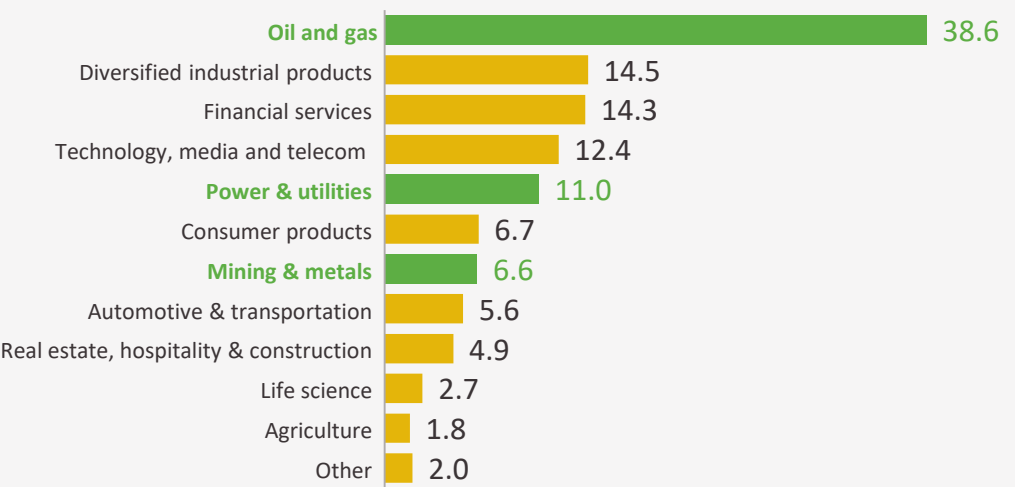


It is crucial that major infrastructure projects, such as the Belt & Road and the proposed Green New Deal, deliver on environmental promises. Investments in the BRI are still focused on high carbon sectors

Support for the Green New Deal among registered voters



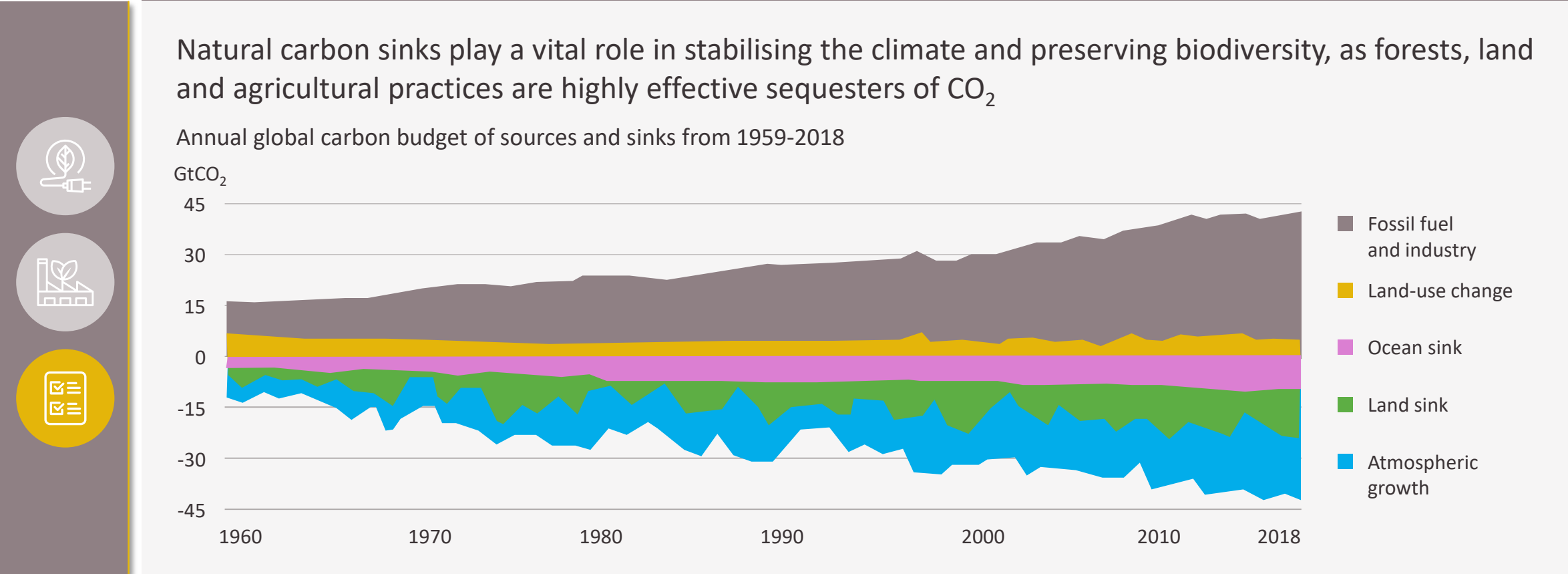
Value of China’s M&A activity in “Belt & Road” countries, 2005-16, \$bn*



Source: YouGov (survey conducted February 10-12, 2019); Mergermarket; EY; Statista
* More recently China has accepted the need to make this initiative more sustainable



Policy is key to accelerating the transition to a sustainable energy system



Source: Centre for International Climate And Environmental Research (CICERO)

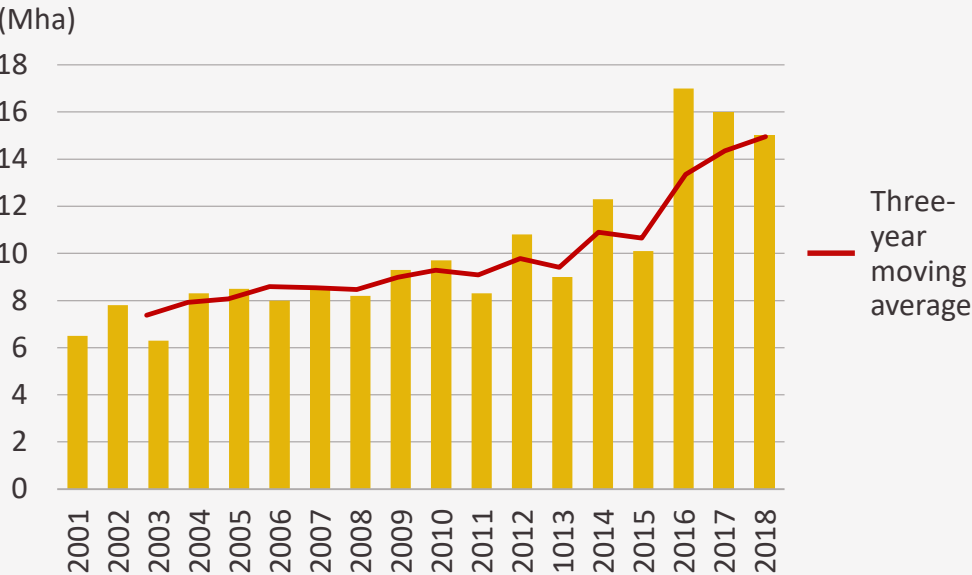


Policy is key to accelerating the transition to a sustainable energy system

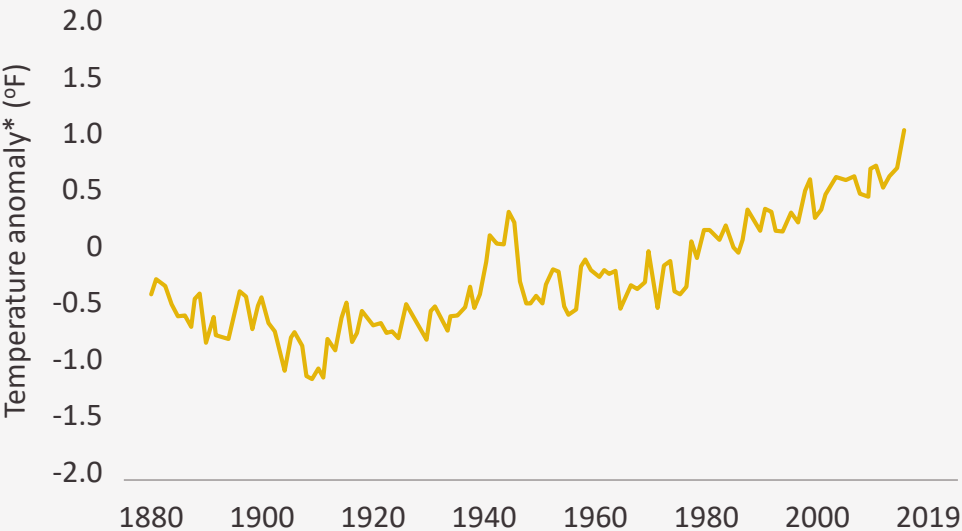


Policymakers therefore need to encourage natural carbon sinks, but the world is moving in the other direction. As sea-level temperatures rise, the oceans can absorb less carbon dioxide

Global tropical tree-cover loss

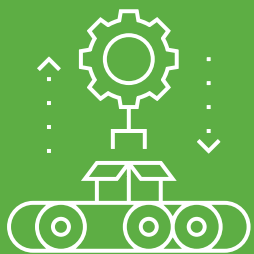


Average sea-level temperature, 1880-2018*



Source: World Resources Institute; EPA; Generation

* A temperature anomaly is the difference from an average, or baseline, temperature



Industry

Section summary

On present trends the production of goods and services poses a risk to a sustainable world. Resource-extraction leaves some ecosystems facing existential risk. Energy emissions are a major contributor to the climate crisis.

In 2018-19, however, there were signs that some companies are taking a new approach. Food and agriculture firms are exploring new ways of producing crops that combine high yields with low environmental damage. More firms are using raw materials in a more considered way. And for the first time ever there is real momentum behind meaningful action to reduce waste.

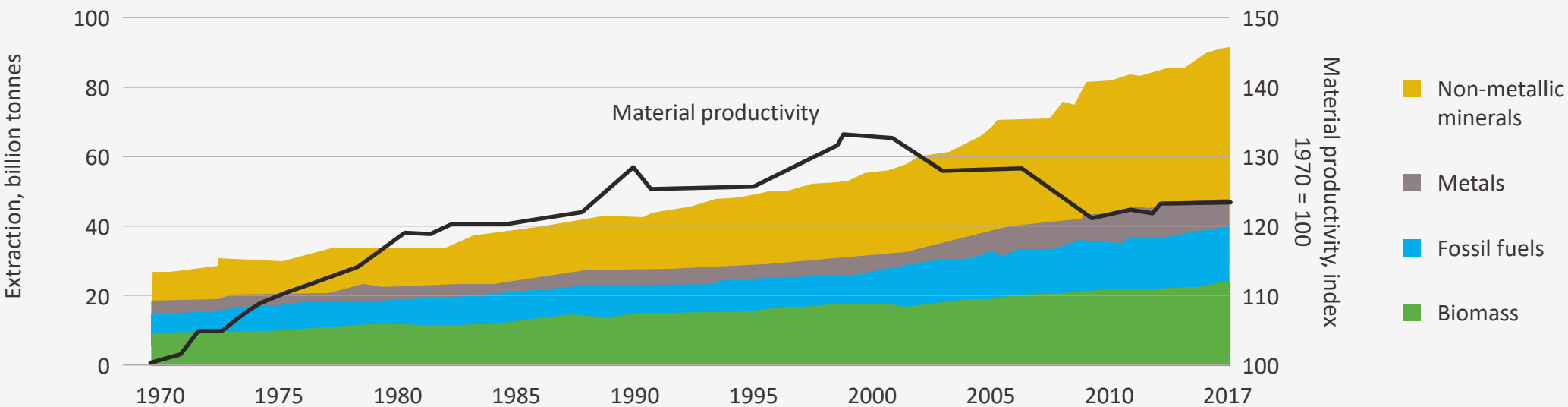


Today’s industrial systems are far from sustainable



Material extraction continues to rise

Global material extraction, four main material categories, 1970-2017



Source: International Resource Panel

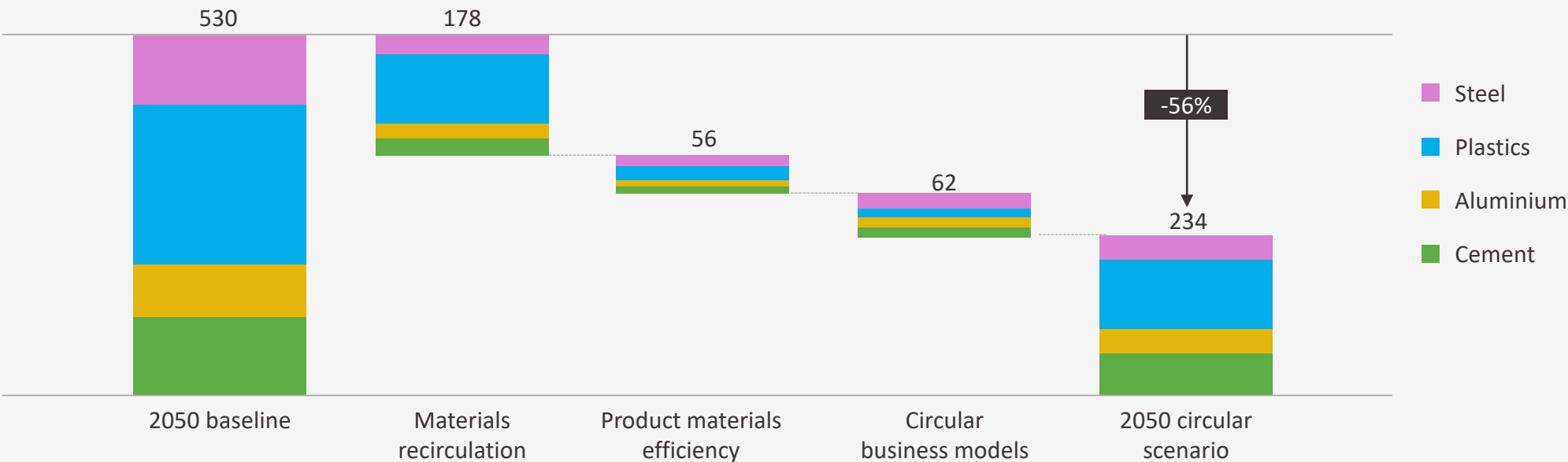


Today's industrial systems are far from sustainable



A more circular approach to production and consumption could cut material use while creating new economic opportunities

EU emissions reduction potential from a more circular economy, 2050 (Mt of carbon dioxide per year)



Source: Material Economics

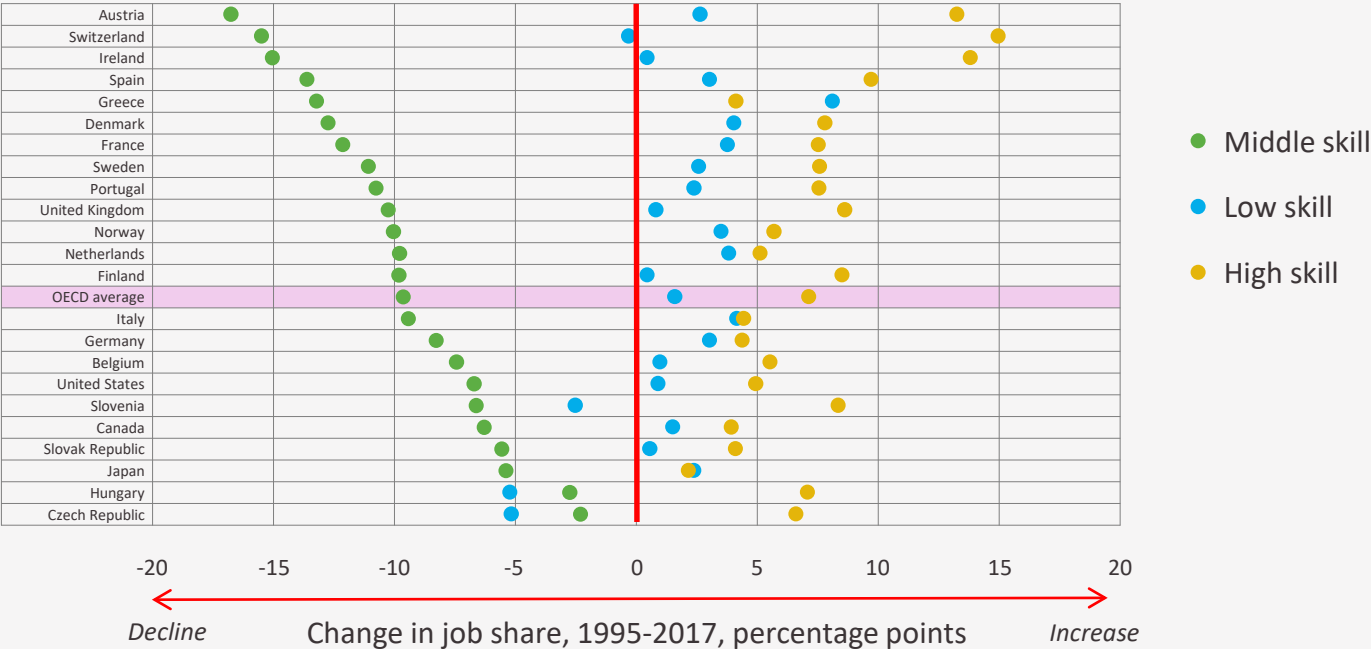


Today's industrial systems are far from sustainable



Any transition away from unsustainable industrial systems must be fair. Middle-skill jobs in manufacturing and industry have been hit hard in recent years, potentially leading to the rise of populism

Job polarisation in OECD countries, 1995-2017. Middle-skill jobs have fallen as a share of overall employment



Source: OECD; Generation

Sustainable industrial systems are characterised by...



A fair transition to
new industrial
models



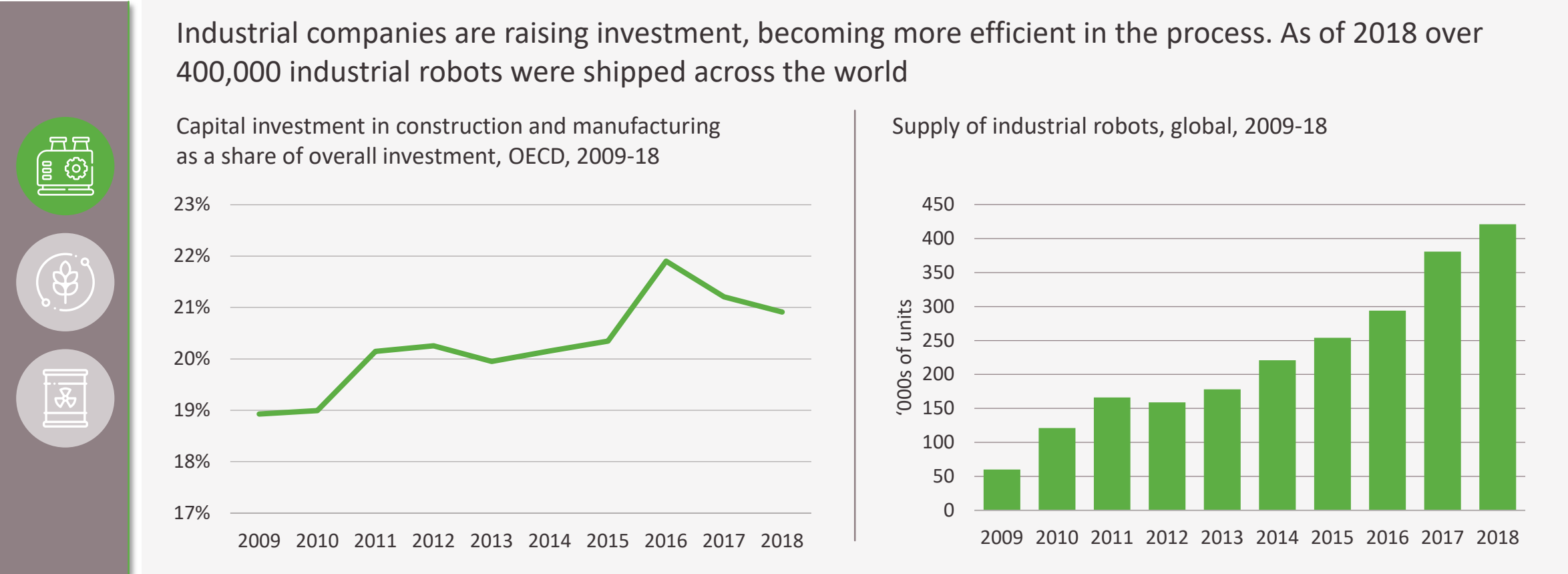
Food systems
shifting towards
becoming more
sustainable



Better
management of
waste



There is a shift towards industrial models which are more productive and less resource-intensive



Source: OECD; International Federation of Robotics; Generation

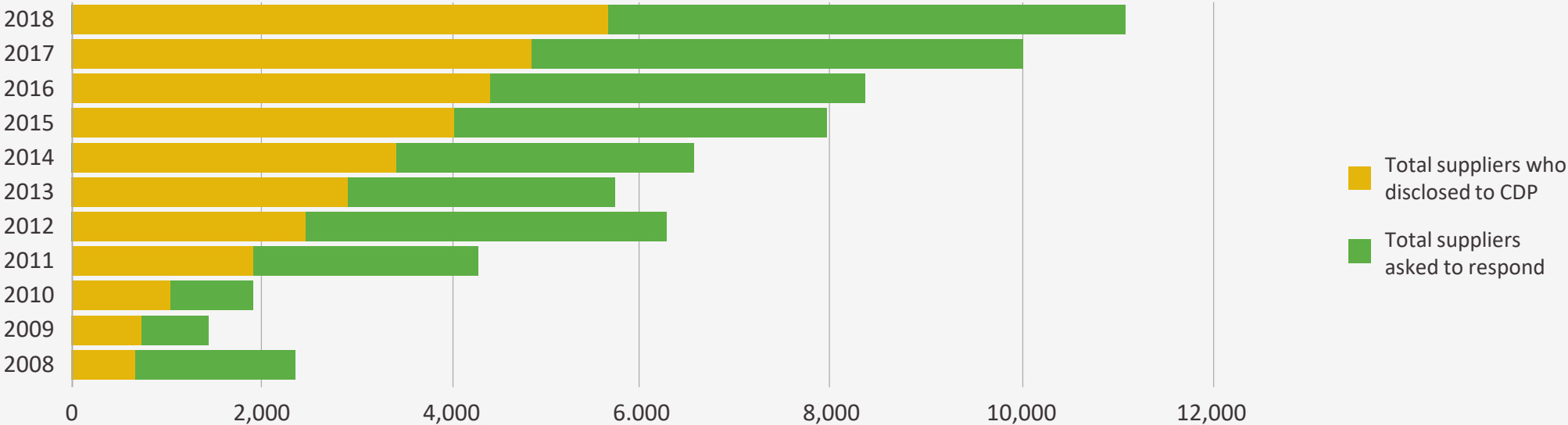


There is a shift towards industrial models which are more productive and less resource-intensive



More firms are making supply-chain disclosures, meaning that they report on efforts to reduce their usage of water and production of greenhouse gases

CDP supply-chain disclosures, global, 2008-18*



Source: Carbon Disclosure Project

* To date, 47 members of the CDP Supply Chain programme have either set or committed to set their own science-based target, with most of these including a scope 3 goal to reduce supply chain emissions

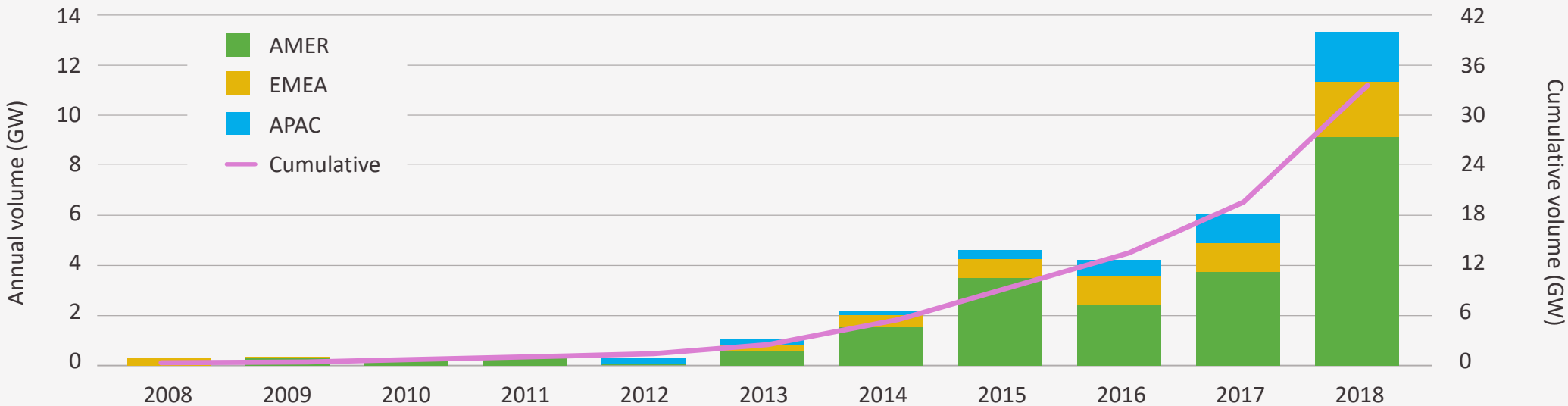


There is a shift towards industrial models which are more productive and less resource-intensive



And more firms are using clean power in their supply chains. Close to 200 RE100** companies have made a commitment to go 100% renewable

Corporate purchases of clean power, 2008-18*



Source: Bloomberg New Energy Finance

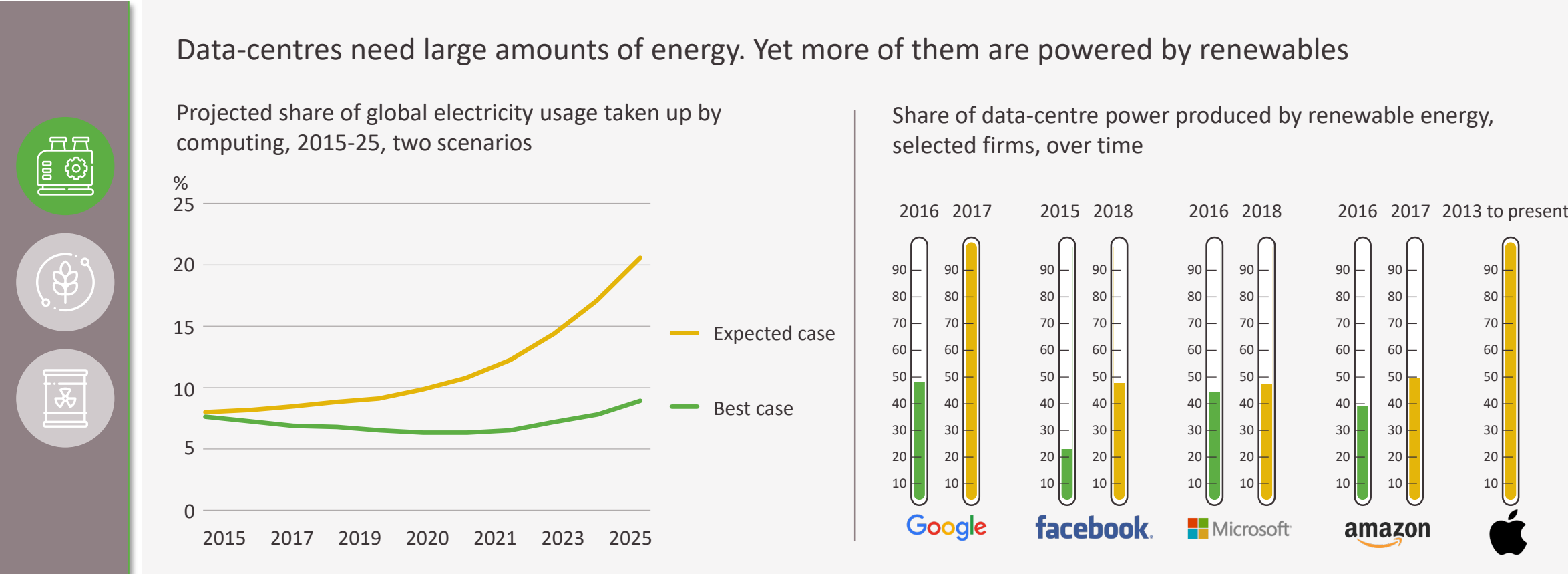
AMER = Americas; EMEA = Europe, Middle East and North Africa; APAC = Asia Pacific

* The 2018 figure is an amount comparable to the generation capacity of the Netherlands

** RE100 is a global corporate leadership initiative bringing together influential businesses committed to 100% renewable electricity.



There is a shift towards industrial models which are more productive and less resource-intensive



Source: Huawei; IHS Markit; Generation

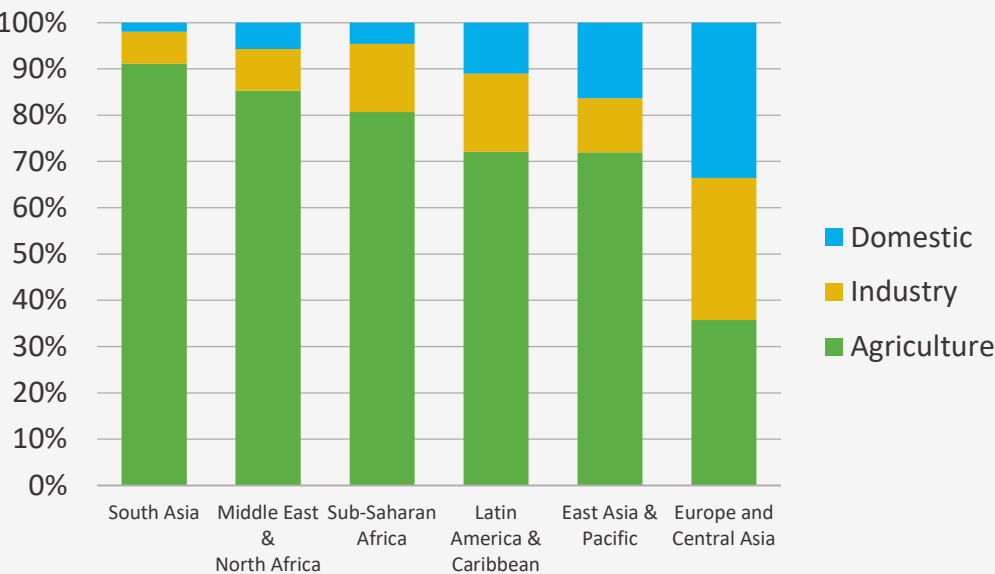


Food systems are shifting towards becoming more healthy and sustainable

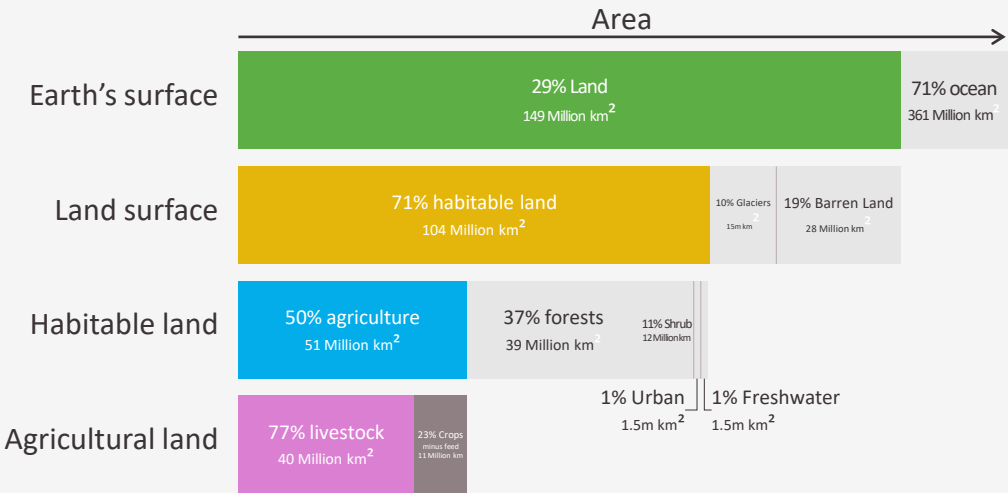


Agriculture consumes around two thirds of all fresh water globally and half of all habitable land

70% of freshwater is used for agriculture



Global surface area allocation for food production



Source: World Bank; Our World in Data; FAO



Food systems are shifting towards becoming more healthy and sustainable



Smarter solutions are needed to reduce the footprint of food. Ag-tech is providing insights on soil health and yields, and helping monitoring and verification of agriculture and forestry

Five use-cases of AI and robotics in agriculture



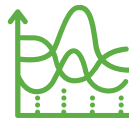
Analysing
satellite
images



In-field
monitoring



Assessing
crop/soil
health



Predictive
analytics



Agricultural
robots



Source: CB Insights

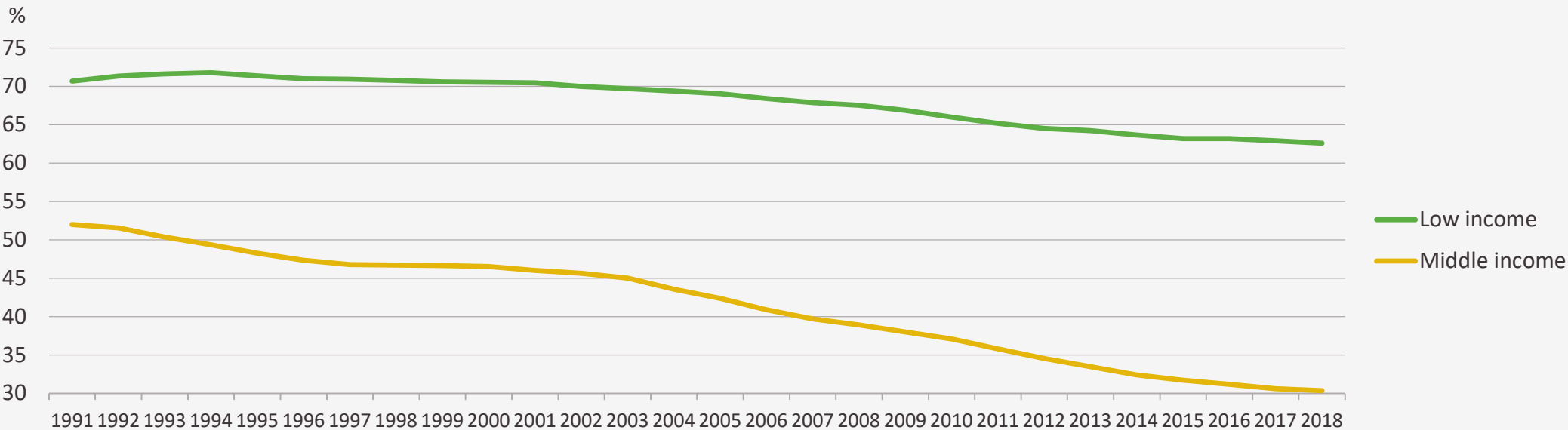


Food systems are shifting towards becoming more healthy and sustainable



The shift towards high-productivity agriculture could have benefits but also risks putting people out of work, especially those in poor countries

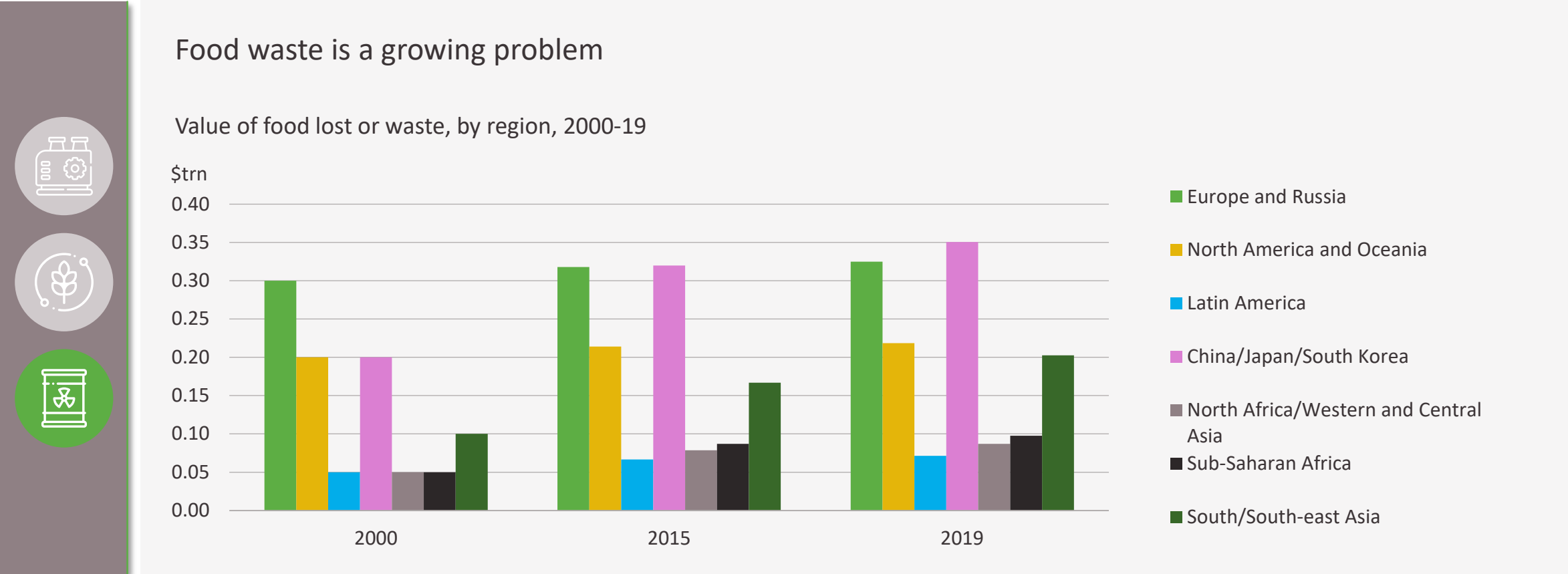
Share of labour force employed in agriculture, global, by country income group, 1991-2018



Source: World Bank



Innovation is needed to tackle the problem of waste



Source: BCG; Generation



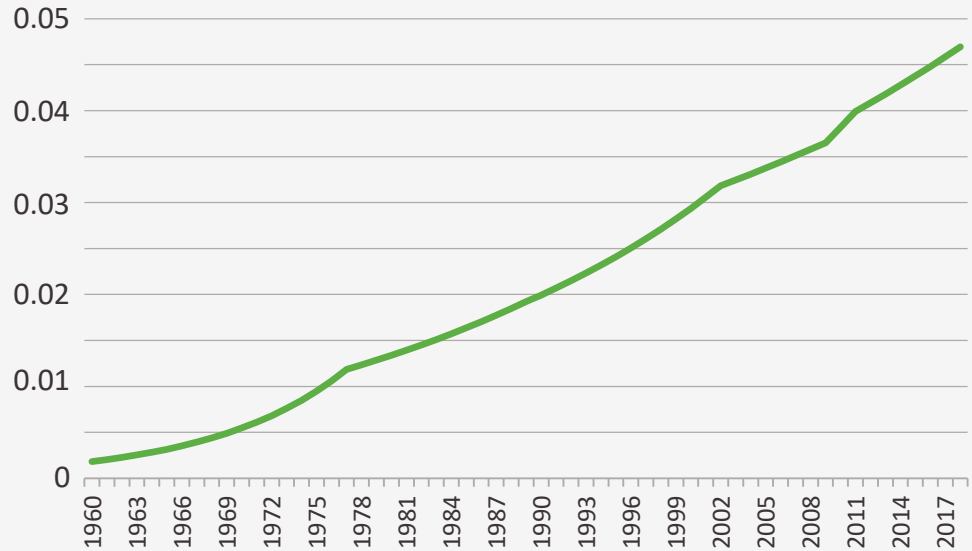
Innovation is needed to tackle the problem of waste



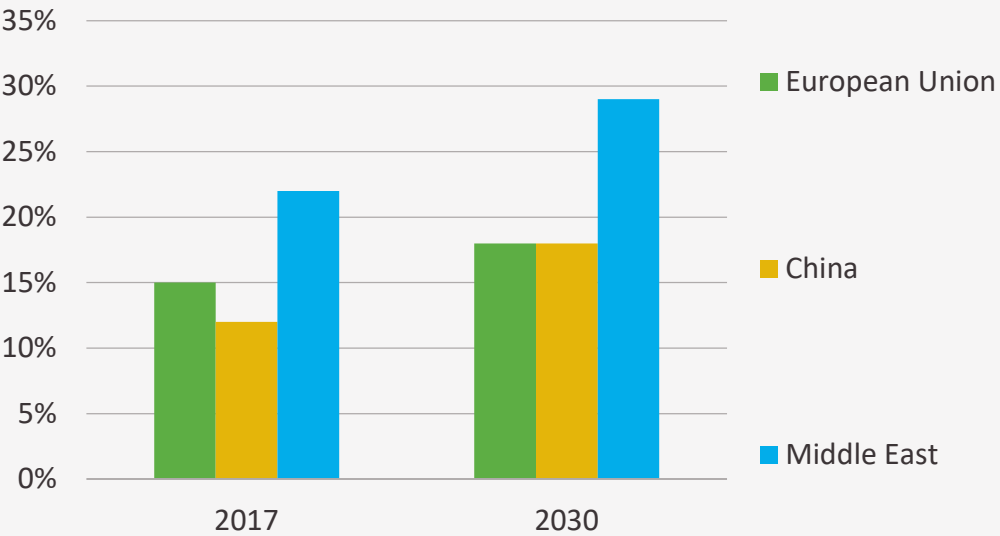
Plastic use continues to grow at unsustainable rates, despite awareness of the issue of plastics pollution

Global plastics production, 1950-2018

Tonnes per person



Projected share of total oil demand from plastics production, by world region, 2017-30



Source: Plastics Europe; IEA



Innovation is needed to tackle the problem of waste



Many companies are making strides to reduce plastics usage and waste

Participation of the largest (by revenue) fast-moving consumer goods (FMCG) firms, plastic packaging producers, and retail companies in the Global Commitment*, 2019 estimate

FMCG



1 Nestlé
2 Procter & Gamble
3 PepsiCo
4 Unilever
5 AB Inbev
6 JBS
7 Tyson Foods
8 The Coca-Cola Company
9 L'Oréal
10 Mars, Incorporated

Plastic Packaging

1 Reynolds
2 Amcor
3 Berry Global
4 Sealed Air Corporation
5 RPC Group
6 Bemis
7 ALPA Group
8 Interplast
9 Aptargroup Inc.
10 Silgan

Retail

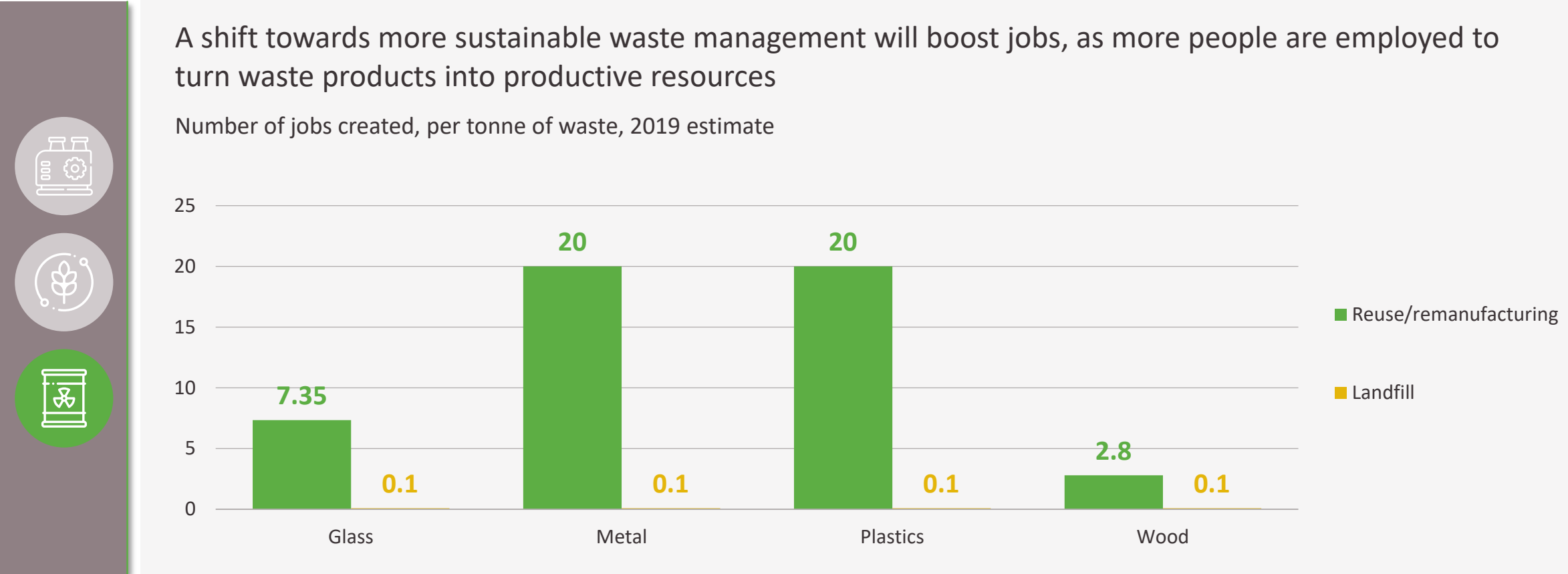
1 WalMart Inc.
2 Costco
3 The Kroger Co.
4 Schwarz Group
5 Walgreens Boots Alliance
6 Amazon.com, Inc.
7 Home Depot, Inc.
8 Aldi
9 Carrefour
10 CVS Health
11 Tesco PLC
12 Aeon Co., Ltd
13 Target
14 Ahold Delhaize
15 Lowe's Companies, Inc.

-  Has signed the Global Commitment
-  Has not signed the Global Commitment

SOURCE: Ellen MacArthur Foundation, March 2019.
*Companies making this commitment pledge to eliminate the plastic items we don't need; innovate so all plastics we do need are designed to be safely reused, recycled, or composted; and circulate everything we use to keep it in the economy and out of the environment.



Innovation is needed to tackle the problem of waste



Source: Tellus Institute and Sound Resource Management; *The Economist*; Generation

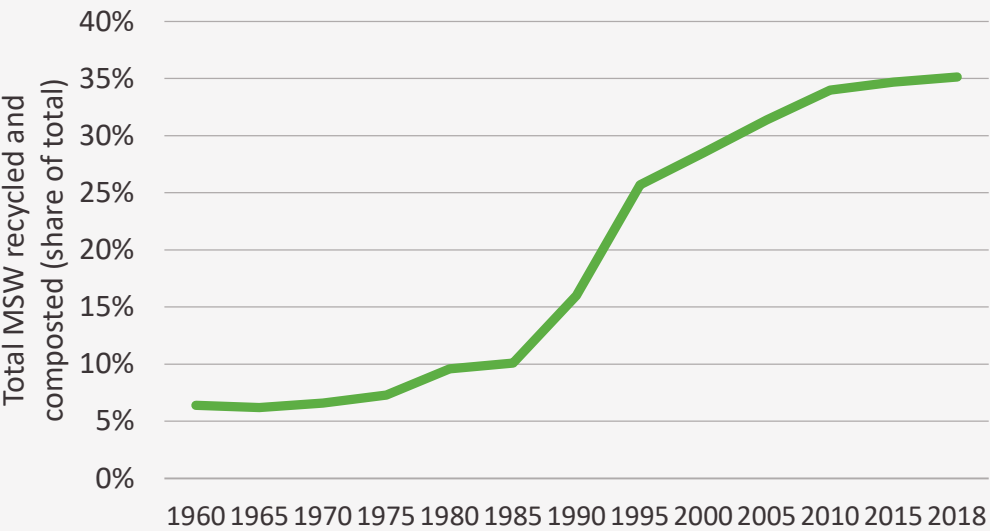


Innovation is needed to tackle the problem of waste

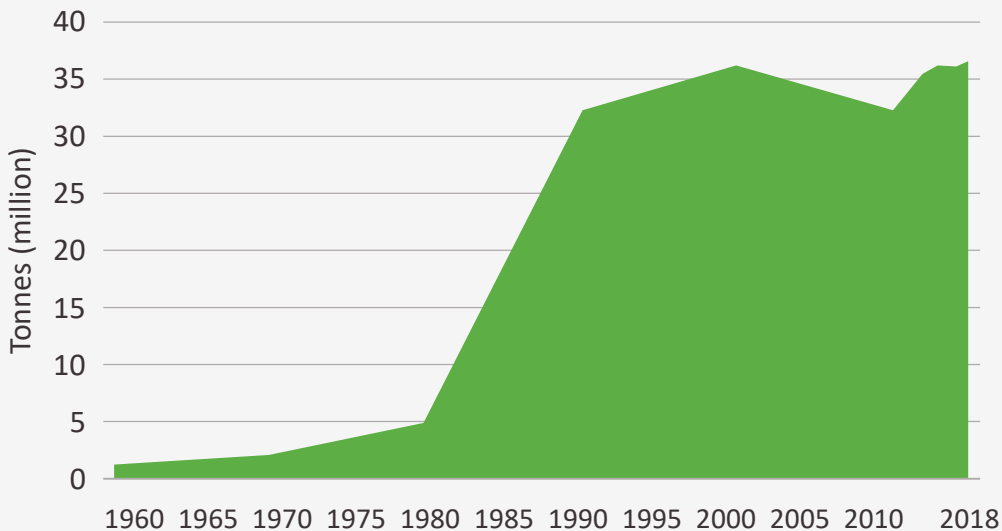


Rates of recycling and reuse have been on a long-term increase, but still only represent 35% for total municipal solid waste in the US

Municipal solid waste* (MSW) recycled and composted, US, 1960-2018



Combustion with energy recovery, US, 1960-2018



Source: Environmental Protection Agency; Generation
* This is more commonly known as “trash” or “garbage”



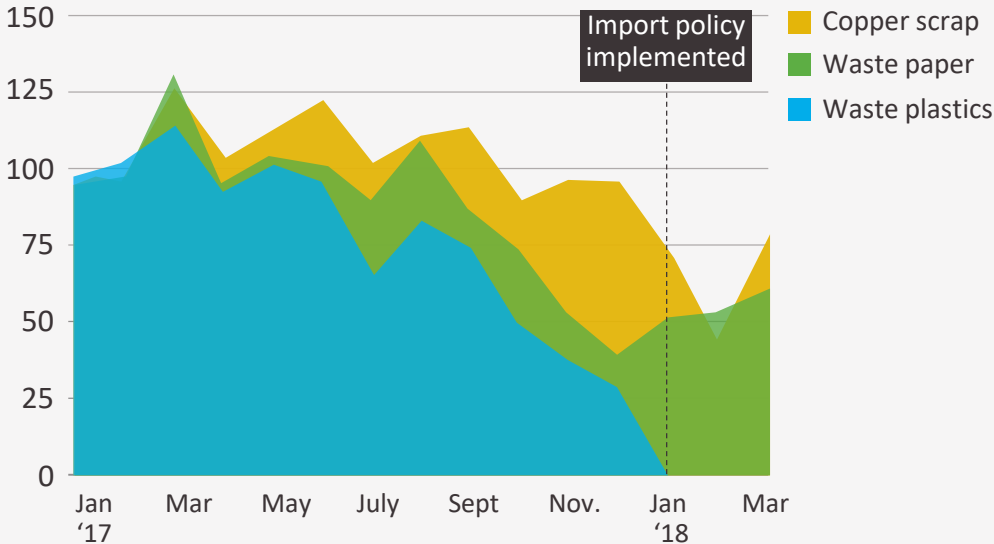
Innovation is needed to tackle the problem of waste



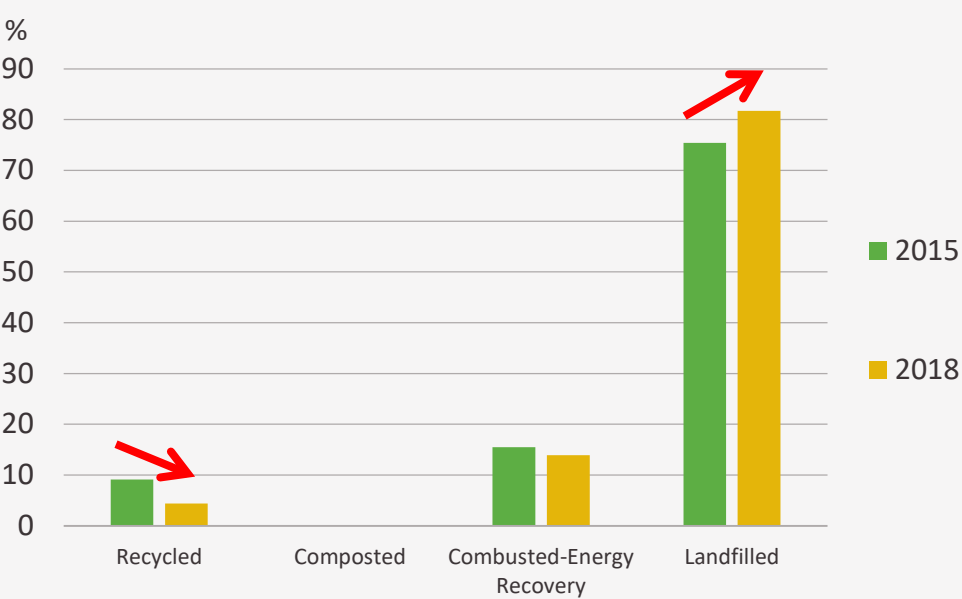
But there are signs that China’s ban on plastic imports is causing recycling trends to go into reverse*

Chinese imports of scrap material, Jan 2017 - March 2018

2016 monthly average = 100



Recycling rates of plastic, US, 2015 and 2018



Source: Global Trade Atlas; Plastic Pollution Coalition; Generation
* Other Asian countries are also exploring banning plastic imports

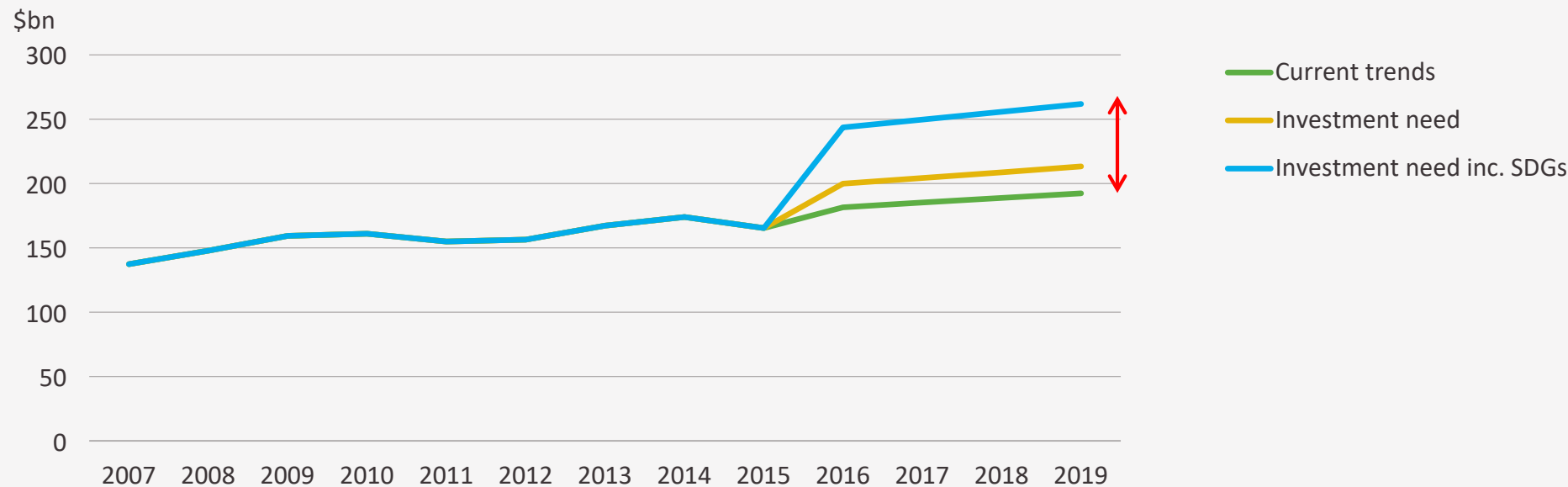


Innovation is needed to tackle the problem of waste



Some countries are investing heavily in waste management, though the world is at least \$50 billion a year short of what is required to meet sustainability goals

Infrastructure water and waste investment at current trends and need



Source: Global Infrastructure Hub



Mobility

Section summary

Transportation is a major source of global emissions, particularly as car ownership across the world continues to rise. The importance of a viable transportation system for social and economic opportunities cannot be overemphasised.

In some respects, global mobility is becoming less sustainable. The rise of ride-hailing may lead to higher congestion and urban sprawl. Public transport appears to be in decline. But there is good news too. Electric and biofuel-powered vehicles are increasingly cost-effective. Freight transport is using existing capacity more efficiently. More governments, especially those in cities, are accelerating that transition.

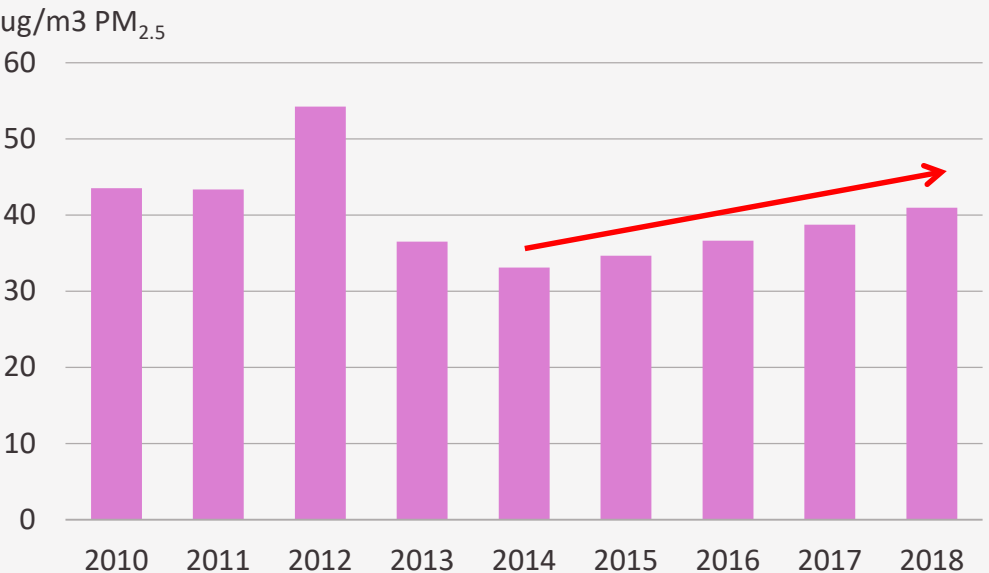


Today’s mobility systems undermine human health and are a major of source of greenhouse gases



Transport has a growing impact on air quality around the world, which poses a major, growing risk to human health

Estimated PM_{2.5} concentration across 4,000 global cities, 2010-18



Average life expectancy lost per person worldwide due to:



Source: WHO; AQLI Air Quality Life Index; Statista; Generation
Note: PM_{2.5} above 35.5 is considered unhealthy for sensitive groups

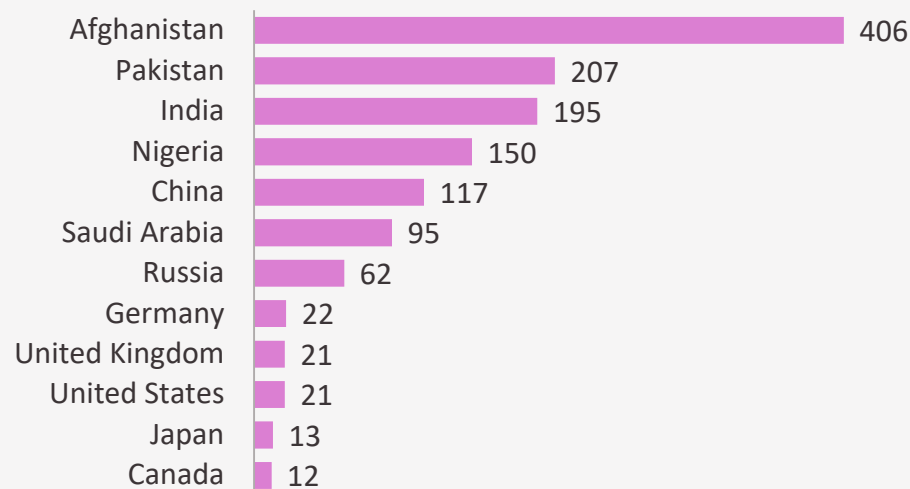


Today's mobility systems undermine human health and are a major source of greenhouse gases



Air quality has a huge impact on public health

Deaths from air pollution per year, per 100,000*



More than 90% of the world's children breathe toxic air every day

29 October 2018 | News release | Geneva

Source: World Health Organisation; Statista; Health Effects Institute, State of Global Air 2018

* Age-standardised, selected countries



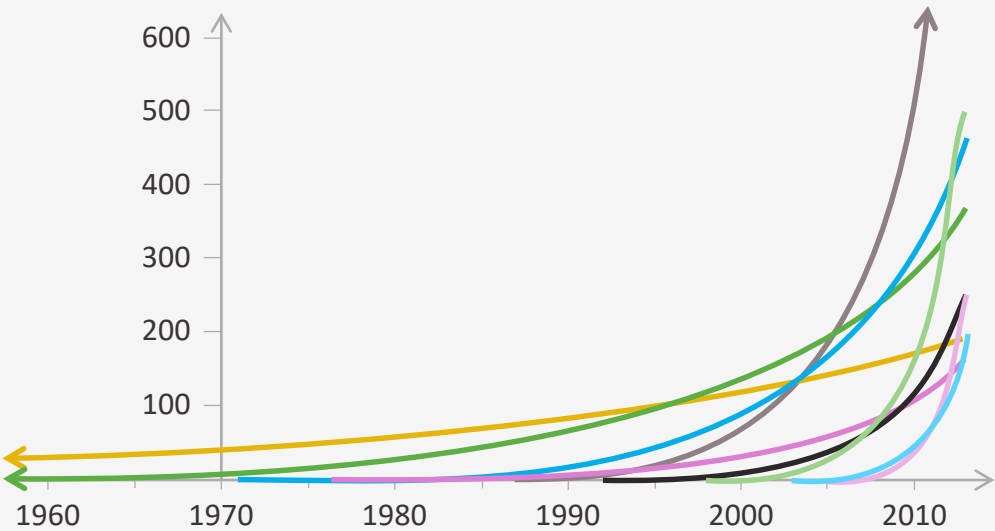
Today’s mobility systems undermine human health and are a major of source of greenhouse gases



Cities are emerging as the locus of radical action on transport

Number of cities adopting aspects of sustainable mobility, plus first city to adopt the measure

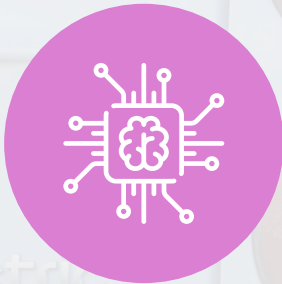
Number of cities



- Metro – 200+, 1863, London, UK**
- Car-free zones – 360+, 1953, Rotterdam, NL**
- Complete streets – 450+, 1971, Portland, USA**
- Bus rapid transit – 160+, 1974, Curitiba, Brazil**
- Car sharing – 1,000+, 1987, Zurich, Switzerland**
- Smart card – 250+, 1992, Oulu, Finland**
- Bike sharing – 500+, 1998, Rennes, France**
- Low emission zone – 200+, 2003, Tokyo, Japan**
- Google Transit web apps – 250+, 2005, Portland, USA**

Source: EMBARQ; Generation

A sustainable mobility system is characterised by:



Appropriate use
of autonomy and
alternative fuels



A decisive move
away from private
car ownership



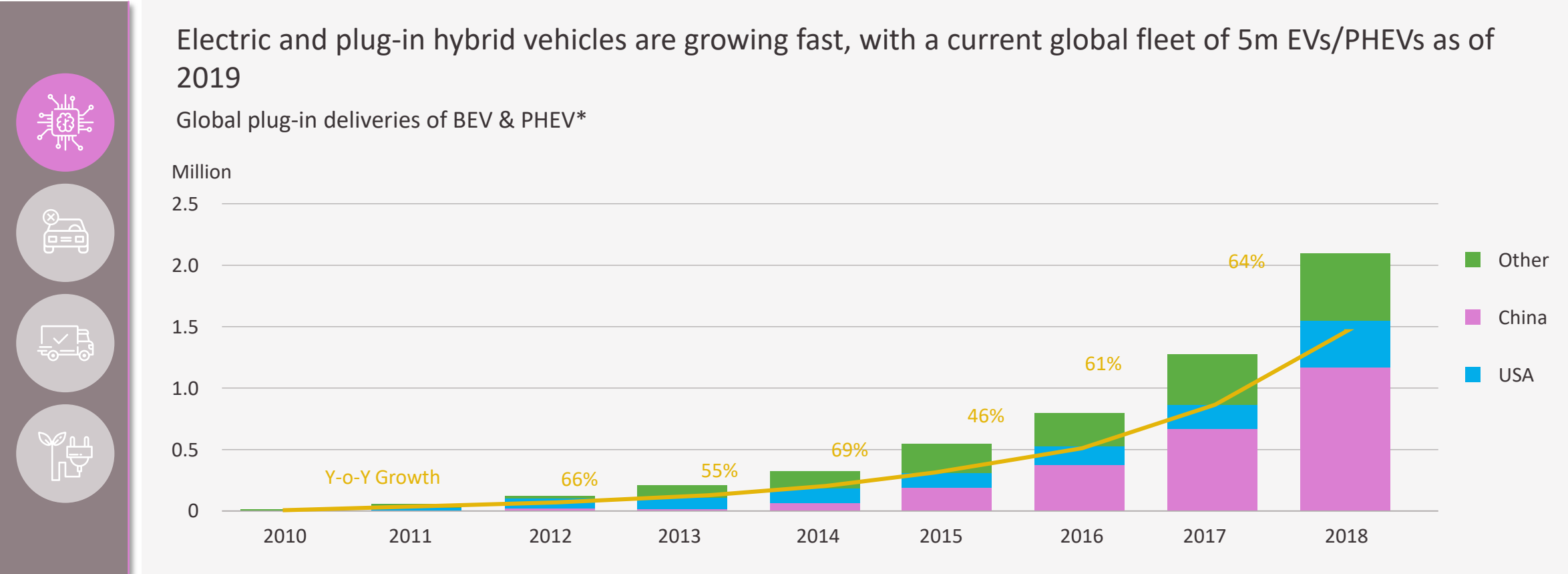
Infrastructure
which enables
more sustainable
choices



Regulations which
encourage
sustainable forms
of transport



The technology driving sustainable transportation is rapidly evolving



Source: ev-volumes.com
* BEV = Battery Electric Vehicle; PHEV = Plug-In Hybrid Car. Chart refers to light vehicles

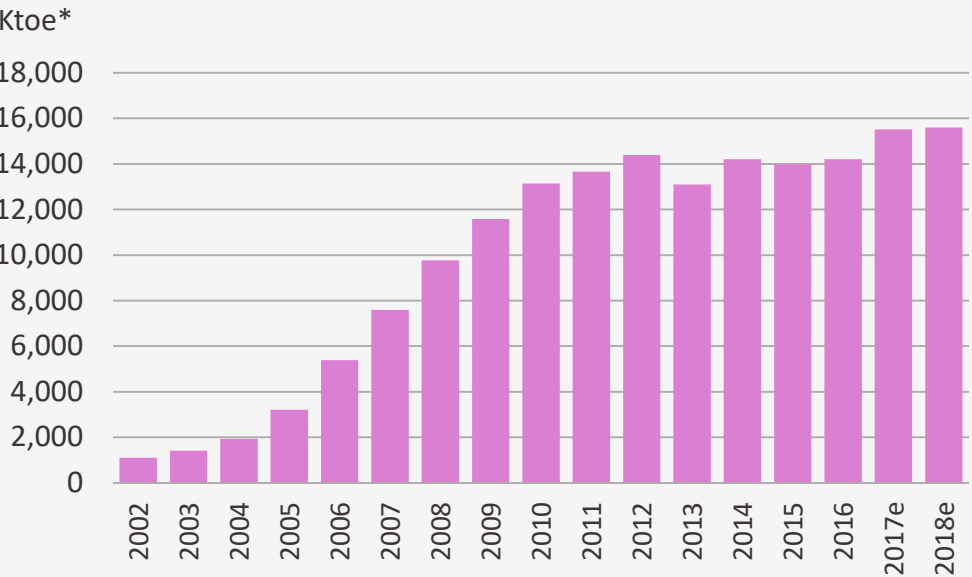


The technology driving sustainable transportation is rapidly evolving

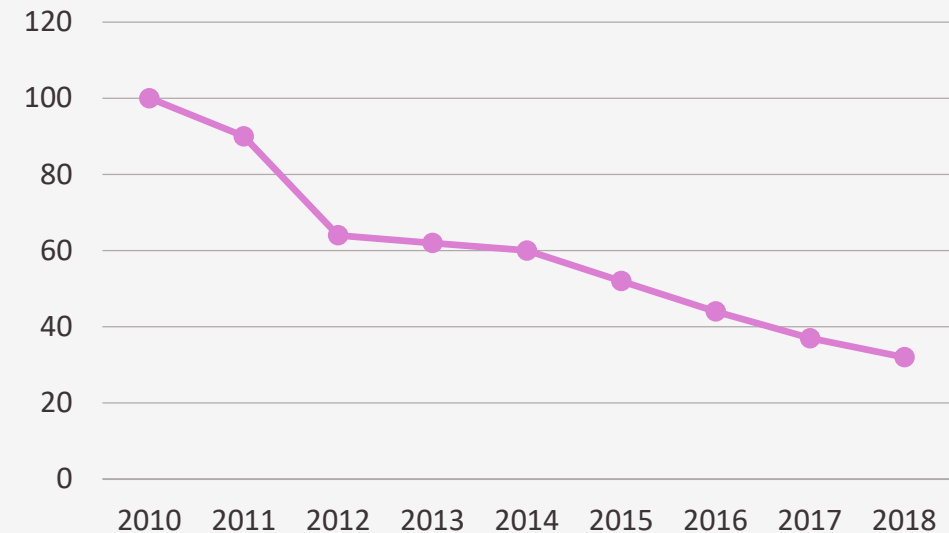


Biofuels are now widely used in transport and hydrogen technology is coming down in cost

Biofuel (liquid and biogas) consumption for transport, EU, 2002-18



Cost of hydrogen fuel cells, 2010=100



Source: Eurostat; EurObserv'ER; GenDrive; ProGen; Generation
* Thousands of tonnes of oil equivalent

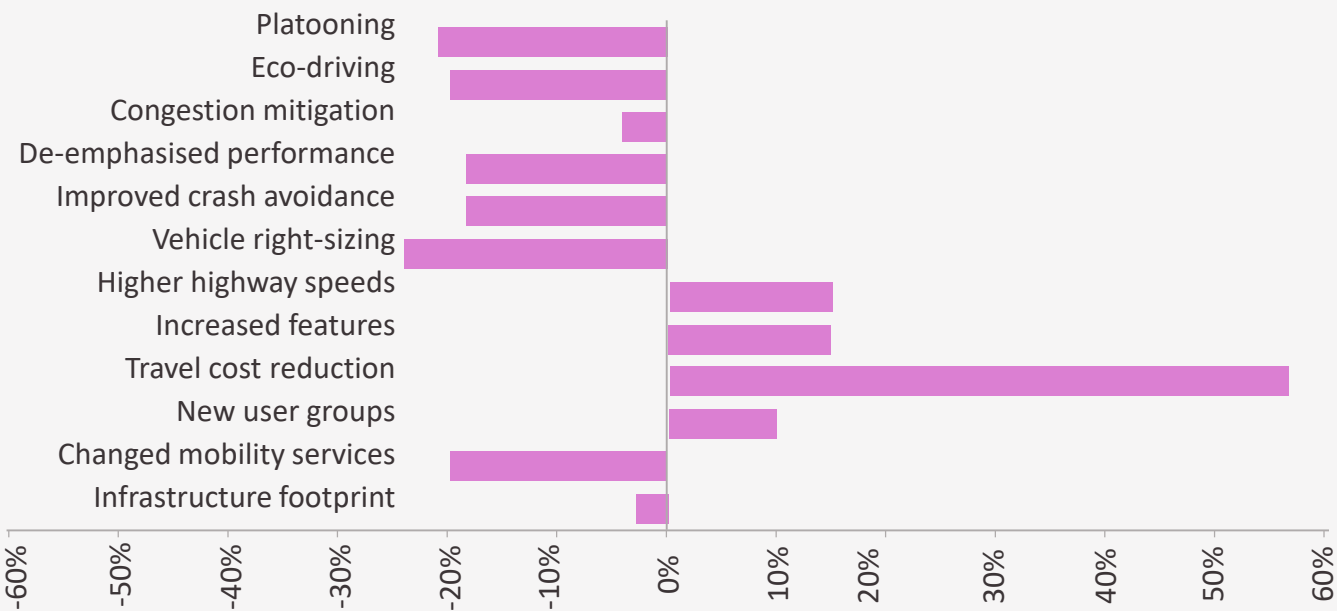


The technology driving sustainable transportation is rapidly evolving



The benefits and downsides of the adoption of autonomy at scale are not yet fully understood

% changes in energy consumption due to vehicle automation



Source: Wadud, Zia, Don MacKenzie, and Paul Leiby. "Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles." *Transportation Research Part A: Policy and Practice* 86 (2016).

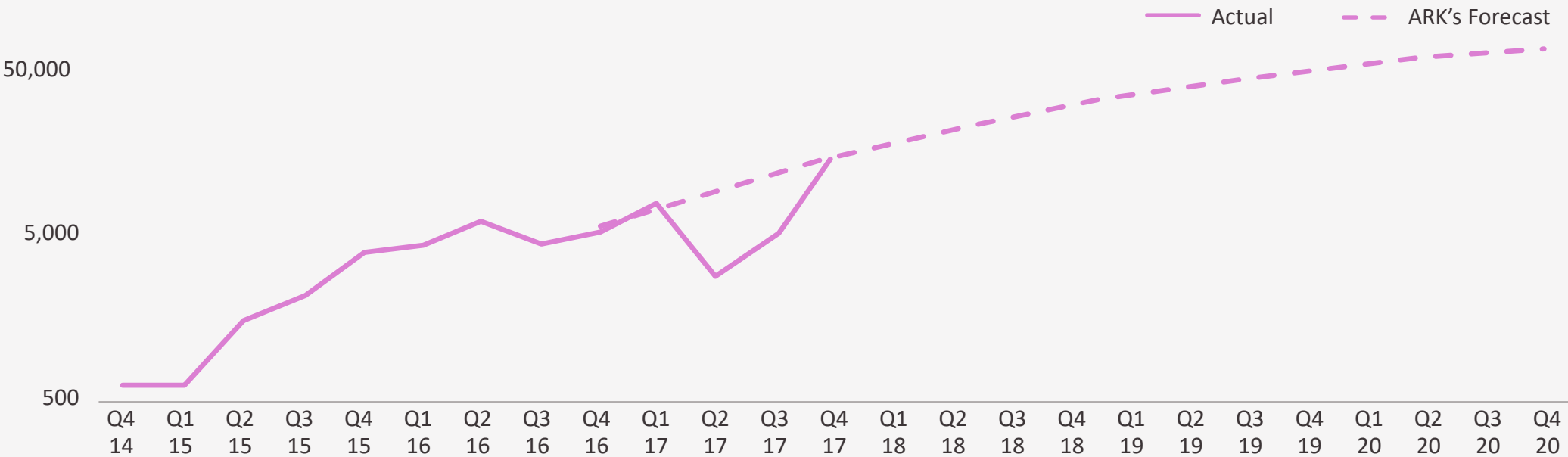


The technology driving sustainable transportation is rapidly evolving



Autonomous technology in cars is improving

Average autonomous miles between Google Car disengagements*



Source: ARK Investment Management, 2018

* Disengagement is when a human safety driver has to take over the autonomous vehicle due to errors or when avoiding a dangerous situation. Please note logarithmic scale

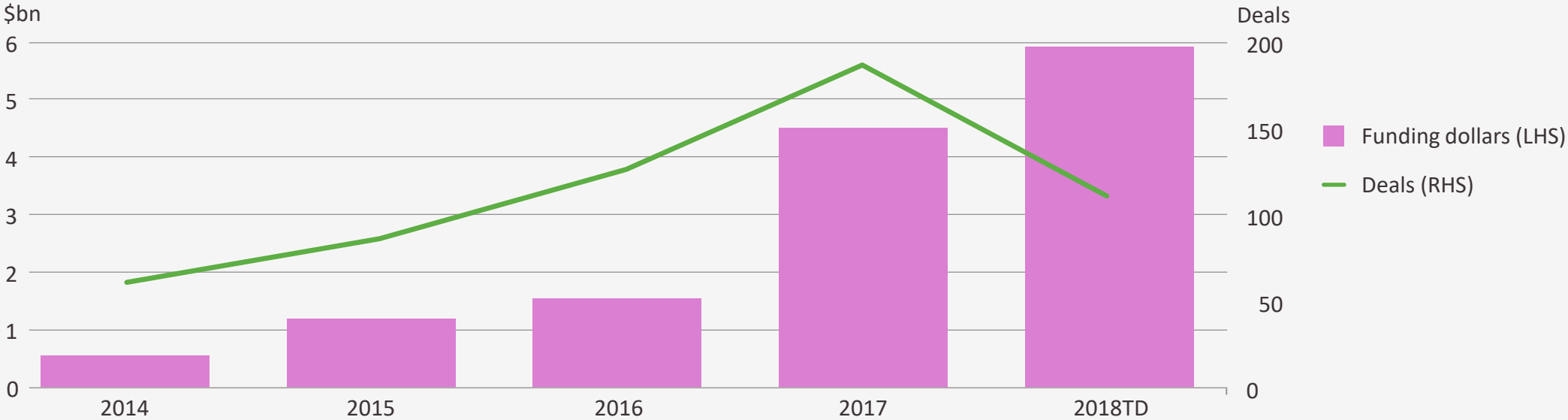


The technology driving sustainable transportation is rapidly evolving



There is a boom in venture-capital funding to autonomy

Auto tech global annual financing history, 2014-18*



Source: CB Insights
*2018 data to September
Tesla has promised 1m robo-taxis by 2020.

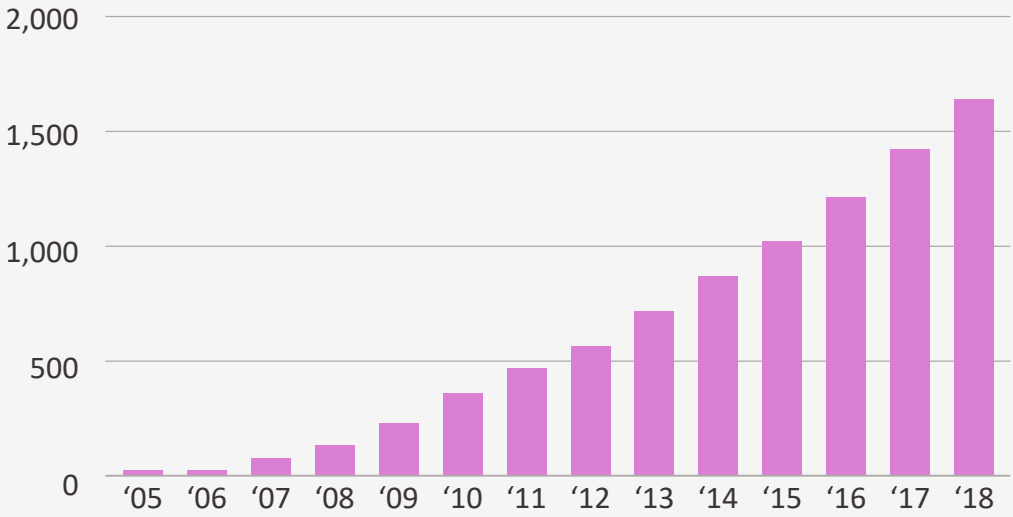


Different sorts of transport options are emerging

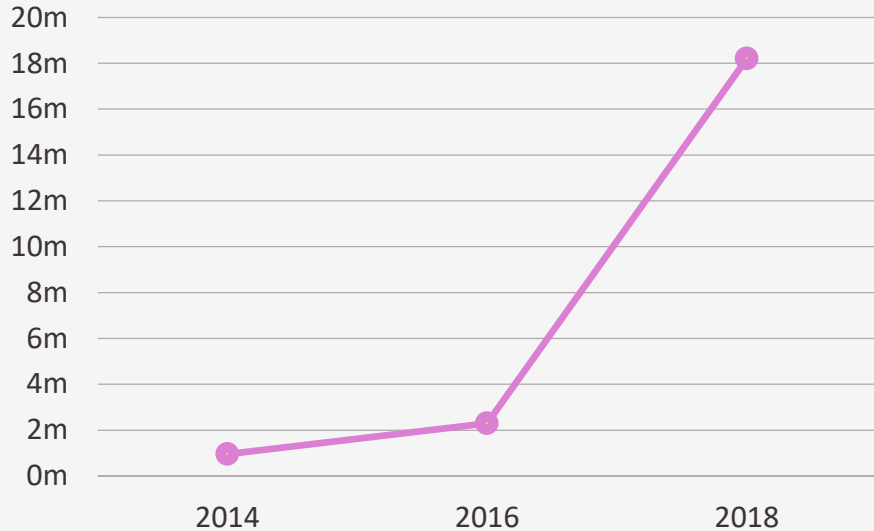


Bike-sharing is becoming more popular across the world, with over 1,500 bike-sharing programmes in operation worldwide

Number of bike-sharing programmes, global



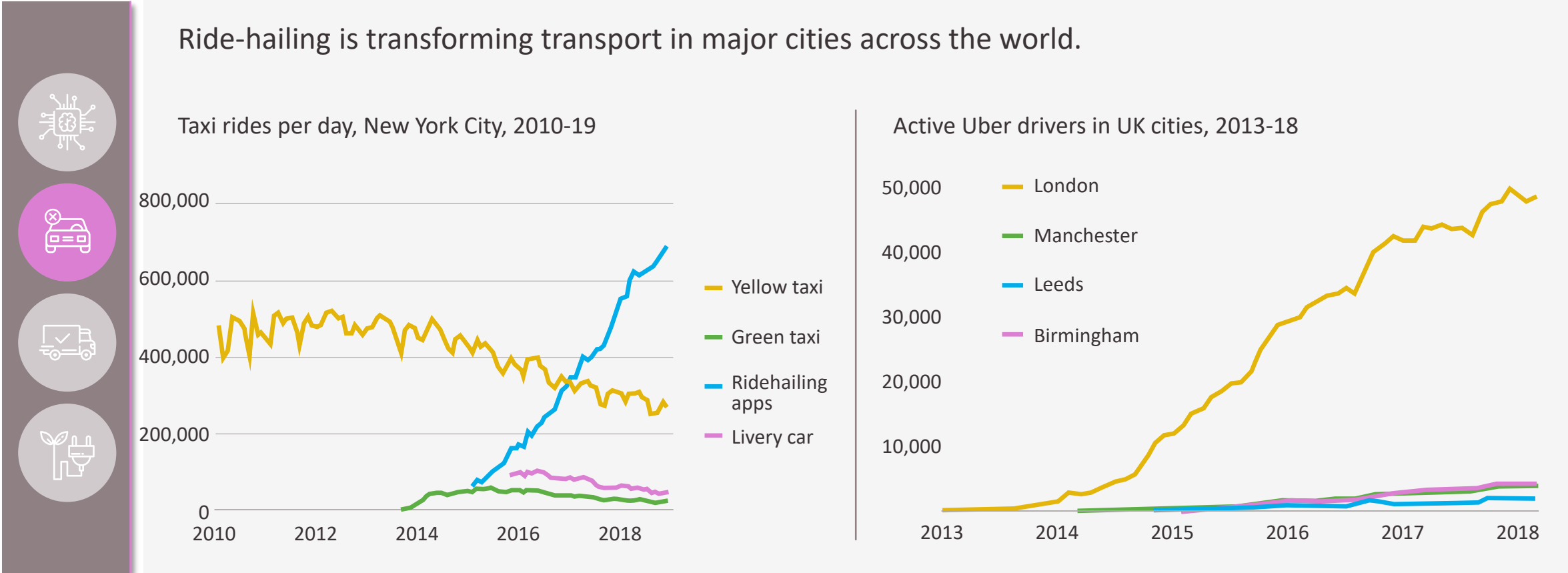
Number of public-use bicycles worldwide



Source: MetroBike's Bike-Sharing Blog; Statista; Business Insider



Different sorts of transport options are emerging



Source: Todd Schneider; Berger, T., Frey, C. B., Levin, G., & Rao, S. (2018): "Uber Happy? Work and Well-being in the 'Gig Economy'"

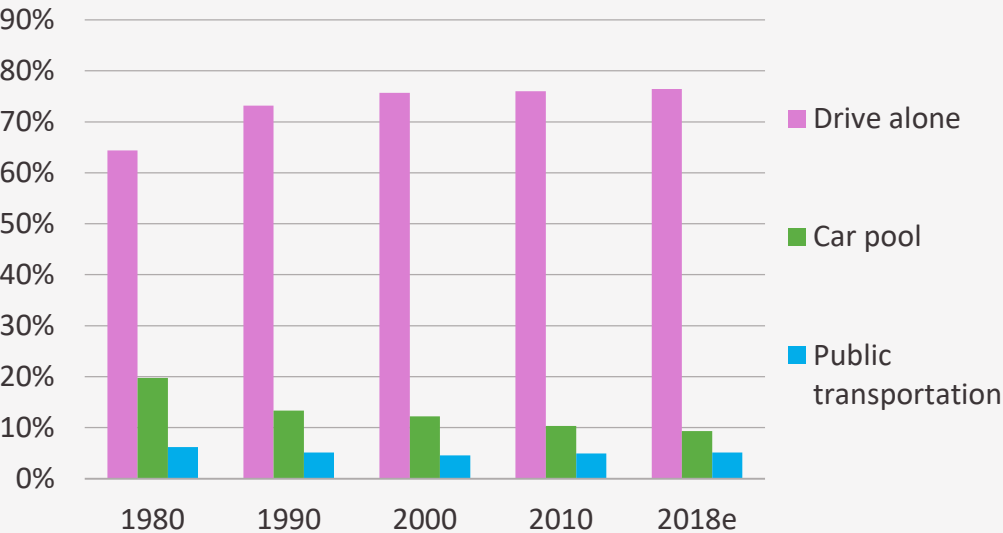


Different sorts of transport options are emerging

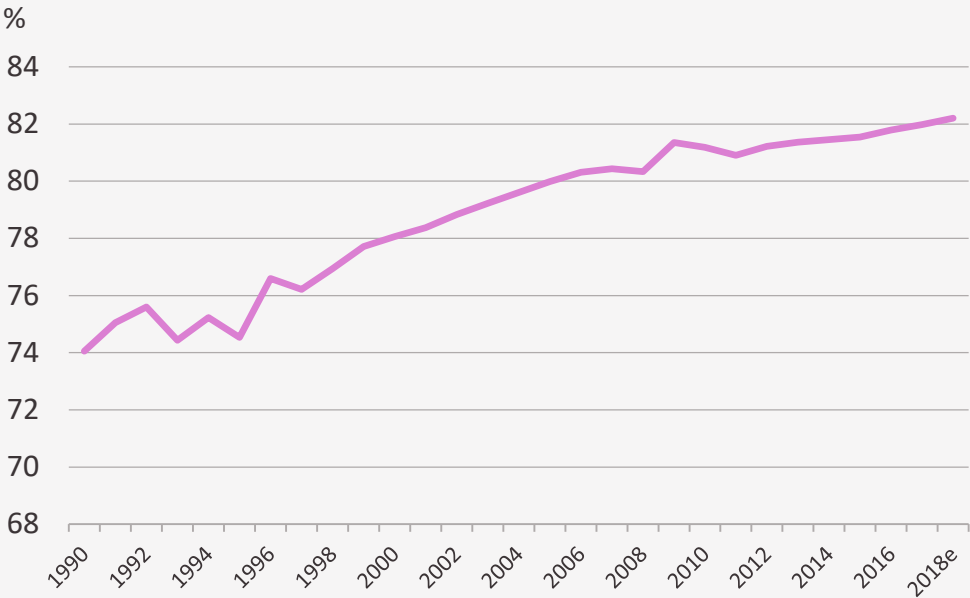


The rise of ride-hailing has not impacted the use of private cars

How Americans get to work, 1980-2018



Private car journeys as % total, Europe, 1990-2018



Source: Alternative Fuels Data Centre; Eurostat; Generation

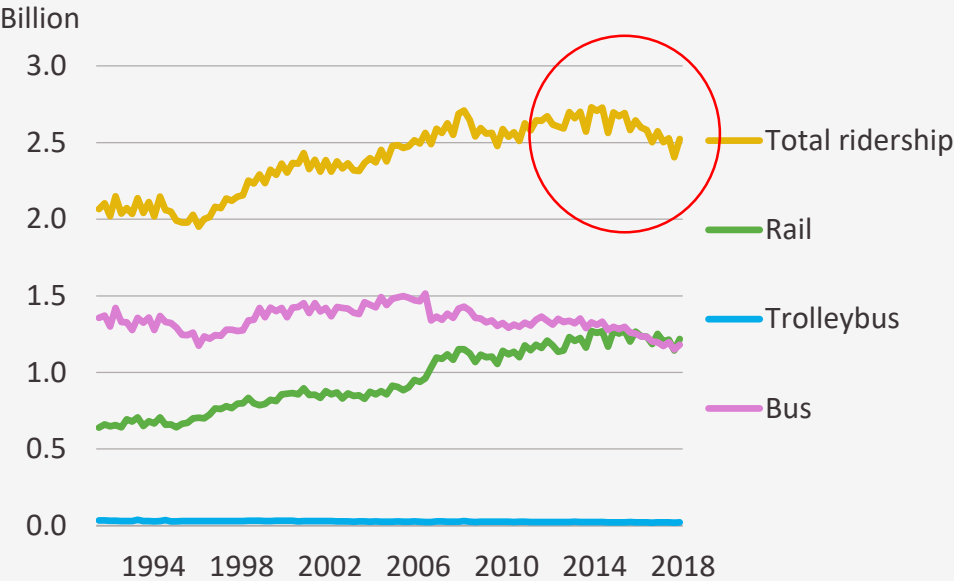


Different sorts of transport options are emerging

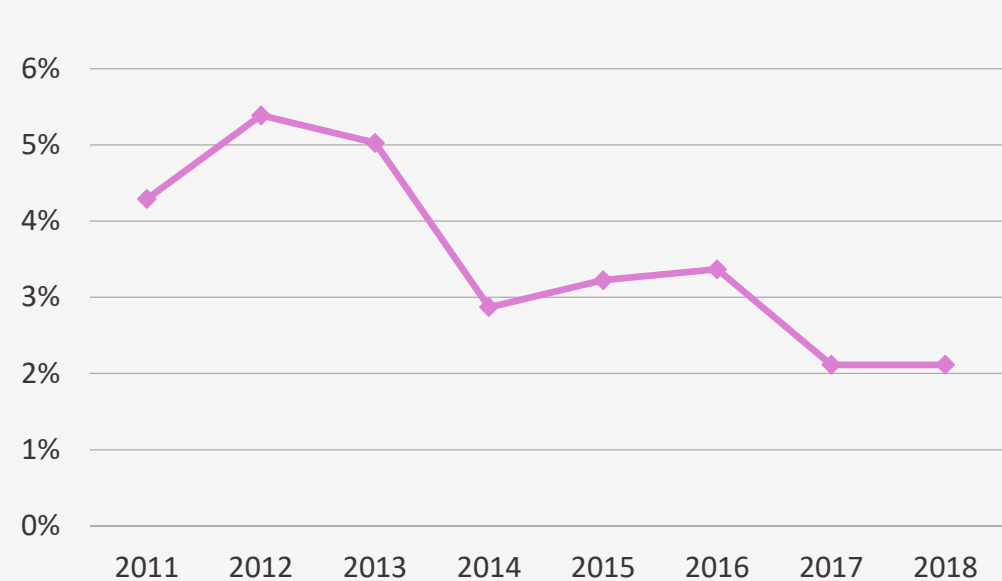


For the moment ride-hailing appears to be pushing people away from public-transport options

Ridership on American public transport, quarterly, 1992-2018



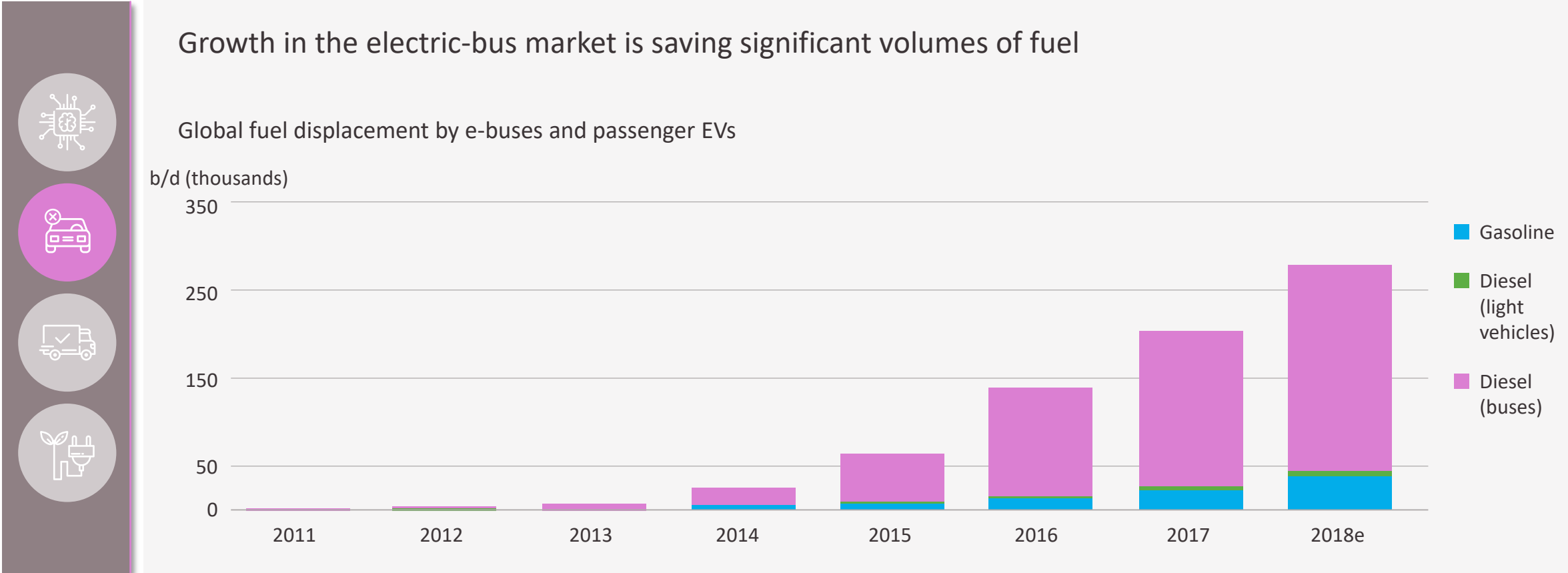
Annual passenger growth rate on London Underground, 2010-18



Source: American Public Transportation Association; Transport for London; Generation



Different sorts of transport options are emerging



Source: Bloomberg New Energy Finance

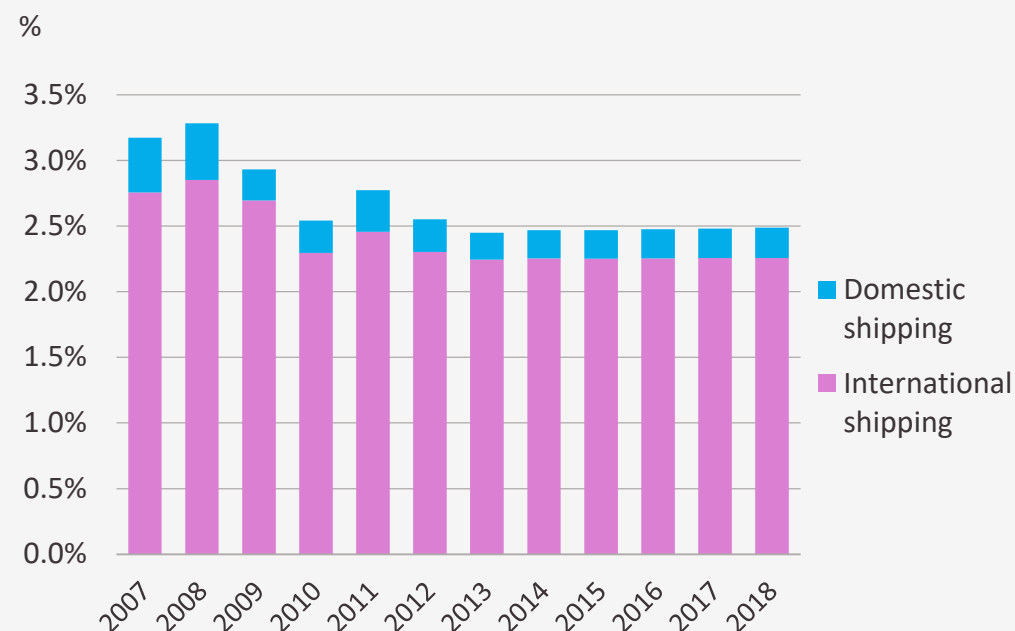


New solutions are needed to move goods more sustainably



Shipping has become more sustainable, though progress may be slowing

Share of global emissions from shipping, 2007-18



A.P. Møller - Maersk aims to be carbon-neutral by 2050



Source: International Council on Clean Transportation; A.P. Møller - Mærsk A/S; Generation

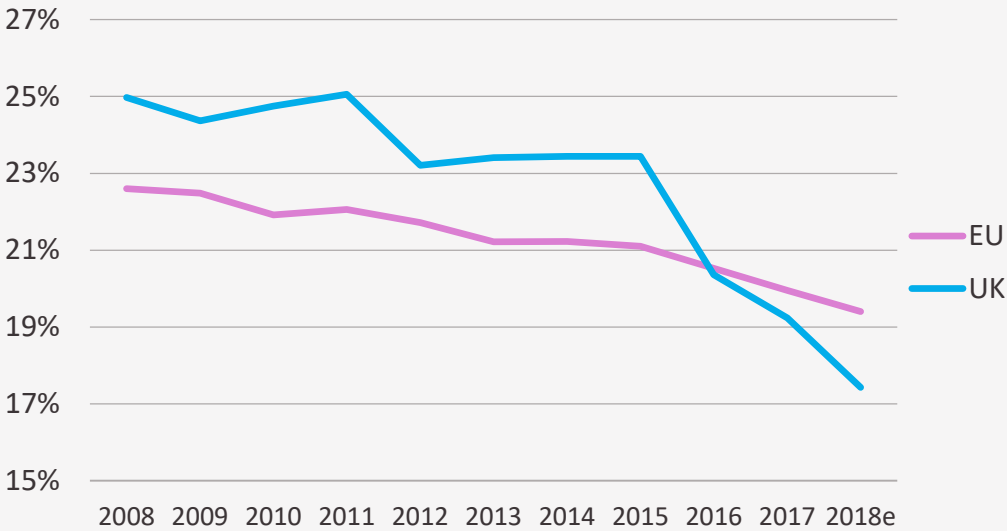


New solutions are needed to move goods more sustainably

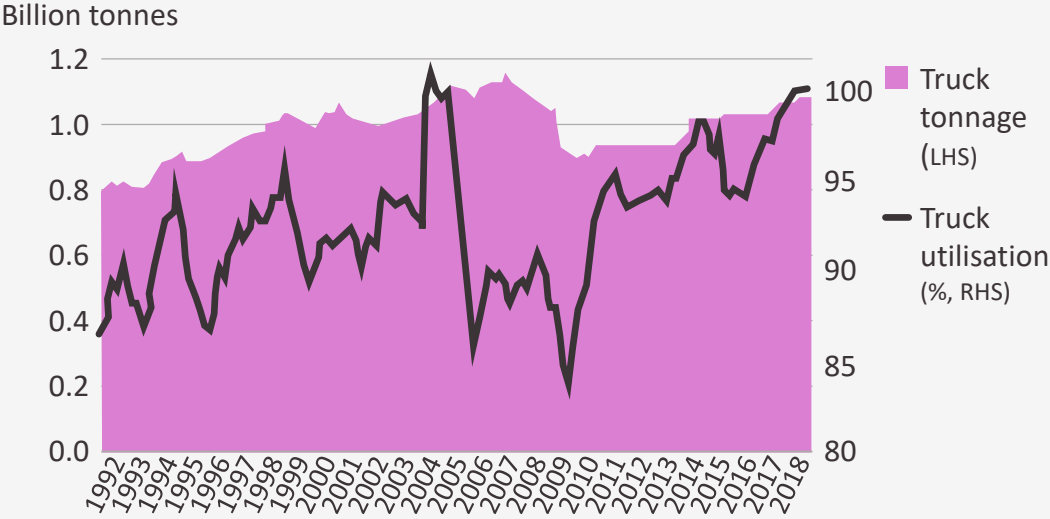


Trucks are less and less likely to roll while empty, reducing emissions per trip

Empty road-freight kilometres as percentage of total, Europe



Truck utilisation, US, 1992-2018



Source: Eurostat; Fleet Owner; FTR; Generation

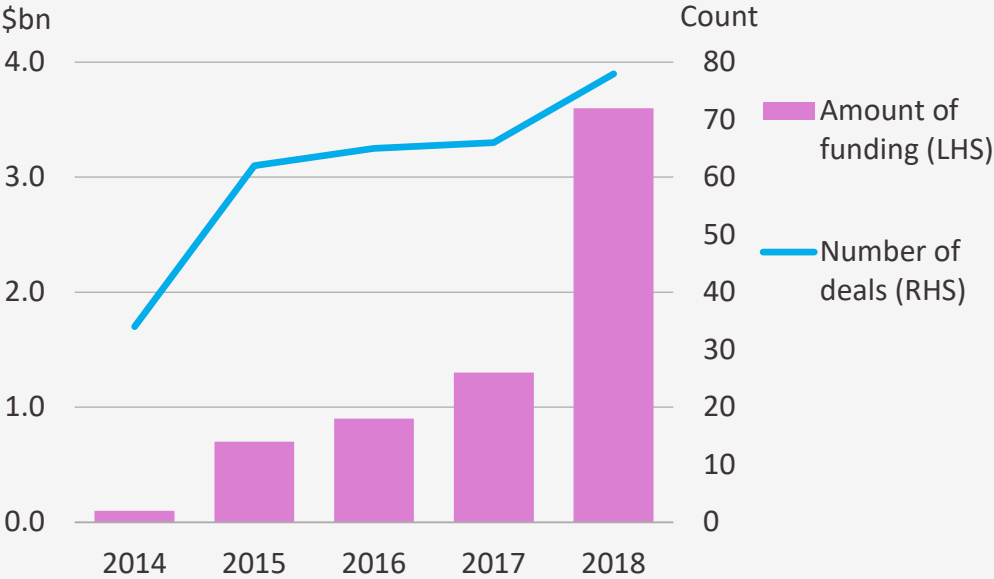


New solutions are needed to move goods more sustainably

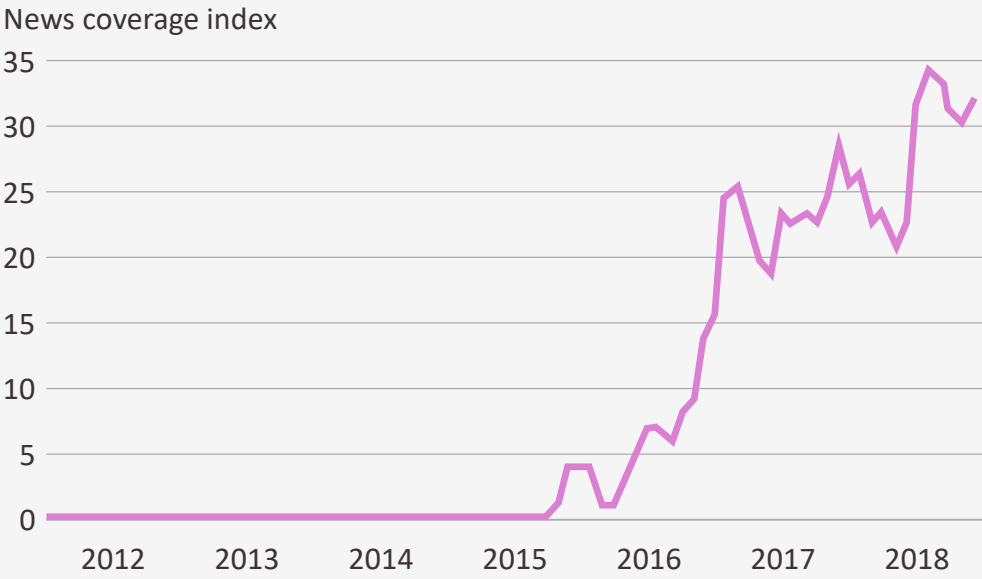


Large amounts of funding to e-commerce and delivery suggest innovation will continue

Venture funding activity for trucking tech startups, 2014-18



Autonomous last-mile delivery is becoming more popular



Source: CB Insights



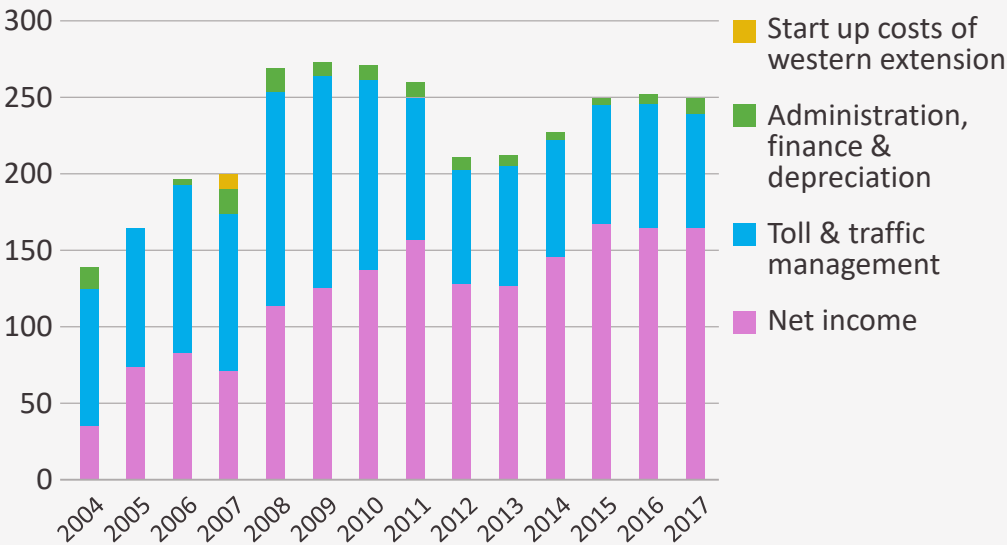
Governments are encouraging their residents to travel more sustainably



Congestion charging is being considered by many cities as a way to raise tax revenue

Revenue breakdown of congestion charge in London

Income and costs in 2017 prices (£m)



New York may soon charge people to drive in Manhattan



Source: Transport for London; Generation

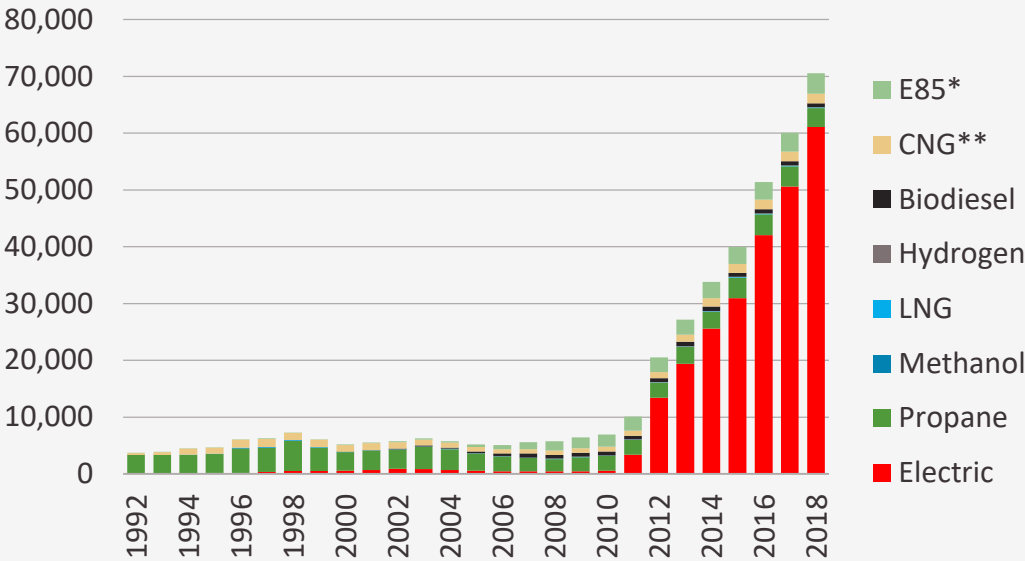


Governments are encouraging their residents to travel more sustainably

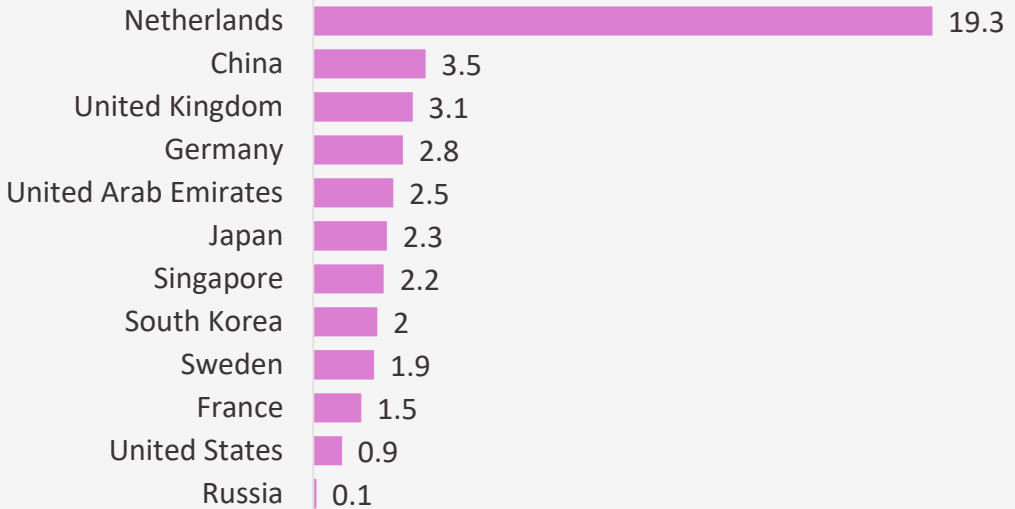


Infrastructure to help EVs is growing, but is unequally distributed across the world. As of 2018 there are 70,000 alternative-fuel stations across the US

Alternative-fuel stations by fuel type, US, 1992-2018



Number of electric-vehicle charging stations per 100km of paved road



Source: Alternative Fuels Data Centre; IEA; Statista
* Blend of 85% ethanol fuel and 15% gasoline
** Compressed Natural Gas



















Governments are encouraging their residents to travel more sustainably



The complete phase-out of the internal combustion engine is under way

Reported measures announced by national governments in relation to internal combustion engines (ICEs), 2010-2019

	Britain	All new cars in the UK will be "effectively zero emission" by 2040, under plans to tackle air pollution
	China	China's province of Hainan will ban the sale of gasoline-fueled automobiles by 2030
	Costa Rica	Initiate phase-out of fossil fuels in transport by 2021
	Denmark	Denmark to ban petrol and diesel car sales by 2030
	France	No new ICE vehicles sold after 2040
	Germany	German cities are starting to introduce bans on older diesel vehicles
	India	Plan to sell only electric models by 2030
	Ireland	Phaseout of cars with tailpipes by 2030

	Israel	No new ICE vehicle imports after 2030
	Netherlands	Amsterdam to ban polluting cars by 2030
	Norway	Target only to sell EVs by 2025
	Portugal	Suggested target on banning diesel cars in Lisbon by 2030
	Scotland	No new ICE vehicles sold after 2032
	South Korea	Seoul will launch bans on old diesel cars driving in the city from 2020
	Spain	Over next two years most petrol stations will need to fit EV charging points
	Sweden	No new cars with diesel or petrol engines will be sold after 2030

Source: Survey of Global Activity to Phase Out Internal Combustion Engine Vehicles, 2018; “How the UK can lead the electric-vehicle revolution”, 2018; Generation



Thank you

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sustainabilitytrends@generationim.com