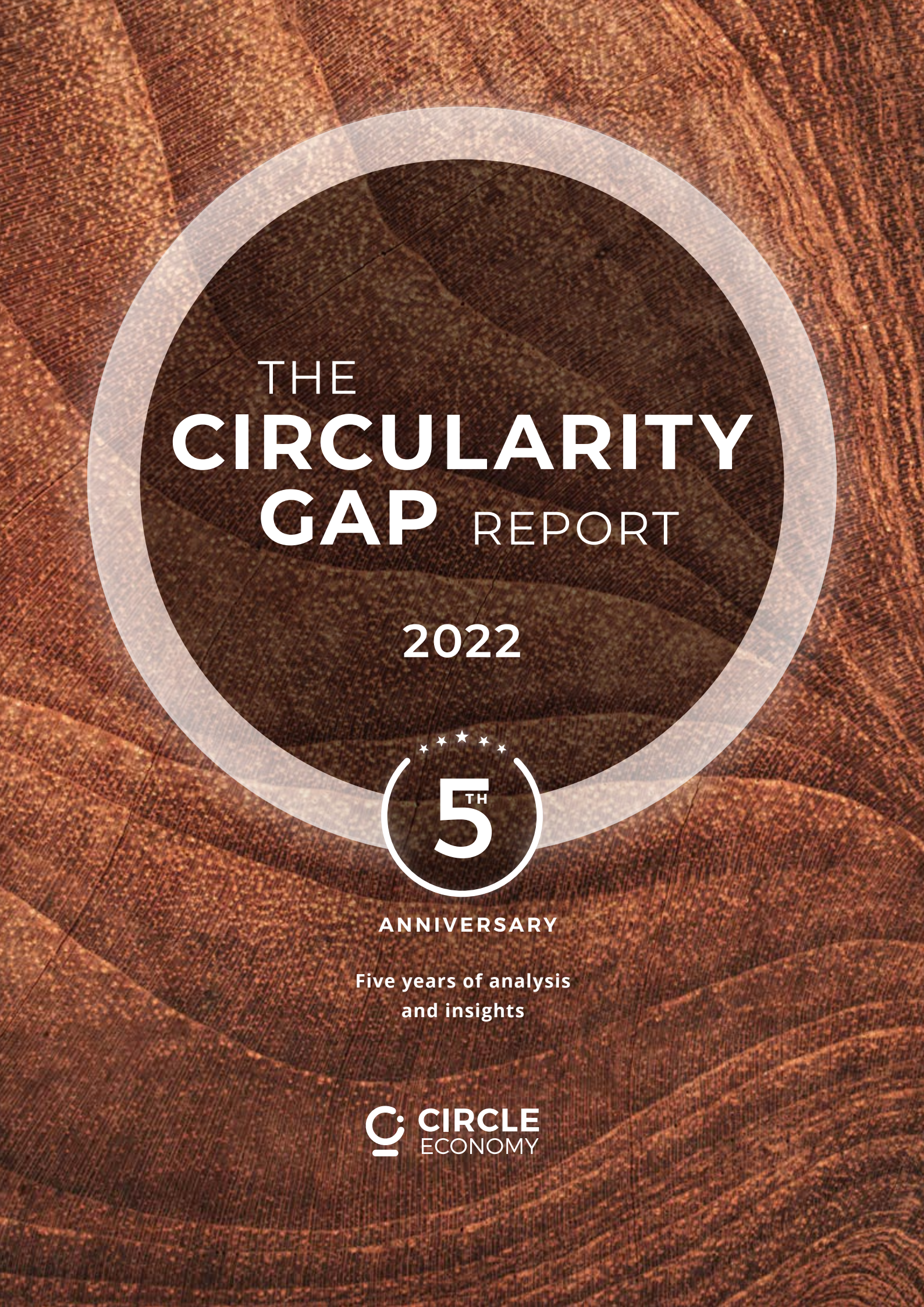

THE CIRCULARITY GAP REPORT

2022

5TH ANNIVERSARY

Five years of analysis and insights

CIRCLE ECONOMY

BEHIND THE COVER

The image we chose to mark our fifth edition is an organic, regenerative and fundamental material: wood. The unique gains and rings that mark each piece represent an untold history—shaped by the climate the tree has grown in. These ripples of impact remind us of the inherent connection between nature and climate—and the lasting impression a changed climate will have on our world.

CIRCLE ECONOMY

We are a global impact organisation with an international team of passionate experts based in Amsterdam.

We empower businesses, cities and nations with practical and scalable solutions to put the circular economy into action. Our vision is an economic system that ensures the planet and all people can thrive.

To avoid climate breakdown, our goal is to double global circularity by 2032.

This report is published as an affiliate project of the Platform for Accelerating the Circular Economy (PACE). PACE is a global community of leaders, across business, government and civil society, working together to develop a collective agenda and drive ambitious action to accelerate the transition to a circular economy. It was initiated at the World Economic Forum and is currently hosted by the World Resources Institute.

IN SUPPORT OF THE *CIRCULARITY GAP REPORT*

STIENTJE VAN VELDHOVEN
Vice President and Regional Director Europe at the World Resources Institute

‘Preventing and reducing resource use and reusing materials in a global circular economy are key strategies to protect the Earth’s environment, as well as its capacity to provide for current and future generations. A variety of metrics are needed to understand progress alongside valuable data, analysis, guidance and examples. *The Circularity Gap Report* has provided insights on these topics over the past five years, and it continues to inform progress and the action required to accelerate the circular transition.’

BORGE BRENDE
President at the World Economic Forum

‘This fifth edition of *the Circularity Gap Report* makes clear that time is fast running out to transition from a linear economy toward a circular economy. In sounding this alarm, this report also thankfully offers solutions. We can take collective action—if the public and private sectors follow the roadmap in the report—and still have the opportunity to meet our climate objectives and realize a sustainable future.’

DIANE HOLDORF
Executive Vice President at the World Business Council for Sustainable Development

‘*The Circularity Gap Reports* have played a vital role mobilising the global circular economy agenda. This edition reinforces key findings from five years of analysis and lays out actions that companies can take to drive transformative change. Widespread adoption of circular strategies across all sectors and value chains are needed to tackle the three most pressing challenges of the climate crisis, nature loss and mounting inequality.’

FRANS VAN HOUTEN
CEO at Royal Philips and Co-Chair at the Platform for Accelerating the Circular Economy (PACE)

‘It’s clear—we must act now! There’s no time to lose. By applying the circular solutions outlined in this report, we can reduce the use of scarce materials and dramatically cut emissions—thereby fighting climate change and biodiversity loss. But we can only do it by joining forces. That’s why I’m calling on all CEOs and business leaders, governments and NGOs to step up and accelerate our combined efforts, so we can reach the goal of doubling circularity within ten years. Let’s take bold actions and deliver impact.’

KATE RAWORTH
Author of Doughnut Economics and Senior Teaching Associate at the Environmental Change Institute, University of Oxford

‘Circularity is not becoming a reality at anything near the speed or scale that these times demand—and the past five years of *Circularity Gap Reports* have provided the essential and authoritative analysis to make this painfully clear. I hope that future editions, over the coming five years, will be able to reflect a profoundly different story; using innovative metrics and powerful case studies to document the industrial circular transformation that is so urgently needed.’

DIMITRI DE VREEZE
Co-CEO at Royal DSM

‘Five years of *the Circularity Gap Report* has shown us that “business as usual” cannot be sustained. As the world’s population grows and crosses planetary boundaries, we must move away from linear production and consumption systems and work together to build sustainable models. Bridging the Circularity Gap is crucial to support the livelihoods of tomorrow’s population and restore the natural environment. Let’s start putting a price on waste and accelerate our joint circular innovation power.’

MARK WATTS
CEO at C40

‘A 1.5-degree world will be a circular world. Now is the time for action to mitigate climate breakdown and cities have a crucial role to play here. Circle Economy’s *Circularity Gap Report 2022* shows us solid solutions and actions that cities can adopt to continue leading the circular transition.’

JANEZ POTOČNIK
Co-Chair at the International Resource Panel of the United Nations Environment Programme (UNEP)

‘The circular economy was not on the European policy agenda for a long time. From the beginning, *the Circularity Gap Report* accompanied policy efforts to raise attention to the circular economy. The reports show us a reflection of what we need to see in implementing the circular economy: the path from words to deeds is a real challenge, which demands our focus.’

FEIKE SIJBESMA
Climate Advocate and Honorary Chairman at Royal DSM

‘Scarcity of resources is largely a result of omissions and mistakes in the design and use of value chains. A switch from a linear to a circular economy enables us to re-use our resources almost endlessly and protect our planet and civilization. *The Circularity Gap Report* shows the threats—as well as the opportunities.’

JULES KORTENHORST
CEO at Rocky Mountain Institute

‘We have less than ten years to mitigate the worst impacts of climate change. Using metrics to gauge our progress in addressing the climate crisis is crucial. The metrics- and data-driven approach that *the Circularity Gap Reports* have pioneered over the past five years has been significant in advancing circular metrics—but we need to go further. We look forward to collaborating and sharing knowledge on this topic to help us reach our 1.5-degree goal.’

DAVID MCGINTY
Global Director at the Platform for Accelerating the Circular Economy (PACE)

‘The triple planetary crisis—climate, nature and pollution—along with the need for greater equity and stability—are why circular action at scale is critical now. *The Circularity Gap Report* continues to be an invaluable tool for measuring progress towards global circularity. As PACE leaders aim to double global circularity by 2032, we are committed to continuing to enhance the data, insights and metrics required to champion and deliver the urgent actions needed.’

5TH

The first *Circularity Gap Report* presented the alarming statistic that the globe's economy was only 9.1% circular, leaving a massive Circularity Gap. The Report, launched in January 2018 during the World Economic Forum in Davos, has since been updated and published every year. This iteration marks the fifth edition. The Reports provide high-level insights into the globe's material flows and key levers for transitioning to circularity. They also support decision-makers with clear metrics, global data and a measurement of the circular economy to guide their action.

Updating the Circularity Metric is not feasible on an annual basis, however, due to the limited availability of data. Since 2020, the Circularity Gap Reporting Initiative has also explored the role of data in the circular transition: how to collect it, communicate it and make it globally accessible.

To contact us and to access interactive visuals and deep dives into our findings, please visit:
circularity-gap.world

EXECUTIVE **SUMMARY**

The harsh reality is that between Paris and Glasgow, more than half a trillion tonnes of virgin materials were consumed. Also, the Circularity Gap got worse, not better. In the six years between headline-grabbing climate conferences, the global economy consumed 70% more than what the Earth can safely replenish.* This cannot continue—we only have one planet. While the 2015 Paris Agreement upped the global ambition with an agreement on binding climate commitments, COP26 in Glasgow was a 'fragile win' for the climate—in the words of COP26 President Alok Sharma. Progress was, however, made on three fronts: recognition of the need to put an end to fossil fuels; setting new rules for carbon markets, and some headway on a mechanism for richer nations to pay for their historical contributions to climate change. But there is still much to be done, making the World Economic Forum in Davos a key moment to advance the agenda ahead of COP27 in Egypt at the end of 2022.

Five years of *Circularity Gap Reports* have revealed how linear the world is—we only cycle 8.6% of what we use, which leaves a massive Circularity Gap of over 90%. And in only two years, global circularity wilted from 9.1% in 2018 to 8.6% in 2020. As a result, the wrong kinds of records are getting broken and set. In 2019, for instance, as well as the world having warmed 1.1-degrees since the pre-industrial era, society also breached boundaries for extraction, consuming 100 billion tonnes of resources. Our analysis connected this resource use to key societal needs and wants—how we eat, move and live—so that we could quantitatively track trends in usage and waste. This allows us to develop people-centred, resource-smart and climate-safe roadmaps for change.

Finally, the tectonic plates of international climate action are visibly shifting—although slowly. It is already 50 years since the landmark Club of Rome report warned of the dangers of natural resource-use and endless economic growth; ten years since the circular economy moved from the fringes to the mainstream—yet remaining far from being the norm—and five years since the first *Circularity Gap Report* gave us a trackable figure for global circularity. Time is not on our side, but momentum is with us. Hot on the heels of COP26, both business and public interest in climate action is high, despite the world still experiencing the compound effects of a pandemic. There is also a valuable storehouse of transferable knowledge out there, backed up by examples of inspiring best practices. So, to achieve the transformation needed, progress both needs to accelerate and scale. We need regenerative and ethical behaviour to become the norm, over extractive and exploitative practices.

The world may feel like it's on fire, but here's the solution: enacted globally, a circular economy can help to close the Emissions Gap. This *Circularity Gap Report 2022* will demonstrate—based on five years of analysis and learnings—how the circular economy is a means to cut resource-use and emissions and boost equitable societies. With our roadmap of 21 circular solutions, businesses, cities and nations can reduce resource extraction and use by 28%, therefore cutting greenhouse gas emissions by 39% and getting the world on a 1.5-degree pathway. Tailoring the roadmap to different localities and sectors can guide all key actors in the course corrections we so desperately need. Whilst our roadmap is a powerful addition to the clean-energy transition already underway, we won't achieve the scale of change needed unless we also drop business as usual behaviours and overcome linear thinking. In this iteration of the Report, we investigate these obstacles, plus showcase real-world examples of circular activity.

Let's work together to close the Circularity Gap, fast and for everyone. It is time for collective action to reset our economy and begin to erase social inequalities. In some places, this is already happening, but it must become the norm, everywhere. So, as promises of environmental action flow in from countries around the world post-COP and attention turns to updating national climate pledges for COP27, circularity must be heavily featured. It carries the solutions countries and businesses need to meet their climate goals, safeguard the Earth's resources and protect all people. It's time for a circular economy.

**1.7 planets, as per the calculation of the Footprint Network.*

In only six years, the global economy consumed an additional half a trillion tonnes of virgin materials, namely minerals, ores, fossil fuels and biomass. These enormous volumes of materials—by and large wasted after use— are climbing year on year. Ultimately, waste is connected to most environmental problems, from biodiversity loss, global warming and air pollution to plastic soup.

In only 50 years, global use of materials has nearly quadrupled—outpacing population growth.[1] In 1972, as the Club of Rome's report *Limits to Growth* was published, the world consumed 28.6 billion tonnes. By 2000, this had gone up to 54.9 billion tonnes and as of 2019, it surpassed 100 billion tonnes. Rising waste levels are accompanying the rapid acceleration of consumption: ultimately, over 90% of all materials extracted and used are wasted.

Or, on the flip side, only 8.6% make it back into our economy. This rate of extraction continues to threaten the planet's future—and our lives on it. And forecasts paint a grim future: according to the International Resource Panel, material use may increase to between 170 and 184 billion tonnes in 2050 if business as usual prevails.[2]

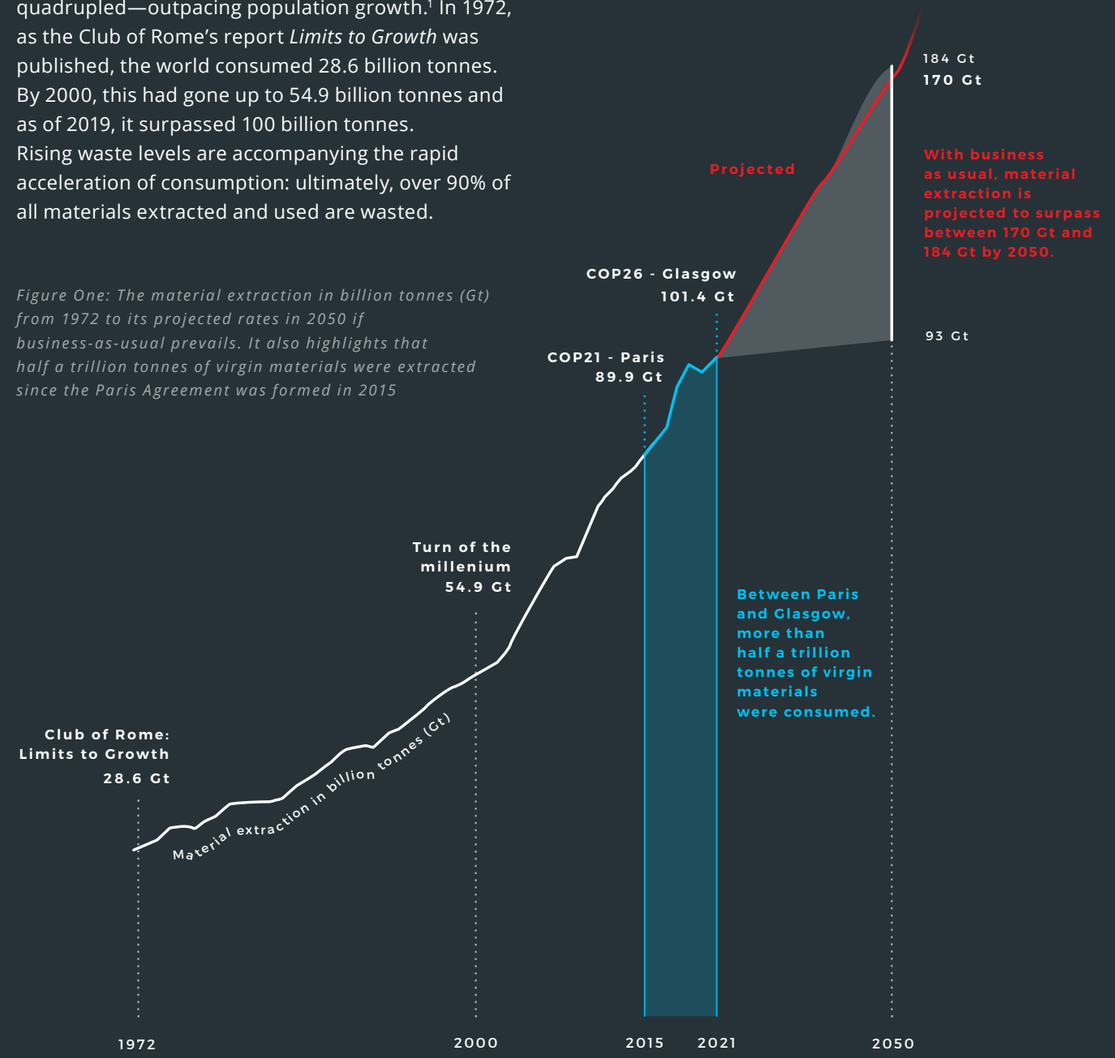

Figure One: The material extraction in billion tonnes (Gt) from 1972 to its projected rates in 2050 if business-as-usual prevails. It also highlights that half a trillion tonnes of virgin materials were extracted since the Paris Agreement was formed in 2015

CREATING AN ENABLING ENVIRONMENT FOR THE THE NEXT FIVE YEARS OF THE CIRCULAR TRANSITION

- **Data-driven digital tools to bring circularity to everyone:** Data-driven, digital tools can scale circularity. They enable businesses, cities and nations to explore what is currently happening, scan for opportunities and then act accordingly.
- **Metrics to track the transition:** If we don't measure, we cannot track progress in a meaningful way, nor can we ultimately locate where the most impactful avenues are. Using data to measure and track circular performance across sectors, businesses, cities and nations will enable actors to set goals, peer review, measure and benchmark performance.
- **A social lens to ensure the transition is safe and just:** A holistic circular economy that applies a social lens to all of its activities may help us support various Sustainable Development Goals, from ending hunger and improving health and well-being to affordable low-carbon energy, and the opportunity for decent work and economic growth.

See more on page 45.

Photo by Sergio Souza

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1 A MODEL MEANT FOR EARTH

Toward an economic and social system that fits our planet

Photo by Max Ravier

The impact of our throwaway culture on the planet and societies is clear: it's destructive. We are living in a time of rampant pollution and waste, resource scarcity, biodiversity loss and warming global temperatures: all of which are linked in some way to our rising levels of consumption. A social and economic system that has this impact on its natural environment cannot be called a healthy one. In the past year alone, a cascade of alarming environmental events swept the globe, from wildfires and storms to floods and droughts. Without action, climate breakdown could displace hundreds of million people by 2050[3] and result in a catastrophic loss of biodiversity. The sixth IPCC report[4] definitively stated—for the first time—that climate change is driven by us: human activity got us here. But it can also get us out—the solution is in our hands. It's been five years since our Circularity Gap Report first calculated the circular state of the world. In this short time, the world has gone from 9.1% circular in 2018 to 8.6% in 2020, annual global resource use has surpassed 100 billion tonnes and inequalities have widened across and within countries—and it is now over 1-degree warmer than in pre-industrial times. We've done the maths; now it's time to examine our key findings and implement solutions that can guide businesses, cities and nations in becoming more circular. This way, they can reach the ultimate goal of contributing to a socially just and ecologically safe space. This edition draws on five years of knowledge to show the power of the circular economy to equitably fulfil our global needs and wants, but with radically fewer materials and emissions. There is no time to lose.

1 50 years since the Club of Rome warning, ten years of circular economy moving towards the mainstream and five years of *the Circularity Gap Report*.

As society has extracted and consumed the Earth's natural resources at alarming rates—tripling in the last half century—warning calls have surfaced repeatedly. Fifty years ago the Club of Rome's landmark book *Limits to Growth* predicted that rapid economic growth and natural resource exploitation would lead to the 'collapse of civilisation' by 2040.[5] And new research[6] shows that we appear to be, unfortunately, right on schedule. A handful of the study's 'worst-case scenarios' based on food production and pollution, among others, have accurately forecasted our real-world situation. The new conclusions appear to confirm that we only have the next decade to change course.

In the years since the *Limits to Growth* predictions, we have seen tremendous progress on the sustainability or 'green' front with a medley of environmental victories. However, we can't downplay our defeats. Take the Paris Agreement, a great example of globally-coordinated action on climate breakdown. In 2015, nearly all countries pledged to limit the average global temperature rise this century to well below 2-degrees in an effort to prevent the worst impacts of climate breakdown, provide support for lower-income nations and be transparent in reporting on action. Things could only get better—or so was the presumption. It is now clear, though, that the blueprints mapped out for the globe in the form of national climate promises—Nationally Determined Contributions (NDCs)—were never powerful enough to fulfil the Agreement's goal of limiting warming temperatures to safe levels. Next to this, the funding pledged to lower-income nations was staggeringly slow and low. Many pinned their hopes on COP26 in Glasgow to deliver meaningful impacts, but outcomes were branded a 'fragile win' by COP President Alok Sharma. While the 2015 Paris Agreement upped the global ambition with an agreement on binding climate commitments, Glasgow failed to deliver on its ultimate target: firmly closing the gap to 1.5-degree with the same level of binding agreements. It did, however, reduce the Emissions Gap as some countries boosted their NDCs: now to meet 1.5-degrees between 19 and 23 billion tonnes of CO_2 equivalents must be removed from the atmosphere, according to Climate Action Tracker. The conference also delivered a breakthrough agreement on phasing out fossil fuels and commitment to a just transition, it demonstrated great business leadership and published a range of pledges that will affect the private sector for years to come. It also set rules for carbon markets that could unlock trillions of dollars in climate finance to protect forests, build renewable energy facilities and more. It, however, once again underperformed on ramping up finance to lower-income nations—among other disappointments.

Analysis shows that even if all original NDCs were fulfilled, the world would still warm up by 3.2-degrees this century[7] and if we include all the updates ahead of COP26, the world would be on track for 2.4-degree warming this century. This is partly because they overwhelmingly focus on the energy transition: ditching fossil fuels in favour of clean energy, such as solar or wind. Entering COP26, only one-third of all nations had any mention of the circular economy in their pledges, less than 40% included any plans for

training to support their implementation and now the updated Pact continues the overwhelming focus on cutting fossil fuels—namely coal—as the primary means to cut emissions. This results in efforts centred solely on energy sources in industries with high greenhouse gas (GHG) emissions: namely electricity, heat, construction, transportation and manufacturing. Although vital, is this alone enough to stem climate breakdown? The answer here is no. We need to explore truly sustainable and transformative alternatives with a wider, more holistic impact to accompany the clean energy transition—that also targets our rising consumption levels and considers training people to support the transition. Egypt is due to host COP27 in late 2022. Governments must ensure it does better than COP26.

TEN YEARS SINCE THE CIRCULAR ECONOMY MOVED TO BECOMING MORE IN THE MAINSTREAM

The circular economy is nature's equivalent of 'living within your means.' Just as living beyond your economic means can be risky and lead to problems in how you are able to operate day to day, living beyond our planetary means is threatening the planet and how safely it can function. The circular economy is an alternative: an approach for living within the means of our planet, while still providing for the global population. It does this by putting forward strategies that we can use to fulfil societies' needs with radically fewer materials and emissions (see more on page 17). Despite a rich history across nations and sectors of society, the circular economy only moved from the fringes of academic thought and emerged in mainstream policy discourse about ten years ago. It became a complementary model to traditional sustainability paradigms, with its more systemic approach: suited to driving change on a large, global scale. It has also been embraced by businesses as a means to reach climate and sustainability targets.

China's *Circular Economy Promotion Law* in 2008 and the European Commission's *Circular Economy Action Plan* in 2015 proved particularly noteworthy early milestones. They triggered a flourish of research and action and introduced the circular economy to the world's two largest economies—together accounting for 35% of global GDP and 25% of the global population. Business engagement has been another determining characteristic of these last ten years. The Ellen MacArthur Foundation's pioneering reports, including a much-cited claim of net annual benefits of €1.8 trillion in the EU alone,[8] were a major spark for the uptake of circular strategies among businesses. Also, in the long-term, a global circular economy that bypasses risks inherent in the linear economy—such as supply chain collapse and a failure to innovate in the face of new laws or regulations—would amass more profits.[9] The parameters of the circular economy now feature in multiple governmental and multilateral policies and goals: from the *EU Green Deal* and the EU *Circular Economy Action Plan*, to the Sustainable Development Goals (SDGs). It is also front and centre for many sustainability-focused business-led coalitions, such as the New Plastics Economy and the Capital Equipment Coalition, among many others. The circular economy is also now increasingly coupled with resilience in calls for 'building back better' since the onset of the covid-19 pandemic.

FIVE YEARS OF *THE CIRCULARITY GAP REPORT*: MEASURING WHAT MATTERS

As the circular economy increasingly moved into the mainstream, we at Circle Economy saw that something was missing: measurements and metrics. Measuring the mass of global consumption—the world's material footprint—is the DNA of *the Circularity Gap Reports*. The first-ever report in 2018 launched the alarming statistic that the globe was only 9.1% circular—with a Circularity Gap of 90.9%.[10] Our analysis showed the world which societal needs and wants—from Nutrition to Housing to Mobility—consume which resources (see more on page 19). Our x-ray of global material use (see pages 22-23) illustrates what happens to products and materials after they have been used. In particular, it uncovers the tiny flow of resources cycled back into the economy—now only 8.6%—and helps us estimate how much material is wasted beyond recovery. This exposes how deeply our linear system is still ingrained in our daily lives. The graphic visualisation has been adopted by many mainstream outlets, such as National Geographic, The New Scientist and the UN's Global Environmental Outlook for Business—to illustrate the severity of our situation.

The Circularity Metric filled a critical space in the circular economy discourse at the time: answering the need for measurement. Capturing the circularity of the world in one number allowed us to track and target performance and identify the key global levers for systemic change, thereby providing guidance for future action. *The Circularity Gap Report* for nations was born and a host of countries have since embarked on a journey to measure their circularity, identifying their most impactful paths. Dedicated territory-specific Reports have been produced for Austria, the Netherlands, Norway, and the province of Quebec—with many more to come. It has also gained impressive traction in the corporate world, with recognised global business leaders endorsing the Reports, such as the CEO of Phillips, and it has encouraged a range international companies—from construction company Rockwool to Europe-wide retailer Action—to understand their role in value chains and close their own Circularity Gaps.

THE CIRCULAR TRANSITION MUST LOOK BEYOND ITS IMPACT ON RESOURCE USE ALONE

In our modern world of interconnected flows across borders and rising inequalities, the circular transition must adapt, looking beyond resource use and efficiency alone. For a balanced outcome, it must examine its links with wider environmental issues and social equity. Resource use is enmeshed with GHG emissions—making the circular economy a powerful tool to cut emissions and combat climate breakdown (see more in Chapter Three). It is also a multistakeholder model and its systems-thinking approach boosts capacity, cooperation and capability to serve universal societal needs. And if done well, it can work to reduce inequalities in the process. It acts as a framework that supports a more resource-smart, people-centric future. That is why in our five years of *the Circularity Gap Report*, our focus has mirrored this shift: we quantitatively tied the circular economy to GHG emissions and analysed how circular strategies can help countries serve the needs of their citizens in equitable and sustainable ways (see more in Chapter Four).

2 From circular, to linear and back again: the Earth's journey.

From the four seasons to day becoming night, our planet Earth functions in a naturally circular manner—and has done so for billions of years. In nature, there is no waste: all materials have value and are used to sustain life in a myriad of ways. Natural processes are run from renewable energy: the oak tree, for example, consumes sunlight to create sugar, which allows acorns to grow—precious food for squirrels. The discarded acorn casings then become nutrients for decomposers, such as worms, which turn them into soil. Even as our human ancestors arrived on the planet, most of their activities were driven by muscle power: be it human or animal. Growing or sourcing materials, and building and transporting products, required hard labour. For this reason, produced goods were extremely valuable and circular economy practices such as reuse were commonplace. Even ceramics, made from clay and therefore available in abundance, were frequently recycled, food leftovers and agricultural residues were used to fertilise crops, excrement to tan leather, and urine to dye fabrics.[11] For the most part, early human societies' existence hinged on careful resource use and management—necessitating respect for the natural environment. Some societies today still use traditional, and inherently circular, practices: but the majority of the world has pivoted far away. Enter the linear economy.

A LINEAR ECONOMY: FROM SCARCITY TO ABUNDANCE; MUSCLE POWER TO MACHINE POWER

In some parts of the world, the Industrial Revolution began around the 18th century. From 1750 to 1953, world manufacturing output increased 24-fold[12]—but this growth was concentrated in a few locations, primarily empire-building nations located in Europe, as well as the US. These counties swiftly traded out muscle power for machines, which allowed for goods to be mass-produced, from the sewing machine to railroad equipment. These products were then shipped around the world, in a process powered by fossil fuels. As industrialisation spread, colonies overseas became the markets for new products—but were also heavily exploited for raw materials to feed further production. Economic growth in such countries was also impeded as imperial powers stifled competition; Portugal, for example, banned most cloth manufacturing in colonial Brazil for decades in the late 18th century[13]—just one of many examples of how social inequalities grew in tandem with environmental degradation. Over this period, the use of natural resources, including fossil fuels, increased tremendously and has continued to increase at an exponential rate.

Now and for the past 200 years, the hallmark of global consumption and resource-use can be aptly described as 'take-make-waste': a linear economy. The end of colonisation and its stifling policies in the 19th century meant a wider range of countries, from China to Brazil and India, could undertake industrial schemes and also rapidly begin using fossil fuels to boost their economies and scale their production.

The world's mission was to produce more and grow economically, and for consumers to consume. In feeding our hungry appetites we have stripped the Earth of life-sustaining systems such as forests, healthy oceans, rich soil and clean air and replaced them with swathes of monocultured land and concrete jungles. Whilst the linear economic model has enabled vast growth and rising wealth across many parts of the world, basic living standards remain unmet in others. Now, in many parts of the world, much of our consumption has become unrelated to meeting human needs.[14]

Growth in consumption was also inevitably tied to waste. As the linear economy began to take hold, planned obsolescence that artificially shortens products' lifespans became commonplace from the 1930s onwards, leading to a peak in consumer waste generation.[15] Recycling, which experienced a 'golden age' more than 130 years ago, decreased pre-World War I and didn't return to full force until the 1990s:[16] It wasn't only consumerism spiralling, but also rubbish going to landfill. And what's more, our analysis found that between the 19th and 21st centuries, global resource use climbed from 7 billion tonnes a year to over 100 billion tonnes.

LET'S FAST-FORWARD TO THE PRESENT: 2022

In the past half-century, the world's population has more than doubled,[17] yet the amount of material flowing through the economy has more than tripled, from 27 billion tonnes in 1970 to 84 billion tonnes in 2015.[18] And in 2021, we reached a worrying milestone: the mass of human-made things, from pavements to apartments to phones, was found to outweigh all living beings and biomass, such as our oceans, trees and animals.[19] Artificial objects have gone from just 3% of the world's biomass in 1900 to on par with it today. Our use of natural resources to make more 'stuff' is not predicted to slow down and looks set to increase from 100 to between 170 and 184 billion tonnes by 2050.

The events of 2020 also served to hold a magnifying glass to the flaws in our system as the covid-19 pandemic swept the world. It exposed our linear economy as extremely vulnerable to shocks. Yet it also served to show how fast changes can occur in times of crisis: governments were admirably swift in responding with safety nets of huge proportions for people's welfare, jobs and health.

Yet governments have failed to use this global event as an opportunity to pivot to a system where societal and environmental health is prioritised over economic growth. A United Nations Environment Programme (UNEP) report confirmed that of the $14.6 trillion spent on preventing economic collapse during the pandemic, a huge portion went toward bail-outs for polluting industries, such as oil and airlines.[20] It was disappointing that no green conditions were attached to the financial support, which could have encouraged action toward net-zero emission targets or investment in long-term technological development. And now, despite GHG emissions dropping by 6% during the pandemic, they were projected to exceed 2019 levels in 2020 by 4% across the G20 as fossil-fuel use spirals upward—despite governments preaching green promises and envisioning net-zero dreams.[21]

We could not be further away from the natural, balanced and circular origin of the world.

THE CIRCULAR ECONOMY

Circularity gives us the tools to transform our linear economy into one where waste and pollution are eliminated, products and materials are reused and nature is regenerated. If we integrate circular strategies into our economies based on the four flows below, we will ultimately require fewer materials and emissions to live.

NARROW: USE LESS

By minimising the overall material inputs into an economy, the emissions present in resources and end-products lowers: especially if priorityis given to the flows with the highest embodied emissions. In practice: Sharing and rental models,material lightweighting, multifunctional productsor buildings, energy efficiency, digitisation.

SLOW: USE LONGER

In extending the functional lifetime of resources, the emissions attached to material flows are spread out and reduced over time. In practice: Durable material use, modular design, design for disassembly, repair, remanufacturing, refurbishing, renovation,remodelling.

REGENERATE: MAKE CLEAN

In using regenerative resources, the emissions in fossil fuels and unsustainable biomass are cut from the economy. In practice: Regenerative material use, renewable energy, regenerative agriculture.

CYCLE: USE AGAIN

Depending on the energy used and emissions released during cycling, this strategy has the potential to eliminate embodied emissions from inputs. In practice: Design for recyclability (both technical and biological), design for disassembly, recycling, waste-to-energy.

Photo by Skyler Ewing

Photo by Jezael Melgoza

SEVEN SOCIETAL NEEDS & WANTS

HOUSING

The need that represents the largest resource and emissions footprint is for construction and maintenance of residential houses, especially in lower-income nations.

NUTRITION

Also with a large footprint is the need for nutrition, which includes agricultural products such as crops and livestock. Food products have short lifecycles in our economy, being consumed quickly after production.

MOBILITY

A considerable resource and emissions footprint is taken up by our need for mobility. In particular, two resource types are used: the materials to build transport technologies and vehicles like cars, trains and aeroplanes; plus, predominantly, the fossil fuels burned to power them.

CONSUMABLES

Consumables are a diverse and complex group of products—such as refrigerators, clothing, cleaning agents and paints—that generally have short to medium lifetimes. Textiles, including clothing, also consume different kinds of resources such as cotton, synthetic materials like polyester, dye pigments, and chemicals.

SERVICES

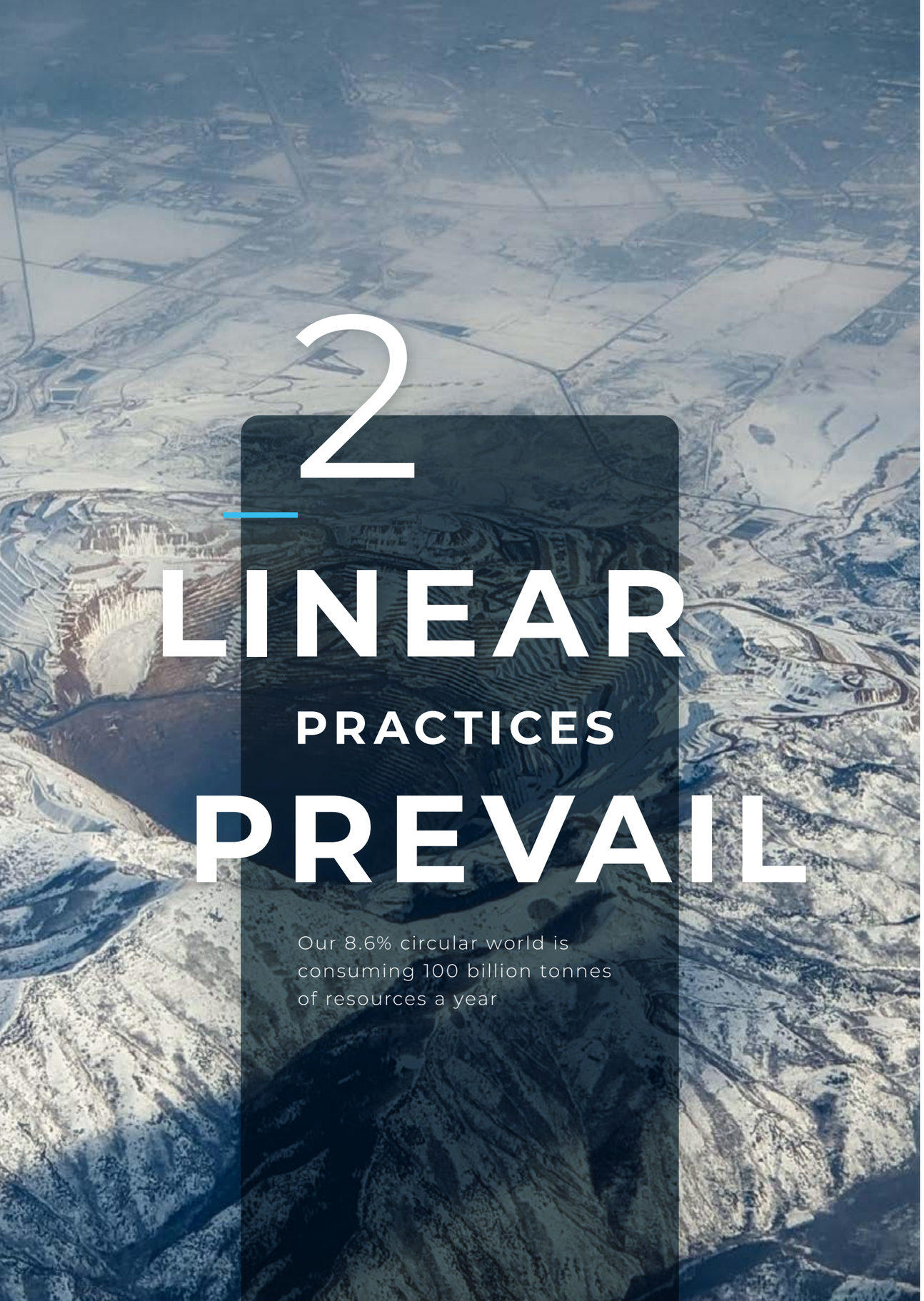
The delivery of services to society ranges from education and public services to commercial services like banking and insurance. The material and emissions footprint is modest in total and typically involves the use of professional equipment, office furniture, computers and other infrastructure.

HEALTHCARE

With an expanding, ageing and, on average, more prosperous population, healthcare services are increasing globally. Buildings aside, typical resource groups include use of capital equipment such as x-ray machines, pharmaceuticals, hospital outfittings (beds), disposables and homecare equipment.

COMMUNICATION

Communication is becoming an ever-more important aspect of today's society, provided by a mix of equipment and technology ranging from personal mobile devices to data centres. Increased connectivity is also an enabler of the circular economy, where digitisation can make physical products obsolete, or enable far better use of existing assets, including consumables, building stock or infrastructure.



2

LINEAR PRACTICES PREVAIL

Our 8.6% circular world is consuming 100 billion tonnes of resources a year

From the bicycles we ride, to the books we read and the buildings we inhabit, nearly all facets of daily life are shaped by materials. And as we do more—be it travelling, buying goods and even eating—we use more resources. Of the 100 billion tonnes of resources that the world uses every year, only 8.6% is cycled back into our economy: over 90% of what we take from the earth to fulfil our needs and wants goes to waste—our throwaway society in practice. In our first report in 2018, we introduced these figures in a material x-ray of our global economy, which visualised the global material footprint that lies behind meeting our key needs and wants, be they Nutrition or Housing. The x-ray depicts these 'hidden currents of our lives—the massive flows of raw materials and products deployed, to such a wonderful and damaging effect, by 7.7 billion humans. Our shared metabolism, you might say,' to quote National Geographic's coverage of our *Circularity Gap Report 2020*. This chapter dives into the material x-ray and what this tells us about why global circularity has reduced from 9.1% to 8.6% in only two years.

FROM PARIS TO GLASGOW...

more than half a trillion tonnes of virgin materials were consumed; and the Circularity Gap got worse, not better. On top of this, resource extraction is forecast to almost double between now and 2050.

In only six years, the world economy consumed an additional half a trillion tonnes of virgin materials, namely minerals, ores, fossil fuels and biomass. These enormous volumes of materials—by and large wasted after use—are climbing year on year. Ultimately, waste is connected to most environmental problems, from biodiversity loss, global warming and air pollution to plastic soup.

The covid-19 pandemic led to rapid behavioural changes and government decisions that occurred almost overnight. However, we failed to see a transformation of consumption patterns: material extraction and global emissions only showed a very minor and temporary decline. Already at the end of 2021, we witnessed soaring energy prices because demand for energy and materials increased so sharply, while GHG emissions also soared.[22]

More structurally, in only 50 years, global material use has nearly quadrupled—outpacing population growth.[23]

In 1972, as the Club of Rome's *Limits to Growth* was published, the world consumed 28.6 billion tonnes. At the turn of the Millenium, this had gone up to 54.9 billion tonnes and as of 2019, it surpassed 100 billion tonnes. Accompanying the rapid acceleration of consumption is rising waste levels: ultimately, over 90% of all extracted and used materials end up as waste. On the flip side, only 8.6% makes it back into our economy.

This rate of extraction continues to threaten the planet's future—and our lives on it. Yet forecasts paint a grim future: according to the International Resource Panel, material use may increase to between 170 and 184 billion tonnes in 2050 if business as usual prevails.[24]

The circular economy provides a framework for decoupling growth from material extraction: it can create the conditions for sustainable development, meeting the needs of the growing population without relying on the use of primary resources.

MASS: THE GLOBAL MATERIAL FOOTPRINT

SATISFYING SOCIETAL NEEDS

Our material x-ray depicts how resource groups (minerals, metal ores, fossil fuels and biomass) are deployed to satisfy the societal needs shown on page 19—as well as what happens to them after we chuck them in the bin (end-of-use). Looking at Figure Two, we see both the volume of extracted resources globally per year (92.0 billion tonnes) and all of the resources that were cycled (8.65 billion tonnes). This brings the total of material inputted into the economy to 100.6 billion tonnes.

Of the total material inputs, a hefty chunk (48 billion tonnes) went into long-term stock: largely buildings, infrastructure and heavy machinery. From that same stock, 17 billion tonnes of materials were removed or demolished, leaving a net addition of 31 billion tonnes in the year. The materials used for this stock are locked-in and won't become available for cycling back into the economy until the stock reaches its end-of-use phase. In terms of the short-lived products that were consumed by the global economy—think of everyday items like clothing or packaging—a large share remains unaccounted for and is assumed to be dispersed into the environment as unrecoverable waste.

In total, 32.6 billion tonnes of materials are collected as waste. The majority of this stream, 23.9 billion tonnes, is lost; it is landfilled, incinerated, wasted at mining operations or otherwise dealt with informally and 'off the books'. Of the materials classified as waste, only 8.65 billion tonnes, or 8.6% of the total material use of society, is actually cycled.

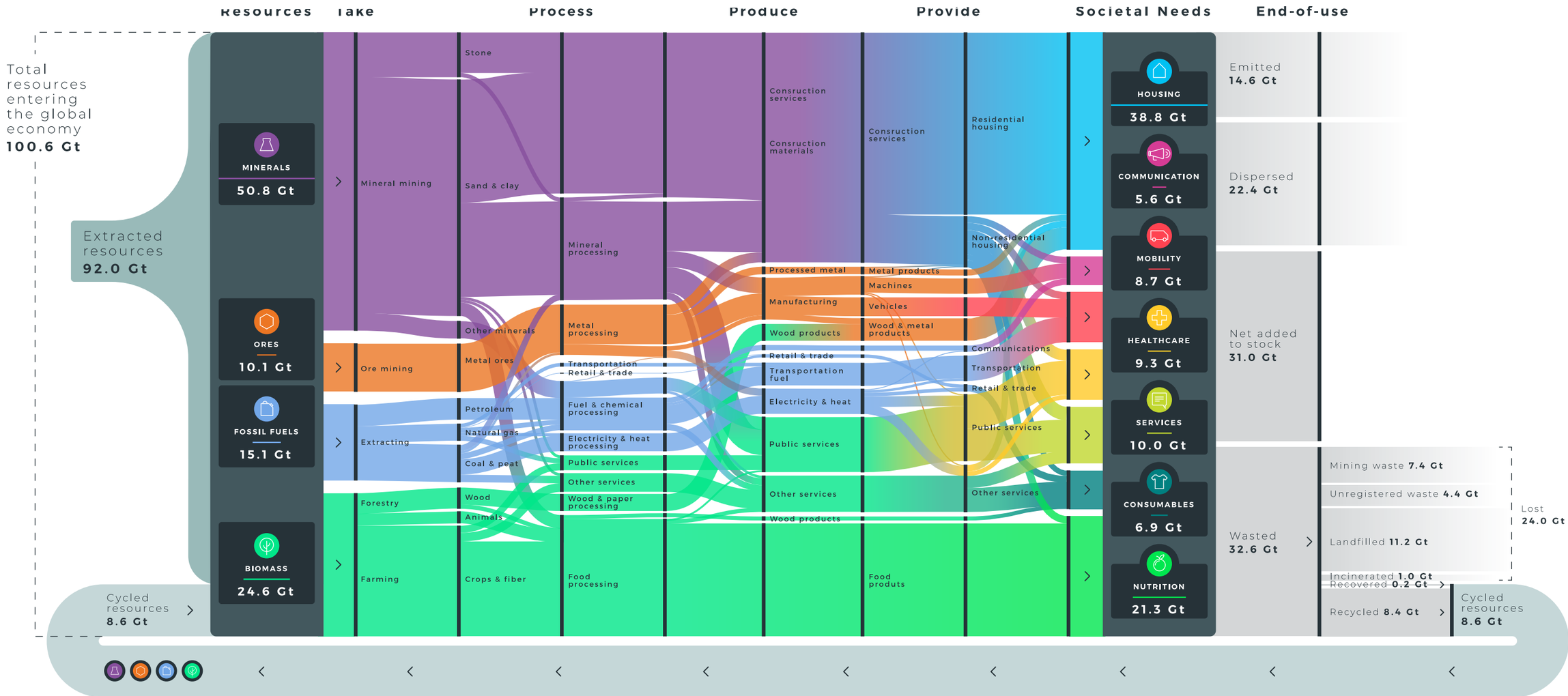


Figure Two: Visualising how our global resource footprint meets our key societal needs—and that the global economy is only 8.6% circular

RECOVERED

- **Waste-to-Energy** more than 65% efficient
- **Biogasification**
- **Component recovery**

RECYCLED

- **Recycling/Reclamation**
- **Backfilling**
- **Composting**
- **Regeneration**

FROM 9.1% TO 8.6% CIRCULAR: WHAT'S GOING ON?

Only two years after the 9.1% measurement, our analysis found that the circularity of the world had fallen to 8.6% (as shown in detail in Figure Two). And we now know that material use is not only increasing, but accelerating beyond even population growth. Since 1970, the American population has grown by 60%, disproportionately accompanied by an increase in consumer spending of 400%: a trend common among nations with an expanding middle class.[25]
The negative shift overall can be explained by two related, underlying trends:

1 **Our growth rate of resource extraction outpaces improvements in efficiency and in end-of-use recovery by a factor of two to three—and as a result, the quantities of secondary materials available for use are falling short.**

Our capacity for recovery and recycling fails to match current rates of consumption. While in many parts of the world recovery is on the rise—steered by comprehensive government policy and technical innovation and investment—our capacity for reuse can't match our need for resources. By way of illustration: solid waste recovery in Europe increased, on average, by 11% between 2011 and 2016, with countries such as Sweden, Austria and Luxembourg leading the way and boasting recovery rates above 80%—but extraction continues.[26] And in the Netherlands, a circular frontrunner, the use of natural resources is barely declining despite efficiency increasing—be it designing a plastic bottle to have a lighter cap, or reducing the amount of pulp required to make a ream of office paper.[27]

Ultimately, our limited capacity to **cycle** materials at an equal level around the world means that quantities of secondary materials available for reuse fall short: we still need huge amounts of virgin materials to satisfy our lifestyles. Overall material consumption must also be reduced to **narrow** flows: if the common denominator (consumption of primary materials) keeps growing, our advances in material efficiency and cycling can never keep up. The processes still entail resource extraction.

2 **To serve the needs of a growing population, we keep extracting materials to build housing, infrastructure and heavy machinery—we should make use of what is already there.**

Countries are continually investing in new buildings and infrastructure to meet a variety of societal needs. Current estimates suggest that 255 billion square metres of buildings exist across the globe—a figure expected to almost double within the next four decades. This is equal to erecting cities the size of Paris every week.[28] This stock build-up is not inherently bad; many nations need to invest to ensure access to basic services, particularly in Build and Grow countries (see Chapter Four). But as our global population is projected to swell to 9.9 billion over the next 30 years and land-use concerns come to the fore, we're increasingly building *up*. This is concerning as tall buildings are inherently unsustainable: skyscrapers require extra resources for foundational and structural support: namely, cement.[29] Cement use is extremely emissions-intensive but demand continues to rise.[30] Also, increasing renewable energy generation, distribution and storage capacity to **regenerate** energy flows will entail building up infrastructure, such as wind turbines or electrical grids. Fortunately, this is happening at scale: G20 members have set new records in building capacity for solar and wind power—nearly doubling the amount of wind power produced in 2020 compared to 2019.[31]

Regardless, when materials, mostly minerals and ores, are invested into stock in the form of buildings, infrastructure and heavy machinery, they become embedded and unavailable as secondary materials for as long as they remain stored and in use. It is, therefore, paramount that virgin resources are not extracted to continue building up this stock, but rather that we design, produce, maintain and reuse buildings, roads and machinery in a circular manner to **cycle** flows.

Chapter Three outlines circular economy strategies that can reduce our overall resource extraction and consumption by 28%—allowing us to make the most of improvements in efficiency, product design, recycling and reuse, so as to **narrow, slow, regenerate and cycle** flows as a result. With this reduction in global emissions by 22.8 billion tonnes, we can close the Emissions Gap and keep warming temperatures to 1.5-degrees.

FROM A MASS FOCUS TO VALUE AND CARBON: THE MASS, VALUE, CARBON (MVC) NEXUS

The circular economy is a big picture and holistic idea. Ultimately, it is a means to an end—the end being a socially just and ecologically safe space. But to reach this goal, we have to look at more than only resource flows. In our 2019 report, we introduced the Mass-Value-Carbon (MVC) nexus, a concept that looks at how much greenhouse gas (GHG) emissions (Carbon) and value-created (Value) are distributed through meeting our key societal needs and wants with materials (Mass). The MVC became the starting point for a more holistic view of our economy.

Our 2021 Report built on this MVC concept and profoundly deepened our exploration; scrutinising how global GHG emissions arise from the extraction, processing and use of resources, and paving the way for a set of solutions that cut both resource extraction and use and GHG emissions. Read more in the next Chapter.

3

THE CIRCU-LARITY-CLIMATE LINK

Enacted globally, a circular economy can help close the Emissions Gap

Photo by Damir Omerovic

Three consecutive *Circularity Gap Reports* were devoted to answering the question of how circular the global economy is and identifying the key levers to move us towards circularity—with a focus on mass. Initially, our inspiration came from the UN's Emissions Gap reports—and for our 2021 analysis, the Emissions Gap returned to the fore, as we undertook the task of quantifying how closing the Circularity Gap could also help to close the Emissions Gap. We found that our climbing rates of resource use are responsible for catapulting billions of tonnes of human-made (greenhouse gases) GHGs into our atmosphere—70% of emissions, to be precise. In 2019 alone, we emitted 59.1 billion tonnes of GHGs to satisfy global needs and wants.[32] Our *Circularity Gap Report 2021* quantitatively mapped how GHG emissions and resources move through our economy, from extraction to end-of-use. In uncovering the synergistic relationship between resource use and GHG emissions, we now present a roadmap of 21 circular solutions for the world that can transform our use of materials and cut emissions.

For a decade, the United Nations Environment Programme (UNEP) has highlighted the Emissions Gap every year. The Emissions Gap assesses the level of GHGs that will be emitted if we continue to plunder along a business as usual path that includes current Nationally Determined Contributions (NDCs), compared to the level we must limit emissions to keep global temperature rise below 2-degrees, and ideally 1.5-degrees. The Emissions Gap that is referred to in this report is defined in reference to a 1.5-degree trajectory to be achieved by 2032, thereby meeting the goal of staying well below 2-degrees of warming, and ideally 1.5-degrees, as specified by the Paris Agreement.

TO CLOSE BOTH THE EMISSIONS AND CIRCULARITY GAPS, WE NEED TO LOOK BEYOND CLEAN ENERGY

Net-zero and decarbonisation promises have never been more prevalent—yet despite the headline-grabbing claims of governments, the use of coal is predicted to rise by 5% in 2021 alone in G20 countries.[33] Not only is climate action disappointing, but so are pledges for action. The vast majority of NDCs crafted during the Paris Agreement in 2015 and updated for COP26—which have the aim of keeping warming global temperature below 2-degrees and ideally 1.5-degrees—fell overwhelmingly short of the goal. They hardly mention resource extraction, use or consumption rates and only one-third allude to the circular economy. Instead, the focus was largely on the clean energy transition: ditching fossil fuels in favour of energy sources such as solar or wind. This resulted in efforts centred on energy sources in industries with high GHG emissions: namely electricity, heat, construction, transportation and manufacturing. Although the energy transition is hugely important, it's not the only way to cut emissions, and as the initial NDCs showed, it's not impactful enough alone.

Based on the material x-ray, in Figure Two, from our formative reports, our 2021 Report mapped this x-ray agaisnt how GHGs flow through our economy. This uncovered how the vast majority of GHG emissions (70%) are ultimately generated through material handling and use—be it the clothes we wear, the phones we own or the meals we eat. This demonstrated how important it is to consider resource use—and consumption levels—in our efforts to cut global GHG emissions. As circular economy strategies ultimately prioritise material value-retention and cut excessive consumption, they can be extremely effective in cutting GHG emissions. This is how closing the Circularity Gap, can help to close the Emissions Gap.

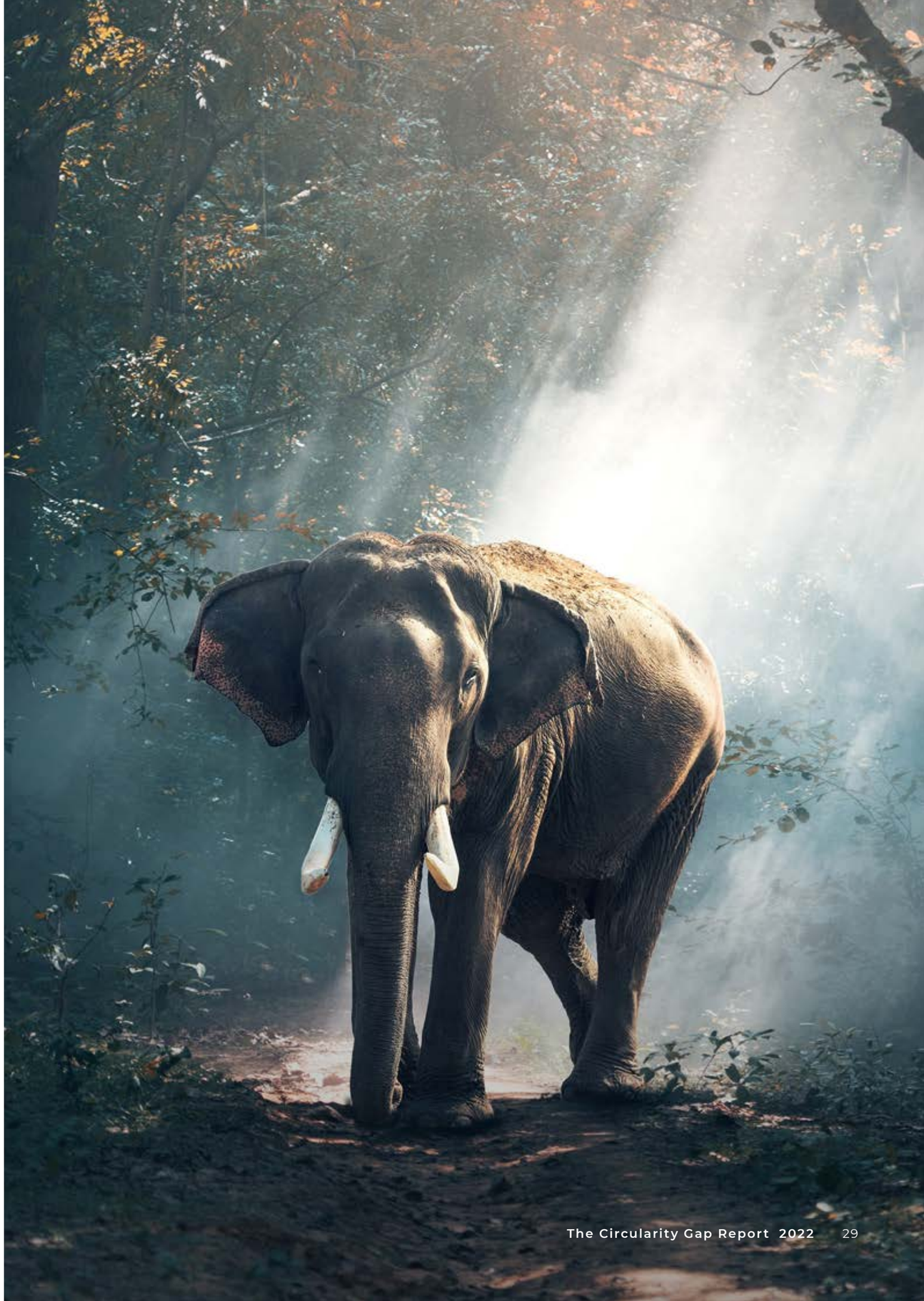
EMISSIONS AND MATERIAL-INTENSIVE NEEDS: MOBILITY, HOUSING AND NUTRITION

In analysing and illustrating how 59.1 billion tonnes of emissions flow along and across global value chains in an emissions x-ray, we gained a deeper understanding of the upstream drivers of global emissions and which societal needs and wants generate the most emissions. After establishing that 70% of all global emissions were tied to resource use and handling, we were left with the question: which needs and wants should we focus on to make the deepest reductions possible?

MOBILITY, HOUSING AND NUTRITION ACCOUNT FOR ALMOST 70% OF GLOBAL EMISSIONS

- Mobility has the largest emissions footprint at 17.1 billion tonnes—largely due to fossil fuel use across passenger and freight transport.
- The production of automobiles, trucks, trains and aeroplanes is relatively limited in emissions contributions.
- Housing, at 13.5 billion tonnes of emissions, has the second largest contribution. This is due to the vast extraction, transport and construction activities it entails, as well as the energy used to light, heat and cool our homes.
- Third in line is the provision of food for Nutrition, which contributes 10 billion tonnes of emissions.
- Land use, land-use change and forestry (LULUCF)—a GHG inventory sector referring to emissions from human land-use activities—is associated with the production of food, but also fibres and clearing for the expansion of urban centres, and is responsible for about 4 billion tonnes of emissions.
- The remaining 30% of emissions flow into satisfying our need for Communications, Services, Consumables and Healthcare.

From this information, we devised scenarios to get us back on track to achieving the Paris Agreements goal: a well below 2-degree world, and ideally 1.5-degrees. In doing this analysis, we started where the NDCs left off: we did not include the clean energy transition in our solutions. This was to make the most valuable contribution to the debate, next to the transition already underway. Therefore, the Emissions Gap we sought to close was uncovered by the NDCs and current policies.



INTERVENTIONS
VORTEX

21 CIRCULAR SOLUTIONS FOR A 1.5-DEGREE PATHWAY

Figure Three on the next page shows how a roadmap of 21 interventions across six scenarios can mitigate climate impact by curbing GHG emissions. We did not model interventions specially for the societal need of Services as the materials used and emissions released in performing such Services are included in other categories. For example, repair interventions—classified as a service—are addressed under most of the other needs and wants. Encompassing actions for businesses, cities and nations, the 21 solutions provide input for a more profound and fundamental transformation of the economy than the current pathways that make up the vast majority of NDCs. This set of 21 circular strategies can keep the planet on a 1.5-degree trajectory by cutting emissions by 22.8 billion tonnes beyond what is achieved by the updated climate commitments: a 39% reduction from 2019 levels.

Together, the combined interventions can almost double the current global Circularity Metric of 8.6%, bringing it to 17%. This results in:

- Shrinking global material use and extraction by 28%.
- Cutting global GHG emissions by 39%—fully closing the Emissions Gap as defined in our report and taking into account the updated NDCs.
- Allowing the world to achieve the Paris Agreement's goal of keep at 1.5-degrees of warming by 2032.*

**If we implement all segments of the roadmap, as well as conditional and unconditional NDCs, as they stood in 2021, by 2032, and then continue decreasing emissions at more or less the same pace to reach net-zero by 2050.*

Some interventions overlap, which means that the total combined effect is significantly less than when all individual interventions are simply added together. This is because some interventions, when combined, will partially cancel each other out. For example, in 'Reduce floor space', we also reduce the volumes of construction and demolition waste (C&DW) that become available for recycling and repurposing. Another example is the absolute impact of lightweighting the global car fleet in 'Vehicle design improvements', which is directly moderated by the size of the said fleet, which in turn is reduced by, for instance, car sharing. This dynamic between interventions and the extent of their overlaps is visually depicted by the boxes.

For each solution, the figure shows its potential to reduce GHG emissions as the width of the intervention 'box', and the material footprint reduction by the height of the box. The image shows the contribution of each intervention separately, as well as for all interventions combined.

LEGEND

HEIGHT
expresses the **material mass** reduction in Gt

WIDTH
expresses the **emissions reduction** in $GtCO_2eq$

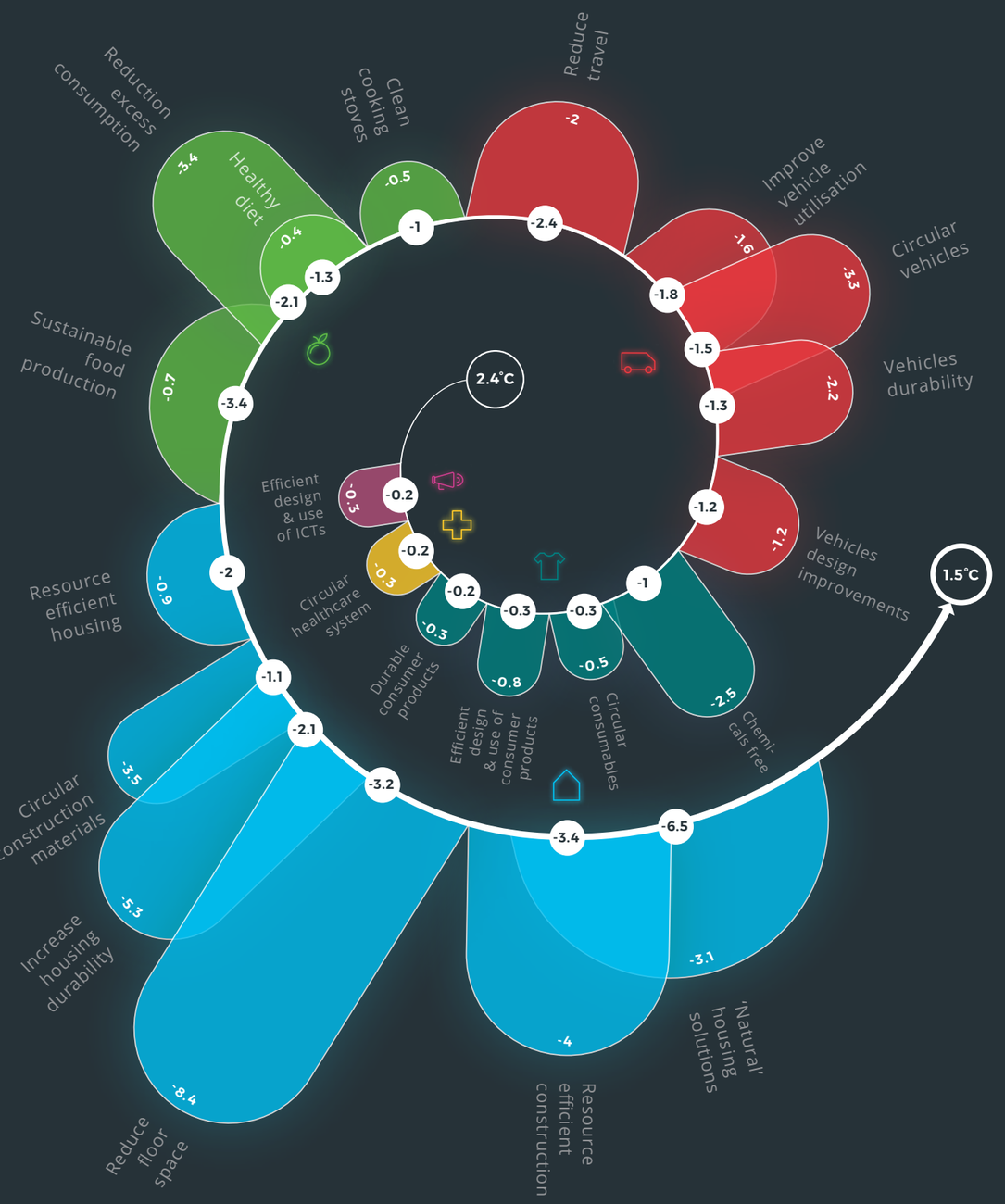
COLOUR
represents a societal need:

- MOBILITY
- CONSUMABLES
- HEALTHCARE
- COMMUNICATIONS
- NUTRITION
- HOUSING

TEMPERATURE
total reduction in global temperature increase by 2050

2.4˚C 1.5˚C

Figure Three: Shows the impact of our interventions on the Circularity and Emissions Gaps



21 SOLUTIONS

spread across six societal needs and wants. Within each solution are strategies: 'how to get there'.

Figure Four: Shows the range of adaptable strategies within each solution

2.4˚C

The forecasted global temperature rise, if current NDCs are implemented by 2050

EFFICIENT DESIGN OF ICTS
Saving: 0.19 Gt emissions and 0.33 Gt material use
Strategies: Buy smaller and lighter electronic devices, increased digitalisation, cloud computing services

CIRCULAR HEALTHCARE
Saving: 0.21 Gt emissions and 0.27 Gt material use
Strategies: Repair, maintenance and durable design of medical equipment, substitute single use medical items for reusable alternatives, virtual health care (ex. Doctor's appointments over skype etc.), medical equipment cascading, medical waste recycling

DURABLE CONSUMER PRODUCTS
Saving: 0.18 Gt emissions and 0.27 Gt material use
Strategies: Repair, maintenance, sharing, and secondhand use of textiles, appliances, furniture, machinery and equipment

EFFICIENT DESIGN AND USE OF CONSUMER PRODUCTS
Saving: 0.30 Gt emissions and 0.80 Gt material use
Strategies: Less/more efficient paper use, less/more efficient and more natural textile use, less/more efficient plastic use, less/more efficient furniture use, less/more efficient electronic goods use

IMPROVE VEHICLE UTILISATION
Saving: 1.83 Gt emissions and 1.64 Gt material use
Strategies: Fuel efficient driving, car pooling/sharing

CIRCULAR VEHICLES
Saving: 1.50 Gt emissions and 3.33 Gt material use
Strategies: Recycle vehicles at end-of-use, use recycled metal and plastics for vehicles

VEHICLE DURABILITY
Saving: 1.23 Gt emissions and 2.18 Gt material use
Strategies: Reuse of motor vehicle components, durable vehicle design and production, optimal vehicle repair and maintenance

VEHICLE DESIGN IMPROVEMENTS
Saving: 1.22 Gt emissions and 1.24 Gt material use
Strategies: Vehicle lightweighting, autonomous driving (safer driving = less need for crash resistant cars), use smaller cars

CHEMICALS-FREE
Saving: 0.96 Gt emissions and 2.50 Gt material use
Strategies: Use bio-plastic, use less plastic, use less chemicals

CIRCULAR CONSUMABLES
Saving: 0.31 Gt emissions and 0.45 Gt material use
Strategies: Recycle plastics, use recycled toilet paper, use recycled writing paper, increase recycled materials in furniture, start closed loop recycling of synthetic fibres

REDUCE TRAVEL
Saving: -2.41 Gt emissions and -1.96 Gt material use
Strategies: Telecommuting, reduced cargo shipping (for example, due to more local consumption)

SUSTAINABLE FOOD PRODUCTION
Saving: 2.07 Gt emissions and 3.40 Gt material use
Strategies: Organic food, seasonal & fresh food, regional/local food, produce your own food, sustainable biomass certifications

REDUCE EXCESS CONSUMPTIONS
Saving: 2.07 Gt emissions and 3.40 Gt material use
Strategies: Replace animal feed with agricultural or food waste, less packaging on food products, food sufficiency (keep caloric supply per person to 2,700 a day)

HEALTHY DIET
Saving: 1.32 Gt emissions and 0.42 Gt material use
Strategies: Consume mostly plant-based diets, eat less sugary foods and beverages, eat less processed foods

CLEAN COOKING STOVES
Saving: 0.97 Gt emissions and 0.41 Gt material use
Strategies: Replace traditional polluting stoves with clean ones

RESOURCE EFFICIENT HOUSING
Saving: 1.96 Gt emissions and 0.79 material use
Strategies: Hang-drying clothing, hot water saving, smart metering, better thermal insulation, lower room temperature

1.5˚C

The forecasted global temperature rise, if current NDCs & circular roadmap are implemented by 2050

RESOURCE EFFICIENT CONSTRUCTION
Saving: 3.45 Gt emissions and 4.05 Gt material use
Strategies: Lightweight/frugal design, local construction materials

NATURAL HOUSING SOLUTIONS
Saving: 6.47 Gt emissions and 3.07 Gt material use
Strategies: Green roofs, passive houses, produce own renewable energy

REDUCING FLOOR SPACE
Saving: 3.16 Gt emissions and 8.38 Gt material use
Strategies: Less living space/co-housing, multifunctional building spaces, limit residential stock expansione

INCREASE HOUSING DURABILITY
Saving: 2.15 Gt emissions and 5.28 Gt material use
Strategies: Refurbishment and renovation

CIRCULAR CONSTRUCTION MATERIALS
Saving: 1.14 Gt emissions and 3.55 Gt material use
Strategies: Construction materials with recycled content, diversion of construction and demolition waste

COLOUR
represents a societal need: COMMUNICATIONS HEALTHCARE CONSUMABLES MOBILITY NUTRITION HOUSING

While we've analysed circularity on the global scale, businesses, cities and nations all have a vital, yet different, role to play in advancing circular solutions. Transitioning to a fully circular economy within a generation will require urgent and large-scale actions from all parts of society. National and local governments will need to provide direction and enabling conditions, consumers will need to make choices that encourage circularity and businesses will need to redesign their processes and products from the ground up.

Nations and their governments essentially establish the 'rules of the game' at the national level through policy or ambitious target setting. They can create the conditions that enable and promote or indeed block or hinder—circular transformations. These conditions will directly influence the activities of businesses and cities in the nation. For instance, taxation is a powerful instrument to create the right incentives that steer behaviour of market players, such as promoting plant-based diets or increasing the share of secondary materials in construction activities. Regulations such as bans (of polluting chemicals or plastic bags, for example) and standards like mandatory minimums (of recycled content in packaging, for example) are also central. While national governments have an important role to play in creating general frameworks, regional and local governments **(cities)** can enhance and adapt them to their specific context. Learn more about how nations can drive the transition on our website.

Cities are responsible for 60% of resource consumption, 70% of global waste and 70% of global GHG emissions. They are also hubs of infrastructure, innovation, manufacturing and business, and are thus crucial locations in which circular economy actions must take place. Even in cases where national governments may not provide suitable enabling conditions for circularity, there are a number of ways in which city governments can integrate and support it through their policies and day-to-day decisions and operations (public procurement, for example). Local governments often have jurisdiction over waste collection, public transport networks, urban planning and local economic development, and are in many cases able to implement impactful changes more rapidly than national governments can. The Mayor of London, for example, has set an ambitious target for London to reach net-zero emissions by 2030, 20 years earlier than the UK government's goal.[34] They are also better positioned to engage with local businesses, nonprofits and community organisations to align their efforts toward circularity goals. Learn more about how cities can drive the transition on our website.

Businesses practically implement and execute actions based on policy set by local and national governments. They can also make fast and independent decisions for their own value chains. This makes them innovation drivers, and businesses around the world have been moving to more circular approaches. There is real opportunity for businesses to reduce costs, build resilience in their supply chains, comply with emerging policies and meet investor and customer requirements, through moving to a more circular approach.[35] Learn more about how businesses can drive the transition on our website.

DIFFERENT COUNTRIES, DIFFERENT RESPONSIBILITIES

To influence our climate future for generations to come and see results,our global roadmap must be tailored to national pathways. Translating these global interventions to the national level must take into account carbon inequality. Nearly half (48%) of cumulative CO_2 emissions over the last quarter century can be attributed to the richest 10% of the globe, whilst the poorest 50% were responsible for only 7%.[36] Over the past few decades, the global carbon budget has largely been spent by the consumption of the rich and has failed to lift other areas of the world out of poverty. And in a cruel irony, this emissions inequality also has another side: lower-income nations who contribute the fewest emissions are also most vulnerable to the impacts of climate breakdown. Such nations are still fighting to receive adequate climate financing from richer nations, following the failure of COP26 on this front.

Our 2021 report presented the emissions and material footprint of three different country profiles, Build, Grow and Shift, (see pages 40-42) in absolute terms from a consumption perspective. It found that Build countries are home to the greatest share of the globe's population but are only responsible for 17% of emissions—yet most at risk for climate induced disasters. Grow countries, home to rapidly industrialising populations, produce 47% of global emissions and 51% of global resource extraction. Meanwhile Shift counties, which house a minority of the global population, produce the largest share of emissions and account for one-third (31%) of all global resource extraction.

Photo by Eberhard Grossgasteiger

4

A CIRCULAR ECO-NOMY FOR SOCIETY

Circular solutions can help move countries toward a safe and just space

Photo by Manish Tulsiani

Our response to the climate emergency must reduce global and local inequalities and protect against overshooting the means of the planet. Our 2020 Report found that all countries are failing when it comes to reaching an ecologically safe and socially just space. Some countries are close, others are far away; each starts from a different point on the map, but all have a distance to go. We believe the circular economy can help close the distance countries have from the safe and just space—but getting there will look very different for different stakeholders and nations. Each country must tailor the roadmap of 21 circular solutions to suit their context and populations. If we don't tailor solutions for different countries and incorporate social and ethical considerations in the circular economy transition, we risk repeating the same mistakes of the linear economy—which has often relied on exploiting people and the planet.

In all *Circularity Gap Reports*, ethical considerations and trade-offs that could potentially arise in the circular transition have been a careful consideration. The circular economy must not perpetuate the same mistakes as the linear economy. We, therefore, pinpoint the seven core societal needs and wants that guide our research: Housing, Nutrition, Mobility, Communications, Services, Consumables and Healthcare (see page 19). The global roadmap must be resource-efficient, but also people-centric; the impact of one circular strategy can have vastly different repercussions on communities in different localities and this must be taken into account.

Consider this: although a healthy diet requires 2,000 calories per day for a typical female, the intake in some countries may be far higher, while malnutrition persists in others. The more calorie-intensive diets could consist of out-of-season, imported foods that have travelled across the globe, or high levels of animal protein. Calling to reduce consumption here may be appropriate and even ethical, but less so in cases where access to basic nutritious food is limited. The circular economy is also about achieving a structural and cultural shift where we can satisfy everyone's universal needs within the boundaries of the planet—but there are important differences between countries and regions to take into consideration.

NO COUNTRY IS WITHIN A SAFE AND JUST SPACE

Countries all exist on a spectrum, which we measured in our 2020 Report along two dimensions: the Human Development Index (HDI) and Ecological Footprint (which measures humanity's demand on ecosystems).[37] In an ideal world, all countries would have strong HDI scores and a low Ecological Footprint—providing for the needs of their citizens within the means of the planet. Currently, no country has created this ecologically safe and socially just space for humanity. Figure Five on the next page demonstrates how no one country has reached the 'safe and just' space. We all have work to do and the circular economy can play a pivotal role.

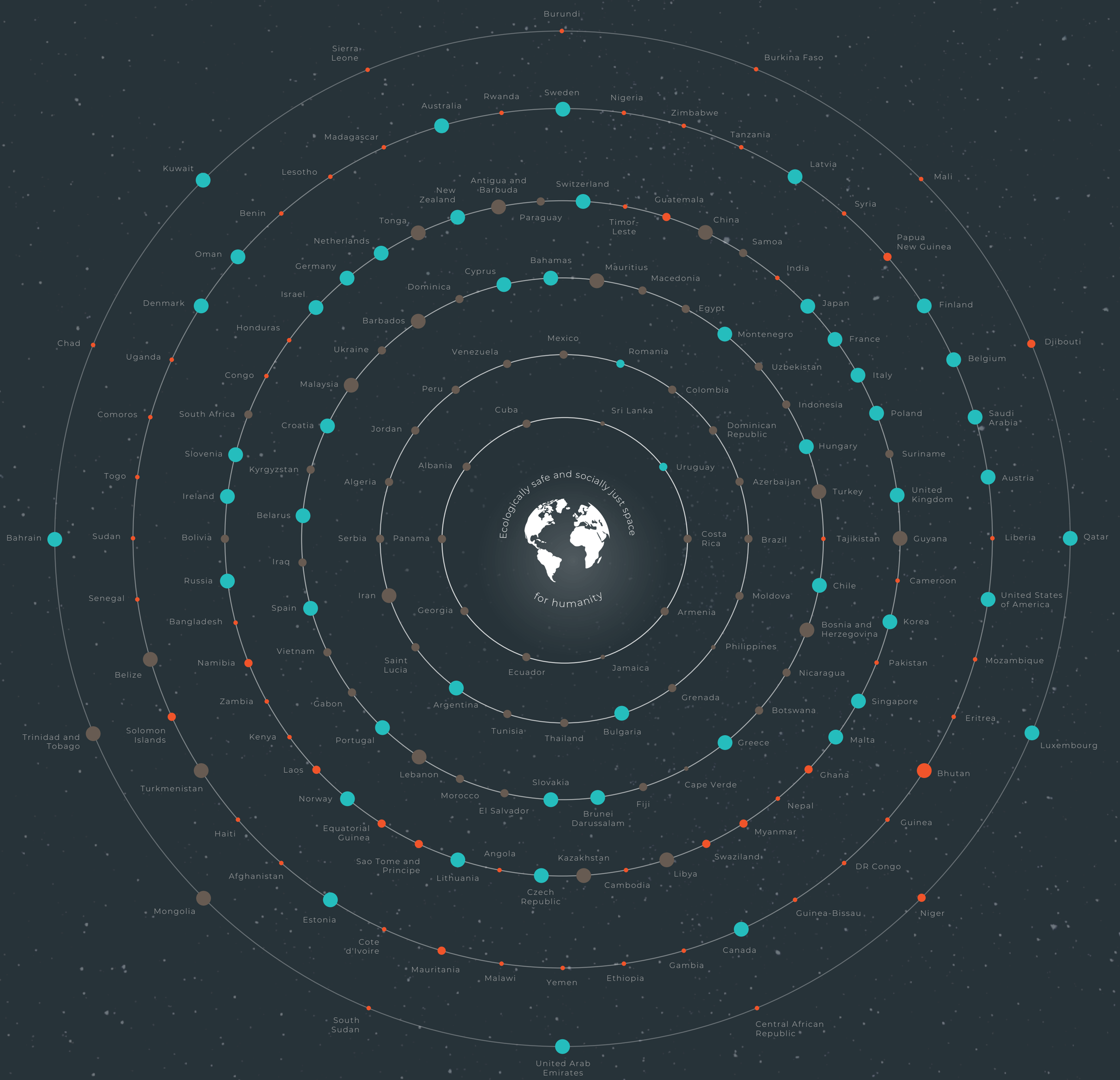
Countries that score high on HDI have stable governments, widespread education and healthcare, high life expectancies, and growing, powerful economies. Low scores indicate unstable governments, widespread poverty, lack of access to healthcare, and poor education. They often also have low incomes and low life expectancies, coupled with high birth rates. Some countries occupy spaces in between.

Implementing the circular economy must recognise that different approaches are appropriate in different contexts to ensure local needs are met, while limiting the environmental impacts of associated resource use.

MAPPING COUNTRIES' DISTANCE FROM THE SAFE & JUST SPACE

The Galaxy shows how far 176 countries are from operating in an ecologically safe and socially just space for humanity: meeting basic human needs while staying within the Earth's biophysical boundaries. Some countries are close, others are far away: each starts from a different point on the map; but all have a distance to go.

CIRCLE ECONOMY



Ecological Footprint

Measured in average Global Hectares (GHa) per person in relation to the earth's biocapacity

Smaller = preferable

within 1 planet

1 to 2 planets

more than 2 planets

Distance to Safe and Just space

Each orbit clusters countries that share a similar distance to the safe and just space.

Closer to center = preferable

0.8 to 1

0.65 to 0.79

0 to 0.649

Social Performance

Measured by the United Nations' Human Development Index (HDI)

Higher = preferable

Figure Five: How 176 countries perform on the basis of both social performance (HDI) and Ecological Footprint.

BUILD

Build countries—such as India and Ethiopia—struggle to meet the needs of their populations, from education to healthcare. While their citizens live within planetary boundaries, these countries are characterised by low HDI rankings. Although it has been on a steady decline for the last two decades, poverty is widespread and covid-19 sparked a surge in extreme poverty in Build countries.[38] These countries are also especially vulnerable to extreme weather events that will threaten lives and damage livelihoods and sectors ranging from agriculture to the built environment. Measures that build up resilience are particularly called for—especially as populations grow and governments strive for increased industrialisation.

While the position of Build countries is precarious, it's also full of opportunity: as they develop infrastructure and work to meet the needs of their citizens, there is a chance to bypass the degrading processes employed by Grow and Shift countries, instead applying circular models.

REVISITING TRADITIONAL KNOWLEDGE, BRIDGING THE TECHNOLOGICAL GAP

Widespread desertification and forest loss have encouraged many Sub-Saharan Africa populations to switch from traditional roofing techniques—using mud and timber—to corrugated iron sheets and sawn timber beams—which have inadequate thermal and acoustic insulation and they can further accelerate deforestation. The association for Voute Nubienne (Nubian Vault) has established a programme in Burkina Faso's capital, Ouagadougou (and has recently expanded to Mali, Senegal and Togo) that promotes an ancient architectural technique to construct timberless vaulted roofs, which protect during the rainy season, stay cool during hot days and radiate heat back at night. The programme teaches villagers to make this roofing themselves using readily available local materials, thereby meeting local housing needs with a low-carbon option that also helps to prevent further deforestation.[39]

In some Build countries, up to 45% of harvested fresh fruits and vegetables can go to waste—mainly due to lack of cold storage.[40] Reducing food waste—and providing affordable solutions for farmers in Nigeria—is ColdHubs: a post-harvest, solar-powered, cooling-as-service solution in Nigeria. By offering an option for storing and preserving perishable foods that adequately meets the financial needs of smallholder farmers, ColdHubs is a solution to the issue of post-harvest losses of fruits, vegetables and other perishable food. The company offers farmers a flexible pay-as-you-store subscription model at rates that they can afford, helping to tackle the barrier of access to financing for cold chain solutions and bridging the technological gap for smallholder farmers.

As India's population grows and urbanisation increases, energy consumption in buildings is expected to grow in tandem. The Indian government has implemented policy schemes to mainstream sustainable practices: appliance standards, mandatory labelling and certification, energy efficiency requirements and utility demand-side management programmes. Buildings have minimum requirements for heating, ventilation and air conditioning systems, and the Ministry of New and Renewable Energy has implemented several programmes on using renewable energy in buildings.[41]

Finally, many Build countries lack access to the technologies and investments required to transition from artisanal to industrial recycling operations. To address this issue, the African Development Bank is financing the implementation of a plastic waste collection and recycling infrastructure in Ivory Coast. Using innovative recycling technologies, this operation not only provides local industries with raw materials, but also supports the social and economic reintegration of 2,000 ex-combatants.[42]

GROW

Grow countries—like China and Brazil—are rapidly industrialising: while they don't yet match the wealth of Shift countries, or have HDI rankings as high, their economies are growing exponentially. They've lifted significant proportions of their populations out of poverty in recent years—fostering a growing middle class—yet social mobility remains relatively low. While it could take a family two generations to transition from low- to middle-income in a socially mobile country, for example, in Brazil it may take nine:[43] so while extreme poverty is less prevalent, much of these countries' wealth remains locked in the middle class. Grow countries' quick-paced growth is matched by a need for resources: they account for more than half of the world's resource extraction and a little under half of global emissions.

LABOUR PROTECTION FOR WASTE PICKERS, SMARTER WASTE MANAGEMENT

Work outside of the formal economy (for example, waste picking) is common in some Grow countries—but still, many waste pickers lack social status and labour protection. In Mexico, Danone has built a sorting centre outside the landfill where waste pickers can sort waste more efficiently and safely. As a result, over 400 families have seen their income rise by 30% and their health care covered.[44]

Meanwhile, Brazil touts a social business, Rede Asta, that helps divert waste from Brazil's vast landfills—each day about 175,000 tonnes of solid waste is collected around the country, only an estimated 2.7% of which is recycled.[45] The women-led initiative collects the waste and unused equipment of hundreds of companies and offers them bespoke designs using the discarded materials—often being used for the company's marketing purposes, for example. This scalable approach is made possible through a nationwide network of artisans, with Rede Asta acting as a matchmaker to facilitate new sales opportunities. Over in São Paulo, outdoor advertising has been banned—making space for street art, community notice boards and trees instead. This move has encouraged a needed shift toward more sustainable lifestyles by reducing consumption, a reduction in visual pollution and improving aesthetics and air quality for communities.[46]

In Bogatá, Colombia, the circular economy is driving smarter wastewater management in a bid to return the Bogatá river to its former glory. Since the 1950s, the river has faced wastewater discharges from domestic and industrial sources, as well as from urban runoff and the dumping of solid waste, leading to water so polluted it could no longer supply the city. Now, the city is implementing circular principles to spotlight flood control, wastewater management and water quality restoration, and the wastewater treatment plant was redesigned with energy efficiency and resource recovery at its heart. Now, the plant generates a significant part of the energy needed for its own disinfection treatment processes, for example. In the future, the plant will also produce biosolids and reusable wastewater for local agriculture.[47]

In another initiative, the city is capturing dangerous biogases emitting from overflowing landfills—and providing vocational training to youth in the process. The Doña Juana Landfill is the first in Colombia to capture landfill biogas and turn it into electricity. In capturing biogas, neighbouring communities are no longer exposed to poisonous gases such as ammonia and hydrogen sulfide, protecting especially poor populations living near the landfill.[48]

SHIFT

Shift countries—like European countries and the US—largely enjoy high HDI scores, but their citizens live far beyond the planet's means. It is estimated that if every person were to live and consume like an American, we would need five Earths to sustain our population.[49] While accounting for a minority of the world, these countries produce 43% of emissions, and account for nearly one-third of all resource extraction. While Shift citizens on the whole enjoy comfortable lifestyles marked by often excessive levels of consumption, and social mobility tends to be high, poverty still exists. While uncommon, extreme poverty—living on less than US$ 1.90 a day—still afflicts about 0.6% of people across Shift countries.[50] The national poverty lines for such nations are often around 20 times greater than this international value for extreme poverty. The gap between rich and poor is widening, too: in the OECD, which is almost exclusively composed of Shift nations, income inequality is the highest it's been for the last several decades.[51] This trend is only set to increase as the costs of housing and other goods are outpacing increases in earnings, putting a tight squeeze on the growth of the middle class.[52]

SHEDDING CAR-CENTRIC URBAN DESIGN, RECYCLE AND REPAIR REIGN

Shift countries have already built up most of their infrastructure—and now, circular strategies centre on undoing some of the harmful patterns these modes of development have created. Barcelona has undertaken an innovative new means for urban living to tackle car-centric design: the formation of 400 by 400 metre 'superblocks' that close off small inner streets to through traffic. Only emergency vehicles, transport for the disabled and vehicles for residential access are allowed. The result? A burst of new spaces for pedestrian use and community events, flourishing biodiversity, more sustainable modes of transport—like walking and cycling—and safer, more cohesive communities. Considered a 'global best practice' for urban design that prioritises people over cars, Barcelona's superblocks have caused green spaces' presence in the city to catapult from 0.6% to 11% in just one year, and have transformed streets into dining spaces, play places and event locales.[53]

Across the world in Rosario, Argentina, the local government has put circular economy strategies into practice to revitalise its economy, address food security crises and reverse unemployment. Its UN-lauded *Urban Agriculture Program* equipped residents with the tools and knowledge needed to start their own urban farms and gardens. Organic and sustainable methods were prioritised, and formerly degraded or unused areas—from strips along railways and highways to low-lying land vulnerable to flooding—were transformed into fruitful green spaces. The programme was a resounding success: the city saw the formation of 800 gardening groups that provided food to 40,000 residents—as well as a number of weekly markets throughout Rosario, boosting social cohesion and a sense of community.[54]

Many affluent Shift countries are dominated by take-make-waste consumption models—consumers purchase products that often end up in landfill long before they should. The City of Paris is taking steps to combat this, supporting recycling centres in launching reuse centres for consumer goods. The centres also run workshops where Parisians can learn to repair their household goods—and plans are in the works for an exchange scheme with the private sector to give municipality waste, from furniture to paving stones, a second life. Between 2016 and 2018 the centres have diverted more than 2,600 tonnes of waste from landfill—equal to savings of 17%.[55] German non-profit association FairWertung is also aiming to give goods another life—primarily clothing. With a focus on transparency and fairness, the association guarantees that donated clothing is properly reused or cycled—rather than shipped around the globe before eventually being discarded.[56]

Photo by Leonid Danilov

5. THE WAY FORWARD

Glasgow did not fully deliver on turning policy into practice and talk into action: the months leading up to the COP27 in Egypt are therefore pivotal to advance the agenda. At the end of this year, nations will gather in Sharm El Sheikh to present their strengthened targets on emissions cuts. Our last five years of *Circularity Gap Reports* have put the problem in stark terms and uncovered the solution: 21 circular strategies that will slash emissions and material use, limit warming and facilitate an increasingly safe and just space for humanity. Aside from these solutions for businesses, cities and nations, we need urgent, large-scale and high-level change in the five years to come. These changes span three core pillars: digital technology, metrics and measurement and social considerations, and also represent Circle Economy's key contributions to accelerating the circular transition (see on the next page).

It's not easy to put a number on global circularity, and in doing so we must bypass some of the intricacies of the global economy. But the benefits of having one number to guide action and to set a benchmark are manifold. We know that the world's circularity is in reverse and stands at only 8.6%. Our 8.6% economy is wasteful, polluting and carbon-intensive. In only six years, half a trillion tonnes of virgin materials were taken from the earth to fulfil societal needs and wants: 70% more than what the earth can safely replenish. Think of the coal extracted from the earth's crust: it's first processed to become petroleum, which feeds into the synthetic fibres that weave the fast-fashion clothes we wear and quickly dispose of, or the harvested timber that is felled in the forest and processed in a sawmill to become the furniture we sit on and then throw away.

This Report has presented the key findings of the past five years to demonstrate how the circular economy and its rich set of solutions can thoroughly contribute to mitigating climate impact and moving the world toward an ecologically safe and socially just space.

With 2021's COP26 yielding mixed outcomes, our message remains: rallying efforts around renewable energy solutions fails to address the chunk of emissions (70%) stemming from resource use and handling. We need the clean energy transition to happen, but it cannot keep us on the well below 2-degrees trajectory alone. Nor does it tackle our rising consumption levels and concerning resource scarcity.

If the world moved away from a linear economy and toward a circular one, our analysis shows that global greenhouse gas (GHG) emissions would drop by 39% and virgin resource use by 28%, and we would reach the goals of the Paris Agreement.Glasgow did not deliver as many had hoped, so now our attention must turn toward COP27 at the end of this year.

Aside from integrating circularity into the actions of businesses, cities and nations, high-level change must be enacted to create the enabling conditions for a more circular world. We must utilise data-driven tools to bring circularity to everyone, use metrics to track the transition and apply a social lens to the transition to ensure no one is left behind.

THE NEXT FIVE YEARS OF THE CIRCULAR TRANSITION NEED AN ENABLING ENVIRONMENT

1. **Data-driven digital tools to bring circularity to everyone.** Digital tools based on comprehensive data sets spur knowledge exchange and innovation at an exponential rate. Global statistical institutions and governments should prioritise frequent—and streamlined—data collection, on both macro and micro levels. They must also collaborate with businesses to make private-sector data available for public sector circular decision making and impact analyses. In data-scarce countries or regions, data alliances can assist in filling the gaps.

Digital tools can enable knowledge and insights generation along the stages of the circular economy transition to explore what is currently happening, scan for relevant opportunities, and then act accordingly. Increased transparency in the supply chain, and more data capture at products' end-of-use will power impactful decision making on where to apply circular strategies and get the most impact. Learn more about digital tools powering the circular transition here.

2. **Metrics to track the transition.** If we don't measure, we cannot track progress in a meaningful way, nor can we ultimately locate where the most impactful avenues are. Using data to measure and track circular performance across sectors, businesses, cities and nations will enable actors to set goals, peer review, measure and benchmark performance. It will also allow them to track progress against their sustainable and circular ambitions or goals and to formulate practical pathways aligned to local contexts. Meaningful measurement also necessitates data, linking to point one above. Learn more about how to track circular performance and measure your benchmark rate of circularity here.

3. **A social lens to ensure the transition is safe and just.** A holistic circular economy that applies a social lens to all of its activities may help us support various Sustainable Development Goals, from ending hunger and improving health and well-being to affordable low-carbon energy, and the opportunity for decent work and economic growth. Potential consequences from one circular solution must be measured to ensure that the transition is safe and just for all and that potential blindspots of the circular economy are managed.

People will ultimately drive the circular transition by putting the solutions into practice, and for this reason, government support is needed to invest in training and skilling the workforce in preparation. Using data and metrics to track and manage how circular jobs are developing across sectors—and in relation to our 21 strategies—must guide and be at the foundation of the transition. Learn more about how the circular transition can put people at its centre here.

Photo by David Marcu

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