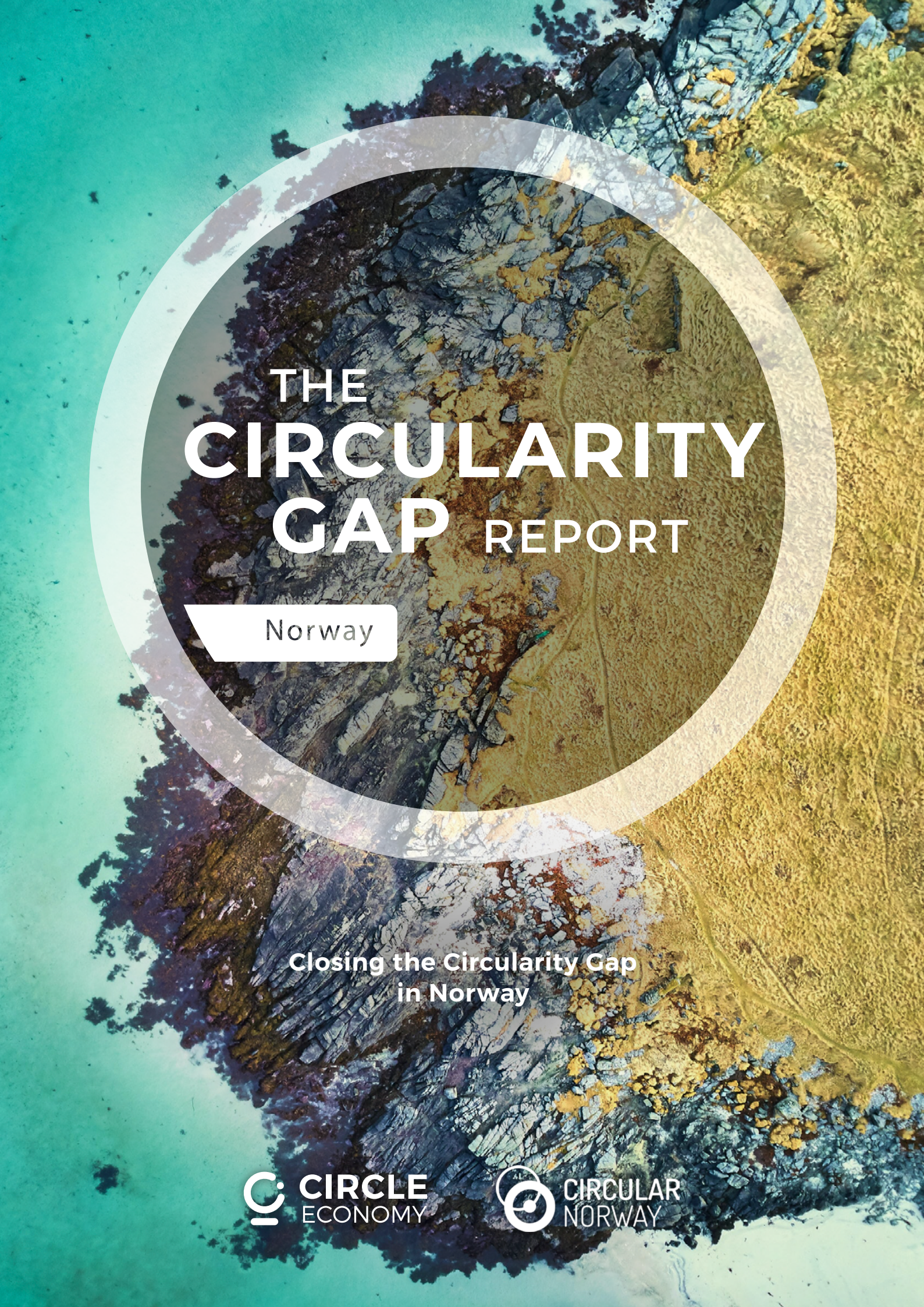


THE CIRCULARITY GAP REPORT

Norway

Closing the Circularity Gap in Norway

CIRCLE ECONOMY

CIRCULAR NORWAY

COVER STORY

This wild image, with its rugged rocks, vegetation and crystal blue water, depicts just a small piece of the Norwegian coastline; yet embodies the diversity the country harbours. The Norwegian nation is poised to implement a circular future through its innovation and resource rich landscape.

Taken by Johny Goerend in Fredvang, Nordland in Norway

WHO WE ARE

Circle Economy works to accelerate the transition to a circular economy. As an impact organisation, we identify opportunities to turn circular economy principles into practical reality. With nature as our mentor, we combine practical insights with scalable responses to humanity's greatest challenges. Through our multiple programmes, we translate our vision of economic, social and environmental prosperity into reality.

CIRCULAR NORWAY

Circular Norway accelerates the transition to a circular economy in Norway.
Together with international partners, we apply models and tools for innovation and business development for cities and businesses for a practical approach to a circular economy. We support politicians, government, organisations and businesses to identify relevant decisions with impact to a circular economy.

PACE
PLATFORM FOR ACCELERATING THE CIRCULAR ECONOMY

The Platform for Accelerating the Circular Economy (PACE)

This report is published as an affiliate project of the Platform for Accelerating the Circular Economy (PACE). PACE is a public-private collaboration mechanism and project accelerator dedicated to bringing about the circular economy at speed and scale. It brings together a coalition of more than 70 leaders and is co-chaired by the heads of Royal Philips and the Global Environment Facility. It was initiated at the World Economic Forum and is currently hosted by the World Resources Institute.

IN SUPPORT OF THE CIRCULARITY GAP REPORT

KRISTIN HALVORSEN
Director, CICERO

'To halve greenhouse gas emissions by 2030, Norway requires major changes in resources use. This report provides valuable insight into how far Norway has come in its circular transition and concrete measures to increase the pace. Not least, it shows how sectors with low direct emissions can also help the world keep global warming below 2 degrees.'

RAYMOND JOHANSEN
Governing Mayor, City of Oslo

'A circular economy can boost economic and social prosperity within planetary boundaries. Oslo wants to be a frontrunner in reducing climate impact and material footprint, scaling-up circular innovation and making it easier for consumers to make circular choices. This report provides an important measurement of circularity in Norway and shows us how to close the Circularity Gap through close collaboration between national and local governments, businesses and citizens.'

NINA JENSEN
CEO, REV Ocean

'Since the dawn of time, the ocean has been inherently circular. It is a critical supplier of life, nourishment, livelihoods and biodiversity. The circular principles in this report provide direction for us to reduce our wasteful practices, reduce our consumption and ensure responsible sourcing of biomass to maintain the health of the ocean.'

JOHN-ARNE RØTTINGEN
Chief Executive,
The Research Council of Norway

'To avoid resource consumption far beyond the Earth's threshold we need to dramatically change how we produce and consume energy and natural resources. In the coming years, the role of the oil and gas industry will decline considerably. The Norwegian economy needs to be diversified as we move towards a more circular and sustainable society. To do so, it is imperative that we increase the pace of research and radical innovation efforts in businesses and public sectors.'

KAROLINE ANDAUR
Secretary General, WWF Norway

'This report shows how seriously the linear economy contrasts planetary boundaries. Transitioning to circularity will require wide-spread holistic and systemic change. Norway currently has no plan for this transition, yet the Government wants "Norway to pioneer in the development of a green, circular economy that utilizes resources better". With the report's recommendations, Norway can halve its material footprint. I hope the Government strategy is at least as ambitious.'

ANJA BAKKEN RIISE
Leader, Future in our hands

'Consumers play a vital role in the transition to a circular economy, but this report demonstrates a considerable gap despite Norwegian political ambitions. Luckily, it also demonstrates the enormous potential for closing the gap. Customers want circular change, but need help from regulators and businesses that dare make a difference.'

SVEIN STØLEN
Rector, University of Oslo

'Closing the Circularity Gap is not just about securing a sustainable economy: it also ensures ecological and social security. If we are to succeed in this, interdisciplinary knowledge and solutions being shared cooperatively between academia, the corporate sector, civil society and political authorities is essential.'

SJUR BAARDSEN
Rector, Norwegian University
of Life Sciences

'The world faces complex challenges: climate change and environmental pollution put unprecedented strain on biodiversity and natural resources. The circular economy, and the guidelines presented in this report, supports the transition towards a resource-efficient and sustainable society. Now, we have a measurement of circularity to base our future goals and plans on. The transition will require interdisciplinary research, collaboration, education and innovation across traditional disciplines.'

THINA MARGRETHE SALTVEDT
Chief Analyst, Nordea

'The transition to a circular economy is essential to fight climate change and resource scarcity. Circular principles can generate business opportunities and economic benefits. As the European Commission shares the Circular Action Plan, Norwegian businesses should grasp the opportunity and build momentum and entrepreneurship in this space. However, it is only through collaboration that business will be able to deliver circular solutions.'

ARILD OLSEN
Local chairman,
Longyearbyen, Svalbard

'Deep in the Arctic Circle, the unique Svalbard is under pressure from the global challenges of climate change, resource scarcity and biodiversity loss. We all must rethink the economic system. The circular economy offers opportunities to create jobs, businesses and value — within planetary boundaries. This report provides an ambition for Norway and a direction to guide us.'

FLEMMING BESENBACHER
Chairman, Carlsberg Foundation

'The transition to circular economy is necessary to create a more sustainable world in line with the powerful UN Sustainable Development Goals. My motto is always: to reduce, reuse, recycle, and rethink. This is a framework fully in line with circular economy and thus we all ought to shift our mindset accordingly. The findings in the Circularity Gap Report Norway will hopefully inspire Norwegian companies, municipalities, and organizations to set concrete goals and measurements for the transition towards a circular economy.'

EXECUTIVE **SUMMARY**

Norway's Circularity Metric is 2.4%, and at 44.3 tonnes per person, per year, it has one of the highest global rates of consumption, per capita. Of all the materials consumed in the country, over 97% are not cycled back into the economy. This is Norway's Circularity Gap. The reality of the linear economy in Norway is complex and suggests that the country should not only strive to increase its circularity but should also prioritise strategies that reduce its overall and absolute consumption: its material footprint.

The circular economy as a means to an end. Closing the Circularity Gap serves the higher objective of preventing further and accelerated environmental degradation and social inequality, on both a local and global level. Transformative measures to cut greenhouse gas emissions are inherent in the circular economy; the circular and low-carbon agenda are complementary and mutually supportive. Circular business models and improved resource efficiency are a means to enhance emission abatement, reduce extraction and could improve supply security when materials are kept in the region. Ultimately, the end goal is to establish an ecologically safe and socially just operating space for humankind.[1]

The material footprint behind Norway's resource use. This study provides a first approximation towards how resource use is allocated across Norway's sectors and societal needs and wants. We see that the need's material footprint originates to a large extent from outside of Norway—typical for a developed trade nation. Norway functions well on renewable energy but still relies heavily on fossil fuels for income. The construction sector produces large amounts of waste, but little is reused or recycled. High-value recycling rates, such as post-consumer plastic, are incredibly high, but overall recycling rates don't match up. In terms of societal needs and wants, Nutrition and Housing and Infrastructure are the biggest contributors to the material footprint.

Consumption at the centre of impact. Our report also analyses how businesses and the government can facilitate the circular economy by encouraging circular consumption among Norwegian consumers, such as encouraging behaviours that prioritise regenerative materials. This is crucial; most production is driven by consumer final demand. Norway's economic profile is strong and generally, consumer spending power is high. But awareness of the circular economy is low among the general population,[2] as is concern over resource scarcity.

A labour market that anticipates the circular transition can accelerate it. As the government shapes its strategies to support investment towards specific circular economy agendas, we must consider and safeguard the workers who will drive the transition. In the face of large unemployment following the pandemic, the world stands at a crossroads: it has the chance to rebuild with a focus on diversification and resilience[3] for a prosperous future. Our report analyses how a circular economy in Norway may transform work across key sectors and demonstrates how government, business and unions can facilitate a just transition by investing in upskilling and training workers for the 21st-century.

Closing the Circularity Gap and lowering the material footprint in Norway. We explore six 'what-if' scenarios which can partially transform the economy to rely less on linear processes: (1) Circular construction, (2) Total transition to clean energy, (3) Circular food systems, (4) Green transport system, (5) A strong repair, reuse & recycling economy and (6) Circular forestry and wood products. Each scenario boosts circularity and reduces consumption in Norway, but when combined, these six scenarios bolster the Circularity Metric from 2.4% to an impressive 45.8% and reduce consumption, the material footprint, by over half, 64.8%. They also slash the country's carbon footprint—carbon emissions from consumption in Norway—by a huge 63%.

The time is now. By attempting to provide a complete picture of Norway's current position regarding the circular economy, we aim to inspire, coordinate and steer action. Our scenarios will assist the government and relevant stakeholders on aligning on a plan to rebuild the Norwegian economy following the stresses of the covid-19 pandemic. Norway can choose to build back better: a future-proof, resilient economy. Make the decision now to protect tomorrow.

NORWEGIAN

Norges sirkularitet er 2,4 prosent, og med et årlig forbruk på 44,3 tonn per person er dette et av de høyeste forbrukene i verden. Av alle ressurser som forbrukes her i landet, blir over 97 prosent ikke sirkulert tilbake i økonomien. Dette utgjør Norges sirkulære gap. Den lineære norske økonomien er kompleks, og løsningen er derfor ikke bare å øke sirkulariteten. Norge bør også prioritere strategier som reduserer forbruket: landets materialfotavtrykk.

Den sirkulære økonomien er et virkemiddel for et inkluderende og rettferdig samfunn. Å lukke sirkularitetsgapet forhindrer ytterligere skader på miljøet og sosiale ulikheter, både på lokalt og globalt nivå. Tiltak rettet mot å redusere klimagassutslipp er en integrert del av sirkulærøkonomien. Ideen om et sirkulært samfunn og lavutslippsamfunnet er uløselig knyttet sammen og utfyller hverandre. Sirkulære forretningsmodeller og forbedret ressurseffektivitet er viktig for å redusere klimagassutslipp, begrense ressursutvinning og samtidig sikre Norges forsyningsbehov. Til syvende og sist er målet å etablere bærekraftige og sosialt rettferdige, levekår for menneskeheten.

Materialfotavtrykket bak Norges ressursbruk. Denne studien viser hvordan bruken av begrensede ressurser (mineraler, malm, fossilt råstoff) og fornybare ressurser (biomasse) drives av samfunnets behov. Materialfotavtrykket knyttet til vårt forbruk kommer i stor grad fra utlandet – noe som er typisk for en utviklet handelsnasjon. En svært høy andel av alt som brukes til å dekke våre samfunnsbehov (elektronikk, bygninger og infrastruktur), går ikke tilbake i kretsløpet, men lagres. Norge er i front når det gjelder bruk av fornybar energi, men økonomien er fortsatt sterkt avhengig av inntekter fra salg av olje og gass. Byggebransjen produserer store mengder avfall, men alt for lite gjenbrukes eller gjenvinnes. Selv om panteordninger har vært brukt lenge, kompenserer ikke det for en generell lav resirkulering i Norge. Innenfor samfunnsbehovene, er mat, bolig og infrastruktur de områdene der omlegging til sirkulærøkonomi kan gi størst effekt på materialfotavtrykket.

Vårt forbruk er kraftsenteret for endring. Rapporten analyserer hvordan virksomheter og myndigheter kan tilrettelegge for sirkulærøkonomi ved å oppmuntre til sirkulært forbruk blant norske forbrukere, for eksempel ved å oppfordre til gjenbruk og ombruk. Dette er viktig da det meste av verdens produksjon er drevet av forbrukernes etterspørsel. Norge har en sterk økonomi med en høy kjøpekraft, men folk flest er ikke kjent med sirkulærøkonomi, og de er heller ikke spesielt bekymret for jordens råvaremangel.

Et arbeidsmarked som forbereder seg på en sirkulær overgang, kan framskynde prosessen. Når regjeringen nå utvikler sine strategier for å støtte investeringer som fremmer sirkulær økonomi, må vi ta i betraktning og ivareta de arbeidstakerne som vil drive overgangen. Arbeidsledigheten i kjølvannet av pandemien gjør at verden står ved et veikryss: vi har nå muligheten til å gjenoppbygge en mangfoldig og robust økonomi som står sterkere i møtet med fremtidige utfordringer. Rapporten vår viser hvordan en sirkulær økonomi i Norge kan skape arbeidsplasser på tvers av ulike sektorer. Trepartssamarbeidet mellom myndigheter, næringsliv og fagforeninger, kan legge til rette for en god overgang til sirkulærøkonomi ved å investere i kompetanse og opplæring av arbeidstakere tilpasset det 21. århundre.

Lukke sirkularitetsgapet og redusere materialfotavtrykket i Norge. Vi utforsker seks «hva-hvis»-scenarier som delvis kan endre økonomien til å bli mindre avhengig av lineære prosesser. Det dreier seg om: (1) Sirkulær byggenæring, (2) Full overgang til ren energi, (3) Sirkulære matsystemer, (4) Grønt transportsystem, (5) En sterk reparasjons-, gjenbruks- og resirkuleringsøkonomi og (6) Sirkulært skogbruk og produksjon av trevirke. Hvert scenario øker sirkulariteten og reduserer forbruket i Norge, men effekten økes enda mer når de seks scenarioene kombineres. Da styrkes sirkulariteten fra 2,4 prosent til hele 45,8 prosent. Det reduserer forbruket (materialfotavtrykket) med over halvparten, 64,8 prosent. Scenarioene viser også hvordan Norges karbonfotavtrykk reduseres – utslippene fra forbruk her i landet – med hele 63 prosent.

Tiden er inne. Ved å forsøke å gi et helhetlig bilde av Norges nå-situasjon når det gjelder sirkulær økonomi, ønsker vi å inspirere, koordinere og motivere til handling. Scenariene i rapporten vil hjelpe norske myndigheter og relevante interessenter med å samkjøre seg for en felles plan for å gjenoppbygge norsk økonomi etter covid-19-pandemien. Norge kan velge å gjenoppbygge til det bedre: en fremtidsrettet og robust økonomi. Det er i dag vi tar avgjørelsen som sikrer oss en tryggere fremtid.

CON-
TENTS

1 INTRODUCTION

For the first time in history, the amount of material consumed by our global economy has passed 100 billion tonnes. Of this, only 8.6%[4] is cycled back into the global economy; this is the world's Circularity Metric. Norway's metric, standing at 2.4%, is only a small fraction of this. However, circularity is complex and we have to look beyond one metric to grasp this complexity. Norway has some of the highest rates of consumption per capita in the world. This means that Norway either extracts or drives the extraction of huge amounts of fossil fuels, metals, biomass and minerals to satisfy the needs and wants of its citizens. If everyone on earth were to live like the Norwegians, we would require the resources of three and a half planets.[5] The average European material footprint, per capita, is between 14 and 19.7 tonnes,[6] per person. Here, an opportunity presents itself: the chance to be a pioneer in reducing consumption, while concurrently increasing the Circularity Metric.

THE LINEAR ECONOMY

The dominant economic model of Norway, and much of the globe, is linear. This linear system is characterised by a 'take-make-waste' process powered by fossil fuels. This model relies on obtaining large quantities of energy and materials through carbon emission heavy processes, which are then quickly used to satisfy needs and wants and then disposed of—thereby shedding value and lacking efficiency. Intensive extraction and use has also resulted in volatility across markets and resource scarcity and constraints: a shortage of materials. But credit must be given: the linear economy has allowed some people, in some parts of the world, at certain times, to profit, prosper and grow. Norway touts several valuable materials from its natural resource base; from oil and gas to hydropower, fish, forests and minerals.[7] The industry that has been built and cultivated around these has hugely contributed to the economic and social successes Norway enjoys today. This includes a high standard of living and strong employment levels with significant gender equality,[8] relative to other advanced economies.

The 1960s marked a particular turning point for the country with the discovery of rich oil and gas deposits on the Norwegian Continental Shelf (NCS).[9] In Norway, success can really be attributed to a long tradition of fossil fuel consumption and trade. But the reality of a 21st-century world means this model is no longer fit for purpose. The world, and Norway, expounds energy to extract valuable resources from the earth faster than it can regenerate, and inefficiently consumes far too many resources per capita, many of which end up wasted.

NO CLEAR CIRCULAR ROADMAP

Norway's Circularity Metric is 2.4%; meaning, of the nation's 235 million tonnes of consumed materials, over 97% of resources are not cycled back into the national economy. These materials are either locked into stock (buildings, capital equipment or bunker fuels), dissipated (emissions released into the air or the dispersion of materials through erosion and run-off), or lost (waste being landfilled or incinerated).

On both a global and national level, urgency is building. Experts predict that climate breakdown—not covid-19—will be the biggest global health threat of the century.[10] Importantly, the scale of the solution needs to match the scale of the emergency. By designing out waste and pollution, keeping products and materials in use, and regenerating natural systems, a circular economy allows us to collectively reimagine and redesign our systems to ensure an ecologically safe and socially just space for us all.[12] A world where functioning social systems fall within healthy planetary boundaries.[13]

As a member of the European Economic Area (EEA), Norway is indirectly subject to most EU climate change and circular economy policies and plans, such as the Green Deal[14] and the Circular Economy Action Plan.[15] On a national level, however, it lacks concrete goals toward achieving wide-scale circularity. It has, although, been active on the climate change front. It has put forth plans to curb greenhouse gas emissions (so-called Nationally Determined Contributions; NDCs) under the Paris Agreement and the national Climate Change Act includes targets for a low-emission society, including a reduction in greenhouse gas emissions of 40% by 2030.[16] Nevertheless, today, all of the country-wide NDCs are not yet enough to get us on a trajectory below a 2°C warming, let alone a 1.5°C pathway. Circular economy strategies have a large part to play in making this happen. A 1.5°C world can only be circular. Clearly, there is ample space for thorough plans to be implemented into Norway's strategies and policies moving forward.

A SOCIAL AND ECONOMIC CROSSROADS

This year, 2020, launched the world into a chaos that had long been predicted, but hardly prepared for; covid-19. The pandemic and economic distress it is causing globally thrust a magnifying glass on the economy and its cracks. The early warnings have long been clear; embedded deep within the 'take-make-waste' tradition lies a toxic cocktail of linear risks. These range from highly dependent global supply chains, material extraction occurring at a faster rate than regeneration and an economic model focused on delivering profits and infinite growth at the expense of stability and resilience. As a result, in a resource-constrained world with high-impact megatrends of rapid population growth and widespread urbanisation, that linear model is flawed and unsuitable.

The impacts of the pandemic have dealt a swift blow to countries across Europe and the world. Norway is not alone in facing unemployment rates at magnitude heights, plummeting oil prices and a recession. Countries, including Norway, require a more resilient system moving forward. The circular economy can contribute to a more resilient system and labour market by reducing the risk of negative shocks and crises—such as climate change or pandemics—by being more agile in its response, innovation and in prioritising reliability over growth.[17] To reap the full benefits of the circular economy, the Nordic model can already begin to prepare its labour market to facilitate circular models and invest in sectors with large growth potential. This report analyses the impact the transition may have on work and workers in Norway and presents a way to begin implementing change.

AN ECONOMY FULL OF POTENTIAL

Several defining aspects of the Norwegian economy can be leveraged to contribute to the move to circularity. This includes the underpinning model of collaboration—tripartite cooperation—between employer and employee organisations, and government. The model has greatly benefited development, especially in the labour market. Also, Norway's infrastructure for oil and gas is state-of-the-art, and this includes a skilled labour that is capable of realignment with the ambitions of the circular economy.

Furthermore, Norway excels in recycling small volumes of high-value resources, such as plastics, glass and paper. It also recycles over 80% of used cars.[18] Yet its overall recycling rates fall well below 50%. Recycling must be optimised for a wider array of resources, including low-value streams. Norway also has a large construction sector which accounts for the biggest resource footprint (43 million tonnes). However, valuable construction and demolition waste is largely not utilised through reuse or recycling. In this way, circularity is not only low due to a lack of cycling, but also because of the continued build-up of stock in buildings and infrastructure, which bloats the already swollen national material footprint, per capita. In Norway, it is imperative—and possible—to reduce the towering rates of consumption. The country also touts a unique set of renewable resources and can very much become a regenerative energy power-house.

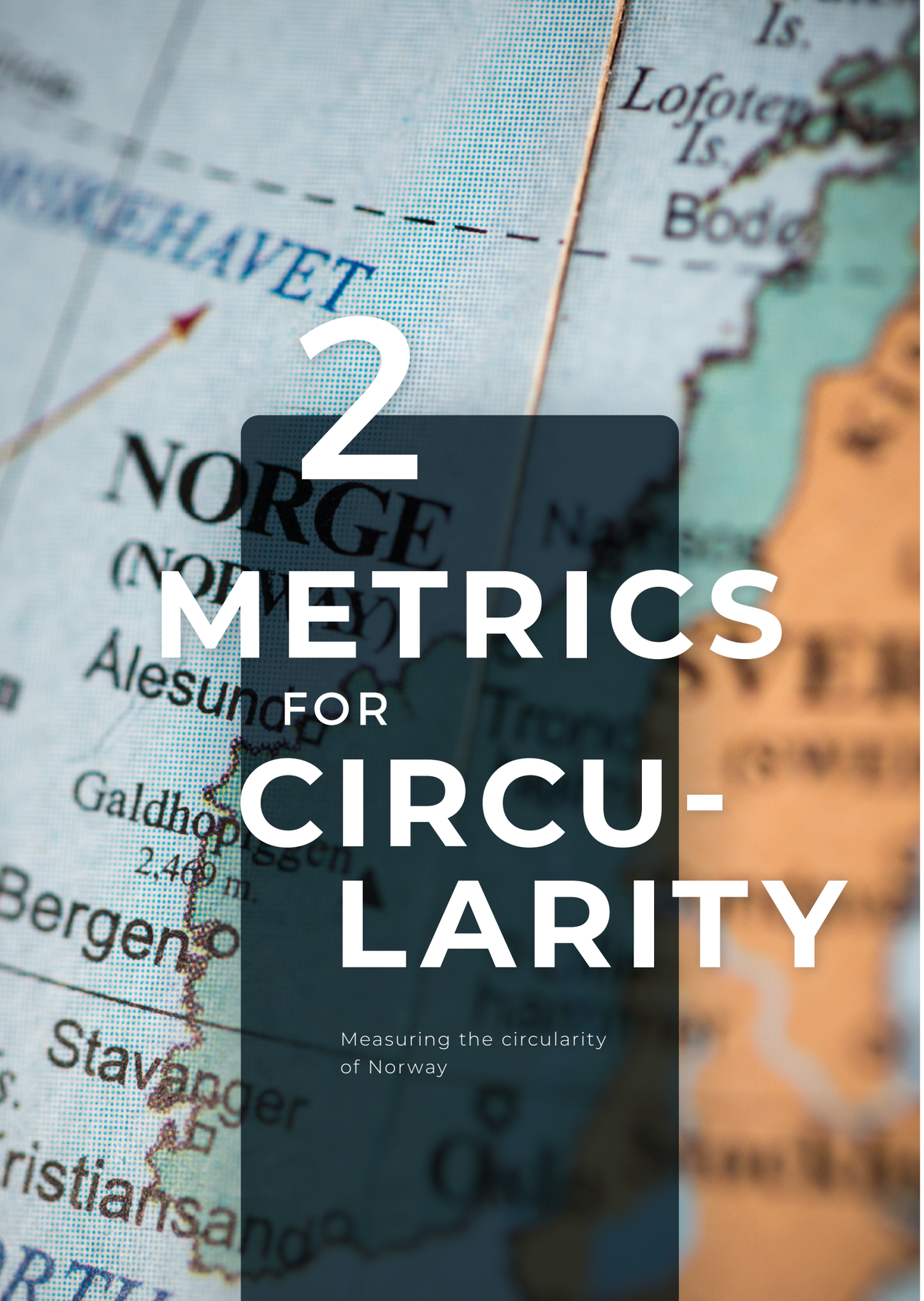
These aspects—recycling and reuse across sectors and reducing overall consumption levels—are just a glimpse of the areas of the economy which can be leveraged for circularity. In chapter four, Bridging the Gap, we will delve deeper into six sectors that can deliver powerful circular impact through four key avenues of the circular economy: slowing flows (use longer), narrowing flows (use less), cycling flows (use again) and regenerating flows (make clean).

TRANSFORMING CONSUMER CONSUMPTION

Global economies face a recession resulting from the impacts of the pandemic. We need to forge a world that will be resilient in the long-term and in the face of shocks and crises. This means, in essence, to reduce the likelihood of these disruptions arising and distributing the risk of impact across multiple supply chains and approaches to value delivery, as well as an overall more efficient resource use, both by industries and final consumers.[19] Circular consumption habits, such as choosing products made from regenerative materials, opting in for circular business models like sharing or renting platforms and repairing owned products over buying new ones, need to be encouraged and convenient. Circularity must be a tangible and accessible option for consumption.
This report dives into the barriers, drivers and behaviours of Norwegian consumers and suggests interventions to make circularity more accessible. At a time where not only governments but also citizens and societies are looking for a 'new normal', now is the time to take consumers by the hand and show them the way.

AIMS OF THE REPORT

1. Provide a snapshot of how circular Norway is by applying the Circularity Metric.
2. Identify how materials flow throughout the economy and how they may limit or boost the current Circularity Metric.
3. Highlight possible interventions within significant industries that can aid Norway's transition to becoming circular and reduce its material footprint.
4. Spotlight avenues for businesses and governments to encourage circular consumption by local consumers.
5. Display how government, business and unions can prepare the labour market for the circular transition: facilitating and accelerating the shift.
6. Communicate a call to action based on the above analysis, to inform future goal setting and agendas.



2 METRICS FOR CIRCU-LARITY

Measuring the circularity of Norway

Measurements are critical to understanding the world around us. As it becomes more urgent for us to adapt our economic system to be more circular, we need to provide a tactical approach to measuring something so abstract and complex. This section explains how we assessed Norway's circularity using our measurement: the Circularity Gap Metric. In the first edition of the global Circularity Gap Report, in 2018, Circle Economy launched the Circularity Metric on a global level, but this current analysis adapts the metric to suit a country profile. Measuring Norway's circularity should also provide an answer to how the Norwegian economy can formulate a plan for moving toward circularity: it provides the initial assessment by locating circular opportunities and priorities in the material flows. By measuring circularity in this way, businesses and governments can track their circular performance over time and put trends into context, as well as engage in uniform goal-setting and guide future action in the most impactful way.

MEASURING CIRCULARITY: A MEANS TO AN END

At the heart of the circular economy is the idea of moving away from the linearity that has dominated value chains for more than 200 years. It means breaking with the 'take-make-waste' tradition and transitioning towards a circular approach under which we refrain from material extraction and optimise the use of existing materials by minimising and eliminating waste.

Closing the Circularity Gap thus serves the higher objective of preventing further and accelerated environmental degradation and social inequality. In recent years, two examples of strategic and ambitious international collaboration have guided global movement towards the ecologically safe and socially just space: The United Nations Sustainable Development Goals (SDGs)[20] and the Paris Agreement.[21] Meanwhile in Europe, the Green Deal was recently launched,[22] placing the circular economy at the heart of its efforts to create a prosperous EU where economic growth is decoupled from resource use, as well as the Circular Economy Action Plan,[23] which contains initiatives along the entire life cycle of products to ensure resources are kept in the EU economy for as long as possible.[24]

The circular economy is a big picture and holistic idea. Exactly how the circular transition can deliver more beneficial social outcomes is not a question with just one right answer. There is no simple straight-line solution and the feedback loops in the system run in all directions.[25] In particular, three connected spheres need to be taken into account; how resources are put to work to deliver social outcomes via provisioning systems. Provisioning systems comprise of physical systems such as road infrastructure, technologies, and their efficiencies[26] and social systems, which include government institutions, businesses, communities and markets.[27] Provisioning systems are the essential link between biophysical resource use and social outcomes. For example, different forms of transportation infrastructure (railways versus highways) have the ability to generate similar social outcomes, but at very different levels of resource use.

In this analysis, we take the metabolism of a country—how resources flow through the economy and are in long-term use—as the starting point for measuring and capturing its level of circularity. To ensure our data is in line with the reality of Norway, we worked with Norwegian research organisation SINTEF and the Norwegian University of Science and Technology (NTNU) as technical knowledge providers and Avfall Norge as a data provider.

MATERIAL FLOWS AND FOOTPRINTS

Figure 1, on page 16, provides a schematic depiction of the metabolism of Norway. It essentially depicts the amounts of materials in physical weight (excluding water and air) that are available to the economy. The left side shows four resource groups that are the result of domestic **extraction**. These are metal ores (such as iron, nickel, titanium oxide), minerals (such as limestone, olivine, dolomite),[28] fossil fuels (such as natural gas and petroleum) and biomass (such as food crops, forestry and manure).

We also see on the left the volume of resources entering the national economy through **import**. Because the imported volumes are manufactured elsewhere and transported to the country, the actual material **import footprint** exceeds the amount of direct imports as shown in the shaded colour. Together, the domestic extraction and the import comprise the **total material input** into the **national economy**.

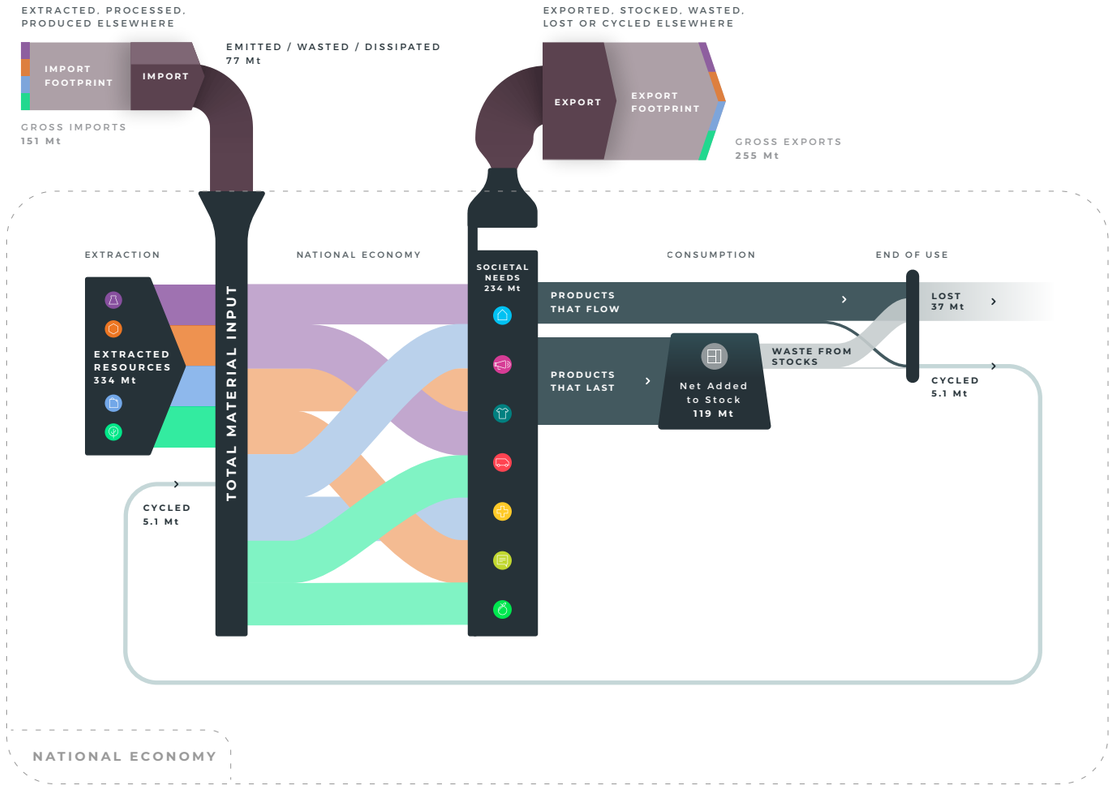


Figure 1 shows a schematic overview of the material footprint and metabolism of a country. Note: material stock and cycled material flows are not scaled to proportion.

Within the economy, the materials undergo operations to convert them into end products. Beginning with the extraction, the resources are **processed**, such as metals from ores, which are manufactured into products in the **produce** stage. The finished products **provide** satisfaction to **societal needs and wants** such as Nutrition, Housing and Mobility, or they are **exported**. Of these materials entering the national economy every year, the majority are utilized by society as short-lived **Products that Flow**—reaching their end-of-use typically within a year, such as an apple, food packaging or a standard toothbrush. The end-of-use resources of these products are typically either **lost** or **cycled** back into the economy. The remaining aforesaid materials enter into long-term stock—referred to as **Products that Last**. These products are namely capital equipment, buildings and infrastructure.

BEHIND THE DATA

To drive our robust and data-driven decision making, we draw from and combine two complementary methods from the field of industrial ecology: the Economy-Wide Material Flow Accounting (EW-MFA)[29, 30, 31] and Input-Output Analysis (IOA).[32, 33, 34] These techniques require data, which we largely gather from the:

- Environmentally-Extended Multi-Regional Input-Output (EE-MRIO) databases (such as Exiobase),
- National Statistical Institutes (such as SSB),
- and the scientific and professional arena (such as IRP, Avfall Norge).

Systems of National Accounts (SNAs) and our affiliated data-providers are the key sources of direct physical input and output data used in the MFA (which maps flows in an economy, such as the imports of products, secondary materials, emissions and stock additions see pages 24-25). The MFA provides a high-level understanding of a region's material metabolism.

The EE-MRIO database Exiobase contains both monetary and physical data and adds a life-cycle perspective to the analysis. Its connection with the MFA is two-fold: the MFA is used to update the Exiobase's material extension and, in turn, the input-output model derives Raw Material Equivalent (RME) flows which are used to complement the MFA.[35, 36, 37]

Updating the material extension is part of the larger process of constructing a Single-country National Account Consistent (SNAC) EE-MRIOT, which allows for an accurate and updated calculation of production and consumption footprints for a specific country.[38, 39, 40, 41] With the MFA system including both direct and life-cycle physical flows—as well as stocks—several variants of the National Circularity Index (NCI) can be estimated to track the country's circular performance.

THE CIRCULARITY METRIC EXPLAINED

Taking the material footprint schematic as a starting point, we now move to how we can measure and capture the level of circularity of a country. This approach builds on and is inspired by, amongst others, the work of Haas et al.[43] It also borrows from the other Circularity Gap Reports performed for a country;[44] Circle Economy's 2019 report on the Austrian economy and the 2020 report for the Netherlands. Ultimately, from the schematic, we can identify six fundamental dynamics of what the circular economy transition aims to establish and how it can do so. This translates into two objectives and four related strategies.

- **Objective one:** Resource extraction from the lithosphere is minimised and biomass production and extraction is regenerative;
- **Objective two:** The dispersion and loss of materials is minimised, meaning all technical materials have high recovery opportunities, ideally without degradation and quality loss; emissions to air and dispersion to water or land is prevented; and biomass is optimally cascaded.

The four strategies we can use to achieve these objectives are:[45, 46]

- **Slow flows—Use longer:** The utilisation of stocks is optimised by, for example, extending the functional lifetime of products, components and materials. Long-life products are designed using durable materials and intermediate services such as maintenance and repair are offered.
- **Narrow flows—Use less:** Material use efficiency is optimised by deploying circular design strategies that aim to minimise material use in delivering a product or service, it also increases the usage rate of products. Energy use is also minimized. This is facilitated through business models that incentivise sharing or resources.
- **Regenerate flows—Make clean:** Fossil fuels and toxic materials are replaced with regenerative sources. The natural capital of ecosystems is maintained and increased in the process.[47]

- **Cycle flows—Use again:** Material cycling for reuse is optimised. This includes improving the collection of materials used in infrastructure and the wide-scale adoption of best-available technologies for (re)processing of resources, such as optimised cascading, which uses residues and recycled materials for extending biomass.

When we measure the combined effect of the above strategies, the cycling of materials comes to the fore as crucial. If we effectively deploy strategies focussed on slowing, narrowing, closing and regenerating the flow of materials, we will ultimately require fewer materials to provide for similar needs. Because of this, fewer materials will be used by the economy, will have a longer lifespan and can be reused more effectively and without harm to the environment. So, for our Circularity Metric to capture this crucial process, we thereby define it as measuring the share of cycled materials as part of the total material inputs into a national economy every year. As such, it illustrates the current progress towards achieving the Circular Economy's ultimate goal of designing out waste by means of the four listed strategies.

We capture circularity in one number; the Circularity Metric. The value of this approach is that it allows us to track changes over time, measure progress and engage in uniform goal-setting, as well as benchmark countries' circularity against the global rate. Additionally, it should provide direction as to how Norway can embrace its circular potential. When considering other elements of the transition, it may prove helpful to develop additional metrics to measure progress and steer action. In particular, we assess the material footprint of activities in the Norwegian economy as a valuable additional measure to the Circularity Metric.

A COMPLEX UNDERTAKING: SCOPING AND TRADE DYNAMICS

Applying the Circularity Metric to the global economy is relatively simple, largely because there are no exchanges of materials in and outside of planet earth. For countries, however, the dynamics of trade introduce complexities to which we must adapt our metric, resulting in certain methodological choices.[48] Firstly, in assessing a country, we can either take a production or consumption perspective. In a production perspective, we consider all the materials involved in any sort of processing of production activity, regardless of whether they are exported or consumed domestically. In a consumption perspective, we can consider only the materials that are consumed domestically. Whether we apply the metric to a consumption or production perspective will yield different results. In this study, we take a consumption perspective in a bid to generate actionable insights for the economy and consumption on the ground.

Secondly, we must consider how the material footprint is a demand-based indicator of material flows. Most production is ultimately driven by the demand of consumers for a certain product or service. In an increasingly globalized world, the chain that connects production to consumption becomes more and more entangled across many regions. Demand-based indicators allow for a re-allocation of environmental stressors from producers to final consumers. This ensures accountability for (mostly *Shift*, see page 21) countries that engage in practices such as industry delocalisation and outsourcing of material-intensive processes. Such an approach supports policies aimed at reducing or shifting consumer demand, at helping consumers understand the composite material implications of their choices, or at ensuring that costs of, and responsibilities for, resource depletion and material scarcity are allocated to entities and regions based on their roles in driving production processes through consumption.

So, why is it imperative to reduce consumption? Well, impact prevention through reduction is better than mitigation in all cases. This is reflected also by environmental management hierarchies (for example, the circular economy waste management hierarchy) wherein reduction of production and consumption is always the preferred and most effective strategy. Therefore, it is imperative for us to also consider methods to reduce Norway's large material footprint, relative to its population size.

Thirdly, when considering what Norwegian citizens consume to satisfy their needs, we must apply a nuanced lens to the direct imports; meaning we work out the full material footprints of the products. To account for the material footprint of raw materials is straightforward, but this is not the case with semi-finished and finished goods. A motor vehicle, for example, may weigh 1 tonne when imported, but all the materials used to produce and transport it across global value chains can be as much as 3.4 tonnes. To represent actual material footprints in imports and exports, we apply so-called raw material equivalents (RMEs) in this study.

Finally, the Circularity Metric considers all secondary materials as adding to a country's level of circularity. These secondary materials can be part of those cycled within the country, as well those that are imported or exported, either as waste destined for recycling or as secondary materials embedded in traded products. However, estimating the shares of traded secondary materials is a difficult undertaking, so we introduce an important assumption: in order to estimate the volume of secondary materials imported, we apply the average Global Circularity Index (GCI)—calculated per resource group—to the net direct imports of the country (aggregated by resource group). Because the GCI includes waste for recycling and partially also secondary materials, we assume that this is a good proxy for the estimation of the total amount of secondary materials in the system. The underlying assumption is that—although varying in terms of volume—imports of every country have the same average share of secondary materials per resource group. To understand the amount of secondary materials that are consumed domestically, rather than are exported, we make our second assumption: that the share of secondary materials in the total consumption of raw materials is equal to the share of imported and domestically cycled secondary materials in the total input of raw materials.[49]

PRACTICAL CHALLENGES IN QUANTIFYING CIRCULARITY

Providing a year-zero baseline measurement of the circularity of a national economy based on resource flows offers many advantages, not least that it can be used as a call to action. But the circular economy is full of intricacies, and therefore, simplifications are necessary, which result in limitations that must be considered. Some detail needs to be shed for the benefit of having an updated and relevant figure of circularity to guide future legislative action.

- **There is more to circularity than cycling.** A circular economy strives to retain the value and complexity of products for as long as possible, with as little degradation as possible.
  The cycling back of resources measured in the circularity metric is only one component of circularity. The Circularity Metric does not, however, explicitly consider other strategies that are core to building a circular economy such as asset sharing, reuse, lifetime extension or remanufacturing. These strategies reduce the necessity for new product creation, thereby preventing waste volumes and slowing down material flows, but they are difficult to measure in this model.
- **Lack of consistency in data quality.** Whilst data on material extraction and use are relatively robust, data on the end-of-use stage—landfill, incineration, composting, for example—are weak, thereby presenting challenges in quantifying global material flows and stocks. The weak data is in part due to the complexity of waste, which is heterogeneous, geographically spread out and categorised differently across statistical sources.
- **Quality loss and material degradation.** The metric focuses on the end-of-use cycling of materials that re-enter the economic system but does not consider in what composition, or to what level of quality. As such, any quality loss and degradation in processing goes unconsidered. In this way, a plastic bottle made from PET (polyethylene terephthalate) may re-enter the economy as a secondary material—recycled PET (rPET). Its quality will determine whether it is to be utilized for building park benches, for example, or if it is re-introduced to manufacture food-grade plastic products. This variance would not be documented in the metric but has strong implications regarding material degradation.
- **Relative compared to absolute numbers.** The Circularity Metric offers a percentage of the total circularity performance from start to finish by considering the relative size of cycled materials as a share of the total material input. This means that as long as the amount of cycled materials increases relative to the extraction of new materials, we see the statistic improving, despite the fact that more virgin resources are being extracted. The statistic, in this case, would show progress, despite a key objective of the circular economy not being met. In order to extrapolate the metric and avoid these uncertainties, it must be accompanied by contextual numbers for the full story.

For a more exhaustive look into the methodology behind the circularity gap, you can visit our website: www.circularity-gap.world/methodology

3

SIZING NORWAY'S GAP

Low metric, sizeable opportunity

Norway is 2.4% circular. This section investigates the specificities of the resource footprint of the national economy. This includes how resources are used and at what volumes, as well as how it serves key societal needs and wants, such as Nutrition and Services. It also assesses how raw materials are processed and assembled to become the products that address local needs. Visualising what happens at end-of-use sheds light on the accumulation of materials in products, goods and the built environment around us. Furthermore, it reveals that Norway's material footprint, per capita is one of the highest in the world; it is important to reduce domestic consumption. These observations provide a clear starting point to identify where different sectors and supply chains should focus their strategies going forward.

GLOBAL CIRCULARITY GOES FROM BAD TO WORSE

Circle Economy's 2020 edition of the global Circularity Gap Report identified that, for the first time in history, more than 100 billion tonnes of materials are entering the global economy every year. But as global resource use reached new heights, the Circularity Metric wilted from its 2018 rate of 9.1% to 8.6% in 2020. The reasons for this on the global stage are threefold. Namely, high rates of virgin material extraction; ongoing stock build-up to feed a ballooning population and low levels of end-of-use processing and cycling.

The consumption of resources varies across continents and geographies, however. In light of the analysis in the 2020 Report, we see that Norway fits the *Shift* country profile—alongside most other high-income countries in the global North (see textbox). This means that it scores very highly on the United Nations' Human Development Index (HDI), between 0.8 and 1, but its Ecological Footprint—an indicator that accounts for human demand of biological sources—reflects its mammoth level of consumption. If everyone on earth were to live like Norwegians, we would require the resources of almost three and a half planets.

In this way, the classic profile of a *Shift* country is one of high impact: these countries produce 66% of gross domestic product (GDP), while having only 20% of the global population. They also consume the largest share of the 100.6 billion tonnes of materials globally and are major world-traders. The pressure is on them to shift away from over-consumption of the planet's resources in servicing their relatively affluent and comfortable lifestyles. Their role in terms of global circularity is also prominent—the true impact of *Shift* countries extends far beyond their national borders, with much of the environmental and social costs incurred elsewhere.

NOT THE SAME BUT SIMILAR: DIFFERENT COUNTRIES COMMON NEEDS

Despite clear divergences between countries, suitable circular economy strategies can be developed based on discernible common needs. Based on the two dimensions of Social Progress—indicated by an HDI score—and Ecological Footprint, countries fall into three broad profiles:

Build— A low rate of material consumption per capita means Build countries currently transgress few planetary boundaries, if any at all. But they are struggling to meet all basic needs, including HDI indicators such as education and healthcare. Country examples: India, Bangladesh, Ethiopia.

Grow— These countries are manufacturing hubs, hosting an expanding industrial sector and leading the way when it comes to building. This rapid industrialisation, as well as a growing middle class, have occurred concurrently with rising living standards. Country examples: Latin American nations, China, Brazil.

Shift— Home to a minority of the global population, material consumption in *Shift* countries is 10 times greater than in Build. Their extraction of fossil fuels is relatively high, as is their participation in global trade. So despite high HDI scores which result in comfortable lifestyles, these countries have a way to go in consuming resources in line with the planet's resources. Country examples: United States of America, EU member states, Middle Eastern nations.

SEVEN SOCIETAL NEEDS & WANTS

Societies need to not only survive, but thrive, and resources are needed to fuel the living. Here we describe the seven key societal needs and wants and which products and services they include, as well as the volume of materials it takes to fulfil them in Norway. Since various products can be allocated differently, here we make our choices explicit. For example, 'radio, television and communication equipment' can be classified either as part of the societal need 'communication', or as 'consumables'. We decided to subsume it under 'communication'.

HOUSING

The need that represents the second largest resource footprint, with **39.4 million tonnes**, is for construction and maintenance of houses, offices, roads and other infrastructure.

NUTRITION

The biggest category in terms of resource use is nutrition. Agricultural products such as crops and livestock require **51.2 million tonnes** per year. Food products have short life cycles in our economy, being consumed quickly after production.

MOBILITY

A considerable resource footprint is taken up by the need for mobility; **35.1 million tonnes**. In particular, two resource types are used: the materials used to build transport technologies and vehicles like cars, trains and airplanes; plus, predominantly, the fossil fuels used to power them.

SERVICES

The delivery of services to society ranges from education and public services, to commercial services like banking and insurance. The material footprint is modest, **36.5 million tonnes**, in total and typically involves the use of professional equipment, office furniture, computers and other infrastructure.

CONSUMABLES

Consumables are a diverse and complex group of products—such as refrigerators, clothing, cleaning agents, personal-care products and paints—that generally have short to medium lifetimes in society. Textiles including clothing also consume many different kinds of resources such as cotton, synthetic materials like polyester, dye pigments, and chemicals. They account for **26.6 million tonnes** worth of resources.

HEALTHCARE

With an expanding, aging 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. This accounts for **29.9 million tonnes** in Norway.

COMMUNICATION

Communication is becoming an evermore 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. Resource use in this group is less intense, standing at **15.8 million tonnes**.

THE MATERIAL FOOTPRINT SATISFYING SOCIETAL NEEDS IN NORWAY

The figure on the next page builds on the schematic material footprint diagram in figure one on page 16. It dives into the material metabolism of Norway; linking how four resource groups (minerals, metal ores, fossil fuels and biomass) satisfy the seven key societal needs and wants shown on page 22. From left to right, the figure shows the domestic extraction of resources (**Take**) which amounts to **333.8 million tonnes**, through the mining of minerals or the production of crops in agriculture or forestry to produce timber for construction, for example. These extraction processes result in raw materials like wood or sand. However, in a national context, domestic extraction represents only one of the inputs to the economy, which include also direct imported products, **74 million tonnes** as well as imports of waste, **0.3 million tonnes**, and of secondary materials, **2.5 million tonnes**. Re-exports—products that are imported and without any processing are exported again—do not make up a significant part of Norwegian imports and therefore are not explicitly quantified in this study.

When considering not just the direct imports, but also the Raw Material Equivalents (RMEs), as previously introduced on page 18, we see that Norway imports **151 million tonnes** of RMEs for a total raw material input of **485 million tonnes**. The raw materials typically undergo processing (**Process**), for example in the production of metals from ores, cement from limestone, or refined sugar from beets. The total amount of processed materials, which on top of raw material inputs also includes local and imported secondary materials, amounts to **488.7 million tonnes**. Subsequently, these refined materials can be used for the manufacturing (**Produce**) and assembly of products like automobiles from metals, plastics and glass, or the construction of roads and houses. These finished products can, in turn, be distributed and delivered to provide services (**Provide)** and access to products that can satisfy societal needs and wants locally or be exported. In 2017, Norway exported some **228.4 million tonnes** of final products with an associated RME of **252.1 million tonnes** and **0.14 million tonnes of waste**. According to our estimates, a total of **2.5 million tonnes** of secondary materials were exported in the same year, which leads to a total volume of approximately **235 million tonnes** of materials consumed by Norwegians, of which **5.5 million tonnes** were either secondary materials, **4.9 million tonnes**, or reused waste, **0.6 million tonnes**.[50]

Essential to identifying and addressing opportunities for a more circular economy is what happens to products and materials after their functional use in our economy (**End-of-use**). This is mostly related to the **235 million tonnes** of material consumption: Norway's consumption footprint. In Norway, the total amount of waste generated amounted to **14.6 million tonnes**, of which **4.4 million tonnes** came from Products That Last and **10.2 million tonnes** from Products That Flow.

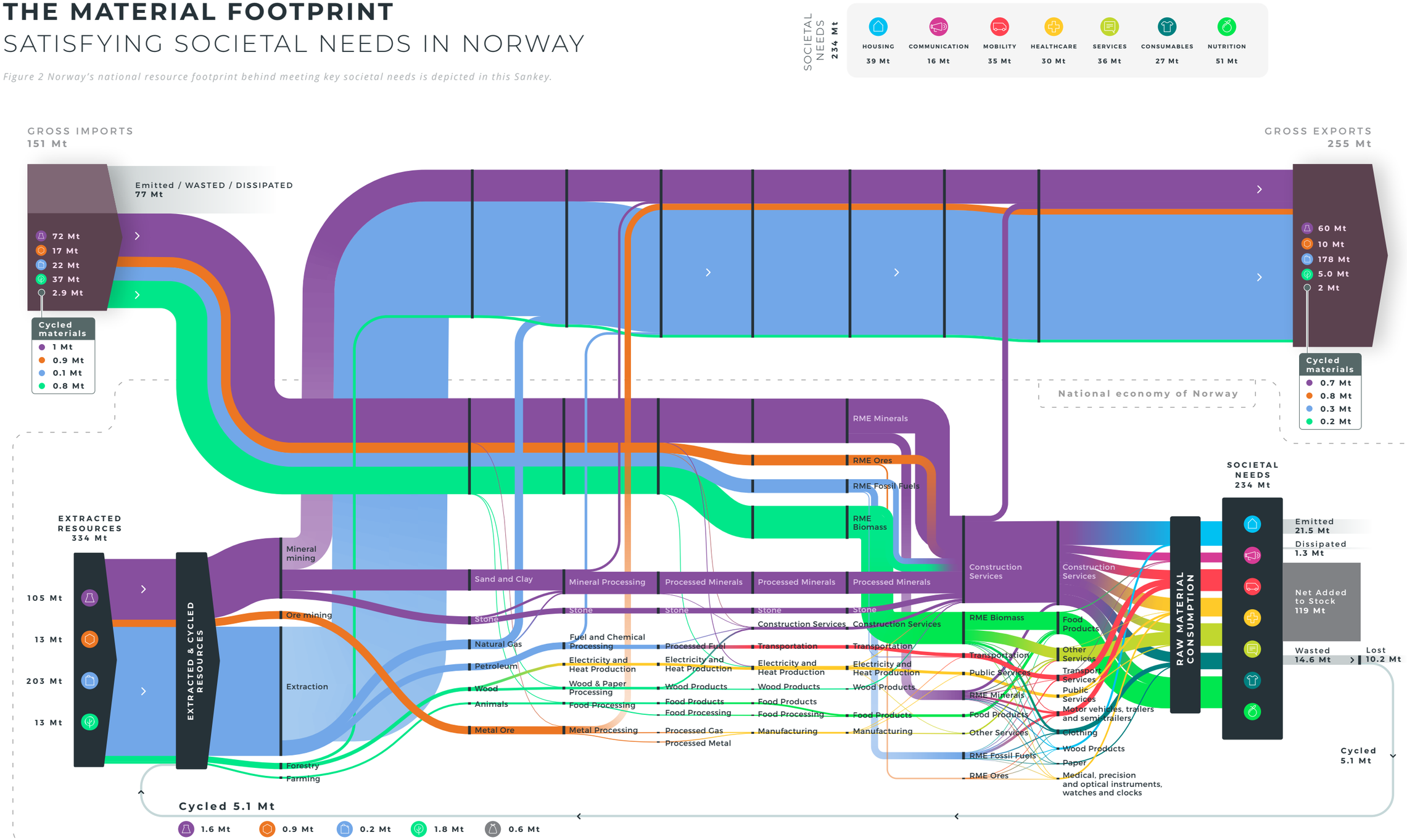
Of the total **15.7 million tonnes**[51] of waste being treated, **5.5 million tonnes**, that is 35%, are either recycled or directly reused, whereas the other **10.2 million tonnes** are lost indefinitely. Of the latter, **3.9 million tonnes**, ends up incinerated while the other **6.4 million tonnes**[52] is either landfilled or treated in unspecified ways. Remarkably, about 65% of the landfilled waste[53] is made of contaminated soils and mixed waste. Aside from materials going to waste, **119 million tonnes** are added to stock (Net Stock Additions) in the form of capital investments such as buildings and infrastructure, machinery and equipment. Another **21.5 million tonnes** are released into the environment as emissions mostly of fossil origin. The remaining **1.3 million tonnes** are dispersed into the environment as a deliberate, or unavoidable consequence of product use. This includes fertilisers and manure spread on fields, or salt, sand and other thawing materials spread on roads and the erosion of metals. Finally, **77.4 million tonnes** are made of all emissions, materials and waste either generated or dispersed in trading partner's regions as a result of Norwegian final demand.

UNCOVERING THE MANUFACTURING FLOWS OF THE NORWEGIAN ECONOMY

The data paints a picture of a country with a number of compounding resource use and trade realities that result in a limited Circularity Metric of 2.4%. It's clear that we further consider other measurements of circularity and opportunity in Norway. Key here is the country's material footprint. This mammoth footprint, per capita, can be reduced by 64.8%, and the Metric increased to 45.8%.

THE MATERIAL FOOTPRINT
SATISFYING SOCIETAL NEEDS IN NORWAY

Figure 2 Norway's national resource footprint behind meeting key societal needs is depicted in this Sankey.



RESOURCES

MINERALS · ORES · FOSSIL FUELS · BIOMASS · WASTE · CYCLED MATERIALS

END-OF-LIFE

Emitted 21 Mt	Dissipated 1.3 Mt	Net Added to Stock 119 Mt	Wasted 15 Mt	Lost 10 Mt
0.3 Mt	0.2 Mt	72 Mt	8.3 Mt	• Incineration 3.9 Mt
0.2 Mt	0.0 Mt	15 Mt	1.3 Mt	• Landfill 6.4 Mt
20.4 Mt	0.0 Mt	25 Mt	0.5 Mt	
0.6 Mt	1.1 Mt	7.6 Mt	4.5 Mt	

A HEAVY IMPORT-EXPORT NATION

The material footprint diagram is essentially employed to assign all of the resource use by the Norwegian population to final consumption; but in a trading nation such as Norway, we cannot ignore the massive impact of imports and exports on the material flows of the country. Of the **234 million tonne** consumption footprint, only **86.4 million tonnes**, 36.7%, originate within the national border itself. Essentially, Norway's import and export rates are amongst the highest in Europe, but there is a significant difference between the two categories. Norway mostly exports raw materials, such as in the oil and gas trade, fish (salmon in particular), non-ferrous metal ores, nonmetallic minerals and timber products. In 2017, Norway exported **228.4 million tonnes** worth of products with an associated footprint of **252.1 million tonnes**. Imports, on the other hand, have a raw material equivalent (RME) value four times that of direct imports. This is because they are largely highly processed goods ready for consumption, which often tend to be non-circular and follow intricate—sometimes inefficient—global material supply chains.

HIGH CONSUMPTION, LOW WASTE PRODUCTION

At **44.3 tonnes** per person, per year, Norway touts a high material footprint. It also has a large biomass footprint of **45 million tonnes** (biomass largely consists of food and nutrients, but also crops and wood). However, when coupled with the per capita waste production, we see the image of a country that consumes a lot, but wastes little. At **2.76 tonnes** per person, per year, Norway's rate is far lower than other *Shift* countries —such as the Netherlands which has a rate of more than **9 tonnes** per person, per year. However, this is also because the majority of Norwegian waste is generated abroad in the production processes of imports, and Norway reportedly imports a lot of finished goods. The RME values of such goods must account for the raft of processes undergone abroad. For instance, the extraction of the iron ores, followed by melting, casting, rolling, finishing and coating it into a final steel plate or bar, as well as all the scrap and waste that are generated in the process.

LIMITED WASTE REUSE AND CYCLING

Although waste production in Norway is relatively low, the volume of this that is cycled and reused is also limited. The total amount of waste generated domestically is **14.6 million tonnes**, while **10.3 million tonnes** is lost and landfilled. Of the domestic recycled materials—which amounts to only **30%** of waste—the data displays how Norway only excels in very small volumes of certain high-value recycling streams. These largely stem from its efficient packaging take-back and recycling schemes; of the country's high-value recycling streams, 99.4% of metals, 64% of plastics, 91% of glass, 85% of organic waste and 86% of paper are recycled.

However, these blindingly high recycling rates are dimmed due to large volumes of hard-to-recycle waste. This includes mixed waste from households, construction waste, oils and hazardous waste stemming from the manufacturing industries and contaminated soils. Clearly, as two thirds of all waste comes from these hard-to-recycle streams, this needs to be addressed in pursuit of circularity. Indeed, despite its large construction sector, modest levels of construction and demolition waste cycling show that it does not readily engage with this rich opportunity. Of all waste generated, construction accounts for about **20%**, but Norway's recovery rate of these materials is only **28.8%**. Alongside this, the level of waste that is recovered through reuse applications is also not high, and this can be attributed to a number of aspects. Typically, agricultural sectors produce large volumes of compostable waste, but Norway has a relatively small national sector.

LOCKED AWAY

The Norwegian material footprint is one of the highest per capita in the globe. In it, it is important to consider the gigantic levels of stock additions; materials that become embedded in long-term, durable products. The estimated Net Addition to Stock stands at **22.7 tonnes**, per person, per year—compared to **4.9 tonnes** in the Netherlands. Additions to stock consist largely of capital investments such as infrastructure, buildings, machinery and equipment, but also bunker fuels. These Products that Last have long life-spans and essentially, these valuable materials are locked away until they become available again at end-of-life. From a circular economy point of view, adding materials to your stock is not a problem, if the products created with them are produced and designed in a circular manner and as long as a country does not endlessly maintain these high levels of stock additions.

A LIMITING COMBINATION

Ultimately, the combination of these hardwired linear conducts limits Norway's circular potential. In efforts to bridge the national Circularity Gap, we consider 'what-if' scenarios in the next chapter. These not only aim to bring up the Circularity Metric, but importantly, reduce the material footprint. Impact prevention through reduction is better than mitigation in all cases.

4

BRIDGING NORWAY'S GAP

Exploration of 'what-if' scenarios for key sectors

Now that we have presented how the Metric is derived and investigated the message it portrays, it's time to analyse the findings and suggest a remedy. First, we identify some of the most impactful sectors of the economy, which we procure based on either a Mass, Value or Carbon level; as well as their potential to reduce the material footprint. For the chosen sectors, we then formulate scenarios that are purposefully constructed to explore and entertain the 'what-if'; free from the constraints of feasibility from a political, social or behavioural (change) standpoint. They serve as an exploration of a potential path forward but also sketch which type of sectors and interventions are most impactful in terms of steering the Circularity Metric and material footprint.

'BANG FOR THE BUCK': SCORING SECTORS ON THE MASS-VALUE-CARBON NEXUS

We have funnelled our energy for the 'what-if' scenarios into six key areas. These scenarios are called (1) **Circular construction**, (2) **Total transition to clean energy**, (3) **Circular food systems**, (4) **Green transport system**, (5) **A strong repair, reuse & recycling economy** and (6) **Circular forestry and wood products**. By focusing on a few key sectors, we can dive deep and apply a diagnostic lens to identify where we can best apply interventions to increase the circularity of Norway. In making our decision, we zoomed into the material flows associated with different areas and sought to complement this information with data on how the sectors score on their material consumption[54] (Mass), financial value creation[55] (Value) and greenhouse gas emissions[56] (Carbon); the Mass, Value and Carbon (MVC) nexus. This holistic tool allows us to identify the key areas which can deliver the highest possible environmental impact when applying circular strategies.

It is also worth noting that in our use of the term sector, we move beyond strict definitions and encompass a range of related areas under one umbrella 'sector'. These areas are also referring to the dominant sectors behind our scenarios. The repair and recycling economies span across the four other sectors and therefore do not score on the MVC nexus.

SUMMARIZING THE **MASS-VALUE-CARBON NEXUS**

Circular construction. Construction[57] leads the way in terms of raw material consumption, with its Mass totalling almost over a quarter, 24.8% and 58.3 million tonnes, of Norway's total. Typically, the sector's mammoth consumption is made up mainly from nonmetallic minerals and metals, but also a considerable share of fossil fuels. As the data has previously uncovered, much of Norway's resources are locked away in capital formation, such as buildings. The broad construction sector is directly responsible for 4 million tonnes of CO_2 equivalents, corresponding to 6% of total emissions, but when operational energy use in buildings is included the number goes up to 9.5 million tonnes (15%), which is more in line with the global average of 16.6 %.[58]

Clean energy. Fuel and energy represents only 8% (5,6 million tonnes) of all Norwegian emissions. In the Netherlands, this sector accounts for almost half, 47%, of all Dutch emissions. This is because Norway boasts nearly 100% renewable energy supplies for electricity, and the majority of greenhouse gas emissions happen abroad as the extracted fossil fuels are burnt. The sector funnels 22% of value addition in Norway, enforcing the dependence the country has on its fossil industry.

Circular food systems. Food and agriculture represent the second-largest raw material consumption: 28.1 million tonnes, which translates to 14% of Norway's Raw Material Consumption. Within this sector, agriculture, fishing and aquaculture are the key consumers of Mass, as well as cattle farming but to a lesser extent. It only represents 4% of the country's value added and, interestingly, food and agriculture emit more greenhouse gas emissions than the fuel and energy sector.
In food and agriculture sectors, a large proportion of this pollution likely stems from the agricultural component of the value chain due to the methane and nitrous oxide from cattle farming and fertilizer use.

Green transport system. Mobility and transport's[59] pollution is huge and accounts for 40%, 27.7 million tonnes, of all of Norway's greenhouse gas emissions, but only 5% of its value added. Although Norway has the highest share of electric vehicles in the world,[60] there is still a high dependence on the transport sector due to the population being so dispersed. The pollution largely relates to the large shipbuilding and shipping sector; an area that Norway has long been at the forefront of. Many ships departing from the Norwegian harbour run off diesel engines and spew large amounts[61] of greenhouse gases and sulphur oxides into the atmosphere. The country is, however, innovating in non-fossil fueled initiatives.
Circular forestry and wood products is among the smaller sector arenas we highlight in this study, but one that has immense relevance to enabling environmental benefits through forest conservation and carbon sequestration. It contributes only 2.7% of Mass and 0.7% of Value and also emits less significant amounts of carbon. However, it is a prominent sector that actively captures carbon, both in Norway's vast forest areas, as well as abroad in import markets for wooden products.

DISRUPT: SEVEN KEY ELEMENTS
OF THE CIRCULAR ECONOMY

BRIDGING THE CIRCULARITY GAP: 'WHAT IF' SCENARIOS

Our six developed scenarios are deliberately not time-specific, nor have we considered the specific actors or policies necessary for their real-life materialization. In this way, they are entirely non-politicised. The scenarios rather serve as the ambitious exploration of a potential path forward and sketch which type of interventions and levers are most impactful in terms of steering the Circularity Metric, as well as impacting the material footprint.

We are aware that measuring the effects of the suggested interventions in terms of their effect on the Circularity Metric and material footprint is a crude simplification which must ignore other relevant aspects such as additional ecological parameters. However, we see the value of this analysis in contributing to the dynamic debate on where to place our bets for enhanced circularity and reduced consumption in Norway and beyond.

For the development of the scenarios, we use the DISRUPT framework, seen to the right of this text, to consider the many relevant strategies for the systemic changes needed for the sketched scenarios to materialise. Ultimate aims include to slow flows (use longer), narrow flows (use less), cycle flows (use again) and regenerate flows (make clean). Revisit the detailed breakdown of the four flows on page 17.

D **DESIGN** FOR THE FUTURE

Account for the systems perspective during the design process; use the right materials, design for appropriate lifetime and for extended future use.

I **INCORPORATE** DIGITAL TECHNOLOGY

Track and optimise resource use, strengthen connections between supply chain actors through digital, online platforms and technologies.

S **SUSTAIN & PRESERVE** WHAT'S ALREADY THERE

While resources are in-use, maintain, repair and upgrade them to maximise their lifetime and give them a second life through take back strategies when applicable.

R **RETHINK** THE BUSINESS MODEL

Create greater value and align incentives through business models that build on the interaction between products and services.

U **USE** WASTE AS A RESOURCE

Utilise waste streams as a source of secondary resources and recover waste for reuse and recycling.

P **PRIORITISE** REGENERATIVE RESOURCES

Ensure renewable, reusable, non-toxic resources are utilised as materials and energy in an efficient way.

T **TEAM UP** TO CREATE JOINT VALUE

Work together throughout the supply chain, internally within organisations and with the public sector to increase transparency and create shared value.

SCENARIO 1: CIRCULAR CONSTRUCTION

The country is moving in a positive trajectory toward circularity in its construction sector, particularly in using environmentally friendly materials such as timber over steel. The world's tallest timber building[62] was erected in Eastern Norway using Moelven's glue-laminated timber; reportedly as strong, flexible and durable as steel. Meanwhile, Norway has pioneered with energy-efficient buildings.[63] The National Museum in Oslo is touted to be 'zero-energy'; it's heated by water from the Oslo Fjord.[64] Such innovations have been cultivated in a sector that is extremely prominent in terms of GDP; in 2018 the Norwegian share of the construction sector on GDP was around 14%—the second-highest level in Europe.[65]

However, the 'narrow' construction sector (defined as on-site work)[66] of Norway is heavily resource-intensive. It accounts for 18.3%, 43 million tonnes, of the entire material footprint and 30 million tonnes of nonmetallic minerals alone. **Extraction processes, part of 'broad' construction (construction materials, manufacturing, real-estate), can also have an intense environmental impact: half of total greenhouse gas emissions and more than 90% of biodiversity loss globally.**[67] Importantly, in Norway, a mammoth amount of resources are built into stock such as buildings and infrastructure; their potential to contribute actively and flow around the economy is minimized. The stock building dynamics of the Norwegian economy necessitate engagement with efficient stock use—namely, maintaining and recirculating what is already in use. Minerals for construction already account for the second-largest share of national extraction and although the construction sector accounts for 20% of all waste[68], only 40.4% of this is currently recovered.

In this 'what-if' circular construction scenario, **virgin materials would not be extracted** and **the cycling of construction and demolition waste into new buildings would be maximised.** The amount of new construction that would, therefore, be possible for Norway would have to match the amount of construction and demolition waste available. So, for these cycled materials to fulfil the need, **construction would also drop by an estimated 60%**.

CYCLE FLOWS—USE AGAIN

This scenario would necessitate that existing materials are reused and **cycled** to reduce the demand for newly extracted and imported building materials. This could be achieved by **sustaining and preserving what is already there**, keeping building components and materials intact and ready for reuse, rather than reverting to the raw material level. This could be done by applying reverse construction and advanced sorting, which allow for structured disassembly of buildings and purer material fractions where **waste can be used as a resource**. Moving to modular construction would facilitate structured disassembly end of use, which requires **design for the future**.

This process could be further bolstered by **rethinking the business model**. When it comes to using secondary materials, standardisation of required quality levels and accurate measurements would also be important to attain price points that are competitive with those of virgin materials, thereby enhancing demand and resulting in a less fragmented marketplace. Secondary materials would also need to be integrated into design, thus placing some responsibility on designers and architects too. **Incorporating digital technology** such as Building Information Management (BIM) systems and material passports could effectively relay information about a material's past use and future potential. Conducting a Building Stock Analysis (BSA) could be an important component of BIM systems. Through the BSA, the material composition of the building stock is analysed, creating a reliable picture of the type and quantity of materials that have been 'locked' into the built environment through construction activities throughout different decades. This information is valuable for architects in order to use these secondary resources as materials for their new designs—which can be modelled through BIM. For example, in Circle Economy's Kongsvinger Region Scan, it was mapped that almost 20% of the stock is made out of wood,[69] which can largely be found in residential buildings, accounting for a great tradition of wooden building practices. BIM could enable us to find future potential applications for materials from the buildings at the end-of-life.

MATERIAL PASSPORTS AND CONSTRUCTION COLLABORATION

In circular construction, 'urban miners' can look at buildings as raw material banks; their materials can be collected, cleaned and used in other construction projects as secondary materials. Digitalisation is playing an increasingly important role in the construction sector and greatly serves the ambition of more sustainable operations. Dutch-based company Madaster operates an online public library to which stakeholders along the construction chain upload BIM on their buildings.[72] They are continuing to expand their service across countries, including Norway. The information provided generates correlating material passports, which can inform sustainable design, disassembly and reuse. Such materials passports can also be made for existing buildings, through techniques such as digital 3D scanning.

Also operating in the BIM space is the Bimsync platform[73] from Norway-based Catenda. Bimsync is a cloud-based collaboration platform which collates data on the entire life cycle of a building. Based on the values of open standards and transparency, the platform also seeks to prevent corruption and unethical behaviour in the construction industry.

SLOW FLOWS—USE LONGER

In calling for stocks to be optimised, flows would also be **slowed**. To fulfil the need of dropping by an estimated 60% in this scenario, **sustaining and preserving what is already there** would be key. The current (residential) housing and (commercial property) offices would be thereby kept in good order through renovation, refurbishment, upgrading and repurposing. In also **narrowing** flows, buildings could also be built or renovated to be multifunctional and contain shared spaces; for example, a building could have a parking space which could easily be transformed into an office.[70] As a result of these slowed and narrowed flows, no buildings that currently form the housing stock would be demolished and building volume could be minimised. Building renovation is also one of the flagship programmes of the European Green deal, hoping to double, or triple, the renovation rate of existing buildings.[71]

In streamlining and enhancing how we cycle construction materials and demolition waste, no virgin materials would need to be extracted, which could alleviate the negative environmental repercussions of mining and processing to produce materials such as concrete and steel for construction. A further benefit would be that the amount of cycled materials in Norway would increase. In this scenario, Norway's Circularity Metric increases to **7.0%** and the material footprint drops by **15%**.

SCENARIO 2: TOTAL TRANSITION TO CLEAN ENERGY

Norway is an energy power-house. Despite only having 1% of the European population, it has 20% of the hydropower resources, half of the water reservoirs used for hydropower, 40% of gas resources and 60% of oil resources.[74] Its diverse set of renewable energy sources—hydropower, energy from biobased materials, wind and solar—provides a good point of departure for Norway's circular journey. And already almost all, 98%, of electricity[75] in the country is generated from renewable sources—namely hydropower.

Currently, refined petroleum products are the biggest sources of greenhouse gas emissions—although the industry is experimenting with emission-reducing and carbon dioxide reuse technologies. These endeavours can contribute to deep decarbonisation of the energy supply in the medium-term, but have no place in a circular economy.

It is increasingly likely that fossil energy extraction may reduce gradually worldwide as efforts to decarbonise the economy advance. This transition is also in line with the EU's ambitious plans to become the first carbon-neutral continent in the world by 2050, Norway's to become a low-emission society by 2050[76] and goals set out in the Paris Agreement. In the long run, it is expected that tax revenues from oil will be lower. Norway could thereby create growth in other industries and technologies. The economy could benefit from diversifying its economic activities to become less reliant on oil, thereby becoming more resilient.

Norway, however, has a strong position in the market for energy as renewable sources and associated technologies can be a key growth area for the economy. For example, Borregaard, operates the world's most advanced biorefinery, ensuring the sustainable use of resources based on renewable raw materials and its unique expertise. While Mo Industrial Park generated 400 GWh of recycled energy, more than the consumption of 24,000 homes, in 2016.[77] Norway's share of renewable energy consumption, as a share of final energy consumption, is already 51%,[78] placing it far ahead of many EU nation-states. But its renewable energy revolution has mostly reached electricity, including its use in heavy industries such as aluminium production. Norway now has the opportunity to diversify energy for industry and transport further—although electric mobility and sustainable initiatives for shipping, for example, are on the increase.

In this 'what-if' scenario of a total transition to renewable energy, linear activities in energy generation could begin to be scaled down. Including **transitioning away from extraction and imports of fossil fuels for domestic energy purposes**. To do so, heavy-duty fuels for industrial heat generation would be **replaced with hydrogen from electrolysis and renewably produced electricity**.

REGENERATE FLOWS—MAKE CLEAN

Fossil fuels used for energy purposes result in greenhouse gases upon combustion; they are dissipative and unretainable. In order to begin to phase them out of the energy supply, we could **regenerate** material flows into the energy sector—while also exploring the use of intermediate solutions such as Carbon dioxide capture and utilization or storage (CCU and CCS) (see the next **Cycle** flows section).

The phasing out of fossil fuel extraction and **prioritising regenerative resources** would require government intervention and **teaming up to create joint value**. This could be enforced through different policy measures and instruments, which would need to aim at creating an orderly and just transition away from these sectors. These range from a gradual phasing out through economic incentives such as expanded carbon pricing to a more radical prohibition of extraction and processing of fossil resources. For example, the reach of the current carbon tax and Emission Trading System (ETS) could be widened to an international level to be effective. Currently, a massive 16%[79] of industrial emissions and 22%[80] of off road transport are untouched by both tax and ETS. Carbon pricing could also be raised to be compatible with the Paris Agreement. In the first half of 2020, the carbon price under the European ETS hovered between €15 and €30 per tonne.[81]

Research and development—such as giving grants to Universities—into alternative fuels such as biobased and hydrogen can fuel the transition. Subsidies should also support the uptake of alternative fuels in the shipping sector; this is already underway. The Norwegian ferry operator Norled is piloting the first hydrogen powered car ferry, for example.[82]

CYCLE FLOWS—USE AGAIN

Although replacing fossil fuels with renewable energy is vital to reduce emissions in the long-term and embed circularity in resource use, in the transition away from linear activities in the fuel and energy sector, supplementary technologies that **cycle** CO_2 could be powerful intermediaries. The need to tackle rising emissions and global temperatures has never been more urgent, so, as countries transition to clean energy, decarbonising the industry by any means possible may also deliver immediate environmental benefits.

CCU and CCS are also regarded by the IPCC as contributing to the deep emission reductions required in energy-intensive industries to limit warming to 1.5°C.[83] Some posit that captured or stored carbon is necessary for making the production of certain materials, such as plastic, circular.[84] However, despite the existence of such decarbonization technologies, many have yet to reach commercial readiness. CCS and hydrogen value chains are still very much in need of investment and innovation to scale,[85] for example. Complex CO_2 infrastructure—carbon capture, compression, transport, storage and monitoring—is necessary for its realisation, while for CCU, large quantities of renewable energy, such as renewably produced hydrogen, should be available. Luckily for Norway, renewable energy is plentiful and it boasts state-of-the-art energy infrastructure.

In regenerating the energy supply flows, fossil fuels would eventually be made redundant and in the intermediary, CCS and CCU could play a role in emissions abatement. This scenario also assumes that all the electricity produced would be from renewable sources, the majority coming from hydropower, energy from biobased sources, solar and wind. If realized in reality, this scenario would increase the Circularity metric to **2.7%**, but it would have a significant reduction of **14.9%** on the country's material footprint.

SCENARIO 3: CIRCULAR FOOD SYSTEMS

Norway is rich in natural resources—including aquaculture and fisheries. As the global population continues to grow to reach almost 10 billion by 2050, according to United Nations[86] estimates, food systems that are typically linear need to adapt—and many already are. Many food systems today typically optimise short-term resource extraction and production, often at the cost of soil health and dwindling wildlife populations. The inefficient use of biomass globally, from feed to fertilizer, in the agricultural process has brought proponents of circular agriculture and aquaculture to the fore, attesting that it can reduce the environmental impact of fish, cattle and crop farming, while producing good yields from crops.

In Norway, agricultural products such as crops, fisheries and livestock require 51.2 million tonnes of resources per year. This significant industry is a dominant source of greenhouse gas emissions and food products currently represent a dominant Mass flow, 12% of Norway's total, as well as waste flow. Meanwhile, food waste from farm-to-fork represents a financial loss of more than 20 billion (NOK) annually.[87]

An important aspect of reducing the ecological footprint of the industry, beyond production, is in steering dietary habits. This includes the balance of dietary proteins; animal versus plant-based. In Norway, animal-based diets have a long history and meat consumption continues to rise. Since 1989, it has shot up by 45%.[88] Generally, animal-based foods have a larger impact[89] than plant-based ones in terms

of land usage, water consumption and greenhouse gas emissions. Norwegian diets also consist of many imported foods. The busy global food trade has multiple environmental drawbacks: more species are threatened by implicated imports than are by domestic production across a range of countries[90] and some countries practice deforestation to grow crops and rear cattle for international trade,[91] for example. And of course, local food doesn't need to travel as far to reach our plates, requiring fewer energy-intensive processes and transportation. Although local sourcing is not a silver bullet, it can benefit local food production and support the development of regenerative agricultural systems.[92]

In this 'what-if' circular food systems scenario, **all food waste from farm-to-fork would be eliminated** and **the material intensity of fishing and aquaculture would be reduced through responsible sourcing**. Selected food imports would also stop and consumption of **domestically produced meat, dairy and cereals for food and feed would dominate**. Lastly, this scenario assumes that all **biomass related to food systems is sustainably and responsibly sourced** and therefore circular. This includes biomass from food, such as fish, cereals and agricultural products, as well as waste from food crops and manure, for example.

NARROW FLOWS—USE LESS

In reducing food waste, shifting diets so that they revolve around the local and slashing the intense material use of fishing, aquaculture and food waste, this scenario calls for flows to be **narrowed**. The material footprint of food could be reduced by consuming local products, particularly meat, dairy and cereal products. This can be incentivised by players along the value chain collaborating to create joint value. The government could lower value-added taxes for local products. However, in introducing these tax breaks, it is crucial that any reductions in taxes would also reach the final consumer and thus encourage a shift in demand.

In reducing food waste, **digital technology** could be incorporated to allow for a deeper insight into wasted food and generate information on its origin. The hospitality sector, for example, could reap benefits from food waste technology such as Winnow Vision,[95] which employs Artificial Intelligence to offer rich insight into food waste and, in turn, reduce it by half. The elimination of food waste would be further optimized by **using waste as a resource**. Food waste, including from municipalities, could be widely used as agricultural animal feed. While in aquaculture, continued reliance on feeds from wild-caught fish is not sustainable, and Norwegian companies are already exploring the potentials of using omega-3 rich microalgae in feed. This is pertinent as it plans to increase its aquaculture exports fivefold by 2050[94] and microalgae could replace the large amounts of biomass, such as imported soy, that are funnelled into feeding aquaculture instead of being used for direct food consumption. Meanwhile, in fishing, the government could also ensure the implementation of methods to prevent bycatch of fish, sea mammals and seabirds. More stringent regulations on trawl nets, gill nets and danish seine nets, which are still used for the majority of fishing in Norway, could facilitate this.[95]

REGENERATE FLOWS—MAKE CLEAN

In applying circular principles to agriculture and diets, many flows must be **regenerated** by using cleaner resources and sustainable schemes. Generally, the production of food products revolves around biomass and, therefore, has the potential to be fully regenerative. In nature, food systems are entirely circular and produce no waste. However, as fertilisers and pesticides are sourced from mineral and fossil resources, and soils are exhausted, the food system has lost its self-replenishing nature. Therefore, shifting to a circular food system means **prioritising regenerative resources** and ensuring a healthy, localised balance between animal farming and agriculture that ensures their mutual reinforcement, for instance, by using crop waste and trimmings as animal feed and using manure based fertilisers. Regulation would be required to anchor this balance in law.

Further, **teaming up to create joint value** and communication with final consumers could be crucial in attracting demand and educating consumers about the relevance of a balanced, circular food system. This also applies to one of the key export products of Norwegian farming—fish. Certification schemes like Aquaculture Stewardship Council (ASC)[96] and Marine Stewardship Council (MSC)[97] can ensure regenerative aquaculture and fisheries through standards on the type of feed, fishing volumes and water pollution. Ensuring that fish stocks can naturally replenish themselves helps preserve healthy fish stocks and battles overfishing. Expanding the reach of these certification schemes and lobbying for regulatory

SUSTAINABLE SEAS, SLASHING FOOD WASTE

In an excellent example of the circular economy in practice, Norway based Ocean Forest,[98] founded by Lerøy Seafood Group and the environmental organisation Bellona, is pushing for sustainable food production and reduced CO_2. The company uses excess nutrients in the sea from fish farms—phosphorus, nitrogen and CO_2—to cultivate sugar kelp and mussels. These can, in turn, be used for human consumption, feed and renewable energy—as well as the absorption of CO_2. Startup AlgaePro, meanwhile, is developing a technology to cultivate microalgae, which can be used for feed in aquaculture. The process uses bio waste from municipal waste management, as well as CO_2 and waste heat. The company hopes it can commercialise microalgae cultivation, therefore promoting a circular bioeconomy.

Stemming food waste is increasingly attracting the attention of investors. Matsentralen,[99] a warehouse for storage and distribution of overstock food and groceries, has seven locations across Norway to link food retailers and producers with charities that distribute waste food. In 2014, Matsentralen received 617 tonnes of food and groceries from 44 different suppliers in the Oslo region. This company is also driven by inclusivity and the non-profits that redistribute to food to disadvantaged people.

quotas that are truly aligned with maintaining the health of populations could further advance Norway towards regenerative fishing and aquaculture.

In making the food system circular, food that enters the system would be cultivated in a way that is sustainable and enhances the environment, food waste would be at zero and food sources would increasingly come from local geographies. This would increase the Circularity Metric to **12.6%**, and it would have a reduction of **5.7%** on the country's material footprint.

SCENARIO 4; GREEN TRANSPORT SYSTEM

Norway is globally revered for its high electrical car adoption.[100] In 2018, electric or plug-in hybrid electric cars had a combined market share of nearly 50%.[101] This places it firmly en-route to achieving the government target of phasing out the sale of new fossil fuel-based cars by 2025.[102] The shipping sector is also prominent in Norway, both in terms of reputation, use and emissions. However, the country is making strides in greening this area up. The Green Shipping Programme has been launched and it touts the world's first fully electric and autonomous container ship, while Teekay has developed technology to facilitate shuttle tankers using their emissions as fuel.[103] Norway also accounts for nearly 30% of the global battery-powered ship fleet.[104]

Despite global acclaim on the e-mobility front, a massive 40% of all Norway's greenhouse gas emissions can be traced back to the mobility and transport sector. Meanwhile, the societal need and want of Mobility still has a considerable resource footprint: 35.1 million tonnes. A huge amount of this goes to the materials needed to build transport technologies such as cars and ships, as well as any fossil fuels still used to power them.

In this 'what-if' scenario of a green transport system, **car-sharing and rental in all passenger vehicles would occur** and **motor vehicle's components would be reused, leading to a reduction in the sector's gross output for final demand by 10%. Mechanical equipment would also be reused, expanding the average lifetime of motor vehicles**. T**he electrification of passenger vehicles and ferries** would be widespread, as would be **design improvements in car and other transport manufacturing**.

NARROW FLOWS—USE LESS

In increasing resource efficiency through business models that focus on access to products—ultimately aiming to serve more people with less products—flows can be **narrowed**. Instead of car ownership being the norm, **rethinking the business model** and prioritising shared platforms could deliver large benefits, especially as the average European vehicle is parked for 92% of the time.[105] Shared mobility could be increased through regulatory interventions and incentives, such as increasing the threshold for tax exemptions of VAT for income related to rental and car sharing from currently NOK 10,000 (€943). This would increase the attractiveness of people sharing their vehicles on peer-to-peer sharing platforms such as Nabobil.[106] Public platforms, such as Vy Bybil[107] which offers carsharing for electric cars, could be expanded with subsidies and/or tax exemptions for users. This would decrease the usage cost and thereby reduce the allure of car ownership. Lastly, the expansion of public transport in urban areas could also reduce the need for cars and the materials used to build them.

REGENERATE FLOWS—MAKE CLEAN

In driving the electrification of transport to a new frontier, flows will be **regenerated**. Regulatory interventions and incentives could make carbon-neutral mobility a requirement for new vehicles, beyond only the automotive sector. This would in turn direct more funding and attention towards increasing the maturity of hydrogen and expanding electric powertrains and charging infrastructure for electric cars, but also ferries and leisure boats. Success stories are already emerging: the Ampere ferry operated by Norled is the world's first battery electric car ferry (page 37). Lastly, by **designing for the future**, the reduced number of moving parts in electric vehicles and ferries would further increase their durability and extend the useful lifetime. Importantly, up to 80% of a products' environmental impact is determined at the design phase.

CYCLE—USE AGAIN

To transition away from dependency on imported materials and help retain the value of materials within the Norwegian economy, flows need to be **cycled**. Research and development could be directed **toward sustaining and preserving what's already there**; in this case, giving automotive batteries a second life. This is pertinent in Norway, where due to the early and scaled uptake of e-mobility, the first cycles of batteries reaching their end-of-life due to decreased capacity have accumulated. At present, lithium-ion batteries are the most common type in the EU used for e-mobility.[109] This strengthens the need for secondary-use applications. This could be for other energy storage applications, as well as entering recycling technologies that could recover the maximum number of materials possible; key materials in batteries such as EV ones are cobalt, nickel, aluminium and lithium.[110] New regulatory frameworks for batteries plan to be implemented as part of the Circular Economy Action Plan; this will revolve around the recovery of valuable materials, rules on recycle content and improved collection and recycling rates.

In creating a sustainable transportation system in Norway that applies circular business models and design and further cleans up transport fuel, fewer materials and energy would be needed. This would not increase the Circularity Metric, it remains at **2.4%**, but it would have a reduction of **6.3%** on the country's material footprint.

SCENARIO 5: A STRONG REPAIR, REUSE & RECYCLING ECONOMY

Norway excels in recycling small volumes of high-value materials, especially from post-consumer packaging. With a 97% recycling rate for plastic bottles, it's far ahead of the EU's 2029 target date for countries to recycle at least 90% of their plastic bottles.[111] But Norway's overall recycling levels are low (30%). The incineration of mixed waste accounts for 16.8% of all generated waste; landfilling of mixed waste accounts for 10% and the landfilling of contaminated soils, 15%. In addition to the incineration of food waste, paper waste, oil and hazardous waste are major contributors of waste generation.[112]

Repair, as well as reuse and refurbishment, are also key elements in making the system more circular: keeping materials and products in use and maximizing their efficiency is crucial for a functioning circular economy. A one-man repair shop in Norway embroiled in a legal battle with Apple recently hit international headlines. While the man, Henrik Huseby, maintains he refurbished and repaired iPhones, he lost the case to Apple for what has been called 'a setback for the right-to-repair movement'.[113] However, in Norway, many other more localised and cultural barriers prevent the repair movement from growing. These include a lack of convenience for consumers to reach repair services and high prices, as well as a lack of labour working in the sector. We will explore this more in Chapter five.

In a strong policy step, many countries, including Norway for almost 20 years,[114] have implemented Extended Producer Responsibility (EPR) schemes across products and waste streams—cars, tyres, electronic goods, packaging, batteries—bringing the concept of sustainable and circular design to the forefront of industry.[115] With suppliers being responsible for the waste they produce, the opportunity to explore circular design innovation, such as optimisation for recycling and repair, as well as reuse and remanufacturing, comes to the fore.

In this scenario of a strong repair, reuse and recycling economy, **the average lifetime of electrical products and machinery increases, as do household goods through the application of rental, sharing and repair models**. This scenario also suggests interventions that target the recycling industries, such as striving for **zero material for landfill or incineration** and **substituting primary material with recycled material**.

SLOW FLOWS—USE LONGER

Materials and products are valuable and to move away from its throwaway culture, the economy should increase its capacity to **slow** flows. Following in the footsteps of the EU Circular Economy Action Plan, Norway could also impose legislative and non-legislative measures to give users a 'right-to-repair'.[116] The planned EU law will extend to phones, tablets and laptops and hopes to eliminate designed obsolescence (when manufacturers or brands artificially shorten product life spans).[117] Repair is facilitated by **designing for the future**. Therefore, manufacturers could integrate modular design into their work to create products with components that can be easily replaced. A measure that could encourage this is a mandatory extension of warranty, which might incentivise higher repairability at minimal costs. Meanwhile, tax exemptions for repair activities could increase cost attractiveness and balance high labour costs. If flows are slowed, the number of imports necessary would reduce, and the stronger repair economy would mean that domestic production of new products could decrease.

CYCLE FLOWS—USE AGAIN

The circular economy requires us to close material loops and improve waste treatment through **cycling** flows. This would require **teaming up to create joint value** along the often complex value chains of materials, from producers to recyclers, retailers and consumers. Tax exemptions and reductions could be imposed to encourage recycling. Gains have been made in this space; the EU has already pledged to ensure that all plastic packaging is recyclable by 2030; a clear incentive for member-states to increase attention in this space to avoid higher taxation. Furthermore, recyclable packaging begins with **designing for the future**. This includes designing for disassembly and using high material purity. This could mean striving for mono-material designs in plastic packaging, for example, which makes the sorting and processing of packaging waste easier, while high purity materials are more easily recovered and recycled.
In terms of infrastructure, Norway is strong in some areas: it has extensive curbside collection and a world-leading deposit return scheme for plastic bottles from Tomra,[118] for example. It, therefore, would be useful to expand deposit return schemes to other waste streams that are fit for high-value recycling and reuse.

In enhancing the repair and recycling economy of Norway, waste would be reduced and materials would have value for longer. This would increase the Circularity Metric to **5.4%**, and it would have a reduction of **7.6%** on the country's material footprint.

SCENARIO 6: CIRCULAR FORESTRY & WOOD PRODUCTS

The forest-rich landscape has allowed Norway's forestry industry to become a prominent and traditional pillar of the economy. It typically includes activities such as forest management, as well as the harvesting and processing of wood into timber products, pulp and paper. As a regenerative resource, timber and wood can be key renewables in a circular Norway, especially as the demand for biobased materials increases.[119] It has been reported that Norwegian exports of pulpwood, sandwood and woodchips have increased—between 2011 and 2015 pulpwood exports rose from 0.7 to 2.6 billion m3—and there are reasons to anticipate that this will rise further.[120] Therefore, there is huge potential, and necessity, in exploring how to keep the underlying nutrient cycles intact and stay within the productive capacity of ecosystems, both those affected in Norway and abroad through products consumed in Norway.

Norway is already active in sustainable forest management and responsible sourcing, and it widely utilises its timber products across a plethora of applications: buildings, bridges, biofuels, biopolymers and cellulose for agriculture, nutrition and fisheries, and more. There may be scope to further maximise the value of these materials in line with the Circular Economy Action Plan. This calls for the 'efficient use of bio-based resources through dissemination of best practices on the cascading use of biomass and support for innovation in the bio-economy'. In essence, cascading maximises resource effectiveness by using biomass in products that create the most economic value over multiple lifetimes.[121] The forestry industry has recently garnered NOK 750 million[122] on a package of measures, including to enhance innovation and increase R&D.

In the 'what-if' scenario of circular forestry and wood products, **all flows would be sustainably and responsibly sourced, as well as safely returned to the biosphere, and therefore circular.**

REGENERATE FLOWS—MAKE CLEAN

Ensuring the sustainable sourcing of biomass means, in essence, to guarantee that it comes from ecosystems that are managed according to environmental standards that enable **regeneration**. In terms of the current progress on responsible sourcing in Norway, our analysis does not display such details. However, Norway's national implementation of the Norwegian PEFC Forest Standard (Program for the Endorsement of Forest Certification) and the FSC (Forest Stewardship Council) across virtually all of its forest properties indicates that its domestic forestry is indeed sustainably and responsibly sourced.[123] Further than responsible sourcing, more attention could be given to regenerating forests through heightened conservation and forest habitat protection, such as for forest trees' genetic resources.[124]

Norway could now work toward ensuring that all of its imported wood is sustainably and responsibly sourced by using sources that adhere to sustainability criteria and certification schemes. This entails **teaming up to create joint value**. The Norwegian government had previously publicly shared its doubts on ethical procurement being promised by certification schemes, and the European Union recently implemented the EU timber regulation (EUTR), which prohibits any illegally sourced timber from entering the EU market. Certification of sustainable sourcing could be made mandatory for all imported wood, thus ensuring the use of 100% sustainably sourced wood in Norway. Norway has now pledged millions in combating illegal deforestation, including investment in Reducing Emissions from Deforestation and forest Degradation (REDD). Norway's International Climate and Forest Initiative (NICFI) works internationally to stem deforestation using REDD. Further, **Incorporating digital technology** to digitally track the journey of a standing tree to its final destination could be enhanced by using blockchain technology and Radio Frequency Identification (RFID), according to European Commission researchers.[125] By mainstreaming and exporting such technologies, transparency, reliability, security and traceability could be greatly enhanced. This could be imperative to increasing the available toolkit to halt deforestation and monitor illegal logging.

SLOW FLOWS—USE LONGER

Norway could also strengthen infrastructure to track and cascade nutrients throughout different production and consumption stages, thereby **slowing** flows. Essentially, the lifetime of timber and wood products could be extended and be used in the highest value applications.

Currently, much biomass waste, largely wood, is incinerated for energy recovery. A better capturing of the value of wood coming out from construction could be obtained by **designing for the future**, through demolition and renovation activities (see scenario one, Circular construction, on page 34). A higher value recovery of this wood in reuse applications or high value recycling could greatly improve the sustainability performance of the built environment[126] and wider sectors. In optimal cascading, initial uses from timber could be as big beams in construction, followed by uses in furniture, for example, followed by shredding to go into shredded wood applications and lastly, once incinerated and embodied energy is recovered, ashes can return to the biosphere to spawn new trees.

Indeed, 'using the entire log' is something already practised across the Norwegian industry. Borregaard's vanilla flavour produced from Norwegian timber's lignin is in increasing demand as an alternative to vanilla flavours made from oil, the dominant product in the market.[127] Also within the company, wood chippings are treated so that cellulose fibres are released, while remaining timber parts, such as binding agents and sugar compounds, are separated in the pulping processes with components flowing toward the ethanol factory; remaining residual organic material is biologically treated to become biogas (methane).[128]

If Norway were to ensure that all of its timber and paper resources were sustainably sourced, ideally cascaded throughout life, and safely returned to the biosphere, it could therefore be considered circular. This, in turn, would boost Norway's Circularity Metric to **7.5%,** and reduce its material footprint slightly by **3%**.

COMBINED INTERVENTIONS

Individual interventions along a range of platforms have a limited impact on the Circularity Metric and the material footprint, but when we combine the interventions we see a substantial impact.

In our broad 'what-if' image for the economy, if we harness the cross-intervention synergies, Norway reaches a circularity metric of **45.8%** and the material footprint of consumption is lowered by a remarkable **64.8%** to merely **80.6 million tonnes**.[129] Additionally, there would be a drop in Norway's carbon footprint of 63%, and an estimated 33.1 million tonnes of waste generated abroad would be avoided.

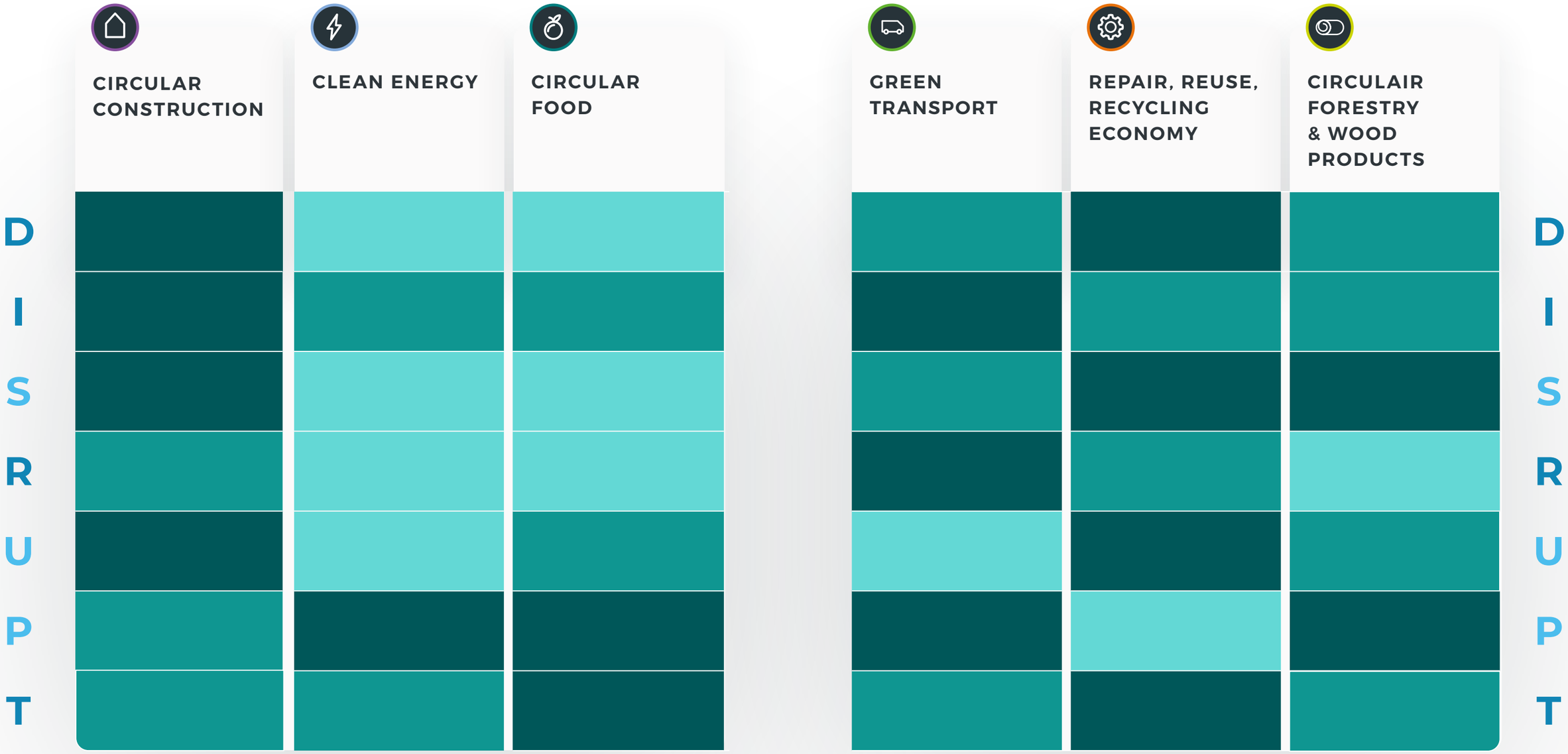
When combining the interventions, it is crucial to be aware of potential overlaps across the different interventions. In particular, the scenarios on repair, recycling, as well as fossil resource consumption, are applied across sectors, thereby also influencing the industry specific interventions on construction and agriculture. Therefore, we prioritise interventions according to principles of the circular economy. We begin with strategies that aim to **reduce** inputs, secondly applying **repair** and **reuse** focused scenarios and only lastly applying those focused on **recycling**.

RELEVANCE OF CIRCULAR STRATEGIES
ACROSS SCENARIOS

Figure 3 depicts the six core sectors we consider to be key change agents in Norway's circularity and identifies which platforms of our DISRUPT framework holds the most potential.

HIGHLY RELEVANT
MODERATELY RELEVANT
LESS RELEVANT

D **Design** for the future
I **incorporate** digital technology
S **Sustain & preserve** what's already there
R **Rethink** the business model
U **Use** waste as a resource
P **Prioritise** regenerative resources
T **Team up** to create joint value



SCENARIOS, INTERVENTIONS & STRATEGIES

	INTERVENTIONS	STRATEGIES	IMPACT & FOOTPRINT
1. CIRCULAR CONSTRUCTION	**No extraction of virgin materials** **Cycle better and stop extracting new resources**	SLOW • Extend lifetime of buildings for longevity • Repurpose, renovate, refurbish, upgrade buildings CYCLE • Reverse construction and sorting • Enable environment for smart material management	Circularity from 2.4% to 7.0% Reduction of material footprint by 37%, decrease to 144 million tonnes.
2. CLEAN ENERGY	**Transition away from extraction/imports of fossil fuels for energy** **Renewables for industrial heat generation**	REGENERATE • Team up to create joint value through trade regulation and value chain collaboration • Invest in research and development in fuels CYCLE • Contribute to decarbonisation with CCE and CCS	Circularity from 2.4% to 2.7% Reduction of material footprint by 14.9% to 195.1 million tonnes.
3. CIRCULAR FOOD SYSTEMS	**No food waste** **Ensure a healthy, localised balance between animal farming and agriculture** **Biomass related to food systems is sustainably and responsibly sourced**	NARROW • Team up to create joint value with tax breaks • Use digital technology to reduce food waste • Invest in alternative animal and fish feed REGENERATE • Regulation to prioritise regenerative resources • Reliable certification schemes for fish and feed	Circularity from 2.4% to 12.6% Reduction of material footprint by 5.7%, decrease to 220.4 million tonnes
4. GREEN TRANSPORT SYSTEM	**Car-sharing, reuse of vehicle components and mechanical equipment** **Electrification** **Design improvements**	NARROW • Rethink the business model to encourage sharing platforms REGENERATE • Encourage carbon-neutral vehicles through regulations • Increase durability vehicles with circular design CYCLE • Invest in automotive battery cycling	No change from 2.4%. Reduction of material footprint by 6.3%, decrease to 214.8 million tonnes.
5. STRONG REPAIR, REUSE, RECYCLING ECONOMY	**Apply rental, sharing, repair models** **Zero materials to landfill/incineration** **Increase use of recycled materials**	SLOW • Legislation to support 'right to repair' • Increase use of modular design CYCLE • Team up to facilitate cycling along complex value chains • Design for disassembly and recycling	Circularity from 2.4% to 5.4% Reduction of material footprint by 7.6%, decrease to 211.8 million tonnes
6. CIRCULAR FORESTRY, WOOD PRODUCTS	**Ensure sustainable and responsible sourcing** **Flows must return to the biosphere**	REGENERATE • Reliable certification schemes • Digital technology to boost transparency SLOW • Extend lifetime of wood products by designing for the future	Circularity from 2.4% to 7.5% Reduction of material footprint by 3%, decrease to 225.1 million tonnes
7. THE POWER OF COMBINED INTERVENTIONS			Circularity from 2.4% to 45.8% Reduction of material footprint by 64.8%, decrease to 70.3 million

5 CONSUMING CIRCULARITY

How business and government can enable circular lifestyles

The transition to circularity cannot be realised if individual consumer consumption remains linear. Ultimately, Norwegian business and government are pivotal players in creating the conditions to facilitate circular consumption. Based on empirical research—qualitative interviews—and secondary research, this chapter identifies how changemakers—businesses and government—can drive the adoption of a circular economy. They can do this by engaging with a consumer-centric approach—the idea that products and services are designed with the end-user in mind. Our analysis provides an insight into the role of Norwegian consumers in the circular economy and key drivers, barriers and behaviours in this space. How can changemakers ensure the circular strategies of slow flows (use longer), narrow flows (use less), cycle flows (use again) and regenerate flows (make clean) materialise in the offering available to consumers? These questions are ever more pertinent for a national and global economy hard hit by the impacts of the covid-19 pandemic. As well as our sweeping 'what-if' sector scenarios that explore interventions to increase circularity and slash the material footprint, individual consumers also play a prominent role; most production is ultimately driven by the demand of consumers.

Consumer choices can embody the national mindset shift of seeing beyond short-term benefits. The circular economy is a holistic model that aims to reshape how we create, provide, add and obtain value. It also reimagines—rather than restricts—the way we consume, therefore opening up new avenues for consumer engagement. In this way, the consumer and their behaviours provide ample ground for innovation.[130] Norway, as a highly developed and economically successful nation, has the chance to be hugely impactful and lead the consumer-centric innovation curve.

In this chapter, we focus on the consumption behavior of the individual, defining it as 'an activity whereby individuals obtain, purchase and use from "external" parties'.[131] Consumption in Norway is reflected in the country's socio-economic status. Importantly, Norway is a high-income country with citizens that generally have high spending power. The majority of consumer's disposable incomes goes into services and it takes **36.4 million tonnes** to satisfy this societal need and want. Meanwhile, online retail shopping is a popular pastime, with electronics and clothing attracting the most spending on foreign online stores.[132] Consumables, which include clothing and household appliances, require **26.6 million tonnes** worth of resources in Norwegian society. Notably, no nation in the world spends as much money on houses, homes and cottages per capita as Norwegians do.[133]

Among Norwegian consumers there is a lack of adoption of the circular economy, which is likely down to low levels of familiarity and misconceptions of circularity. Half of consumers (51%)[134] are unfamiliar with the term 'circular economy', and only 12% know the meaning of the term. However Norwegian consumers are reportedly more quizzed-up on the broader notion of sustainability—62% stated that sustainability concerns impact their buying decisions. This paves the way for acting along circularity lines, especially as 26%[135] belong to two consumer categories called 'smart' and 'dedicated', meaning they want to make a difference through their buying decisions. This is important as the adoption of circularity on an individual level typically spans across four stages: awareness, understanding, commitment, and action (see more on page 50). Not all four levels of this model are necessary for change, but interventions taken by changemakers should tap into at least one of them.

In our analysis, we develop interventions based on **drivers** and **barriers** for, and **behaviours** of, consumers in adopting circular consumption. We use the Awareness to Action model (see page 50) to highlight how we can use the drivers and barriers in recommending what interventions changemakers can take in encouraging a move away from linear practices. The Awareness to Action model allows for the design of different levels of engagement and adoption. The interventions discuss opportunities to push out the adoption agenda according to slow flows (use longer), narrow flows (use less), cycle flows (use again) and regenerate flows (make clean) (see page 17).

AWARENESS TO ACTION FRAMEWORK

"Passive" engagement

UNDERSTANDING

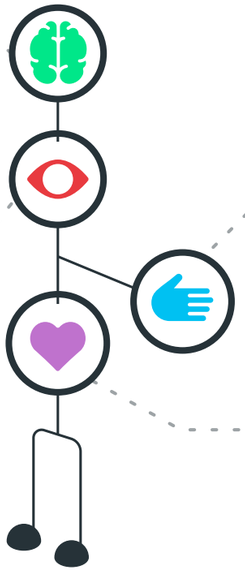
FOCUS
Education, Knowledge & Communication

OUTCOMES
Sense of Ability, Responsibility, Trust & Authenticity

AWARENESS

FOCUS
Knowledge & Information

OUTCOMES
Connection, Trust & Authenticity



"Active" engagement

ACTION

FOCUS
Availability & Affordability, Safety, Convenience & Comfort

OUTCOMES
Trust, Standardisation

COMMITMENT

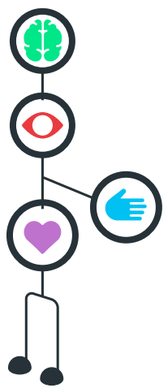
FOCUS
Trust & Security, Attractiveness

OUTCOMES
Conviction, Sense of Contribution, Belonging & Responsibility

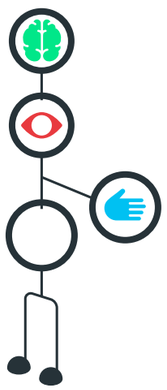
Figure 5 shows a schematic overview of our Awareness to action framework

NORWEGIAN BRAND INITIATIVES IN PRACTICE:

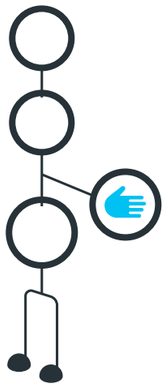
The below is meant to examplify the focus of Norwegian brands when mapped onto the framework above. These are not absolute and will shift depending on the initiatives highlighted.



BERGANS
Long Live the Product



NEW MOVEMENTS
New sneakers, old materials



VESTIAIRE COLLECTIVE
Preloved fashion

FOUR STEPS TO CIRCULAR ADOPTION

To create Awareness for circularity changemakers must develop and deploy knowledge and information around circularity through different media channels. This passive level removes negative connotations from environmental needs: socioeconomic opportunity is made clear and personal and/or collective values can connect to the circular narrative. Communications should not be overly complex and aim to be eye opening whilst aptly relaying on urgency and relevancy.

To create Understanding of circularity, changemakers must emphasize education, knowledge and communications. Building a positive narrative around circularity should continue, as well as encouraging a sense of responsibility among consumers to make diligent decisions. This level creates a sense of ability and empowerment; trust in circularity rises.

To create Commitment to circularity changemakers must enable a sense of trust and security, emphasized by providing quality, convenience and comfort. Circular options must appear to outweigh linear ones. At the commitment stage individual consumers are diligently and emotionally convinced to pursue and contribute to circularity. If not enough understanding is present at this stage though, large scale adoption will be challenging.

To create Action on circularity changemakers must focus on availability, safety and favourable pricing. Legislation and certification can be highly effective, stimulating convenience and providing ease and comfort with the circular choice. Any of the prior levels—awareness, understanding, commitment—can be fairly low if national standardization enables action. High trust in legislative bodies in Norway supports our argument to champion circular action by imposing change; this can provide mass availability and supports affordability.

1: SLOW—USE LONGER

In slowing material loops, product lifespans are extended and consumers can use them for longer and, in turn, slow the life-cycle based value creation of new goods. Strategies that create such solutions hone in on elongating the lifespan of products through repair, maintenance, upgrading, reuse, resell and using durable materials. A functioning circular economy would eliminate designed obsolescence—artificially shortening product life spans[136]—as it seeks to achieve maximum product and material durability.

LINEAR PRACTICE 1.1: HIGH TURNOVER RATES OF PRODUCTS

In Norway, consumers enjoy staying up to date[137] with recent technological developments, resulting in a high replacement rate of products. This reality is **driven** by the high spending power of individuals and the country's high-income status, as well as familiarity and competence with the fast pace of digital innovation. Common **behaviours** in this space are procuring new products such as electronics and furniture and hoarding old devices. A **barrier** facing consumers in shifting their behaviour toward slowing flows is linked to the lack of knowledge around the circular economy generally. A long-term perspective and sensitivity for sustainability issues, such as resource security, is often missing among consumers. Living in a high-income and stable country such as Norway means that resource scarcity and environmental crises are not visible threats. Lastly, research demonstrates that Norwegians are both price- and brand-sensitive, but loyalty to a particular brand tends to be the dominating force.

Consumers can be encouraged by changemakers to avoid purchasing virgin resourced products, thereby slowing-down flows. To both increase **awareness**, **understanding** and **commitment**, the long-term usage potential and the price benefits involved in the extended use of technology products should be communicated. These benefits would be enhanced if modularity and upgradability in electronics became the norm. By not having a linear alternative, this could facilitate **action** in the form of 'hassle-free' upgrades. Businesses should also shift their focus from quick product releases to upgrades. On the policy side, consumer **commitment** and **action** can be boosted through the development of legislation to report on product durability which can feed into informed consumer's purchasing decisions[138] and extended product warranties.

LINEAR PRACTICE 1.2: A SMALL SECOND-HAND MARKET

Although the second-hand market has grown in recent years, some **barriers** exist in preventing it from blossoming. These include a lack of quality assurance which leads to apprehension and distrust over quality and value, concerns over how sanitary pre-owned products are and a non-user-friendly[139] model for obtaining second-hand goods. As a high-income nation, a key consumer **driver** is an expectation of high-quality goods. But seemingly, second-hand products in industries such as clothing, electronics and kitchen appliances are negatively framed as being for a lower socioeconomic range.[140] A second driver is finding something unique, which the second-hand market is well placed to accommodate.

Around the world, fashionistas flock to second-hand shops to pick up the latest fashion items at a bargain price; they're seen as heritage products. This is precisely a fact that could be spotlighted by changemakers to increase consumer's **awareness**, and in that way, the sector's appeal. To also increase **commitment** and **action**, changemakers could seek to include insurance companies or in-house experts in quality assurance initiatives. These—through platforms such as Ex.tronics for electronics and Vestiaire Collective for clothes—prove the quality of products to the consumer, thereby easing low-quality concerns. In the same vein, warranties could be placed on refurbished and second-hand products. Lastly, to increase consumer's **commitment** and **action**, simply a broader portfolio of secondary goods would make uptake more likely, as well as increasing the convenience of finding such goods.

LINEAR PRACTICE 1.3: LOW USE OF REPAIR SERVICES

Repairing products to extend their lifespan is at the heart of a functioning circular economy. But the economics of repair in Norway are not attractive; materials are cheap, while labour is expensive, resulting in an industry where the repair of goods costs more than new products. This is a major **barrier**. Alongside this, repair skills are also deteriorating across many western countries. Unfortunately, the mainstream availability of linear options—purchasing new products—also makes it easier for consumers to indulge. In today's model, many Norwegian consumers wonder 'where would I go for repair? How easy is it to repair my item?'. These embroiling barriers contrast the easy gratification of a brand-new purchase delivered to the consumers doorstep. The repair economy does, however, have multiple **drivers**, not least that if done well, it's cheaper and it has many environmental plus-points.

In creating a repair economy that consumers can commit to and use, changemakers can help consumers learn about repair; workshops and trainings to enable repairing and upgrading could boost consumer adoption on all four levels. Meanwhile, fostering a repair 'community' would also increase **commitment** and **action**. For example, repair cafes or repair spots in shops would also deliver instant gratification—one accompanied with an environmental kick. From the design side, modular and standardised product design which facilitates easy-repair at a later stage would increase **commitment** and **action**, as would an increase in automation in repair processes, as it would reduce the need for labour. Lastly, from the policy side, VAT exemptions could be applied for repair services and spare parts, and increased on new products. The EU VAT directive[141] also ready suggest reductions particularly for bicycles, shoes and leather and second-hand goods.

2: NARROW—USE LESS

In using fewer components, materials and energy to create new goods, flows can be narrowed. For the consumer, participation in sharing and rental models, as well as reducing consumption overall, contributes to this flow. The motto, 'quality over quantity' rings true here.

LINEAR PRACTICE 2.1: OWNERSHIP OVER SHARING

Sharing platforms are based on the sharing of products and assets that often have low usage or ownership rates, reducing the number of products needed and waste generated.[145] But in Norway there is a clear preference for ownership; 45% are aware of the sharing economy, 19% have registered to one or more sharing platforms, but only 6% are active users.[146] This stems from the cultural **barriers** of a low-willingness to share, high regard for self-sufficiency, as well as a modest offering of existing sharing platforms. Again, this reality is shaped by the unique status of Norway; it's high-income, people's ability to afford owning

'LONG LIVE THE PRODUCT'

Bergans of Norway, an outdoor equipment manufacturer and retailer, collaborates with its customers through services such as repair, rental, reuse and redesign. Led by the 'long live the product' slogan, the company aims to engage customers in the circular process; once garments can no longer be used, they can be returned to be repaired, redesigned or resold, while products such as backpacks, tents and skiwear are also available for a rent. As an extra incentive to drive uptake, customers can get a 20% discount on a new item that is bought at the same time that they return used clothing items. Meanwhile, if the shop cannot repair or resell the items, they are turned into upcycled goods or donated for reuse in insulation of filler materials.[142]

Rental and reuse platforms are increasing in popularity globally and have global reach, such as Vestiaire Collective which sells 'preloved fashion'.[143] Norway market-based FINN.no extends beyond clothing and is a 'marketplace' platform for people, from individuals, to small and large businesses, to buy and sell products—mainly used— such as furniture, electronics, clothing and much more. Lastly, a consumer-to-consumer shipping service launched by Helthjem ('meg-til-deg' in Norwegian, 'me-to-you' in English)[144] facilitates the distribution of used goods (80% of goods traded are used) among consumers and it is known for its convenience. The pick-up and delivery is all arranged online, and all the user has to do is put the package on their doorstep.

goods and the population's geographic dispersion limit the opportunity for sharing and for platforms in their infancy to mature.

A baseline approach changemakers can take to increase consumer's **awareness** and **understanding** is communicating the benefits of the sharing economy: it's flexible, economical and delivers social benefits too. This includes forging an open society through increased interaction with strangers which could broaden social contracts.[147] To increase **commitment** and **action**, introducing a sharing platform for premium products that consumers don't readily have access to could encourage use; by focusing on higher segment products, the economical drive for sharing becomes bigger. To further push **action**, tax breaks or subsidies could be provided to sharing platforms; no VAT on shared goods, or tax refunds for shared goods.

LINEAR PRACTICE 2.2: LOW MOTIVATION TO REDUCE CONSUMPTION

Norway's material footprint per person, per capita, (44.3 tonnes) is one of the highest in the world; many resources flow into satisfying their high-standard of living. But the country has also been thrown into a pool of uncertainty as covid-19 led to high unemployment rates and now, a potential recession. In a time when Norway wants to focus on creating wealth, encouraging consumers to reduce consumption presents many **barriers**. This is also because there is a lack of sensitivity for, or low knowledge of, global resource scarcity and environmental crises associated with excessive material consumption, as is typical in times of economic hardship, environmental concerns fall to the back of the queue. Also, more practically, there is a national preference to purchase goods in small, regular batches, due to an aversion to large expenditures. Browsing and purchasing the large availability of products is also seen as a social activity.

To increase consumer **awareness** and **understanding** of the need to reduce consumption, the narrative needs to be reframed: don't just consume less, but consume better. Quality over quantity. This can be accompanied with education on the urgency and need for action. Examples of *Shift* countries' impacts beyond their borders, in terms of plastic waste[148] for example, can be powerful. To further increase **understanding**, changemakers can seek to strengthen an individual's fact-base around their consumption using smart metres which record electricity consumption or generally increasing transparency on products material and energy efficiency, for example. Imposing VAT reductions on circular products, such as ones containing non-virgin materials or shared goods, could also increase circular consumption. Meanwhile, the virtualisation and digitalisation of services easily encourage **action**. This move literally dematerialises many platforms and increases easy and fast access to a large pool of consumers—such as when Netflix moved from DVDs to online streaming.

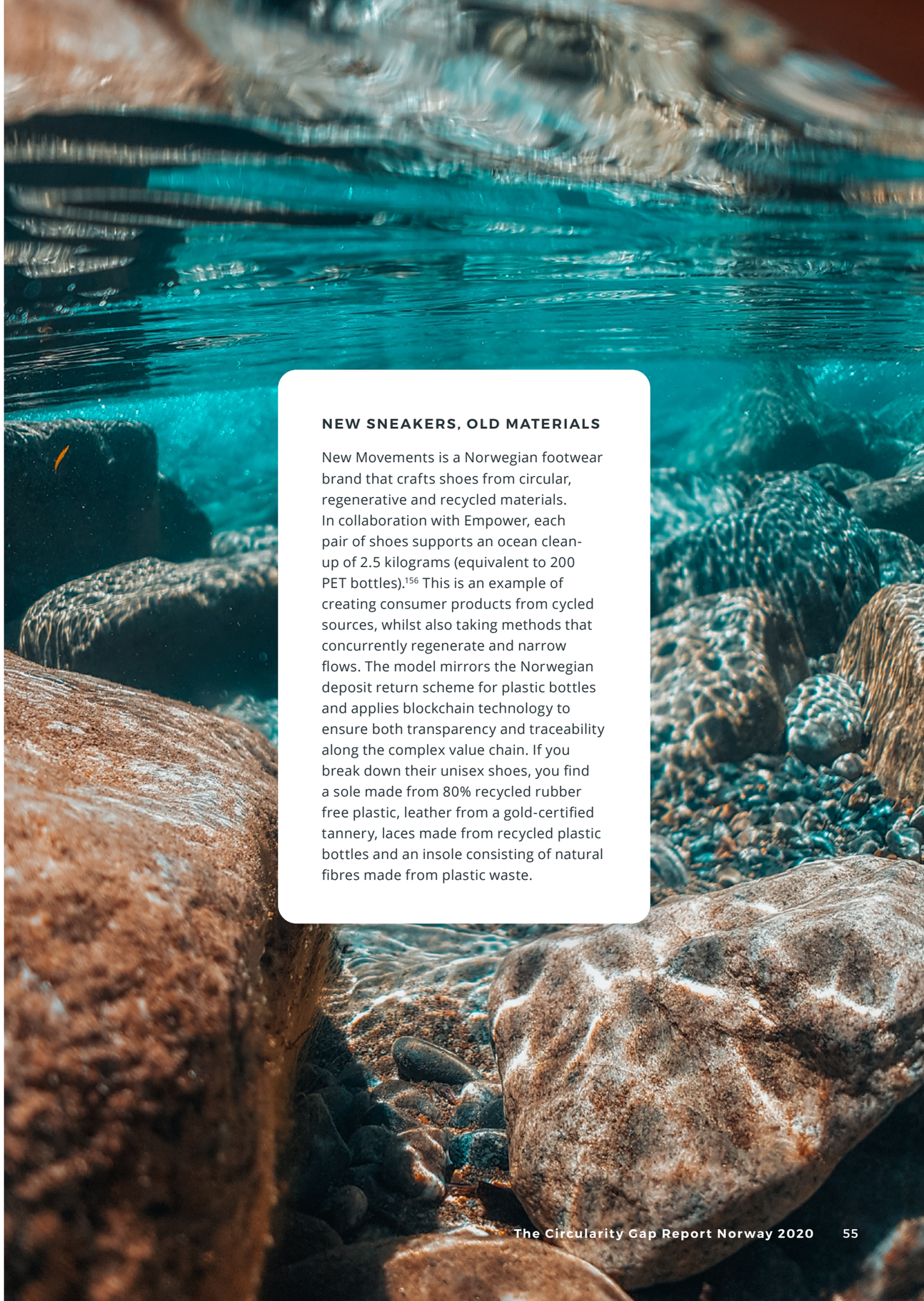
3: REGENERATE—MAKE CLEAN

In regenerating flows, all hazardous substances must be removed; renewable energy is used and natural ecosystems are regenerated. In the consumer sphere, regenerating flows means going for the green option: choosing organic, toxin-free, carbon neutral, for example, as well as participating in compensation and usage schemes, whereby biological cycles become relevant.

LINEAR PRACTICE 3.1: ENVIRONMENTAL SCEPTICISM

There is an overall reluctance to accept the climate crises and its urgency among consumers in Norway. Clear **barriers** in this are **driven** by how the country owes much of its great wealth—living standards, economic security—to a sector much at odds with sustainability progress: oil and gas. In Norway, only 49%[149] of consumers think mankind's role in global warming can be considered 'high'. As both a **driver** and **barrier**, Norwegians enjoy a good standard of living with little awareness of the supply chains underlying goods and services. Also, due to the vast spaces of untouched wilderness, the average consumer may not worry about the relevance of biodiversity loss and habitat threat on a global scale. Lastly, levels of governmental trust are high and therefore, not enacting enough domestic policies to reach the Paris Agreement[150] is likely not questioned.

Communicating about climate can be tricky, but it's hugely important to increase consumer **awareness** and **understanding** of the climate crisis. Communication and messaging from changemakers on the urgency of the situation and its specific link to the environment is crucial. Correspondingly, education and information should be supplied on the environmental and social benefits of using products made from regenerative and non-toxic materials specifically. The discourse can be reframed to be positive rather than



NEW SNEAKERS, OLD MATERIALS

New Movements is a Norwegian footwear brand that crafts shoes from circular, regenerative and recycled materials. In collaboration with Empower, each pair of shoes supports an ocean clean-up of 2.5 kilograms (equivalent to 200 PET bottles).[156] This is an example of creating consumer products from cycled sources, whilst also taking methods that concurrently regenerate and narrow flows. The model mirrors the Norwegian deposit return scheme for plastic bottles and applies blockchain technology to ensure both transparency and traceability along the complex value chain. If you break down their unisex shoes, you find a sole made from 80% recycled rubber free plastic, leather from a gold-certified tannery, laces made from recycled plastic bottles and an insole consisting of natural fibres made from plastic waste.

negative; rewarding rather than punitive; a balance should be struck[151] between negative or urgent messages to ones that are more constructive and suggest what people can do to help. To also boost **commitment**, consumers could be connected to global environmental issues through experiences utilising technology such as virtual or augmented reality; imagine an experience where you can dive into plastic soup infiltrating oceans or wildfires ravaging forests across the world. Lastly, brands that use influential and trusted individuals to push forward the climate crises can strengthen consumer understandings of how we each have a role to play, potentially leading to behavioural change.

LINEAR PRACTICE 3.2: LOW PLANT-BASED PICK-UP

The biggest societal need and want in Norway is Nutrition, accounting for 51.2 million tonnes of resources annually. Animal-based diets are very dominant in Norway; in 2018 there were approximately 1.4 million metric tons of fish sold for consumption. Plant-based meat alternatives and 'flexitarian'[152] diets are increasing in popularity among Norwegian consumers, but overall numbers of vegetarian (3%) and vegans (1%)[153] have remained the same for the past 10 years and since 1989, meat consumption has risen by 45%.[154] Diets have changed with the years and now typically consist of many imported foods due to long local winters and a limited agriculture sector. However, awareness around the environmental impact of relying on imports, for example, is not always understood. A further **barrier** in encouraging diet change could be that food systems in Norway, and consumers, prioritise price, standardisation, simplicity and speed.[155]

Sustainable consumer diets can greatly contribute to reducing carbon emissions, increasing biodiversity and healthy soil. Changemakers can drive consumer **awareness** and **understanding** by communicating and educating consumers on the impact of their food choices, from transport to energy-intensive production processes, as well as the positive health impacts of dietary shifts toward plant-based sources. To also encourage **action**, financial incentives to promote responsibly sourced and plant-based products could be compelling, as well as providing incentives for consumers to consume locally sourced products and move away from 'big discounters'.

4: CYCLE—USE AGAIN

Cycling flows pertains to the recycling and reuse of waste products, components and materials. To the consumer, this can be a hidden flow as secondary material innovations and technologies are creeping into standardized products, such as plastic water bottles containing rPET and biodegradable plastic bags. At the same time, this, therefore, relates to the individual consumer being an active part of the material supply stream.

LINEAR PRACTICE 4.1: NEWNESS ASSOCIATED WITH QUALITY

Across this chapter, we see a common **barrier** in misperceptions over quality: 'new' products created from virgin materials are considered to perform better, as well as being more hygienic. Core to this barrier is the idea that the value and quality of secondary materials—in recycled, reused or refurbished goods—is not defined, thereby giving rise to insecurity. Consumers may wonder, 'how long will this product last?' However, a key **driver** here is that many materials that undergo recycling—nylon, glass and sometimes plastic—can achieve the same quality of virgin materials. But other materials such as cotton and paper may result in products with a slightly different look and feel.

Changemakers can play a major role in increasing **awareness** and **understanding** of the efficacy of secondary materials, which in turn can help consumers avoid misinformation and understanding which leads to avoidance. Taking this to the **commitment** and **action** level in Norway, but also the wider EU, are certification bodies and quality standards, such as Forest Stewardship Council (FSC)[157] for paper and carton and EUCertPlast[158] for plastics. These communicate guaranteed product quality and safety standards for secondary materials. On the policy level, material taxes—such as increased carbon pricing which would impact the fossil fuel feedstock for virgin plastic — will increase the price of virgin and carbon-intensive products, making secondary material-based goods more attractive. Lastly, by placing warranties on refurbished goods, as suggested in intervention 1.2 on page 52, producers can guarantee quality to the wary consumer.

LINEAR PRACTICE 4.2: LACK OF INFRASTRUCTURE FOR RECOVERY

The existing infrastructure in Norway overwhelmingly supports the linear economy and inhibits circular behaviours. For example, a lack of recycling streams for materials beyond glass and plastic supports throwaway culture. Overall in Norway, only 30% of resources are recycled (see page 26 for more information.) **Barriers** in this space include convenience; consumers are less likely to allow their post-consumer waste to be recovered if the infrastructure is not nearby, a point that is exacerbated and **driven** by the high dispersion of the population across remote areas. Consumers may also be deterred by a perceived lack of transparency[159] in the recycling industry; high-profile stories across Europe have told of waste being shipped off to emerging economies. In the textiles space, some collected materials are sorted and recycled domestically, but the majority, 86%, is sent to Europe, Africa and Asia.[160]

Changemakers can increase consumer **awareness** on the recycling process: infrastructure, processes and the qualities that can be obtained from different materials. They can also make many moves to create both **commitment** and **action** in this space. Firstly, take back schemes can be organised by retailers to collect used products or materials and reintroduce them to the manufacturing stream, and the successful Deposit Return Schemes[161] used for plastic and glass, for example, can be expanded to include batteries and electrical equipment and electronics. A joint venture between Hydro and Northvolt marks the first pilot battery recycling plant in Norway.[162] Meanwhile, close loop initiatives can be launched by businesses or retailers so consumers can participate in value recovery across a range of items, from coffee cups to textiles and phones. Finally, material scans of recovered goods can give consumers information about the quality of a used product which can inform their ability to make sensible decisions; for example, with this extra insight, a consumer could understand how close to its end-of-life a product is through how worn out the materials are.

LINEAR PRACTICE 4.3: HOARDING BEHAVIOUR

A common consumer behaviour is hoarding: keeping goods such as unused fully or partially functioning electronic equipment and building 'hibernating stock' in the home. This is **driven** by the often large homes in Norway; space is not always an issue. **Barriers** to changing this behaviour include a lack of knowledge on how to best cycle unwanted products, how to responsibly dispose of electronics and a lack of trust in value estimates to enable cycling. Also, as alluded to in intervention 3.1, a lack of convenience in accessing the correct disposal avenues leads to hoarding and, eventually, incorrect disposal.

To change consumer behaviour along all four levels, changemakers could introduce circular product labelling schemes that inform consumers on circular processes such as optimal recycling and sorting. Although such a scheme is already in place for curbside collections,[163] no such labelling exists for electric equipment, appliances and bulky waste. Neutral information—such as from the government or a consortium of businesses—on how to sustainably dispose of an item can also increase **awareness**. To further enhance **understanding**, **commitment** and **action**, actual services that facilitate the circulation of products and materials could be impactful, as well as 'inventory passports' that enable consumers to check the value and potential use of goods in their home. Lastly, to encourage **action**, user guides could be distributed to consumers for them to see how to correctly cycle products.

NORWAY'S LINEAR PRACTICE AND THE ROLE OF CHANGEMAKERS

FLOW	LINEAR PRACTICE	BARRIERS	ROLE OF CHANGEMAKER	IMPACT ON CONSUMER
SLOW	1.1 High product turnover rate	**High consumer spending power** **Familiar with technological innovation** **Low knowledge of resource scarcity**	Communicate long-term use and price benefits Facilitate 'hassle-free' upgrades with circular design Legislation to support product durability; extended product warranties	Awareness, Understanding, Commitment Action Action, Commitment
SLOW	1.2 Small second-hand market	**Framed as lower 'socioeconomic'** **Distrust over quality and value** **Concerns over sanitation**	Reframe appeal of second-hand products as 'heritage' products Quality assurance initiatives and warranties on refurbished/resold goods Increase volume of second-hand electronics to increase uptake	Awareness Commitment, Action Commitment, Action
SLOW	1.3 Low use of repair services	**Framed as lower 'socioeconomic'** **Distrust over quality and value** **Concerns over sanitation**	Designing for repair and introducing automation processes Repair cafes and repair spots in shops Repair workshops and trainings	Commitment, Action Commitment, Action Commitment, Action
NARROW	2.1 Ownership over sharing	**Low willingness to share** **Small offering of existing platforms** **Widely dispersed population**	Communication on benefits of sharing e.g. open society Tax breaks of subsidiaries on sharing platforms, no VAT on shared goods Sharing platforms for premium products	Awareness, Understanding Action Commitment, Action
NARROW	2.2 Low motivation to reduce consumption	**Low knowledge of resource scarcity** **Preference to purchase small quantities** **Shopping as a social activity**	Reframe narrative on quality over quantity through education Strengthen fact base on consumption e.g. smart meters Digitalisation and virtualisation to reduce materials in services	Awareness, Understanding Understanding Action
REGENERATE	3.1 Environmental scepticism	**Low urgency on environmental issues** **Rich natural landscape at odds with global worry** **High trust in government**	Education on the benefit and positivity of becoming more circular Technology to make the urgent message more tangible e.g. virtual reality Influential/trustworthy people used in communications	Awareness, Understanding Commitment Commitment
REGENERATE	3.2 Low plant-based pick-up	**Animal protein dominant in diets** **Low understanding of environmental impact of import reliance**	Education and communication on environmental and health benefits of plant-based and local food Financial incentives for responsibly sourced and plant-based offerings	Awareness, Action Action
CYCLE	4.1 Newness associated with quality	**Virgin materials seen as quality and long-lasting** **Sanitation concerns over secondary goods**	Education and communication on efficacy, cleanliness of second-hand goods and materials Certification body labels for second-hand goods Material taxes to increase price of virgin materials and new goods	Awareness, Understanding Commitment, Action Commitment, Action
CYCLE	4.2 Lack of infrastructure for recovery	**Not convenient to access material recovery points** **Perceived lack of transparency in recycling industry**	Increase consumer knowledge on how recycling works Expand take back schemes in shops and for materials Close-loop initiatives led by businesses or retailers	Awareness Commitment, Action Commitment, Action
CYCLE	4.3 Hoarding behaviour	**Large homes can accommodate many goods** **Low knowledge on how to cycle unwanted goods**	'Inventory' passports for goods Clear product labelling and user guides schemes for end-of-life disposal	Understanding, Commitment, Action Action

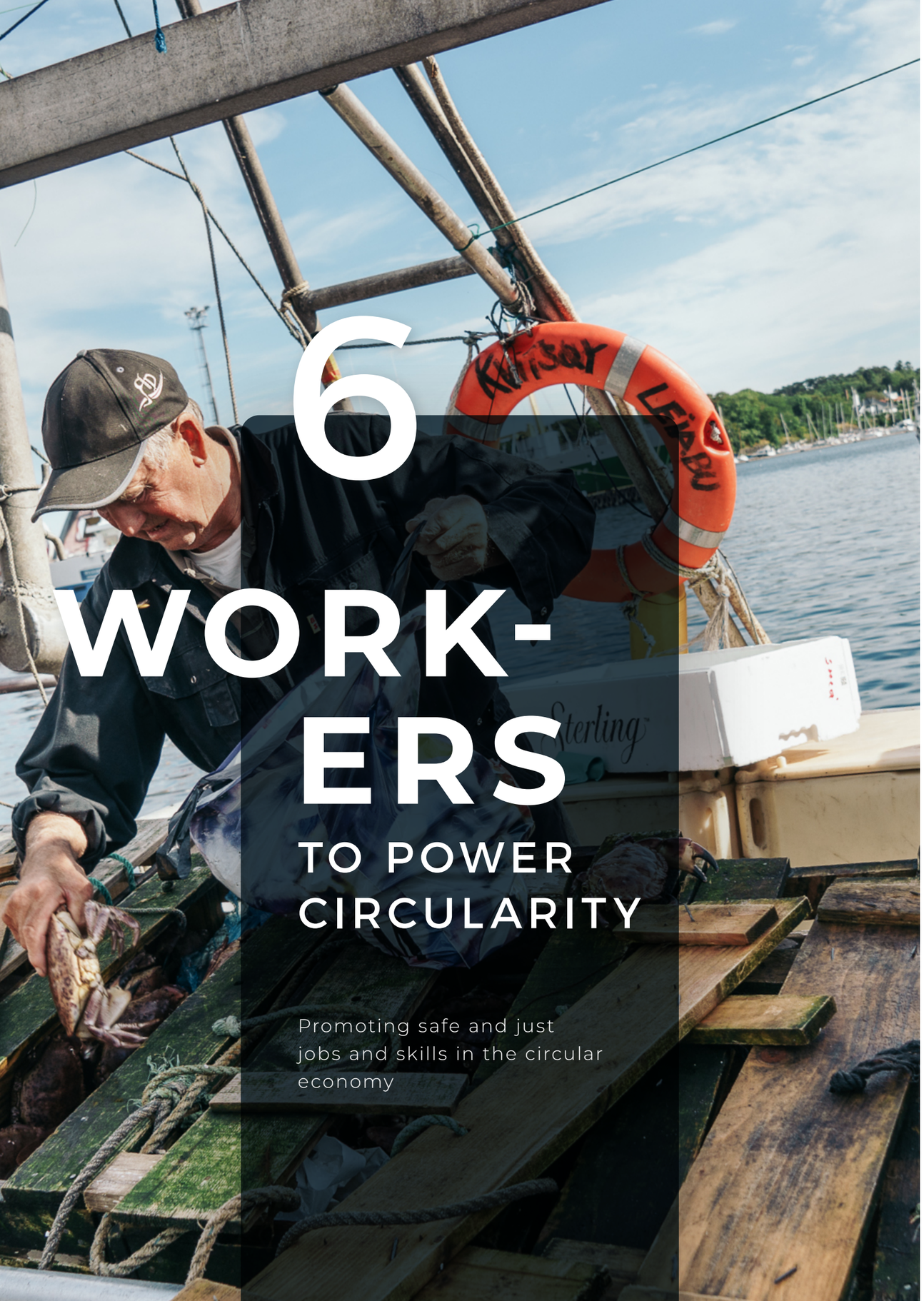
CONSUMING FOR TOMORROW

Our analysis demonstrates some concrete examples of how changemakers can increase consumer's adoption of circular practices.

A crucial turning point. Life was hugely altered during the covid-19 pandemic. Complex and long global value and production chains were massively disrupted, resulting in many nations going 'back to local'. In some ways, it was a real-time experiment in downsizing the consumer economy; imports and exports both in goods and people were paused. As 'normality' resumes, we may see a persevering notion of 'glocalisation' that is adapted to the local, but with a globally cooperative ethic.[164] Changemakers and consumers may be more driven by purpose[165] now as the vulnerability of our systems has been exposed, as well as our interconnectedness between humans, nature and the environment.

In line with EU momentum. As part of the EEA, Norway should strive to follow its best guidelines. Documents such as the Green Deal, the Circular Economy Action Plan and The EU's Sustainable Consumption and Production Action Plan aim to increase the awareness and demand for more sustainable and innovative goods and production technologies in the continent's industries. A range of policies already foster sustainable consumption, such as recycling labels and packaging guidelines, and Norway now has an analysis fostered to its specific cultural space and socioeconomic status.

A blueprint to take forward. Our Awareness to Action model, see Figure four page 50, provides a guideline for change to enable the adoption of the individual consumer in Norway. Circular consumption can accelerate the transition to circularity and the ability for changemakers to enact this circular mindset is a huge possibility for the country.



6

WORK-ERS

TO POWER CIRCULARITY

Promoting safe and just jobs and skills in the circular economy

A labour market that anticipates and prepares for the transition towards a circular economy can accelerate it and maximise its potential. To prepare for this, Norwegian changemakers—business, government and, crucially for the labour market, unions—have a vital role to play in ensuring that the shift from a linear workforce to a circular one is safe and just for workers. Based on qualitative interviews and secondary research, this chapter outlines the vital importance of the labour market in fully realising a circular economy. Workforce development, upskilling and training are core drivers to bring about circular change, such as the interventions depicted in our 'what-if' scenarios. How may the labour market be impacted as Norway increasingly adopts circular models and strategies? For three of the 'what-if' scenarios presented in chapter four—Circular construction, Total transition to clean energy, and a Repair, reuse and recycling economy—we depict how roles may change as circular models and strategies are adopted and the necessary roles changemakers can take to facilitate and accelerate the shift. We do this through three descriptive lenses: how the roles needed may transform (+/-), and how demand may increase (+/++) or decrease (-/--). Our analysis defines circular jobs along the DISRUPT framework, as presented on pages 65.

The transition to a circular economy is anticipated to initially be labour intensive. This is because the core pillars behind preserving a material's maximum value for as long as possible (reuse, repair, remanufacture and recycling), hinge on processes that typically require more labour than in the linear economy where resources are often wasted, lost or built into stock.[166, 167] In this way, a plethora of opportunities for work and workers are present in the circular economy transition. As well as requiring a general upskilling as a result of task diversification and advances in technology, the circular economy calls for a fundamental shift in mindsets at all levels of the workforce. The rate of the circular economy transition in different nations will both depend on skills available in the labour market and shape the local, regional and national skills markets. Prioritising skills and lifelong learning is therefore vital for remaining competitive, building resilience and creating inclusive job opportunities.

Originally applied to the energy transition, the concept of a just transition is also relevant to the circular economy. Just transitions can help tackle existing inequalities and recognise that some workers are at greater risk of missing out on the benefits economic transitions offer. Norway, along with much of the world, stands at a crossroads: it has a great opportunity to rebuild its economy following the impact of covid-19. This rebuilding must focus on diversification and resilience.[168] In preparing for the circular transition now as part of rebuilding, Norway will be in a better place to secure a just transition. In the face of large-scale unemployment following the covid-19 pandemic, such an approach is vital. Certain industries that contribute to the circular economy have huge growth potential that could create the diversity and resilience that is needed in the labour market. Now is the time to engage and prepare the workforce.

The need to promote employment in the circular economy has already been emphasised in the European Commission's Green Deal and the Circular Economy Action Plan.[169, 170] The new European Skills Agenda also highlights the importance of skills development for safeguarding jobs and the role of nations in developing skills policies that are aligned with the needs of their workers as well as the EU's ambition towards carbon-neutrality, circularity and resilience.[171] Adult and lifelong learning is already common in Norway, including among lower-skilled and unemployed people supported by the introduction of the Competency Reform, with more reforms being put in place to improve the integration of people currently distant from the labour market.[172]

THE NORDIC MODEL FOR A CIRCULAR ECONOMY

The tripartite model between employers, government and unions ensures close cooperation and is key to facilitating wage bargaining and income policy. This model served to ensure strong labour force participation before the complications introduced by the covid-19 pandemic, and it will be an important basis for achieving a just transition to the circular economy.

The government creates the conditions and the incentives for businesses to adopt circular business models and, in turn, demand for circular jobs. The Norwegian government has already shown support for circularity by funding circular economy skills development allocated to the Federation of Norwegian Enterprises and the funding made available through Innovasjon Norge to companies developing circular business models.[174]

Business and industry also have strong roles in driving the market for circular products and services (which is the idea of selling the service and outcome of a product, rather than the product itself), alongside public procurement. As employers, businesses can also improve and uphold decent work opportunities and equitable access to upskilling.

DISRUPT: SEVEN KEY ELEMENTS
JOBS IN THE CIRCULAR ECONOMY

The circular labour market is comprised of all kinds of jobs in different sectors, ranging from manufacturing and creative industries to waste and resource management. Jobs in the circular economy, shortly 'circular jobs', are occupations that directly involve one of the strategies of the circular economy or indirectly support such activities. The circular economy creates a wide variety of jobs related to each of the strategies in the DISRUPT framework. Go to page 33 for more information on the DISRUPT strategies.

D — **Design For the Future:** Product Developers find innovative ways of utilising construction and demolition waste in new products for the construction industry.

I — **Incorporate Digital Technology:** Facility Managers maintain data on construction components. They understand how to integrate and interpret virtual information management systems.

S — **Sustain & Preserve What's Already There:** Repair Technicians repair appliances, machines or capital equipment. They possess strong technical and manual skills which can be acquired through a formal and informal education and training.

R — **Rethink the Business Model:** Demand Planners oversee supply and demand to make refurbishment a profitable business model. This role requires logical thinking and reasoning.

U — **Use Waste as a Resource:** Process Operators sort by-products for use in other products, for example to produce livestock feed made from waste flows. Knowledge of the quality of incoming raw materials is crucial.

P — **Prioritise Regenerative Resources:** Biosource Advisors work with biorefineries and the agrifood, forestry and construction sectors to identify new feedstock for use as biomass. This role requires strong technical and interpersonal skills.

T — **Team Up to Create Joint Value:** Procurement Professionals stimulate the demand for secondary materials and discern and connect new suppliers in order to do so. This profile points to the need for entrepreneurial, interpersonal skills.

1. CIRCULAR CONSTRUCTION

The construction sector in Norway is significant in terms of material use, value generated (see the MVC nexus on page 31) and employment—rates have steadily grown between 1990 and 2019, accounting for 234,624 people in 2018.[175, 176] The integration and scale-up of circular strategies and models into the sector will require a progressive approach that prevents the depletion of valuable raw materials. This will likely require a large attitude shift, rather than simply bridging a knowledge gap. Traditionally, construction sectors are driven by a risk-averse mindset, which seeks to limit costs, is bound to tight regulations, such as safety, and is not required to hold responsibility for projects past the point of delivery. These conventions do, however, contrast the extended responsibility component of the circular economy.

A circular construction industry would be underpinned by digitalisation and modernisations that increase efficiency and reduce waste and emissions, such as in modular construction and secondary material processing. In this way, the circular economy points to the emergence of roles outside of those traditionally associated with the onsite construction sector, including in design, manufacturing and resource management. Currently, despite the financial and employment opportunities associated with the market for secondary materials and components, very few companies occupy this space in Norway. In fact, most construction companies still demolish buildings with a view to recycling rather than capturing and reusing building elements, products and materials.

In this section, we outline how roles and skills could **transform (+/-)** and **increase (+)** in slowing and cycling flows of products and materials through circular construction strategies. Revisit scenario one, Circular Construction on page 34, for a deeper insight into the sector's role in the Norwegian economy.

SLOW FLOWS — USE LONGER

Slowing building stock flows would entail a decline in traditional new-build construction activities, the integration of energy and resource-efficient practices into the renovation and retrofitting of buildings and the optimal use of existing buildings. In doing so, we could expect the demand for skilled labour in Norway to shift towards the renovation and repurposing of buildings that are not currently in use and the integration of digital skills for utilising Building Information Models (BIM) and material passports across the value chain. Additional labour would also be required to ensure that unused or waste materials from the aforementioned processes are reused where possible—or recycled as a last resort.

(+/-) Transformation in construction work. Onsite Tradesmen, Construction Managers and Harvest Operatives would have to devote more time to the handling, sorting and storing of materials on-site. This would require knowledge and understanding of secondary materials and standardised solutions and systems to reduce waste and ensure materials are properly sorted and reprocessed. It would also require greater collaboration with reverse logistics providers and suppliers of secondary materials.

(+/-) Transformation in Facility Management. Digital technologies to keep track of resources and materials used in construction, such as BIM, material passports (see page 35), and the industry's existing product databases such as NOBB, EFO, NRF would become more common. For positions such as Facility Managers and Developers, knowledge on energy efficiency standards and digital skills could aid informed decision-making regarding building adaptations, maintenance and renovations. Such knowledge would also ensure smart decision-making in regard to the resource-efficiency of new building parts. Digital skills would also become relevant amongst Repair Operatives utilising BIM in predictive maintenance schedules.

(+/-) Transformation in Planning and Design. Together with Urban Planners, Architects and their clients would have a key role to play in determining the functions of existing buildings. As well as raising awareness for circular strategies in existing buildings, they can apply zoning and flexible, adaptive design to new buildings. In this way, Urban planners, Architects, Civil Engineers and Construction Managers all could have an influence in the uptake of circular strategies and the way existing buildings are used. This would require knowledge of modular design and energy and area efficiency principles.

CYCLE FLOWS — USE AGAIN

Cycling flows of building stocks calls for buildings to be dismantled and construction materials and demolition waste to be sorted, reprocessed and tracked so that they can be fed back into the built environment at their highest possible value. A shift in mindset across the sector and great collaboration across the value chain would be needed to facilitate this; including assigning adequate time to update content information on BIM and material passports systems, like Madaster (see page 35), to support the traceability of materials; assess buildings for deconstruction rather than demolition; and separate and log materials so that they are accessible for reuse in the market.[177]

(++) Increase in Product Development. The demand circular construction creates for used elements, products and materials could open up significant job opportunities in Norway. Procurement Specialists, Designers and Product Developers with an understanding of material science would be needed to develop innovative uses for concrete, wood and beams to prevent these high-value materials being lost or downcycled. For example in the case of wood products, see page 42.

(+/-) Transformation in Material Management. Digital skills would become necessary for Deconstruction Auditors and Site Analysts to utilise BIM. Novel technical skills would also be needed to locate and remove reusable elements from buildings, minimise contamination and mixed waste produced on-site and ensure that materials are properly sorted and stored by Harvest Operatives.

(+/-) Transformation in Architecture and Engineering. Architects and Civil Engineers with knowledge of circular design practices—including modular design and mono-material components—will be key to supporting the cycling of flows. From ensuring bolted connections are used instead of welded connections, to building in layers,[178] they could ensure that buildings are designed and constructed for disassembly in ways that support the removal and reuse of building elements.

ROLE OF CHANGEMAKERS

Public procurement can be a powerful tool for driving circular strategies forward—and consequently circular skills. Requirements for circular models could be integrated into conditions for social housing corporations and building regulations, for example. This could include exploring options for a building's reuse before demolition, scaling-up modular construction, ensuring the traceability of materials and introducing minimum percentages of recycled materials to be used in new products.

Business, government, research and education institutions can also play a role in developing circular skills. Training could be based on existing sustainability guidelines and certifications schemes, such as those available through SINTEF and Norway's Green Building Council. Small and Medium Enterprises (SMEs) with little means for funding re- and upskilling programmes could be supported in the public provision of training schemes.

Facilitating knowledge exchange and sharing on circular construction principles could also prepare the labour market well. Closer collaboration between industry, academia and vocational training could encourage this, such as vocation education and training (VET) apprenticeships in companies pioneering circular solutions.

2. TOTAL TRANSITION TO CLEAN ENERGY

Norway boasts a frontrunning position in the renewable energy landscape with potential for even further growth. Historically, the oil and gas industry has been a major employer in Norway, but employment has been decreasing since 2014. In 2018, around 51,900 people were employed directly in extraction, related services and pipeline transport.[179] A large share of employed people also have a role in the supporting industries, many of which have the potential to shift towards supporting renewable energy growth. For example, many large engineering firms that traditionally served the fossil industry have already been working for several years on wind energy, demonstrating the sector's readiness for the shift. Norway now also employs significant numbers of people in hydropower (around 11,700 in 2018), wind energy (3,500 in 2018) and biomass (2,400 in 2018), and one of the world's most advanced biorefinery plants in Sarpsborg.[180] In moving to a circular economy, employment would over time be shifted from fossil fuels to renewable energy and related services. As efforts to decarbonise the global economy rise, creating a strong and diversified labour market could enhance Norway's resilience. However, regardless of the likely global energy transition, the renewable market is growing rapidly and is a valuable space for investment and job creation. The labour intensity for renewable energy is significant, particularly during installation and maintenance, and the types of direct and indirect jobs diverse. Research in North America finds that: per US$1 million investment, 2,65 jobs can be created in fossil energy compared to 7,49 jobs in renewable energy.[181] Here lies an opportunity to

prepare the workforce to engage in and pioneer in a future-proof sector.

All forms of energy infrastructures require decommissioning as they reach their cessation period. This can involve the replacement of old infrastructure or complete removal of the infrastructure to return a site as close to its original state as is reasonably practicable.[182] This provides ample and long-term employment opportunities related to the deconstruction of different energy infrastructures, repurposing of components and the further reuse and recycling of materials in renewable energy or other industries.[183, 184] Importantly, as part of a just transition, Norwegian changemakers now have a huge opportunity. They could implement workforce development and training programmes to reskill the current skilled workforce to be involved in this reuse stage—both as part of the decommissioning of fossil fuel energy, and the ongoing and future decommissioning of renewable energy infrastructure. In doing this, the high costs related to decommissioning could be partially mitigated. Long-term job opportunities could also be created by more proactively planning for the skilled labour required to reuse or recycle renewable energy infrastructure at its end-of-life on an on-going basis in the future.[185] Norway is already a renewable energy powerhouse and now has the opportunity to also pioneer a domestic industry for the reuse of energy assets. See scenario two, Total transitions to clean energy, on page 36 for more information.

In this section, we outline how roles and skills could **transform (+/-)** and **increase (+/++)** as flows are regenerated and cycled to facilitate a rise in renewable energy usage.

REGENERATE FLOWS — MAKE CLEAN

In regenerating flows, fossil fuel extraction would decrease, energy sources used for industry and transport would diversify and the market for and share of renewable energy would grow.

(++) Increase in Biomass Sourcing. Biobased energy expansion would require a sustainable pipeline of feedstock. Demand for Procurement Managers and Biosource Advisors working with and within plants and biorefineries would thereby increase. They would need to identify new sources of feedstock, such as residual streams from the agrifood, forestry and construction industries, such as wood demolition waste, and work with these businesses to develop a supply chain for the feedstock. Concurrently, Process Operatives and Logistics Managers would be needed to manage the advanced collection, sorting and transportation of biomass to processing plants and biorefineries.

(+) Increase in Research and Development. Research Scientists, Process Engineers and Innovation Managers with a strong understanding of the opportunities and constraints of different energy sources would be needed to develop renewable energy solutions for industry and transport. This includes opportunities to use the existing energy-infrastructure now operating with fossil resources to gradually transition to renewable sources. For example, the use of sustainably produced hydrogen, and bio-based resources including pyrolysis oil or biogas.

(+) Increase in Offshore Maintenance. To keep offshore wind turbines operating at their highest value and thereby maximise their yield, Drone Operators and High-Precision Engineers working on land with an ability to utilise predictive analytics and supervise power lines would be needed. These skills could mitigate the length of time turbines are out of action whilst being repaired and make investments more profitable.

CYCLE FLOWS — USE AGAIN

Cycling flows would call for infrastructure and assets from different energy industries to be reused, as they become available during refurbishment, the infrastructure reaches end-of-life or the energy source it's designed for is phased out. Norway has an advantage here: as a seafaring nation, its competencies in offshore development have excelled. Norway could now excel in the reuse of offshore assets alongside those from the decommissioning of oil and gas infrastructure. Creating this domestic industry for reuse would ensure employment opportunities associated with the reuse of high-value assets would not be lost to other countries. In current decommissioning of oil and gas infrastructures, we see potential for job and skill development across multiple stages: the removal of the infrastructure; decontamination and refurbishment; assessment and testing; and finding a route to market for materials in other industries.[186] Many of these skills also apply to offshore wind and therefore are attractive for investment and could create long-term employment opportunities.[187]

(+) Increase in Quality Control. In determining which assets can be reused under similar conditions and which need to be recycled or downcycled, Test Engineers, Fabrication Specialists and Technicians would be in demand. This would also require skills to implement an administrative process to support quality assurance.

(+/-) Transformation in Operations. During the decommissioning process, Operators and Heavy Lifting Engineers are needed to manage the safe removal and storage of large assets, whilst minimising damage. They could also contribute to inventory and data management so that high-value components can be tracked for reuse. Workers who have experience working with, or currently work on the infrastructure being decommissioned could already harbour the necessary skills.

(++) Increase in Engineering and Design. Industrial Designers would need to work with Engineers and Technicians to develop innovative solutions for the reuse of assets. They would need to locate applications for hard-to-recycle materials and rare earth metals that are common in renewables. Ensuring that new energy infrastructure is built so that it can easily be restored once it reaches its end-of-life—design for decommissioning—would also be necessary.[188, 189]

ROLE OF CHANGEMAKERS

Across the world, countries are undergoing transitions to renewable energy and it is imperative for business and government to share learnings and knowledge. These range from innovative solutions and regulations for reusing decommissioned assets, to the training pathways and social protections that should be implemented to ensure a safe and just transition for workers.

Employers could also seek to locate new industries close to existing fossil industry locations. This could help to limit the negative implications for workers embedded in the industry that also own homes, have settled families and have largely invested in local areas close to work.

3. A STRONG REPAIR, REUSE AND RECYCLING ECONOMY

The repair, reuse and recycling economy spans jobs in manufacturing, retail trade and resource management sectors. Currently, employment rates in manufacturing are low and in decline, largely due to the offshoring of production activities.[190] In comparison, retail trade is the largest private-sector employer (representing more than 10% of jobs) and there have been steady increases in employment in resource management sector year-on-year, as well as high turnovers in line with increasing volumes of waste.[191, 192] And although the repair and reuse sector in Norway is growing, it is somewhat fragmented and there is a need for skilled workers, as delineated in barrier 1.3 on page 53.

As Norway embraces the circular economy, it could expect to see jobs in retail transform to become more service-oriented and require a wider range of skills. Increasing job opportunities within manufacturing and resource management would also be likely, given the labour intensity of repurposing for reuse, recycling, repair and remanufacturing activities.[193, 194]

In this section, we outline how the roles and skills in the sector could both **transform (+/-)** and **increase (+/++)** to facilitate the slowing and cycling of products and materials in the repair and recycling economy.

SLOW FLOWS — USE LONGER

In slowing flows, there would be a reduction in the import of electrical products and household goods, an increase in repair services and an increased ubiquity of rental and sharing models. A strong foundation of skills to support this already exists in the retail sector and tertiary industries which could be swiftly harnessed for circularity.

(++) Increase in Repair and Maintenance. Operatives, Engineers and Repair Technicians would be needed to clean, sort and repair returned items. This could occur as manufacturers of the original items decide to open up additional revenue streams through refurbishment or product-as-a-service models or independent remanufacturers provide services to retail stores or brands.

(++) Increase in Logistics. Logistics Managers and Drivers would be needed to operate increasingly complex reverse logistic systems in order to transport products between users, remanufacturers and service providers. Examples here include companies such as Helthjem, see more information on page 53.

(+/-) Transformation in Business Management. Asset Managers and Investors would need new skills and management philosophy to transition from a buy-sell model to a product-as-a-service model.

(+/-) Transformation in Service Provision and Marketing. Implementing service models, such as clothing or electronic rental services, will require much of the capacity of the customer-oriented roles that are already present in Norway's significant tertiary industries. Meanwhile, consumers need to be attracted to use the service models. Marketing Managers who have a strong grasp of the circular economy would be needed to develop offers that appeal to users, such as Bergan's 'long live the product' (see page 53) concept and second-hand markets. Similarly, User Experience Designers would need to ensure that access to the services is simple and convenient;[195] this is pertinent in Norway as repair and service models are not the norm; see page 52 for more information.

CYCLE FLOWS — USE AGAIN

Cycling flows calls for primary materials to be substituted for secondary and recycled materials. Such processes would require advanced logistics, material sorting and reprocessing activities, as well as adjustments in the way products are designed and manufactured.

(+/-) Transformation in Engineering and Design. Designers and Product Manufacturers would need to revisit the way they view materials. Skills would include maximising the potential of secondary materials and reducing material complexity while still producing high-quality products. Designers could, therefore, require a high-level understanding of material science and the value chain they work within. Designers and Manufacturers would also benefit from visiting processing plants to fully appreciate the lifecycle of materials and the real-life challenges material complexity presents the recycling process.[196]

(+/-) Transformation in Resource Management. Norway already excels in certain high-value recycling streams and its accompanying infrastructure. However, here a mindset shift would be important for expanding their ambitions further. Public sector stakeholders working in the procurement of resource management should understand the importance of scaling advanced sorting and recycling technologies and receive upskilling on their wider social and environmental implications. Jobs in resource management are often seen as low-skilled and low-quality jobs.[197, 198] As the industry embraces more advanced, technology-intensive practices, this will increase demand for different skills in the industry, including for Engineers, Technicians and Operators, alongside the increasing number of Recycling Operatives and Sorters that will be needed to feed the advanced recycling processes.

ROLE OF CHANGEMAKERS

As well as creating and transforming positions in the retail trade industry, moving to a circular economy allows changemakers to mainstream other opportunities, such as creating an inclusive workforce. Learning from work integration and other social enterprises in Europe that have expertise in running repair services in ways that meet the needs of different workers, such as De Kringwinkel in Belgium, could create local job opportunities for workers that have specific needs and may face issues in accessing and retaining work in the mainstream labour market.[199, 200]

Furthermore, employers should be encouraged to improve the quality and image of jobs in the resource management industry. They could do this by providing workers with equitable access to upskilling to adapt their skills as the industry develops. Recognition for their skills through certifications or a skills passport, building on training already available through organisations such as Avfall Norg[201] and skills frameworks from other countries, such as the SWITCH competency framework in Scotland.[202]

To boost Manufacturers and Designers awareness, Norway should embrace the EU's ecodesign directive, as well as its future iterations. This could serve to educate professionals on various end-of-life stages of a product, mono-materials and encourage the use of secondary materials in products.[203]

FUTURE-PROOFING THE LABOUR MARKET

Understanding of how the circular economy will impact the global labour market is growing and this analysis serves to shed a light on how it will impact key Norwegian sectors on the ground. In order to realise a just transition, there are certain concluding points to consider.

Comprehensive skills intelligence. Many of the skills needed in the circular economy already exist in Norway, including in manufacturing and energy industries. Strengthening skills intelligence on the skills needed to scale circular business models, should be based on up-to-date information of the Norwegian context; on country, regional and sectoral levels.[204] Valorising skills in this way will also support government, business and social partners as they design upskilling and training pathways in order to support workers currently employed in extractive industries into those that contribute to the circular economy. Social partners can also involve workers in the valorisation of their skills and in the development of pathways.

Strong vocational education training for a diverse workforce. Preparation is key for a workforce transitioning from linear to circular models. The circular economy demands a range of skills; from highly-skilled to practical skills. In light of the current shortage of VET placements in Norway,[205] as well as low completion rates, these pathways should be strengthened to ensure the labour market is accessible and that the right range of skills is available to drive the transition.

Policy instruments to support circular jobs. Although the labour-intensive nature of the circular economy can create employment opportunities, with labour costs outweighing material costs in Norway it is difficult to secure the business case for circular products and jobs. Policy action, such as exemptions on repair and remanufacturing services, could flip the balance on labour and material costs and better accommodate circular employment opportunities in Norway. Similar instruments are needed to put a fairer price on scarce resources and a greater value on the human capital required to keep those resources performing at their highest value. The government also has significant purchasing power with procurement accounting for 28.4% of total government expenditure in 2015.[206] It can, therefore, play a key role in driving demand for circular business models and circular skills.

JOBS & SKILLS TO POWER NORWEGIAN CIRCULARITY

LEVER	FLOW	STRATEGIES	IMPACTS ON THE NORWEGIAN LABOUR MARKET	RELEVANT ROLES
CIRCULAR CONSTRUCTION	SLOW	Decline in traditional new-build construction activities Integration of energy and resource efficient practices in renovation Optimal use of buildings	Transformation in construction work Transformation in facility management	Construction Managers Harvest Operatives Facility Managers Developers Repair Operatives Urban Planners Civil Engineers
	CYCLE	Dismantle buildings over demolition Sort, reprocess and track construction buildings materials, products and elements Design for disassembly	Increase in Product Development Transformation in Material Management Transformation in Architecture and Engineering	Procurement Specialists Designers Product Developers Deconstruction Auditors Site Analysts Harvest Operatives Architects Civil Engineers
CLEAN ENERGY	REGENERATE	Decrease fossil fuel extraction Diversify energy for transport and industry Grow the renewable energy markets	Increase in Biomass Sourcing Increase in Research and Development Increase in Offshore Maintenance	Procurement Managers Biosource Advisors Process Operatives Logistics Managers Research Scientists Process Engineers Innovation Managers High-Precision Engineers
	CYCLE	Reuse of infrastructure and assets from energy industries	Increase in Quality Control Transformation in Operations Increase in Engineering and Design	Test Engineers Fabrication Specialists Technicians Operators Heavy Lifting Engineers Industrial Designers Engineers Technicians
REPAIR, REUSE AND RECYCLING ECONOMY	SLOW	Reduce the import of electrical products and household goods Increase in repair services Mainstream rental and sharing models	Increase in Repair and Maintenance Increase in Logistics Transformation in Business Management Transformation in Service Provision and Marketing	Operatives, Engineers and Repair Technicians Logistics Managers and Drivers Asset Managers Investors Marketing Managers User Experience Designers
	CYCLE	Substitute primary for secondary and recycled materials Advanced logistics, material sorting and reprocessing activities Changes in design and manufacturing	Transformation in Engineering and Design Transformation in Resource Management	Design Product Manufacturers Public Procurement Professionals Engineers Technicians Operators Recycling Operatives Sorters

7 THE ROAD AHEAD

Norway can increase its Circularity Metric to nearly 50% and reduce its material footprint by well over half. Enacting our 'what-if' scenarios will entail fundamental shifts to the way the Norwegian economy operates. These span major changes in how industries approach design and production, and investment in circular imports, such as biomass, to how consumers are encouraged to move, passively or actively, to circular consumption. Our metric and these scenarios can assist the Norwegian government and relevant stakeholders in crafting a bold and full plan for a circular economy; all part of rebuilding a robust and resilient post-covid-19 economy.

A huge opportunity for Norway. Although the pandemic has caused pain and disruption, it has also paved the way for change. The potential of these changes warrants exploration and scale-up, and require multi-level engagement from government, business and civil society. Only a group effort from multiple stakeholders will get us on a positive trajectory once again. In terms of circular consumption, Norwegian consumers typically put more responsibility on municipalities and government than companies[207] and herein lies an opportunity to grasp: initiatives that narrow, slow, regenerate and cycle flows can be pushed through at policy level. Meanwhile, for the labour market, government, businesses and unions have strong roles to take to prepare national work and workers so that the labour market can be resilient in the face of change.

All countries are critical change agents. We are all operating in a world that is only 8.6% circular, and the legacy of the linear economy is embedded deep in Norway's society too. National governments are key influencers in global coordination and this year, 2020, is a year of utmost importance. All countries need to deliver their National Determined Contributions (NDCs) and many have had their economies damaged by the covid-19 pandemic. But at the same time, no country is an island; the globe is interconnected. Other countries can also delve into their circularity transitions with a multidimensional lens, as Norway has done, facilitating peer-to-peer learning and circular knowledge exchange. Now is the time. And this time, let's put a regenerative and inclusive model at the core; a circular economy.

THREE STEPS TO BRIDGE THE CIRCULARITY GAP THROUGH LEADERSHIP AND ACTION

1 - **Drive national progress toward circularity forward with metrics and goals.** Our analysis demonstrates the complexity of Norway's economy and has made clear where linear conduct is embedded; these can be focus areas. Norway must also set goals to keep its progress thoroughly on track and measurable. Progress can be actionable and focused. The Metric also presents a measurement of progress toward a circular economy which can be revised.

2 - **Ensure a national coalition for action is both diverse and consumer- and worker-centric.** This will bring together frontrunning businesses, governments, NGOs and academics to collectively boost capacity and capability to better serve societal needs and wants more sustainably. It will work to ensure that consumers are actively involved with circular economic activities and that the labour market is prepared. A national circular economy can only be fully realised if avenues facilitating consumer consumption and jobs are orientated toward circularity.

3 - **Strengthen global knowledge and pace toward circularity and consumption reduction.** Norway can learn a lot from other country's national journeys. Peer-to-peer learning and knowledge transfer will increase the pace towards global circularity. When it comes to the circular economy, we are all developing countries.

REFERENCES

1. Raworth, K. (2017). Doughnut economics: seven ways to think like a 21st century economist. White River Junction, Vermont : Chelsea Green Publishing.
2. SB Insight. (2019). The Nordic Market For Circular Economy Attitudes, Behaviours & Business Opportunities. Retrieved from: SB Insight Report
3. OECD. (2020). Building Back Better: A Sustainable, Resilient Recovery after COVID-19. Retrieved from: OECD website
4. Circle Economy. (2020). The Circularity Gap Report Global 2020. Circle Economy.
5. Open Data Platform. (n.d.). Global Footprint Network. Retrieved from: Open Data Platform website
6. The range is due to a difference in data sources. 14 tonnes from Eurostat and 19.7 tonnes from Exiobase
7. Norwegian Environment Agency. (2015, November 02). Norway. Retrieved from: Norwegian Environment Agency website
8. International Labour Organization. (2019, June). Getting and staying together: 100 years of social dialogue and tripartism in Norway. Retrieved from: International Labour Organization website
9. Ministry of Petroleum and Energy. (2019, March 8). Norway's oil history in 5 minutes.Retrieved from: Ministry of Petroleum and Energy website
10. Reuters. (2018, November 28). Climate change 'biggest global health threat' of century, doctors warn. Retrieved from: Reuters website
11. Ellen MacArthur Foundation. (n.d.). What is the circular economy? Retrieved from: Ellen MacArthur Foundation website
12. Raworth, K. Doughnut economics : seven ways to think like a 21st century economist.
13. Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., de Vries, W., de Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Sustainability. Planetary boundaries: guiding human development on a changing planet. Science (New York, N.Y.), 347(6223), 1259855. https://doi.org/10.1126/science.1259855
14. European Commission. (n.d). A European Green Deal. Retrieved from: European Commission website
15. European Commission. (2020, March 11). Changing how we produce and consume: New Circular Economy Action Plan shows the way to a climate-neutral, competitive economy of empowered consumers. Retrieved from: European Commission website
16. Lovdata. (n.d.). Act relating to Norway's climate targets (Climate Change Act). Retrieved from: Lovdata website
17. Stockholm Resilience Centre. (n.d.). Retrieved from: Stockholm Resilience Centre website
18. Autoretur. (2020, May 8). Materialgjenvinningen øker. Autoretur leverer igjen over kravene. Retrieved from: Autoretur website
19. Camacho-Otero, J., Boks, C., & Pettersen, I. (2018). Consumption in the Circular Economy: A Literature Review. Sustainability, 10(8), 2758. doi:10.3390/su10082758
20. United Nations. (n.d). The 17 goals. Retrieved from: United Nations website.
21. European Commission. (n.d.). Paris Agreement. Climate Action. Retrieved from: European Commission website
22. European Commission. A European Green Deal.
23. .European Commission. (2020, March 11). Changing how we produce and consume: New Circular Economy Action Plan shows the way to a climate-neutral, competitive economy of empowered consumers. Retrieved from: European Commission website
24. European Commission. (n.d.). A European Green Deal. Retrieved from European Commission website
25. O'Neill et al. (2018). A good life for all within planetary boundaries, Nature Sustainability, 1, 88–95
26. Cullen, J. M., Allwood, J. M. & Borgstein, E. H. (2011). Reducing energy demand: what are the practical limits? Environ Sci Technol, 45, 1711-1718.
27. Jo, T.-H. (2011). Social provisioning process and socioeconomic modeling. Am J Econ Sociol, 70, 1094- 1116.
28. NGU. (2004). Mineral Resources in Norway. Retrieved from: NGU Report
29. Eurostat (2018). Economy-wide material flow accounts - Handbook. Manuals and Guidelines. 2018 edition.
30. Mayer, A., Haas, W., Wiedenhofer, D., Krausmann, F., Nuss, P., & Blengini, G. A. (2019). Measuring progress towards a circular economy: a monitoring framework for economy□wide material loop closing in the EU28. Journal of industrial ecology, 23(1), 62-76.
31. Haas, W., Krausmann, F., Wiedenhofer, D., & Heinz, M. (2015). How circular is the global economy?: An assessment of material flows, waste production, and recycling in the European Union and the world in 2005. Journal of industrial ecology, 19(5), 765-777.
32. Miller, R. E., & Blair, P. D. (2009). Input-output analysis: foundations and extensions. Cambridge university press.
33. Tukker, A., de Koning, A., Owen, A., Lutter, S., Bruckner, M., Giljum, S., ... & Hoekstra, R. (2018a). Towards robust, authoritative assessments of environmental impacts embodied in trade: Current state and recommendations. Journal of Industrial Ecology, 22(3), 585-598
34. Tukker, A., Giljum, S., & Wood, R. (2018b). Recent progress in assessment of resource efficiency and environmental impacts embodied in trade: An introduction to this special issue. Journal of Industrial Ecology, 22(3), 489-501
35. Stadler K, R. Wood, T. Bulavskaya, C.J. Sodersten, M. Simas, S. Schmidt, A. Usubiaga, J. Acosta-Fernandez, J. Kuenen, M. Bruckner, S. Giljum, S. Lutter, S. Merciai, J.H. Schmidt, M.C. Theurl, C. Plutzar, T. Kastner, M. Eisenmenger, K. Erb, A. de Koning, A. Tukker (2018) EXIOBASE 3: Developing a Time Series of Detailed Environmentally Extended Multi-Regional Input-Output Tables, Journal of Industrial Ecology 22(3)502-515. doi: 10.1111/jiec.12715
36. Kovanda, J., Weinzettel, J., & Schoer, K. (2018). What Makes the Difference in Raw Material Equivalents Calculation Through Environmentally Extended Input-Output Analysis?. Ecological economics, 149, 80-87
37. Schoer, K., Wood, R., Arto, I., & Weinzettel, J. (2013). Estimating raw material equivalents on a macro-level: comparison of multi-regional input–output analysis and hybrid LCI-IO. Environmental science & technology, 47(24), 14282-14289
38. Edens, B., Hoekstra, R., Zult, D., Lemmers, O., Wilting, H., & Wu, R. (2015). A method to create carbon footprint estimates consistent with national accounts. Economic Systems Research, 27(4), 440-457.
39. Giljum, S., Lutter, S., Wieland, H., Eisenmenger, N., Wiedenhofer, D., Schaffartzik, A., & West, J. (2015). An empirical assessment comparing input-output based and hybrid methodologies to measure demand-based material flows. Paris: Organisation for Economic Co-operation and Development.
40. Giljum, S., Lutter, S., Bruckner, M., Wieland, H., Eisenmenger, N., Wiedenhofer, D., & Schandl, H. (2017). Empirical assessment of the OECD inter-country input/output database to calculate demand-based material flows. Paris: Organisation for Economic Co□operation and Development
41. Giljum, S., Wieland, H., Lutter, S., Eisenmenger, N., Schandl, H., & Owen, A. (2019). The impacts of data deviations between MRIO models on material footprints: A comparison of EXIOBASE, Eora, and ICIO. Journal of industrial ecology, 23(4), 946-958.
42. CBS. (2020, June 3). Notitie circulair materiaalgebruik in Nederland. Retrieved from: CBS website
43. Haas, W.; Krausmann, F.; Wiedenhofer, D. & Heinz, M. (2015). How Circular is the Global Economy? An Assessment of Material Flows, Waste Production, and Recycling in the European Union and the World in 2005. Journal of Industrial Ecology Volume 19, Number 5, p. 765-777.
44. Circle Economy. (2019). The Circularity Gap Report Austria. Retrieved from: Circle Economy website
45. Bocken, N. M., De Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 33(5), 308-320.
46. Circular Strategies. (n.d.). Retrieved from: Circular Strategies website
47. Konietzko, J.; Bocken, N. & Hultink, E. J. (2020). A Tool to Analyze, Ideate and Develop Circular Innovation Ecosystems. Sustainability, 12(1), 417.
48. CBS. (2020, June 3). Notitie circulair materiaalgebruik in Nederland. Retrieved from: CBS website
49. This assumption is applied at the level of single resource group (biomass, metals, minerals and fossil fuels), that is: If the share of secondary biomass, say recycled paper, in the total input of biomass is 1%, then also the share of consumed recycled paper in the total consumption of biomass will be 1%.
50. This means that Norway's Raw Material Consumption (RMC) stands 229 Mt, up to 235Mt if secondary materials and reused waste are included
51. On top of the 11.8 million tonnes as reported by SSB, this number also includes 2.8 million tonnes of polluted soils, and an estimated 0.9 million tonnes from trade dynamics.
52. This number also includes 2.2 million tonnes of polluted soil.

53. Other mismatches for subtotals are due to 1.) aggregation (we provide our aggregation in the methodology document) and 2.) our use of more detailed category tables: https://www.ssb.no/en/statbank/table/07355/tableViewLayout2/

54. Consumption-based accounting, reference year: 2017. Refer to our methodology document for more information: www.circularity-gap.world/methodology

55. Value added at basic prices. Constant 2015 prices (NOK million); Production account and income generation, by industry, (SSB)

56. Greenhouse gases total in tonnes of CO2 equivalents, Greenhouse gases from Norwegian economic activity, by industry (SSB), which includes ocean transport and international air travel.

57. The MVC considers 'broad' construction, which includes construction materials manufacturing, on-site construction (incl. civil engineering) an nbd real estate services. 'Narrow' construction, with 43 million tonnes Mass, only considers on-site construction.

58. Circle Economy. (2020). The Circularity Gap Report 2019. Circle Economy website.

59. This category includes vehicles, ocean transport and international air transport.

60. World Economic Forum. (2019, March 21). These countries have the highest share of electric vehicles. Retrieved from: World Economic Forum website

61. Clean Technica. (2019, June 21). Norway announces plan to cut emissions from ships 50% by 2030. Retrieved from: Clean Technica website

62. The Explorer. (2019, April 26). Norway is Greening the construction industry. Retrieved from: The Explorer website

63. The Explorer. (2019, April 26). Norway is Greening the construction industry. Retrieved from: The Explorer website

64. The Explorer. (2019, April 26). Norway is Greening the construction industry. Retrieved from: The Explorer website

65. Euroconstruct. (2019, May). Briefing on European Construction. Retrieved from: Euroconstruct website.

66. De Valence, G. (2018). Defining the Built Environment Sector. DOI 0.13140/RG.2.2.32777.49764.

67. European Commission. (n.d.). Circular Economy Action Plan. Retrieved from: European Commission website

68. Up to 24% for the broad construction sector

69. Circle Economy. (2020) Circular Kongsvinger region phase 1 & 2. Retrieved from: Circle Economy website

70. 3E. (2019, March 29). How flexible and adaptable buildings serve circular economy. Retrieved from: 3E website

71. Simon, F. (2019). The EU releases its Green Deal. Here are the key points. Euroactiv. Retrieved from: Climate Change News website.

72. Metabolic. (2019). On the journey to a circular economy, don't forget your materials passport. Retrieved from: Metabolic website

73. The Explorer. (n.d.). Construction collaboration that lasts a life cycle. Retrieved from: The Explorer website

74. Energi Norge. (n.d.). About energy Norway. Retrieved from: Energi Norge website

75. Ministry of Petroleum and Energy. (2016, May 11). Renewable energy production in Norway. Retrieved from: Ministry of Petroleum and Energy website

76. Lovdata. (n.d.). Act relating to Norway's climate targets (Climate Change Act). Retrieved from: Lovdata website

77. Mo Industrial Park. (n.d.). Retrieved from: Mo Industrial Park website

78. Energi Norge. (n.d.). Fornybarometeret 2020, Retrieved from: Energi Norge website

79. OECD. (n.d.). Environmental Tax Profile Norway. Retrieved from: OECD website

80. OECD. (n.d.). Environmental Tax Profile Norway. Retrieved from: OECD website

81. Ember. (n.d.). Carbon Price Viewer. Retrieved from Ember website

82. Riviera. (2019, July 16). Norway's first hydrogen-powered car ferries take shape. Retrieved from: Riviera website.

83. IPCC. (2018). Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Retrieved from: IPCC website

84. Zero Emission Resource Organisation (ZERO). (2020, May). Sirkulær karbonøkonomi. Retrieved from: Zero Emission Resource Organisation website

85. DNV. (2019). Energy Transition Outlook, p.25 Retrieved from: ETO website

86. United Nations. (2017, June 21). World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100. Retrieved from: United Nations website

87. A Elstad Stensgård, A., & Jørgen Hanssen, O. (2016, September 12). Food Waste in Norway 2010-2015. Retrieved from: Food Waste in Norway Report

88. Helsedirektoratet. (2017). Årsrapport. Retrieved from: Helsedirektoratet website

89. Isaksen, T. (2018, April). The plant protein trend in Norway: Market overview and future perspectives. Retrieved from: NMBU website.

90. Lenzen M, Moran D, Kanemoto K, Foran B, Lobefaro L and Geschke A 2012 International trade drives biodiversity threats in developing nations Nature 486 109–12

91. Smithers, R. (2017). Vast animal-feed crops to satisfy our meat needs are destroying planet. The Guardian. Retrieved from: The Guardian website.

92. Ellen MacArthur Foundation. (2019, May). Cities and Circular Economy for Food. Retrieved from: Ellen MacArthur Foundation website

93. Winnow Solutions. (n.d.). Winnow Vision - Advanced AI Food Waste Technology. Retrieved from: Winnow Solutions website

94. The Explorer. (2020, March 10). Algae: A sustainable, circular resource for the future. Retrieved from: The Explorer website

95. Norwegian Seafood Council. (n.d.). Fishing fleet. Retrieved from: Norwegian Seafood Council website

96. Aquaculture Stewardship Council. (n.d.). Certifying environmentally and socially responsible seafood. Retrieved from: Aquaculture Stewardship Council website

97. Marine Stewardship Council. (n.d.). Sustainable fishing. Retrieved from: Marine Stewardship Council website

98. Lerøy. (n.d.). Ocean Forest. Retrieved from: Lerøy website

99. Matsentralen. (n.d.). Retrieved from: Matsentralen website

100. Ministerie van Buitenlandse Zaken. (n.d.). E-Mobility in Norway. Retrieved from: Ministerie van Buitenlandse Zaken website

101. Henly, J., & Ulven, E. (2020, April 19). Norway and the A-ha moment that made electric cars the answer. The Guardian. Retrieved from: The Guardian website

102. Fleet Europe. (2016, June 5). Norway to ban new fossil-fuel cars from 2025. Retrieved from Fleet Europe website

103. The Explorer. (2020, January 9). The Norwegian transport sector puts climate in the driving seat. Retrieved from The Explorer website

104. Urban Insight. (n.d.). Race to electrification – Norway in pole position. Retrieved from: Urban Insight website

105. OECD. (2019). Business models for the circular economy opportunities and challenges for policy: Opportunities and challenges for policy, p.31. Retrieved from: OECD: Business models for the circular economy book

106. Nabobil. (n.d.). Private car rental in your neighbourhood. Retrieved from: Nabobil website

107. Vygruppen. (n.d.). Bybil. Retrieved from: Vygruppen website

108. European Commission. (n.d.). Circular Economy Action Plan. Retrieved from: European Commission website

109. Drabik, E., & Rizos, V. (2018). Prospects for electric vehicle batteries in a circular economy. Retrieved from: CEPS Research Reports

110. Drabik, E., & Rizos, V. (2018). Prospects for electric vehicle batteries in a circular economy. Retrieved from: CEPS Research Reports

111. Taylor, M. (2018, July 12). Can Norway help us solve the plastic crisis, one bottle at a time? The Guardian. Retrieved from: The Guardian website

112. Calculations based on SSB and Avfall Norge data.

113. Right to Repair. (2020, June 4). Apple crushes one-man repair shop in Norway's Supreme Court, after three-year battle. Retrieved from: Right to Repair website

114. European Environment Agency. (2016). More from less: Material resource efficiency in Europe. Retrieved from: EEA website

115. Government of the Netherlands. (n.d.). Accelerating the transition to a circular economy. Retrieved from: Government of the Netherlands website

116. Rankin, J. (2020, March 11). EU plans 'right to repair' rules for phones and tablets. The Guardian. Retrieved from: The Guardian website

117. Bäunker, L., & Gardien, K. (2020, June 8). How circular design can help us in times of crisis. Medium. Retrieved from: Circle Economy blog

118. TOMRA. (n.d.). Reserve Vending Machines for Collecting Drink Containers for Recycling. Retrieved from: TOMRA website

119. Innovasjon Norge. (2020). Verdiskapingspotensial i nye anvendelser av massevirke og sidestrømmer (33-2019). Retrieved from: Innovasjon Norge website

120. Innovasjon Norge. (2020). Verdiskapingspotensial i nye anvendelser av massevirke og sidestrømmer (33-2019). Retrieved from: Innovasjon Norge website

121. Circular Economy Practitioner Guide. (n.d.). Cascading. Retrieved from: Circular Economy Practitioner Guide website

122. Innovasjon Norge. (n.d.). Forestry. Retrieved from: Innovasjon Norge website

123. NIBIO Bærekraftig Skogbruk I Norge. (n.d.). Sammendrag. Retrieved from: NIBIO website

124. NIBIO Bærekraftig Skogbruk I Norge. (n.d.). Sammendrag. Retrieved from: NIBIO website

125. European Commission. (2019, June 13). Science for Environment Policy. Blockchain technology could improve traceability of wood through supply chain. Retrieved from: European Commission website

126. Circle Economy. (2020) Circular Kongsvinger region phase 1 & 2. Retrieved from: Circle Economy website

127. Prosess21. (n.d.). Biobasert Prosessindustri. Retrieved from: Prosess21 website

128. Borregaard. (n.d.). From wood to valuable products. Retrieved from: Borregaard website

129. 141.4 million tonnes if we include secondary materials

130. Pantzar, M., Strube, R., Gionfra, S., and Modée, K. (2018) Sustainable consumption – policy approaches for systems change. Policy paper produced for the Think 2030 Conference. Institute for European Environmental Policy.

131. Pantzar, M., Strube, R., Gionfra, S., and Modée, K. (2018) Sustainable consumption – policy approaches for systems change. Policy paper produced for the Think 2030 Conference. Institute for European Environmental Policy.

132. Virke. (2020). The trade report. Retrieved from: Virke website

133. Virke. The trade report.

134. SB Insight. (2019). The Nordic Market For Circular Economy Attitudes, Behaviours & Business Opportunities. Retrieved from: SB Insight Report

135. Food Navigator. (2018, May 25). 'We see low perceptions as an opportunity': Orkla targets ethical consumers. Retrieved from: Food Navigator website

136. Bäunker, L., & Gardien, K. (2020, June 8). How circular design can help us in times of crisis. Medium. Retrieved from: Circle Economy blog

137. Santander Trade. (n.d.). Norway: Reaching the Consumer. Retrieved from: Santander Trade website

138. Dashinsky, A. (2016, September 27). Product Design for Sustainability. Medium. Retrieved from: UX Design blog

139. Consumption Research Norway (SIFO) - Oslo Metropolitan University. (n.d.). Motivations for and against second-hand clothing acquisition. Retrieved from Consumption Research Norway (SIFO) article

140. Consumption Research Norway (SIFO) - Oslo Metropolitan University. (n.d.). Motivations for and against second-hand clothing acquisition. Retrieved from Consumption Research Norway (SIFO) article

141. ten Wolde, A. (2019). Blog 3: Best practices from the Netherlands for a European Circular Economy. Holland Circular Hotspot. Retrieved from: Holland Circular Hotspot blog.

142. Pádua Pieroni, M., Blomsma, F., McAloone, T. C., & Pigosso, D. (2018). Enabling circular strategies with different types of product/service-systems. https://doi.org/10.1016/j.procir.2018.03.327

143. Vestiaire Collective. (n.d.). Retrieved from: Vestiaire Collective website

144. Schibsted. (2019). Sustainability Report. Retrieved from: Schibsted report

145. Mieras, E. (2016, June 16). 5 roads to a circular economy – Part IV: sharing. Retrieved from: PRé Sustainability website.

146. Jakobsen, S. E. (2016, February 15). Few norwegians drawn into new sharing economy. Retrieved from: Science Norway website

147. Jakobsen, S. E. Few norwegians drawn into new sharing economy.

148. The World Bank. (2018, June 8). Planet over Plastic: Addressing East Asia's Growing Environmental Crisis. Retrieved from: The World Bank website

149. SB Insight. (2017). Nordic Consumers & Climate Change. Retrieved from: SB Insight Report

150. Climate Action Tracker. (n.d.). Norway. Retrieved from: Climate Action Tracker website

151. Climate Action Tracker. Norway.

152. Bremnes, E. (2019, October 14). People are embracing plant-based, ready-made food – but is it always healthy? Retrieved from: Science Norway website

153. Bremnes, E. People are embracing plant-based, ready-made food – but is it always healthy?

154. Norden. (2015). Moving towards a circular economy – successful Nordic business model. Retrieved from: Norden website

155. Amilien, V. (2011). From territory to terroir?: the cultural dynamics of local and localized food products in Norway. Sosiologisk Årbok. 3. 85-106.

156. New Movements. (n.d.). Retrieved from: New Movements website

157. Forest Stewardship Council. (n.d.). Retrieved from: Forest Stewardship Council website

158. Plastics Recyclers Europe. (n.d.). Recyclers Certification. Retrieved from: Plastics Recyclers Europe website

159. Navas Estrada, M. D. (2019, May). People's Attitudes, Expectations and Perceptions About Recycling in Oslo, Norway. Retrieved from: UiO DUO Research archive

160. Palm, D., Elander, M., Watson, D., Kiørboe, N., Salmenperä, H., Dahlbo, H., & Moliis, K. (n.d.). Towards a nordic textile strategy: Collection, sorting, reuse and recycling of textiles. p.46. Retrieved from: Towards a Nordic textile strategy ebook

161. Kipperberg, G. A Comparison of Household Recycling Behaviors in Norway and the United States. Environ Resource Econ 36, 215–235 (2007). https://doi.org/10.1007/s10640-006-9019-x

162. Hydro. (n.d.). Hydro and Northvolt launch joint venture to enable electric vehicle battery recycling in Norway. Retrieved from: Hydro website

163. Grønt Punkt. (n.d.). Emballasjemerking. Retrieved from: Grønt Punkt website

164. Goffman, E. (2020) In the wake of COVID-19, is glocalization our sustainability future?, Sustainability: Science, Practice and Policy, 16:1, 48-52. https://doi.org/10.1080/15487733.2020.1765678

165. BCG. (2020, April 30). People Priorities for the New Now. Retrieved from: BCG website

166. Rreuse. (2015). Briefing on job creation potential in the re-use sector. Retrieved from: Rreuse website

167. Willeghems & Bachus. (2018). Employment impact of the transition to a circular economy: literature study. Retrieved from: Circular Flanders website

168. OECD. (2020). Building Back Better: A Sustainable, Resilient Recovery after COVID-19. Retrieved from: OECD website

169. European Commission. (2019). Communication from the Commission: The European Green Deal Retrieved from: European Commission website

170. European Commission. (2020). Circular Economy Action Plan: The European Green Deal. Retrieved from: European Commission website

171. European Commission. (2020). European Skills Agenda For Sustainable Competitiveness, Social Fairness And Resilience. Retrieved from: European Commission website

172. OECD (2019). OECD Economic Surveys Norway, December 2019: Overview. Retrieved from: OECD website

173. Andersen, S, K., Ibsen, C. L., Alsos, K., Nergaard, K., & Sauramo. P. (2015). Changes in wage policy and collective bargaining in the Nordic countries–comparison of Denmark, Finland, Norway and Sweden. in G van Gyes & T Schulten (eds), Wage bargaining under the new European Economic Governance. European Trade Union Institute, Brussels, p. 139-168. Retrieved from: Research Gate

174. More information available via Innovasjon Norge. (n.d.). Sirkulærøkonomi. Retrieved from: Innovasjon Norge website

175. Statistics Norway (2019). This is Norway. Retrieved from: Statistics Norway website

176. More information available via Statistics Norway. (2018, May 4). Continued Growth for Construction. Retrieved from: SSB website

177. Nordic Council of Ministers. (2018). Circular Economy in the Nordic Construction Sector: Identification and assessment of potential policy instruments that can accelerate a transition toward a circular economy. TemaNord. Retrieved from: Nordic Council of Ministers website

178. Circle Economy, Sustainable Finance Lab & Nederland Circulair. (2018). Building value: A pathway to circular construction finance. Retrieved from: Circular construction finance report

179. Statista. (n.d.). Number of employees in the oil and gas industry in Norway from 2008 to 2018, by sector. Retrieved from: Statista website

180. Data available from the International Renewable Energy Agency. Retrieved from: IRENA website

181. Garrett-Peltier, H. (2017). Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model. Economic Modelling, 61, 439-447. https://doi.org/10.1016/j.econmod.2016.11.012

182. Topham, E., & McMillan, D. (2017). Sustainable decommissioning of an offshore wind farm. Retrieved from: ScienceDirect website

183. Invernizzi, D. D. et al (2020). Developing policies for the end-of-life of energy infrastructure: Coming to terms with the challenges of decommissioning. Energy Policy, 144, 111677. https://doi.org/10.1016/j.enpol.2020.111677

184. RSA. (2015) The RSA great recovery & zero waste Scotland programme: north Sea oil and gas rig decommissioning & Re-use opportunity report. Retrieved from: RSA website

185. National Audit Office. (2019). Oil and gas in the UK – offshore decommissioning. Retrieved from: National Audit Office website

186. RSA. (2015) The RSA great recovery & zero waste Scotland programme: north Sea oil and gas rig decommissioning & Re-use opportunity report. Retrieved from: RSA website

187. Lindaas, J. C. (2020). Decom Tools, Summary report from visiting companies in the decommissioning industry, Norway. Retrieved from: Interreg North Sea Region report

188. P. Wang, L.Y. Chen, J.P. Ge, W. Cai, W.Q. Chen. Incorporating critical material cycles into metal-energy nexus of China's 2050 renewable transition. Appl. Energy, 253 (2019), p. 113612

189. Invernizzi, D. D. et al (2020). Developing policies for the end-of-life of energy infrastructure: Coming to terms with the challenges of decommissioning. Energy Policy, 144, 111677. https://doi.org/10.1016/j.enpol.2020.111677

190. Statistics Norway. (2019). This is Norway 2019. Retrieved from: Statistics Norway website

191. Statistics Norway. (2017, June 1). Higher turnover for waste activities. Retrieved from: Statistics Norway website

192. Weghmann (2017). Waste management in Europe. Good jobs in the circular economy? European Public Service Union. Retrieved from: Weghmann website

193. Rreuse. (2015). Briefing on job creation potential in the re-use sector. Retrieved from: Rreuse website

194. Virke. The trade report.

195. Lekan, M., & Rogers, H. A. (2020). Digitally enabled diverse economies: exploring socially inclusive access to the circular economy in the city. Journal of Urban Geography. DOI: 10.1080/02723638.2020.1796097

196. Schoenmakere, M. D., & Gillabel, J. (2017). Circular by design: products in the circular economy. European Environment Agency. Retrieved from: EEA report

197. Vernon, J., & George, C. (2001). Employment Effects of Waste Management Policies. Final Report - January 2001 prepared for European Commission, Directorate-General Environment. Retrieved from: Employment Effects of Waste Management Policies report

198. Weghmann. (2017). Waste management in Europe. Good jobs in the circular economy? European Public Service Union. Retrieved from: EPSU report

199. Cools, P. & Oosterlynck, S. (2015). De Kringwinkel: a symbiosis between jobs

200. for the long-term unemployed and waste reduction? ImPRovE Case Study N. 8. Antwerp: Herman Deleeck Centre for Social Policy. Retrieved from: ImPRovE report

201. ENSIE. (2019). Impact-WISE. Retrieved from: ENSIE website

202. Avfall Norge. (n.d.). Videreutdanningskurs I avfall Og sirkulær økonomi. Retrieved from: Avfall Norge website

203. Switch Forum. (n.d.). Competency Framework. Retrieved from: Switch Forum website

204. EUR-Lex. (2019). Commission Regulation (EU) 2019/2021 of 1 October 2019. Retrieved from: EUR-Lex website

205. European Commission. (2020). European Skills Agenda For Sustainable Competitiveness, Social Fairness And Resilience. Retrieved from European Commission website

206. OECD. (2019). OECD Economic Surveys Norway, December 2019: Overview. Retrieved from: OECD website

207. Methodology for Assessing Procurement Systems. (2018). Assessment of norway's public procurement system: testing new methodology. Retrieved from: Methodology for Assessing Procurement Systems website

208. Task Force Healthcare. (2017, April). TFHC Market Study. Aligning Dutch Smart Solutions to Norwegian Opportunities. Retrieved from: Task Force Healthcare website

ICONOGRAPHY

Page	Photographer
1	Johny Goerend
10	Echo Wang
14	Victor Maschek
20	Guillaume Briard
28	Tobias Bjørkli
35	Arvid Malde
39	Guillaume Briard
48	Gadiel Lazcano
55	Axel Eres
61	Erwin Doorn
62	Huang Zheng
64	Katie Doherty
74	Tord Sollie

ACKNOWLEDGEMENTS

Circle Economy and Circular Norway would like to thank the funder, authors, contributors and interviewees for their contribution to the preparation of this third edition of the Circularity Gap Report, Norway. Authors and contributors and interviewees have contributed to the report in their individual capacities. Their affiliations are only mentioned for identification purposes.

FUNDING PARTNERS

Avfall Norge, Biogass Oslofjord, Elektroforeningen, FINN, Forbrukerrådet, RENAS, Schibsted, Skift, Virke

LEAD AUTHORS

Marc de Wit (Circle Economy), Laxmi Haigh (Circle Economy), Caspar von Daniels (Circle Economy), Alexander F. Christiansen (Circular Norway)

CONTRIBUTING AUTHORS

Alex Colloricchio (Circle Economy), Jacco Verstraeten-Jochemsen (Circle Economy), Simone Gager (Circle Economy), Noah Baars (Circle Economy), Esther Goodwin Brown (Circle Economy), Joke Dufourmont (Circle Economy)

CONTRIBUTORS

Anja Ronesen (Renas), Bjørn Arild Thon (Renas), Bjørn Kjærand Haugland (Skift), Britt Nilsen (Schibsted), Camilla Gramstad (Virke), Cathrine Barth (Circular Norway), Cecilie Lind (Avfall Norge), Frank Jaegtnes (EFO), Gunstein Instefjord (Forbrukerrådet), Ivar Horneland Kristensen (Virke), Karen Sund (Biogass Oslofjord), Kathrine Opshaug Bakke (FINN), Kity Gjerstad (Forbrukerrådet), Leif Nordhus (Circular Norway), Maren Esmark (Naturvernforbundet), Mathias Juell Johnsen (Skift), Tone Svendsen Endal (Skift), Villeman Vinje (NyAnalyse), Ivanna Gomez (Circle Economy), Marijana Novak (Circle Economy)

INTERVIEWEES

Are Tomasgard (LO), Eirik Wærner (Multiconsult), Ingun Grimstad Klepp (SIFO/Oslo Metropolitan University), Lars Almklov (DNV GL), Rannveig Ravnanger Landet (BNL), Rune Torhaug (DNV GL)

SCIENTIFIC ADVISORY BOARD

Daniel Beat Müller (Norwegian University of Science and Technology NTNU), Kirsten Svenja Wiebe (Sintef), Moana Silva Simas (Sintef)

ADVISORY BOARD

Naturvernforbundet, VIRKE, NyAnalyse, RENAS, FORBRUKERRÅDET, Skift, Schibsted, FINN, Avfall Norge, ELEKTROFORENINGEN, BIOGASS OSLOFJORD

COMMUNICATION

Ellen Høvik (Circular Norway), Yasmina Lembachar (Circle Economy), Lena Baunker (Circle Economy)

DESIGN & LAYOUT

Nicolas Raspail (Circle Economy), Alexandru Grigoras (Circle Economy) and Inge ter Laak (Circle Economy)

Version 1.1 (August 2020)

circularity-gap.world