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UNDP

A 1.5°C WORLD REQUIRES A CIRCULAR AND LOW CARBON ECONOMY

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About UNDP

UNDP's work on climate change spans more than 140 countries and US$ $3.7 billion in investments in climate change adaptation and mitigation measures since 2008. With the goal to foster ambitious progress towards resilient, zero-carbon development, UNDP has also supported the implementation of the Paris Agreement on climate change by working with countries on achieving their climate commitments or Nationally Determined Contributions (NDCs). The UNDP NDC Support Programme provides technical support for countries to pursue a "whole-of-society", integrated approach that strengthens national systems, facilitates climate action and increases access to finance for transformative sustainable development. The programme is generously supported by the European Union and the governments of Germany and Spain and works in contribution to the NDC Partnership.

Formally launched at the UN Climate Action Summit in September 2019, **UNDP's Climate Promise** supports over 100 countries to enhance their Nationally Determined Contributions (NDCs) under the Paris Agreement. Delivered in collaboration with a wide variety of partners such as UNEP, the Climate Promise is the world's largest offer of support for the enhancement of climate pledges. While climate change impacts pose a risk for everyone and threaten to roll back decades of sustainable development gains, the poorest, marginalized and most vulnerable populations are disproportionately burdened. UNDP advocates for an inclusive approach to ensure ownership of climate actions across government and society, advance equality, and strengthen social and environmental sustainability.

CLIMATE PROMISE

A SAFE AND SUSTAINABLE FUTURE THROUGH BOLD CLIMATE ACTION

About UNEP

UNEP supports the world to transition to a low-carbon, sustainable future and shift to sustainable consumption and production patterns through several initiatives and programs in the Economy Division. The transition to low carbon development is currently supported by the UNEP and UNEP DTU Partnership's **NDC Action Project**. The project supports ten partner countries worldwide to translate their Nationally Determined Contributions (NDCs) into concrete sector strategies and actions ready for financing and implementation, and to increase the ambition of their NDCs. The project aims to strengthen existing NDC coordination mechanisms, foster accelerated public and private investments in two priority sectors per country, optimize the effectiveness of national policies, and facilitate the sharing of lessons among various actors and across sectors, countries and regions. The shift to sustainable consumption and production and transition to a circular economy is supported by the Economy Division through the Consumption and Production Unit and by UNEP serving as the Secretariat of the One Planet network, the International Resource Panel and the Life Cycle Initiative. These activities and initiatives support governments and other stakeholders in enhancing the efficiency of resource use, while also reducing pollution including greenhouse gas emissions across multiple sectors of their economies.

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The aforementioned activities are supported financially by a wide range of funding partners including Belgium, Canada, Denmark, the European Union, Finland, France, Germany, the Global Environment Facility, Israel, Japan, Netherlands, Norway, Sweden, Switzerland, the United States of America and the SUN Institute Environment & Sustainability. The full list of funding partners for the Life Cycle Initiative is available here.

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Lead Authors: Alexandra Soezer, UNDP and Charles Arden-Clarke, UNEP

Contributing Authors from UNEP and UNDP:
Theresa Aigner, Maria Jose Baptista, Marina Bortoletti, Bettina Heller, Nils Heuer, Miriam Hinostroza-Suarez, Llorenç Mila i Canals, Pablo Montes, Clementine O'Connor, Martina Otto, Fabienne Pierre, Helena Rey, Claire Thiebault, Elisa Tonda, Katie Tuck, Feng Wang, Ran Xie, Tim Scott, Sarwat Chowdhury, Sanna Due.

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Jason T Quirk

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Executive Summary

A 1.5°C world requires a circular and low carbon economy

There is an urgent need to take a more comprehensive approach for the transition to a low carbon economy if the world is to achieve carbon neutrality by 2050. Broad multi-stakeholder collaboration is needed to create the integrated policies required for this deep transformation of our societies and economies. The necessary policies must be designed holistically to include vulnerable communities and all segments of the population, implying socio-economic planning integrated with environmental and resource efficiency measures. Making our economies more circular is essential, not only to integrating economic, social and environmental objectives, but also to grasping the potential for substantial and accelerated reductions in GHG emissions across all sectors. Changes in production methods, product durability, reuse, recycling, more informed consumer choice and behavioural change need to be deeply embedded in economic and development policy frameworks. By ensuring that circular economy approaches are part of countries' Nationally Determined Contributions (NDCs) - we can harness the huge potential that more efficient and cleaner use of resources has to deliver greenhouse gas (GHG) emission reductions and additional benefits that efficiency and circularity provide. These benefits can include creating new jobs at local and national levels by linking production more closely with consumption, expanding recycling, refurbishment and re-manufacturing and creating new enterprises based on recovered waste streams.

Identifying pollution hotspots across our economy

The UNEP Sustainable Consumption and Production Hotspots Analysis Tool (SCP-HAT) provides a desk-top analytical tool for countries to determine the resource and pollution intensive hotspots associated with their current production and consumption patterns. This enables countries to determine which sectors of their economy are the primary sources of GHG emissions and provides an initial indication of the potential for their reduction. The SCP-HAT is being applied to guide revision of NDCs, and to refine its analysis of GHG emissions by sector and for a more disaggregated assessment of reduction opportunities. The Circular City Scan is a similar tool to be applied at city level, which includes assessments of sectoral GHG emission reduction opportunities. An increasing number of countries are already applying or are considering applying the SCP-HAT in various policy making contexts including NDCs.

Massive potential for sectoral GHG reduction through circular economy approaches

The following sectors are key to the economic development of all countries and provide substantial opportunities for climate change mitigation through resource efficiency and more circular material flows: the buildings sector, the industry sector, and notably the value chains of plastics, textiles and electronics, the tourism sector and the agriculture and food sector. There are also specific opportunities at the city level for the transition to a low carbon and circular economy which require actions at that level of governance, infrastructure and organization of value chains.

Building sector

The use of alternative materials in construction, including recycled materials, more intensive use of buildings and enhanced energy efficiency in the use phase can reduce GHG emissions from the sector by 50 percent to 80 percent by 2050. Value retention processes in the industry sector, including remanufacturing, refurbishment, repair and direct reuse can enable very high efficiency in value retention while providing a holistic approach to re-design value chains, and reducing GHG emissions by 79 percent to 99 percent, depending on the sector.

Industry sector value chains – plastics, textiles and electronics

Around 388 million tonnes of plastics were produced in 2015 with 99.5 percent being from petro-based sources. On current trends the plastic industry could account for 20 percent of the world's total consumption of fossil fuels by 2050. There are major opportunities to reduce GHG emissions, through re-use, recycling and

substitution with bio-based alternatives. Re-use of plastic packaging can offer GHG reduction of 85% compared to single use plastic, while some bio-based plastics have a negative emissions potential. Recycling 1 tonne of plastics can reduce emissions by 1.1–3.0 tonnes of CO2e compared to production of one tonne of virgin plastics from fossil fuels.

The textiles and footwear industry accounts for an estimated 8 percent of the world's greenhouse gas emissions, currently amounting to 3.3 billion metric tons which is set to rise by 49% by 2030 on current trends. While the dyeing and finishing of textiles accounts for around 36% of GHG emissions global, the use phase accounts for 24%. Extending the useful life of textiles, closed loop recycling, decreasing water use, synthetic recycled fibres and changes in laundry practices can together dramatically reduce this contribution of textiles to climate change.

Nearly 45 million tonnes of electronic waste were generated globally in 2015, yet the resource recovery potential of secondary raw materials is worth Euros 55 billion Euros comprising base metals, precious metals and plastics. Re-using, lifetime extension and recycling of electronics and reducing the hazardous and climate-related chemicals in electronic products reduces both climate and human health impacts. Take-back systems and Extended Producer Responsibility provide incentives for the private sector and mobilize finance to reduce GHG emissions from the sector.

Tourism and food sectors

In the tourism sector, roadmaps for low carbon development and more resource efficiency can be developed at the destination level, enabling leadership from this sector on GHG emission reduction in collaboration with other sectors in the economy. A major GHG footprint of tourism is related to food production, distribution, and disposal, which can be reduced by sourcing more sustainable and locally produced food. Policies and actions along the food value chain can substantially reduce the 37 percent contribution of this sector to global GHG emissions. Promoting sustainable agricultural production, promoting urban and peri-urban farming, reducing food loss and waste, designing food systems to deliver healthy and sustainable food, and promoting behavioural change for more sustainable diets can achieve these reductions.

Cities

Rapidly growing cities are an important geographical and jurisdictional focus for GHG emission reductions that is further enhanced by the shorter value chains which can be created within and around cities. Integrated approaches to urban planning and design and linking key sectors by resource and energy flows, creates important opportunities for efficiency and circularity. Food value chains for urban consumers based on urban and peri-urban agricultural production can establish more circular and sustainable food systems, with lower GHG emissions.

Expanding the collaboration

Achieving low-carbon societies requires collaboration amongst international development partners, and there is currently an opportunity for UNDP and UNEP jointly to support developing countries in the enhancement of their NDCs. This jointly developed guidance note sets out a range of technical resources and analytical tools that can be offered to countries to accelerate achievement of the Paris Agreement targets, by enhancing the resource efficiency and circularity of their national economies. By securing greater engagement of key Ministries and other actors engaged in climate change mitigation policies and actions, it will also be possible to accelerate the transition to more sustainable consumption and production patterns as set out in the 2030 Agenda on Sustainable Development.

UNDP and UNEP will develop this strategic partnership on circular economy to: (i) support circular policies; (ii) help design innovative circular economy business models that engage systematically private sector actors; and (iii) facilitate access to finance to scale-up implementation of innovative solutions to enhance countries' climate ambition. This UNDP-UNEP collaboration will be developed with countries implementing NDCs and resource efficiency measures.

Enhancing NDCs through a transition to Circular Economies

Introduction

NDC stands for the Nationally Determined Contributions (NDCs) that countries have made to the Paris Agreement. The climate plans and climate goals each country is making as part of their contribution to the Paris Agreement, are outlined in their NDCs. As part of 2015 Paris Agreement, every five years countries are required to revise their NDCs and make them more ambitious to ensure our national and collective climate actions keep pace with the escalating climate crisis. Although the UN's annual climate conference – COP26 – has been postponed until 2021, governments around the world are working at full tilt to strengthen their climate plans through enhancing their NDCs ahead of the COP26 deadline. The UN system is offering extensive support to back up these efforts, and under UNDP's Climate Promise, over 100 countries are receiving direct support from the UN system with this revision process.

A circular economy is one based on the principles of designing out waste and pollution, retaining the value of materials and products and keeping them in the economy, while also regenerating natural systems. The objective of establishing a circular economy requires governments, businesses and consumers to look beyond the current "take, make and dispose" extractive industrial model, and to redefine growth, focusing on positive society-wide benefits. The transition to a circular economy entails decoupling economic activity from the consumption of natural resources and designing negative externalities like waste and pollution out of the system. Underpinned by a transition to renewable energy sources and a more sustainable use of biodiversity and ecosystems, the circular model builds economic, natural and social capital simultaneously[1].

The objective of this paper is to harness relevant expertise within UNDP and UNEP, provide a set of new analytical tools and integrated policies and approaches that support the transition to truly circular and more resource efficient economies, based on sustainable consumption and production patterns. Particular focus is paid to how circular economy approaches can help countries raise the ambition of their NDCs and national climate plans.

Circularity provides a model to transform the current economic model towards a sustainable future. As outlined in the UNEP circularity platform[2], circularity's underlying objective is that materials should be kept at their highest possible value as they move and are retained within the value chain. This reduces the use of natural resources and environmental impacts per unit of economic activity or output, while continuing to enable improvements in human well-being. Lifecycle thinking, which enables the identification of strategic intervention points along the value chain and the engagement of all stakeholders, is also essential to a successful and sustainable transition to a circular economy.

Circularity needs to be inclusive to not only support the conservation of the environment but also the well-being of all. Such an inclusive approach enables businesses to increase revenues by accessing impact investors and create new customer value as resource efficiency benefits multiply across the entire value chain. The transition also triggers governments to invest in cost-effective solutions to address the climate crisis and the risks posed to citizens' health. A circular economy generates new and decent jobs, while enabling a switch to more equitable and sustainable economies. This helps conserve the natural environment as circular models require the extraction of fewer resources and help prevent, or at least better manage and where possible re-use, pollutants and wastes. Circular policies and practices also need to be complemented by more responsible consumption choices, which reinforce those policies and practices on the supply side with actions by public and private consumers. These also serve to reduce inequalities among societies at all levels, from the local to global.

Creativity and cooperation among all value chain actors, supported by enabling policy frameworks established by public authorities, are essential for the transformation towards a circular economy. They are required to ensure nobody is left behind – especially in the informal sector – and encourage meaningful behavioral change of relevant stakeholders' groups, and to create innovative solutions along the value

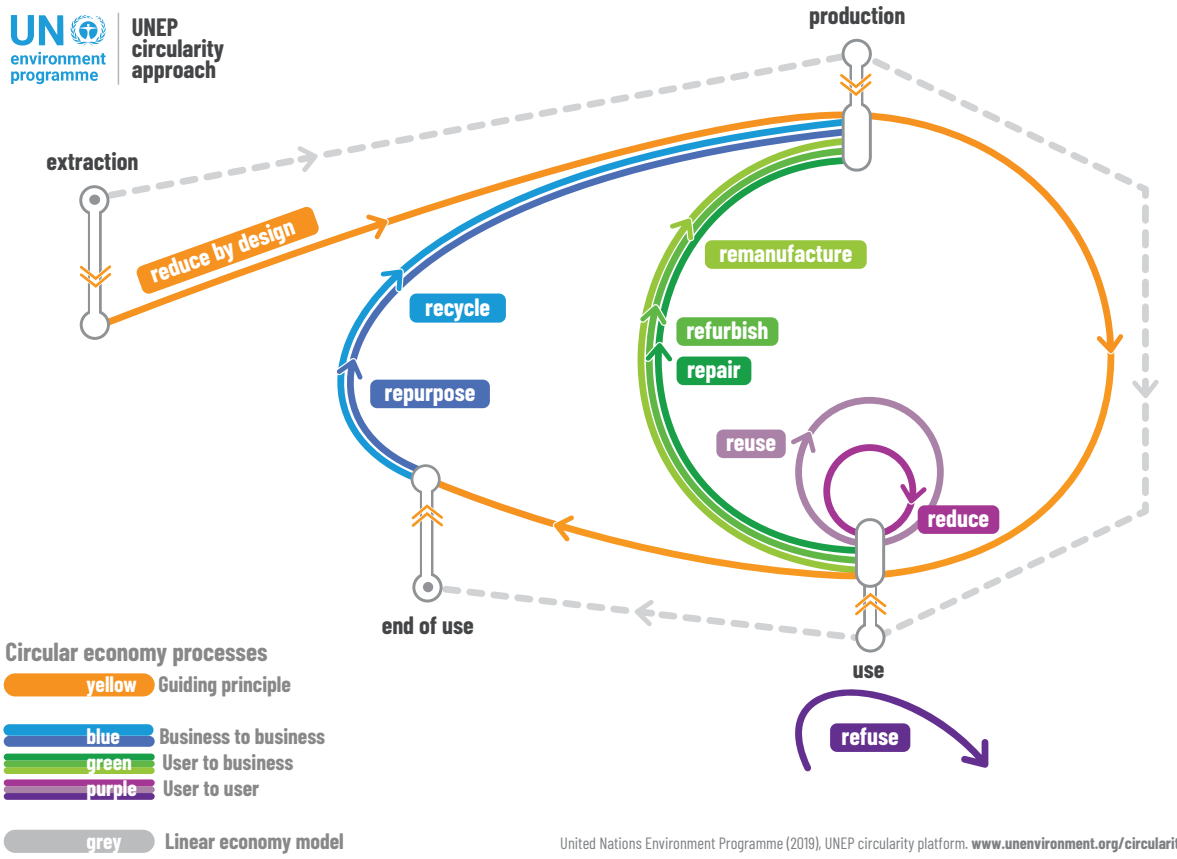
1 Ellen Macarthur Foundation (2013), Towards a Circular Economy: the economic and business rationale for an accelerated transition.
2 UNEP (2019), UNEP Circularity Platform, www.unep.org/circularity

chain. Such solutions can ensure, for example, that toxic chemicals are kept out of or easily separated from recycling streams and the workers managing them.

Circularity is built on the overall guiding principle of ''Reduce by design''. Applied from the earliest stages of design of products and services, "Reduce by design" aims to reduce the amount of material, particularly raw material consumed during production and/or during use. Circularity builds upon value retention loops, as follows:

- ''User-to-user'' value retention processes, where a product or component remains close to its user and function [Refuse, Reduce and Re-use]
- ''User-to-business'' value retention processes, where a product or component is upgraded and producers involved again [Repair, Refurbish and Remanufacture]
- ''Business-to-business'' value retention processes, where a product or component loses its original function [Repurpose and Recycle]

Figure[3]: Visualization of the UNEP circularity approach



United Nations Environment Programme (2019), UNEP circularity platform. **www.unenvironment.org/circularity**

The current COVID-19 pandemic shows how vulnerable and inefficient economic systems and the value chains on which they are built are, especially when serving a take-make-waste economic approach. Economic resilience in a rapidly changing world will require less linear production and consumption systems, which also reduce resource depletion, pollution including greenhouse gas emissions and disruption of natural ecosystems. The International Labour Organization estimates 6 million jobs, globally, could be created by 2030 through circular models. Chatham House in its recent report 'Promoting a Just Transition to an Inclusive Circular Economy' stresses the need for well-designed public policies to achieve a transition to circular economies. While many governments have started to promote policies with circular economy aspects, there is a need for accurate information on the benefits of circular economy. This requires new analytical tools and more integrated policies which support the transition to a truly circular economy. This paper is UNDP and UNEP's contribution to providing this support, with a particular focus on how circular economy policies and measures can raise the ambition of countries' Nationally Determined Contributions to the Paris Agreement on climate change.

3 Source: United Nations Environment Programme (2019), UNEP Circularity Platform, www.unep.org/circularity

A Circular Economy approach to Nationally Determined Contributions (NDCs)

In order to achieve a 1.5°C world, a fundamental shift is needed in the way we deliver on societal needs and mitigate emissions

Progressively deeper cuts in greenhouse gas emissions are key to reaching the ambitious goal of the Paris Agreement to limit temperature increase to well below 2°C (aim of 1.5°C) and transition to a low carbon economy. These emissions are closely related to resource use, as the production of materials and goods make up the lion's share of global greenhouse gas emissions. According to the International Resource Panel, natural resource extraction and processing account for approximately 50 percent of the total greenhouse gas (GHG) emissions.[4] Reducing reliance on carbon-intensive materials of primary origin, and avoiding waste, are effective means to reduce greenhouse gas emissions. Each country will have a unique role to play as leading change agents for the circular transition.[5]

A footprint analysis combined with a systems approach can help countries create and apply an integrated set of sustainable development indicators

Mapping material and energy flows and their related impacts using a footprint approach and material flow analysis, and developing an understanding of how resource flows help meet societal needs, enables countries to identify new and enhanced circular mitigation opportunities. A footprint analysis can also help identify opportunities to reduce GHG emissions which cut across sectors and national borders[6] and facilitate international cooperation along global supply chains. In the buildings and construction sector, there are many examples ranging from the substitution of cement by fly ash to substitution of reinforced concrete with secondary or regenerative construction materials, to designing buildings as material banks to allow for reuse and recycling of building materials at the end of a building's lifetime. Besides direct reductions of GHG emissions through substitution, the use of regenerative materials can generate additional reductions from the growth phase or the reduction of waste.

Low-carbon and circular economy policies are complementary and reinforce each other

Material-use strategies are a central component of the circular economy and can help deliver the transformational change necessary to decarbonise our economies.[7] The share of material production in global greenhouse gas emissions increased from 15 percent to 23 percent during the period 1995-2015. Over half of the carbon footprints from material use are direct emissions from material production processes. Energy supply for the entire value chain accounted for 35 percent of emissions, mining for 2 percent, and other economic processes for 9 percent.

The most intensive materials in terms of GHG emissions were iron and steel (32 percent), cement, lime, and plaster (25 percent), rubber and plastics (13 percent) and other non-metallic minerals (13 percent).[8] Sustainable sourcing of materials, reuse, recycling and the efficient use of materials provide crucial additional means to support the ambitions of the Paris Agreement. Additionally, the circular economy is a unique opportunity for developing countries to redefine development and growth along a circular path, rather than a linear pathway. This way they can skip the catching-up phase and leapfrog into a postindustrial society.[9] Furthermore, a circular mitigation approach is one in which countries and cities[10] take responsibility for upstream emissions and look beyond their national borders,[11] which is yet another crucial part of a 1.5°C world.

4 IRP (2019). Global Resources Outlook 2019: Natural Resources for the Future We Want.
5 Circle Economy and Shifting Paradigms (2020), The circularity gap report 2020 - When circularity goes from bad to worse: The power of countries to change the game.
6 Stanley Foundation (2017), Looking Beyond Borders The Circular Economy Pathway for Pursuing 1.5° C.
7 Material Economics (2018), The Circular Economy - a Powerful Force for Climate Mitigation.
8 IRP (2019), Ibid.
9 UNDP (2017), Circular Economy Strategies for Lao PDR
10 Shifting Paradigms (2019), Circular economy opportunities in Almaty – A metabolic approach to define a resource efficient and low-carbon future for the city.
11 Stanley Foundation (2017), Looking Beyond Borders The Circular Economy Pathway for Pursuing 1.5° C.

Low-carbon circular policies should target environmental as well as socio-economic objectives to secure support from large parts of society

The transition to a circular economy requires the engagement of national, subnational and supranational jurisdictions and thematic institutions – social, economic, environmental. Policy options should target the direct sources of greenhouse gas emissions as well as the underlying causes and should aim to leverage demand side measures entailing changes in consumer choice, lifestyles and the opportunities offered by behavioural change.[12]

To give two examples, in the building sector a more intensive use can be achieved when individuals choose to live in smaller units in multifamily residences rather than single family homes, a change that is becoming increasingly popular in urban areas. Individuals can be encouraged to share homes and related residential facilities (e.g., co-housing) and to move to smaller residences when families downsize when their children move out. More intensive use may also be attractive when it is associated with urban lifestyles and easier access to job markets and public amenities. In the transport sector more intensive use of private transport takes the form of ride-sharing, car-pooling, using cars from shared fleets for individual rides, as well as using more need-appropriate vehicle sizes. For individual use, this would mean smaller vehicles, for shared use this would mean lean, comfortable cars optimized for their passenger number.

Behavioural change also has a role to play in the transition to a circular economy, and a transition to a just society in which there is a more equitable use of the world's natural resources and no one is left behind. Only then, can the transition to circular economy benefit all countries and all sectors of society. This also requires taking care of the work force of the incumbent linear industries and giving them a perspective in a circular future. This could be through favouring investment in less resource and pollution intensive enterprises which offer new employment opportunities and by providing training to accompany such a transition.

Circularity can be achieved while improving livelihoods and economies and create new business opportunities and crowd-in private investment into NDC implementation.

The circular economy is a major opportunity for economic competitiveness. In Europe alone, it can contribute as much as 1.8 trillion Euros to the economy by 2030.[13] The success of a transition to a low-carbon circular economy therefore requires careful integration within a country's 'Jobs, Growth and Competitiveness' agenda.[14]

How to Get Started?

A footprint assessment of the country's economy, looking at its flows, stocks, conversions, imports and exports of materials and products is the logical first step. From that point one can identify the hotspots of adverse domestic and international impact of the linear economy as a result of domestic consumption. The hotspots should guide priority setting in the national development agenda and in climate change mitigation and adaptation.

UNEP's **SCP Hotspots Analysis Tool (SCP-HAT)** is an online application with data on the environmental and socio-economic performance of 171 countries over the last 25 years. It allows countries to quickly identify and analyse hotspots at country and sector level and provides key country information in the context of most relevant policy questions.

12 Kris Hartleya, Ralf van Santen, Julian Kirchherr (2020), Policies for transitioning towards a circular economy: Expectations from the European Union (EU)
13 EMF (2015), Circular economy would increase European competitiveness and deliver better societal outcomes, new study reveals
14 Circle Economy (2020), Circular Jobs Initiative.

The SCP-HAT tool currently structures the economy in 26 sectors and product categories, and provides results for the whole national economy and for each of the 26 sectors with the following methodological principles:

1. **Framework** that combines national environmental and socio-economic data with trade information for the estimation of supply-wide environmental pressures and impacts (footprint approach).
2. **Domestic production ("territorial" approach"):** environmental pressures and impacts are allocated to the country where they physically occur, irrespective of where goods and services are finally consumed.
3. **Consumption footprint ("footprint approach"):** environmental pressures and impacts are allocated to the country where final consumers reside, irrespective of where those pressures and impacts physically occur.

Results of the tool are provided in visuals and tables and allow policy makers to quickly identify the key impact areas that require policy actions, and short and long-term strategies to reduce the environmental impacts. An upgraded version of the SCP-HAT is being developed for use by the end of 2020 to increase sectoral coverage, integrate new impact indicators (environmental and socio-economic), as well as to support more detailed analysis on GHG emissions. This version will also identify interlinkages between sectors, including to inform the design of NDCs and circular economy policies.

Circle Economy developed the interactive tool **'Circular City Scan'** that can be used in collaborative innovation processes between stakeholders working towards practical and scalable solutions in cities to accelerate the transition to a circular economy. The tool provides a guided approach to explore circular opportunities, based on socioeconomic data, material flows, and corresponding circular case studies. Ultimately, it will allow municipalities to make an informed selection of focus areas based on local statistical data and provide guidance for the design of circular opportunities that are most relevant in a specific context. This process of identifying and reviewing opportunities is called a Circle City Scan.

The results of the assessment are compiled in a visually powerful findings report that can be easily shared with stakeholders. UNEP, **Circle Economy** and **ICLEI** are collaborating on a methodology for circular jobs (creation of jobs linked to circular economy approaches in cities), building on the Circular City Scan and the UNEP urban metabolism work.

The results of the UNEP SCP hotspot analysis tool and Circle Economy's circular city scan can inform sectoral prioritization for NDC enhancement and can be fed into an enhanced NDC implementation plan. The results and visualizations will showcase sectors that are key to national development which cut across resource flows and sectors, and geographic regions and environmental concerns. The enhanced NDCs can be tailored to immediate business interests in the country. Through engaging the private sector, coalitions of stakeholders can be developed for each strategy and be supported with trainings on: (i) an enabling policy framework; and (ii) circular business models. Based on enhanced NDC implementation strategies, technical and financial support needs will then be identified.

Enhanced NDCs have the potential to help countries decouple economic growth from resource use and make material use regenerative, rather than depletive. This will be done by proposing approaches which reduce the input of virgin materials, improve the use of existing assets and reduce the output of harmful waste. Some countries have incorporated the circularity perspective into their revised NDCs. Chile's NDC submitted on 9 April 2020 includes measures on circular economy, highlighting synergies of the material recovery and reuse with climate mitigation and adaptation. Other NDCs that have been recently revised also touch upon measures concerning circular economy in their NDCs: the Marshall Islands' NDC includes recycling and reuse in the waste sector targets, while Surinam's NDC highlights recycling of waste and reuse of road material for urban planning.[15]

15 Data on NDCs can be found in the UNFCCC's NDC Registry.

Key Sectors for NDC Enhancement and Low-Carbon Development

The International Resource Panel has identified significant opportunities to decouple economic growth from resource use.[16] The objectives are to achieve transformational change that will contribute directly to the goals of the Paris Agreement, help reduce GHG emissions while encouraging sustainable economic development that supports the achievement of Agenda 2030. Building synergies between the Paris Agreement and Agenda 2030 means decoupling GHG emission increases from economic growth by making material use regenerative, rather than depletive. Concrete opportunities for a low-carbon and sustainable economic development can be identified in key sectors of developing countries. The following entry points are high on the development agenda of all countries and provide a substantive basis for climate actions: the buildings sector, the industry sector, including a number of value chains such as plastics, textiles and electronics, the tourism and food and land use sectors and a geographic focus of cities. The following sections highlight the key hotspots in the different sectors and value chains which can trigger the most significant enhancement of NDCs through circular economy and resource efficiency.

The Building Sector

Relevant for all developing countries with growing economies and growing urbanization is the buildings sector. It is responsible for almost 40 percent of energy related greenhouse gas emissions, 11 percent of which related to 'embodied carbon', the sector presents significant opportunities to reduce emissions.

Findings from the International Resource Panel (IRP)[17] show that material efficiency strategies, including the utilization of recycled material instead of virgin construction material could reduce GHG emissions in the material cycle by 80 percent to 100 percent (China) and by 50 percent to 70 percent (India) in 2050, respectively.

In G7 countries, **Long-Term Strategies** that provide guidance for near- and medium-term climate action planning and formulation of NDCs could result in cumulative savings between 2016-2050 of five to seven Gt CO2e and show significant potential are:

i. more intensive use of buildings (up to 70 percent GHG reduction in 2050),

ii. construction with less material (8 percent to 10 percent reduction in 2050),

iii. sustainably harvested timber (1 percent 8 percent GHG reduction in 2050)

iv. improved recycling of construction material (14 percent to 18 percent GHG reduction in 2050).

Linked with increased energy efficiency measures the overall emission reductions from the construction, operations, and dismantling of homes can be 35 percent to 40 percent in 2050 in the G7 countries. These savings could be up to 50 percent to 70 percent in China and India.

The Industry Sector

The adoption of value retention processes (or models) for capital equipment and consumer goods is essential for the decarbonization of the industrial sector. This involves remanufacturing, (comprehensive) refurbishment, repair and direct reuse and recycling, and the design of equipment and goods to enable the highest efficiency in value retention to provide a holistic approach to rethink value chains, beyond a focus on recycling alone. Closing the loop at product or component level, rather than only at the level of individual materials enables efficiency gains in both material and energy use, avoiding both emissions and waste.[18] Remanufacturing and comprehensive product refurbishment can reduce GHG emissions by 79 percent to 99 percent, depending on the sector. Value retention processes (VRP) can reduce primary material demand by 80 percent to 99 percent. VRP can decouple economic growth from environmental depletion. As it requires

16 IRP (2019), Ibid.

17 IRP (2020). Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future. Hertwich, E., Lifset, R., Pauliuk, S., Heeren, N. A report of the International Resource Panel. United Nations Environment Programme, Nairobi, Kenya.

18 IRP (2018). Redefining Value – The Manufacturing Revolution. Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy. Nabil Nasr, Jennifer Russell, Stefan Bringezu, Stefanie Hellweg, Brian Hilton, Cory Kreiss, and Nadia von Gries. A Report of the International Resource Panel. United Nations Environment Programme, Nairobi, Kenya.

skilled labour it aligns well with the creation of more skills, and can therefore prioritize the development of human capital over the use of natural resources. Remanufacturing can increase skilled labour hours by up to 120 percent.

Product lifetime extension is yet another strategy to reduce resource use and waste. The lifetime of projects can be extended by increasing durability, predictive maintenance, allowing for upgrading, repair, refurbishing, remanufacturing and recontextualization of products. On the other hand, there are barriers to the adoption of business models which aim to extend product lifetime. Examples are: irregular demand from consumers and variations in their preference for new products; regulation and documentation issues; lack of reverse logistics and remanufacturing infrastructure; and lack of legal or tax incentives.[19]

The plastics value chain

As a major economic actor, the **plastic industry** corresponds to about three percent of the global economy, with estimated revenue of about 1,722 billion Euros in 2015.[20] However, its current linear economic model of 'take, make, use, and dispose' has significant impacts on natural resource depletion, environmental degradation, human health as well as climate change. Producing plastics using fossil fuels is a significant source of greenhouse gas emissions, as is the open burning and incineration of plastic wastes. Greenhouse gas emissions from plastics were estimated to be 390 million tonnes of CO2 in 2012.[21] In 2015, about 388 million tonnes of plastics were produced with 99.5 percent being from petro-based sources.[22] If current trends continue, by 2050 the plastic industry could account for 20 percent of the world's total oil consumption.[23]

Key processes needed for a transition towards a circular economy for plastics will contribute to reducing the greenhouse gas emissions from the sector. These include:

- **Design which can play an important role in promoting circularity.** If 'refill' bottle designs and models were to be applied to all bottles in beauty and personal care, as well as home cleaning, packaging and transport savings would represent an 80 percent to 85 percent reduction in GHG emissions compared to today's traditional single-use bottles.[24] Incentivising the use of reusable shopping bags instead of single-use plastic bags also has significant potential savings of GHG emissions, as long as the durable bags are reused enough times[25]. Product design and business models that enable better reuse, repair, refurbishment and recycling will greatly reduce the impacts on climate and resource depletion from consuming more materials and energy for production and consumption.

- **Material substitution, which refers to the use of renewable, low carbon, or secondary materials as alternative inputs to new production, can provide the same function but contribute to lower emissions.** For example, some bio-based plastics have been shown to have a negative emissions potential with minus 2.2 kg CO2e per kg of bio-based polyethylene (PE) produced, compared to a positive 1.8 kg CO2e per kg of fossil-based PE produced.[26]

- **Recycling which can help reduce GHG emissions from avoiding new virgin material production and end-of-life treatment, such as incineration and landfill.** While measures that increase product utilisation and extend a product's lifetime contribute the most to retaining the embodied energy within products, recycling activities which consume energy, still require much less energy input than the production of virgin materials. Increasing recycling rates require improving recyclability, collection, and sorting processes, as well as reducing contamination of recycling streams and exploring the potential of upcycling to virgin-quality. It is estimated that recycling 1 tonne of plastics could reduce emissions by 1.1–3.0 tonnes of CO2e compared to producing the same tonne of plastics from virgin fossil feedstock.[27] Recycling all global plastic waste could provide an annual energy saving equivalent to 3.5 billion barrels of oil per year.[28]

19 [footnote: The Long View report]
20 UNEP (2018), Mapping of global plastics value chain and plastics losses to the environment.
21 Barra et al. 2018. Plastics and the circular economy. Scientific and Technical Advisory Panel to the Global Environment Facility. Washington, DC.
22 UNEP (2018), Mapping of global plastics value chain and plastics losses to the environment.
23 Ellen MacArthur Foundation (2016), The New Plastics Economy: Rethinking the future of plastics.
24 Ellen MacArthur Foundation (2017), The new plastics economy: catalysing action.
25 UNEP (2020). Single-use plastic bags and their alternatives Recommendations from Life Cycle Assessments.
26 Ellen MacArthur Foundation (2019), Completing the Picture: How the Circular Economy Tackles Climate Change
27 Ellen MacArthur Foundation (2016), The new plastics economy: rethinking the future of plastics
28 Rahimi, A and García, J.M. 2017. Chemical recycling of waste plastics for new materials production, Nat. Chem. Rev. 1, doi:10.1038/s41570-017-0046.

The textile value chain

The **textile industry** is one of global importance, providing high levels of employment, foreign exchange revenue and products essential to human welfare. However, it is also an industry with high resource use and impacts detrimental to human health and the environment. The current linear system is characterized by sharply increasing consumption, driven by low prices and short use cycles, coupled with very low reuse and recycling rates. The impact of the industry on climate change is notable, with the global apparel and footwear industries accounting for an estimated 8 percent of the word's greenhouse gas emissions, emitting 3.3 billion metric tons of greenhouse gases along the value chain per year. Of particular concern is that the climate impact is set to increase 49 percent by 2030 if current trends continue.[29]

When analyzing the climate impacts of global apparel (clothing) across the value chain, the following picture emerges:

- The highest impacts (36 percent) occur in the wet processing steps of dyeing and finishing, which are especially energy intensive as large volumes of water need to be heated and thus cause emissions of GHG from burning fossil fuels (particularly coal). Asian countries, particularly China, India and Bangladesh, all have high shares of the various global textile manufacturing stages, and all rely heavily on fossil fuels for energy generation.
- This is followed by the use phase (24 percent), due to the electricity used in washing and drying the garment, which - as for the production phase - varies widely depending on the electricity mix of each country. In addition GHG emissions are determined by the income level of the consumer, climate of the country and consumer behaviour.
- Fibre production has the third-highest contribution (12 percent) to climate impact, arising primarily from the production of synthetic fibres, which make up close to two thirds of the total fibres used in global apparel and are produced from fossil fuels, mainly crude oil. They thus have high non-renewable resource use and climate emissions, arising from extracting fossil fuels and producing the ethylene and other chemicals from which polyester is made.[30]

Changing the current linear system for designing, producing and consuming textiles to a more circular one thus holds the potential for substantial CO2 emission reductions. Action can be taken to:

- **Extend the useful life and closed-loop recycling of textiles** (with fewer textiles being made, less hazardous chemicals and less energy will be used, resulting in less water pollution and fewer harmful gases being emitted). The current underutilization of clothes also comes at an economic value – with an estimated $460 billion cost to consumers per year for throwing out clothing that they could continue to wear[31];
- **Changing laundry practices**, improving process efficiency and favoring clean energy sources;
- **Supporting innovation** for producing synthetic fibres from secondary materials; and
- **Decreasing the use of water** in the wet processing.

For those actions to materialize at a more significant scale stronger regulatory policies are required which will in turn drive and accelerate collaboration and financing. This will enable industry-wide participation and trigger the changes in consumption habits needed for the predominant business model to also change.

The electronics value chain

The **electronics sector** covers a wide range of products from household appliances, cooling and freezing equipment, lamps to TVs and monitors, consumer goods and IT products. Production and consumption of these products has an intensive use of resources and energy. Each product in these categories has a different lifetime profile, which means that each category has different material composition, waste quantities, economic values, as well as potential environmental and health impacts, if recycled inappropriately. Consequently, the repair, refurbishment, collection and logistical processes and recycling technology differ for each category, in the same way as the consumers' attitudes and behaviors when disposing of e-waste also varies a lot across different countries and cultures.

29 Quantis (2018). Measuring Fashion: Environmental Impact of the Global Apparel and Footwear Industries Study; Ellen MacArthur Foundation (2017). A New Textiles Economy: Redesigning Fashion's Future.
30 Unep (forthcoming). Sustainability and Circularity in the Textile Value Chain. Global Stocktaking.
31 Ellen MacArthur Foundation (2017). A New Textiles Economy: Redesigning Fashion's Future.

Increasing levels of electronic consumption and production lead to proliferation of e-waste. Most e-waste is handled by improper and unsafe treatment and disposal through open burning or in dumpsites, and it poses significant risks to the environment and human health. In 2016, it is estimated that 44.7 million tonnes of e-waste were generated globally. The resource recovery potential for embedded secondary raw materials is worth 55 billion Euros comprising base metals, precious metals and plastics. In the meantime, this amount of e-waste also contains at least: 2,200 kilo tonnes of hazardous metals (mercury, cadmium, chromium, lead and lead glass), 300 kilo tonnes of batteries, and 4.4 kilo tonnes of chemicals (BFR, hexavalent chromium, ozone depleting substances)[32].

There is a big potential to reduce the climate impacts and pollution for the electronics sector through a circular economy approach by:

- **Promoting reuse, lifetime extension and recycling in the electronics sector** which will reduce the consumption and production of new materials or products, thus resulting in less pollution and climate impacts.
- **Reducing the hazardous and climate-related chemicals in electronic products** which will lead to less impacts to the climate and human health.
- **Establishing better collection and recycling through take-back systems and Extended Producer Responsibility schemes** which will ensure that climate-friendly solutions are supported financially by private sector actions and public policies.

Circular Cities

A third critical area with a high potential for sustainable and low-carbon development are circular cities. The IRP 2018 Weight of Cities report[33] mentions that cities' populations will grow to 66 percent of the global population by 2050. In particular, this growth will be seen in the Global South, especially in Asia and Africa, where projected increases in resource requirements of 90 billion tonnes by 2050 far exceed what the planet can provide sustainably.

Sustainable development requires a new approach to urbanization. There is significant potential to reduce resources in transport, the heating and cooling of buildings - which reduce emissions by 54 percent - energy use and metals, and land and water use. Integrated approaches to urban planning and design and integration across key sectors, particularly the 'transition trilogy' of transport, buildings and energy are highlighted in the "Guidelines for Integrated Approaches at Neighbourhood Level", issued by UNEP to guide implementation of the findings of the Weight of Cities report. Cumulative benefits from such integrated approaches, can achieve GHG and resource use reductions in the order of 35 percent to 54 percent at city level.

A shift to circularity will require a change in the way resources are managed in the metabolism of a city. We already see a shift starting to happen in cities in the Global North such as Amsterdam and Glasgow; where innovative business models offer services rather than the selling products. A range of approaches to resource efficiency and circularity are promoted including industrial symbiosis, re-economy through reduce, reuse and recycle and defining the new approach to sustainable urban development.

Tourism

The **tourism sector** has increased its contribution to global GHG emissions and its energy use as a result of the associated rapid growth in international and domestic travel. The growing trend of travelling further distances over shorter periods of time, and the preference for energy-intensive transportation modes, accommodation, and activities has driven the rise in emissions from this sector. Tourism now accounts for 4.5 GtCO2-eq per year and is widely considered to be one of the fastest growing economic sectors (UNWTO 2017). UNWTO estimates that there will be 1.8 billion international tourist arrivals in 2030. Growth in arrivals is expected to lead to a significant increase in emissions from the sector. A business-as-usual scenario that examined tourism emission trajectories projected a 169 percent increase between 2010-2050 (Gössling and

32 Baldé, C.P., Forti V., Gray, V., Kuehr, R., Stegmann,P. : The Global E-waste Monitor – 2017, United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association(ISWA), Bonn/Geneva/Vienna.

33 IRP (2018). The Weight of Cities: Resource Requirements of Future Urbanization. Swilling, M., Hajer, M., Baynes, T., Bergesen, J., Labbé, F., Musango, J.K., Ramaswami, A., Robinson, B., Salat, S., Suh, S., Currie, P., Fang, A., Hanson, A. Kruit, K., Reiner, M., Smit, S., Tabory, S. A Report by the International Resource Panel. United Nations Environment Programme, Nairobi, Kenya.

Peeters 2015), indicating a widening gap between necessary emission reductions and observed trajectories. According to UNWTO/ITF latest research, in 2016, transport-related emissions from tourism contributed to 5 percent of all man-made emissions and are projected to increase to 5.3 percent by 2030 against a current ambition scenario. The projected increase represents 25 percent growth, from 1,597 million tonnes of transport-related CO2 attributable to tourism in 2016 to 1,998 million tonnes in 2030. A recent study (Becken' et al, 2020) on tourism and climate change policies highlights that tourism is mainly perceived as a vulnerable sector that requires adaptation. However, policies that address the tourism's carbon intensity are less common, despite the sector's carbon footprint. Gaps in current NDCs and National Adaptation Plans (NAPs) of countries dependent on tourism are also evident in relation to policy objectives targeted at tourism, and indicators that measure progress.

The tourism sector is rarely identified in the GHG emission inventories and long-term low carbon development strategies developed by countries, as they usually follow the sectors defined by the IPCC. The tourism industry is cross-sectoral by nature, hence its relevance and potential contribution to addressing climate change, recognizing its dependencies/interactions with other sectors defined by the Intergovernmental Panel on Climate Change (IPCC).

A circular/value chain approach to the sector allows for the identification and assessment of these interdependencies, to develop holistic responses that enable action within the sector and that can drive action across the sectors on which it is reliant. For example, a major GHG footprint of the tourism industry, specifically accommodation, is related to food production, distribution, and disposal (i.e. IPCC sectors: Agriculture, Land-use change & Forestry, Energy, and Waste). UNEP, through its project **'Transforming Tourism Value Chains'** has developed **Roadmaps for Low Carbon and Resource Efficient Tourism**, where systemic interventions are proposed to promote sectoral leadership and increased collaboration across the broader economy. The potential for these approaches is increasingly relevant in countries where the tourism sector is a driving force of the economy.

Agriculture and Food

The food sector is the dominant user of our natural resources, responsible for 60 percent of global terrestrial biodiversity loss, 33 percent of degraded soils, and the overexploitation of 20% percent of the world's aquifers. According to the latest IPCC Land Use Report, while Agriculture, Forestry and other Land Use (AFOLU) account for 23 percent of global GHG emissions today, if we take the whole food system into account (this means, from pre to post-production activities, including consumption), GHG emissions can represent up to 37 percent. Livestock production represents 80 percent of agriculture's GHG emissions. Between 2010-2016, global food loss and waste generated eight to ten percent of total GHG emissions, and cost about $1 trillion per year. At the same time, the estimated impact of unhealthy diets (including obesity, malnutrition, and undernutrition) on the global economy could be as high as $3.5 trillion per year, or $500 per individual.

Opportunities for building circularity in food systems and reducing GHG emissions include:

- **Sustainable agriculture practices**, with more efficient use of natural resources, food and crops diversification for increasing resilience, and closing nutrient loops as far as possible. Within sustainable agriculture practices, climate smart agriculture is an example of an integrated approach to managing landscapes - cropland, livestock, forests and fisheries - that addresses the interlinked challenges of food security and climate change.
- **Promoting urban-rural linkages and urban/peri-urban farming**, strengthening connections between farmers and consumers, and empowering urban communities to grow some of their own food, with a focus on schools and children.
- **Reducing food loss and waste as far as possible**, and increasing the use of food by-products, cosmetically imperfect produce. Food loss and waste can also be directed into the bio-economy as inputs for new products for consumption or other uses, such as compost or for energy generation, according to the waste hierarchy.
- **Designing food systems that make healthy, sustainable foods widely accessible**, and supporting behaviour change interventions that promote the uptake of healthy, sustainable diets and food waste reducing practices.

A sustainable, low-carbon future will also require a transformation of the world's **food and land use systems**. The Global Consultation Report of the Food and Land Use Coalition, 2020[34] lays out how a transformation of food and land use systems can contribute directly to the achievement of the Paris Agreement. Beyond this such a change can safeguard biological diversity, improve human diets and food security and provide socio-economic benefits for rural communities.

The Food and Land Use Coalition proposes a 10-points reform agenda that will address new consumption patterns, new production systems, improved consumer choices and more regenerative techniques for food production. This will require appropriate policies to protect natural capital and transparent and fair wages for everyone involved in the food production value chains.

Demand side policies and actions for NDC Enhancement and Low-Carbon Development through Circularity

Promoting circularity and resource efficiency requires actions at different stages of the value chain with the objective of keeping resources as long as possible in the economy and reducing pollution, including GHG emissions. Addressing key hotspots in sectors and value chains can provide a strategic entry point for interventions at the production stages. It is however important to couple these with interventions at the consumption and use stages of the system, thereby ensuring the highest combined impact. This section will address four policy actions on the demand side, as well as for public – private collaboration to enhance climate benefits:

1. **The inclusion of circularity requirements in public procurement decisions,** as an opportunity to create and upscale the market for circular products and services (section 5.1);
2. **Promoting consumers awareness and information about climate change and other environmental issues,** including through labelling, to orient public and private consumers decisions (section 5.2);
3. **Developing incentives for secondary materials** to be safely returned into the economy and used for new products (section 5.3); and
4. **Strengthening public-private partnerships in building circularity** in our economies through extended producers' responsibility schemes (section 5.4).

Advancing climate objectives and improving resource efficiency by leveraging sustainable and circular procurement practices

The UN Sustainable Development Goals (SDGs) have reiterated the strong link between environmental protection, sustainable development and public procurement. More specifically, circular procurement focuses on closing energy and material loops within supply chains and helps value retention along the entire value chains, i.e. by remanufacturing and reusing products and components several times in a circular manner without causing additional harmful impacts. As such, **circular procurement advances the SDGs** as it contributes to the enabling conditions of a system which creates value and social well-being while maintaining resources at their highest possible value in the whole lifecycle, ultimately creating an economy which is regenerative. **The combination of public and private sector action for circular products and services** can help scale the market for these products and services. As part of its work on sustainable consumption and production, and continuous engagement with building circularity into our economies, UNEP has published **Building circularity into our economies through sustainable procurement**[35]. This report illustrates how the adoption of new business models based on innovative and resource-efficient solutions can contribute to advancing climate targets and SDGs.

34 The Global Consultation Report of the Food and Land Use Coalition September (2019), The Food and Land Use Coalition
35 United Nations Environment Programme (2019) Building circularity into our economies through sustainable procurement. Available at: https://www.unenvironment.org/resources/report/building-circularity-our-economies-through-sustainable-procurement

For example, the case study ''*Selling light as a Service"* (Philipps) demonstrates how the company Bruynzeel reduced its carbon footprint by 231 tonnes of CO2 using the procurement solution called 'product-service systems'. This innovative approach consists of switching from buying physical products to a mix of products and services to meet a specific demand. The adoption of circular procurement criteria in tenders' specifications can also help achieving CO2 emission reductions. For example, the choices of materials or the optimization of a products lifetime can help create less resource-intensive solutions, leading to greater carbon benefits when compared with standard practices. A case study on infrastructure work conducted in the Netherlands highlights that nearly 9,000 tonnes of CO2 will be saved during a 50 year lifetime of the infrastructure, thanks to its design and the selected road surfacing materials that extended the standard expected product's lifetime.

Looking more specifically into the tourism sector, UNEP has also produced its 2019 report **Transforming tourism through sustainable procurement**. This sets out a number of sustainable procurement good practices deployed by corporate buyers in the tourism industry, which aim at transforming the tourism value chain to low-carbon and resource-efficient operations. For example:

- **Embedding circularity in the procurement of linen and towels in France**, where Betterfly Tourism estimated that the production of unbleached bed linen enabled the reduction of GHG emissions by 32 percent during the lifecycle of bed linen;
- **Procurement of a biomass boiler to operate a green industrial laundry site in Dominican Republic**, outlines how the GHG emissions of the first green industrial laundry site, based on Cleaner Production, whose main energy source is steam generated by a biomass boiler, dropped from 6,455,025 Kg/ CO2to 1,075,838 Kg/ CO2;
- Food procurement case studies demonstrate that reducing import of produce by preferring and empowering local suppliers do help reduce subsequent GHG emissions (for example: **Virtual agricultural clearing house programme to facilitate local food procurement in Saint Lucia**)
- Plastic-related case studies (such **Phasing out single-use plastics in meetings & events operations**) also measure the contribution to the reduction of CO2emissions through the procurement of alternatives to single-use plastic items.

Consumer information to reduce GHG emissions and promote resource efficiency

One of UNEP's missions is to help accelerate the world's transition towards more sustainable consumption and production policies and practices by increasing the availability of reliable information to guide consumers' decision-making. The provision of trustworthy consumer information plays an important role in supporting the behavioural change of producers and consumers towards long-term sustainability, in the light of the 2030 Agenda and the SDGs. By helping companies to better inform consumers and therefore to enable them to take decisions in favour of the environment and society, a step closer can be taken to making the SDGs a reality. UNEP & ITC (2017) have developed ***Guidelines for Providing Product Sustainability Information*** that establishes principles that should be adhered to when communicating product sustainability information. When applying the Guidelines, it is important to incorporate life cycle thinking to consider sustainability impacts across the whole product life cycle.

Better sustainability information for a circular economy is particularly important for plastics as the current consumption, generation of waste and pollution are of increasing concern. The UNEP & Consumers International (2020) report, ***Can I recycle this?*** gives recommendations on how current standards, labels and claims can be improved to support a more circular economy for plastic packaging.

Ecolabels can be an effective instrument to improve the sustainability of production processes and communicate these improvements to the consumer. They too, should be based on life-cycle considerations. Establishing and mainstreaming ecolabels can therefore be a successful strategy for governments to enhance their NDCs, particularly when coupled with public procurement.

Increased consumer awareness and concern about climate change and other environmental issues has also led to the proliferation of various other consumer information tools. These can play a vital role in reducing greenhouse gas emissions or other environmental goals like reductions in resource use and waste. The

report ***Consumer Information Tools and Climate Change*** (UNEP, 2020) details how such tools can help reduce GHG emissions in the tourism, buildings and food sectors.

In addition, measures to extend the useful life of products have a role to play for the enhancement of NDCs. Through product lifetime extension, the rate at which natural resources are used and waste produced can be radically reduced, while the economic value embedded in our products is preserved as much as possible. Product lifetime extension strategies such as maintenance, upgrading, repair, refurbishment and remanufacturing make a compelling case towards circularity as it reduces resource use and waste, while preserving the economic value embedded in products. This is a win-win situation for the environment, the economy and the society.

Creating incentives for closed material loops

The concepts of resource efficiency and circularity respond to the need for closing material loops and shifting towards sustainable consumption and production patterns. Taking the plastics sector as an example, it is estimated that $80 billion to $120 billion in material value is lost to the economy annually through single-use plastic packaging alone, which underlines the opportunity for a circular plastic economy.[36] The opportunity for a circular economy for plastics is inherently cross-cutting as circularity requires collaboration of stakeholders across the value chain. It requires demand for sustainable products, design of products for reuse and recovery along with new business models, markets for recovered materials, and systems and technology for efficient collection and reprocessing.

A number of policies and instruments can provide incentives to improve resource efficiency and circularity in the plastic value chain, and thus contribute to enhancing NDCs. Governments have a role to play to require industry to take responsibility for their products after their use, and especially to move away from single-use products. Extended Producer Responsibility (EPR) requirements have been found to work well in certain markets, especially in promoting material recovery at end-of-life and in encouraging a return to durable packaging. Economic measures (taxes/levies) have been successful at moving consumers to reusable plastic bags when effectively implemented, and alternatives are available to consumers. Regulations in the form of bans are relevant for certain products, especially when alternatives (that have demonstrated to be the more sustainable choice by life cycle studies) exist and the plastic use is avoidable.

Achieving a circular plastic economy will require industry to expand the design for reuse and recyclability principles. On the product design side this means shifting from single-use to reuse models and moving towards product delivery systems that avoid difficult to recycle packaging formats. Going hand-in-hand with actions to increase recyclability is the need for actions to secure markets for recycled materials and to provide incentives to increase the use of secondary materials over primary plastics. Governments and industry need to work together to ensure a legislative environment that promotes recycled content in plastic products. Minimum recycled content standards and recycled content requirements as part of sustainable public procurement policies are potential measures.[37]

Partnering with private sector for circularity through Extender Producer Responsibility (EPR) schemes

Extended Producer Responsibility (EPR) has proven to be an effective instrument for the private sector to materialize resource efficiency and circularity gains through eco-design and take-back schemes for products in many countries. An effective EPR system is sustainable when sufficient incentive(s) are consistently available to producers of targeted products who take the responsibilities to take back and treat their end-of-life products and waste. Simultaneously they can invest in the eco-design of products and innovative business models to reduce the impacts on the environment.

Effective collection, reuse, recycling and treatment of products and quality materials will reduce the impacts of products through their life cycle. End-of-life (EoL) management has been the weakest link in the production responsibility chain. EoL is an important stage at which producer responsibility extends into

36 Ellen MacArthur Foundation. (2016). The New Plastics Economy: Rethinking the Future of Plastics. Cowes, UK: World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company.

37 United Nations Environment Programme (2019). Addressing marine plastics: A systemic approach - Recommendations for action. Notten, P. United Nations Environment Programme. Nairobi, Kenya.

existing EPR programmes. Producers should be responsible for taking back their products for collection and recycling while improving the repairability, reusability, and recyclability of the product itself. Municipalities and governments should create relevant policies to guide and incentivize the private sector to implement EPR system with a level playing field, and encourage consumers to return their products at the end of their life cycles.[38]

Specific Entry Points: Examples of Opportunities for Realizing Enhanced NDCs

Lao PDR Circular Economy Strategies

In **Lao PDR**[39], UNDP supported the government to develop strategies in key growth sectors. The predominant trend in Lao PDR is that economic growth is paralleled by a gradual decrease in resource efficiency. A metabolic assessment helped identify promising circular economy strategies which respond to the needs and expectations of society while reducing the inputs of raw materials. This improves the use of existing assets and reduces the output of harmful waste, including greenhouse gasses. The opportunities identified for low-carbon, sustainable development are summarized below:

Lao PDR as resource hub for recycling and remanufacturing

The assessment of the net outflow of materials implied that there is idle transport capacity in the reverse direction. The first identified circular economy opportunity is **reverse logistics of end-of life products** to stimulate the development of the Laotian recycling and remanufacturing industries. Key measures include:

- Extending the lifetime of motorcycles by recovering and remanufacturing end-of-life motorcycles/components.
- Using new technologies to process and sort end-of-life textiles and use these to substitute imported virgin fibres.
- Complementing fibre residues with organic fibres.
- Considering the use of bioleaching to extract metals from electronic waste/e-waste.
- Using idle inbound cargo transport capacity for reverse logistics for end-of life products.

Material substitution for sustainable construction: circular resorts to advance ecotourism

Vientiane is experiencing a construction boom. By substituting carbon intensive construction materials with bamboo and wood, it can safeguard a national architectural character while tapping into domestic rather than imported resources.

The second identified circular economy opportunity is **circular resorts**: By leveraging Vientiane's construction boom, a domestic market for cross laminated timber which is currently exported, can substitute cement imports while also maintaining a national character in urban and rural architecture.

Circular agriculture and hydropower: Algae farming

Hydropower reservoirs are often used for power generation only, but they can provide other goods and services which are made use of in many cases. For example, river water contains agricultural residues like fertilizer which can support algae farming which can provide a raw material for protein production or can serve as an organic fertilizer, while improving water quality. However, such additional uses of reservoirs need to be carefully managed to avoid impacts such as excessive algal blooms which negatively impacts fish stocks, wildlife and water quality.

The third identified circular economy opportunity is **circular agriculture and hydropower**: The production of algae in hydropower reservoirs, which are over-fertilised due to agricultural runoff, can offer new income generating activities. However, the most economically and environmentally rational response will often still be to reduce fertilizer use in agriculture, and/or apply better agricultural management practices.

38 ITU (2018), Extended producer responsibility – Guidelines for sustainable e-waste management.
39 UNDP (2017): Circular Economy Strategies for Lao PDR

Kazakhstan Circular Economy Strategies

In **Kazakhstan**[40], GIZ implemented a resource efficiency project that helped to develop circular economy strategies for the City of Almaty in 2019, funded by the Emerging Market Sustainability Dialogues (EMSD)'s Challenge Fund.

The opportunities identified through a comprehensive metabolic assessment of the City of Almaty are summarized below:

The first identified circular economy opportunity is in the agriculture and food sector
Here, the focus was on composting, certifying organic production and access to new markets as well as land-sharing and urban farming schemes to interlink agricultural and urban areas for a more circular, local food economy. Key measures include:

- Clean organic residues from industries can be composted and used to regenerate the exhausted soils near Almaty.
- Support initiatives for certifying organic production and couple them with quality certification to provide access to new markets.
- Employ land-sharing and urban farming schemes to interlink agricultural and urban areas.

The second identified circular economy opportunity is in the construction sector
Passive design can lower the energy use of new buildings and modular design and urban mining can reduce resource use. Carbon intensive materials can also be substituted with wood-based industrial construction materials. Key measures include:

- Preserve the architectural heritage or spatial lay-out of the city.
- Use passive design to lower the energy use of new buildings and rely on modular design and urban mining to reduce resource use.
- Lower the carbon footprint of the construction sector by substituting carbon intensive materials with wood-based industrial construction materials.

The third identified circular economy is in the industry sector for re-design and repurposing of secondary products and materials.
Expanding the manufacturing industry will provide options to support the development of the agricultural sector by using agricultural residues to produce packaging. Key measures include:

- Use temporary, vacant space in the city for creative industries which re-design and repurpose secondary products and materials.
- Take advantage of the Belt and Road initiative to expand the manufacturing industry with remanufacturing. Service models can help retain ownership of goods produced and remanufactured.
- Use agricultural residues to produce packaging and support sustainable development of the agricultural sector by providing matchmaking services for industrial symbiosis.

Morocco Circular Approaches

In **Morocco** UNEP implemented a **project to assess and improve the environmental performance of hotels** and communicate this to consumers through a Life Cycle Assessment (LCA)-based environmental label. Ten pilot hotels were selected, and their environmental performance was assessed based on four criteria: (1) impact on climate change; (2) water consumption; (3) non-renewable resources consumption; and (4) percentage of certified organic products. The environmental impact was then communicated to consumers in the form of a label rating the hotel's performance on each criterion. As a result, savings in GHG emissions and water and energy consumption have been achieved. The project offers great potential for replication and shows how consumer information tools can initiate positive changes for low-carbon development and SCP-related actions for climate mitigation.

40 GIZ (2019): Circular Economy Opportunities in Almaty

In addition, UNEP and UNDP have collaborated in the development of the **Nationally Appropriate Mitigation Action** (NAMA) in the sector of Tourism in Morocco to "eliminate" emissions from the entire subsector of accommodation, which in 2015 represented 10% of emissions from Moroccan tourism. Implementing this NAMA will make a significant contribution to emission reductions, specifically considering the anticipated growth of the sector with another 200,000 beds to be added by 2030.

Business Innovations to Enhance Circular Economy

The private sector, comprising major enterprises as well as SMEs, is an important player in the transition towards a circular economy. Circularity based business models follow an approach which **incorporates sustainability throughout all business operations** based on life cycle thinking and in cooperation with partners across the value chain.

Common patterns within such business models can be classified in several different elements, following the UNEP Eco-innovation manual and the seven elements from the 3rd Global Circularity Gap Report[41].

Prioritize regenerative resources

Ensure renewable, reusable, non-toxic resources are utilised as materials and energy in an efficient way. In this strategy, **circular supplies** replace the linear (take-make-dispose) by circular approaches based on the consumption of **renewable, recyclable or biodegradable resource inputs** and/or employ **closed loop** approaches in the manufacturing processes. Circular supplies are especially relevant for companies dealing with **scarce commodities** and companies with major environmental impacts based on resource consumption.

Examples:

1. Ghana Bamboo Bikes is empowering people in rural areas with the technology they need to make durable and less carbon-intensive bikes, which can be modified, maintained and repaired locally, out of Ghana's abundant bamboo resources. Sustainability benefits include job creation, increased access to services through the use of bikes and time savings. Also, the use of bamboo means production waste can be used to manufacture charcoal briquettes to reduce indoor pollution.
2. China is playing a major role in the clean power transition globally with private sector investment of more than $758 billion in renewables. Over 2018, China's renewable energy capacity grew 12 percent across all renewable sources, reaching 728 GW installed capacity by the end of 2018, equal to 38 percent of total installed capacity[42]. Other examples of utilization of regenerative resources include biorefineries that use fermented biomass (agricultural residues, manure) to produce a variety of high value outputs such as fuels and chemicals for consumer goods.

Resource recovery

Business models employ new technologies and capabilities to **recover and reuse resource outputs through closed loop recycling, industrial symbiosis and upcycling**. Such models are especially relevant for companies that generate large quantities of **by-products** during their manufacturing processes and/or have access to products at their end-of-life for reprocessing and closing the loop.

Examples:

1. Diseclar in Colombia has developed a manufacturing process that turns non-degradable plastic waste and agro-industrial waste into furniture suitable for indoor and outdoor use. Sustainability benefits include reduced energy consumption, job creation, durable, high quality products for consumers and provision of waste management training at collection centres and awareness raising about recycling.

41 Circle Economy and Shifting Paradigms (2020), The circularity gap report 2020 - When circularity goes from bad to worse: The power of countries to change the game.

42 UN (2019). A decade of renewable energy investment, led by solar, tops USD 2.5 trillion. Press Release. UN Environment Program. Retrieved from: https://www. unenvironment.org/news-and-stories/press-release/ decade-renewable-energy-investment-led-solar-topsusd-25-trillion.

2. Accra, Ghana's capital is becoming the recycling and remanufacturing hub of West Africa. The Agbogbloshie scrapyard, for example, provides employment to an estimated 6,000 to 10,000 people working in the scrap trade, dismantling anything from toasters and irons, to aircraft and mining equipment. The Agbogbloshie Makerspace Platform (AMP) is supporting these recyclers to become designers and manufacturers and achieve higher value addition through their work.

Preserve and extend what's already made

Strategies and measures with these objectives include **product lifetime extension, remanufacturing, refurbishment, repairing, upgrading or re-marketing.** This business model is especially relevant for **capital-intensive Business to Business (B2B)** segments or **high-value Business to Consumer (B2C)** products.

Example:

1. Nudie Jeans launched a repair service which provides customers the opportunity to return well-worn jeans to the stores for repair, for free, as many times as they like. Additionally, Nudie Jeans can be exchanged for a 20 percent discount off the next pair, while returned pairs are either refurbished or recycled for special projects. Through this business model Nudie Jeans reduces waste, saves energy, and reduces the consumption of raw materials and water, while providing a long-lasting product.

Sharing platforms

Enabling the sharing of products and assets that would otherwise have a low ownership or use rate are especially relevant for companies that are looking to **maximize the use** of the products, enhance **productivity** and **value creation**.

Example:

1. Vigga.us in Denmark introduced a business model, where subscribing parents receive regular packages of children's clothing to replace items as they become too small. For a monthly fee, Vigga.us provides organic clothing in the child's correct size. This business model can reduce chemicals and water usage and provides sustainable kids' wear, which are produced under proper conditions, and offers a cost saving to the clients.

Product as a service

Business models create value by turning incentives for product durability and upgradability upside down, shifting them from volume to performance. Such models are especially relevant for companies that develop products with **high value, high Total Cost of Ownership** (TCO), and **hold expertise on product operation, maintenance and reuse**.

Example:

1. Through the company **SOIL**, based in Haiti, customers rent a household toilet for a monthly fee. SOIL sanitation workers collect toilet waste, which is treated and transformed into rich, organic, agricultural-grade compost through a carefully monitored process. SOIL's main sustainability benefits include safe management of human waste and safe sanitation (reducing health risks), while creating livelihood opportunities through selling of compost.

From coffee machines, beds, washing machines, laundry dryers and dishwashers, jeans and packaging, companies offer a range of products as a service for per unit of use and the subscription model can also include additional services such as the delivery of coffee beans. Furthermore, the manufacturer is incentivised to prioritise product lifetime extension to optimise return on assets, for example, by building appliances that last and can easily be maintained. In Sweden, for example, reduced tax on repair, maintenance and rebuilding of private dwellings aims to boost employment, whilst simultaneously shrinking the volume of undeclared work. [43] [44] [45] Lowering labour tax and increasing environmental taxation is a budget-neutral way to encourage circular design and repair, as well as to discourage disposal and consumption of single-use products. Studies show that such alignment of the tax regime with sustainable development ambitions pays off, according to economic models developed by the NGO Ex'tax.[46]

43 Deloitte (2019). International tax: Sweden highlights 2019. Retrieved from: https://www2.deloitte.com/ content/dam/Deloitte/global/Documents/Tax/dttl-taxswedenhighlights-2019.pdf.

44 Eurofund (2013). Tax deductions for domestic service work. Sweden. Retrieved from: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-swedenhighlights-2019.pdf

45 Guardian (2016). Waste not want not: Sweden to give tax breaks for repairs. Retrieved from: https://www.theguardian.com/world/2016/sep/19/ waste-not-want-not-sweden-tax-breaks-repairs

46 Ex'tax (n.d.). The Ex'tax Project. Turning tax into a force for good. Retrieved from: https://ex-tax.com/.

Multi-sided platforms

These platforms rely on having **at least two distinct customer segments** that provide a **mutual benefit** in some way, which would not exist without both parties.

Example:

1. MLouma is a platform, which connects farmers directly to green grocers throughout Senegal. By allowing farmers to market and sell their goods in real-time to hundreds of small grocers, both sides are able to achieve higher profits by cutting out the many intermediaries that exist in the conventional value chain. Additionally, fuel consumption decreases, farmers are no longer dependent on large intermediary companies and higher profits increase job security in smaller enterprises, in particular.

Design for the future

Accounting for the **systems perspective** during the design process, to use the right materials, to design for appropriate lifetime and to design for extended future use, represents a key circular opportunity.

Examples:

1. The CIRCO programme in the Netherlands targets specific industries or material flows with circular design classes. Government subsidies reduce the price by around 75 percent[47]. Such programmes have a regional focus to allow for synergies across industries, whilst targeting specifics such as bike manufacturing, horticulture, or organic fibres. Fairphone is an example of extending product lifetimes through circular design. The modular phone is comprised of individual parts that can easily be replaced by the user.

2. Companies like HWZ International[48] and XLAM are actively promoting Cross Laminated Timber as a strong structural product in South Africa, where timber-frame buildings are already commonplace in higher market segments[49]. Offsite construction allows for major efficiency improvements. Such methods of construction are already at 6 percent market share in China[50]. Other countries such as Tanzania and India, where Modulex[51] operates, can reduce construction time by up to 50 percent. Bandar Sunway, a township and entertainment area in Malaysia, that was formerly a tin-mine wasteland has received international recognition for its sustainable approach to construction and land restoration.[52] Initiatives to encourage the use of renewable materials in the bioeconomy can start bottom-up, as exemplified by Biomimicry South Africa, which promotes nature-inspired solutions through education.[53]

Collaborate to create joint value

Working together throughout the supply chain, internally within organisations and with the public sector to increase transparency and create joint value supports circularity. Such innovate collaborations are evolving with local craftspeople, municipal recycling collectors, and sustainable suppliers to deliver a “one-stop-shop” for upcycled goods (drop off, repair and remanufacture, sales) plus educational workshops and training[54]. Digital collaboration platforms[55] can increase household recycling rates. Users are rewarded with ‘points’ when they recycle, which can then be redeemed in participating businesses for discounts & rewards.

Regulate or disincentivize the production and use of products derived from non-renewable resources

Regulations have triggered innovative changes to the design, production, consumption and disposal of plastics, contributing to more resource efficient, sustainable use of resources. This reduces pollution and accelerates the transition to circularity in our economies.

Example:

1. Regulations on single-use plastics announced by the European Union and implemented by numerous developed and developing countries alike have helped to create joint action by retailers, waste managers, consumers and entrepreneurs to find and disseminate alternatives and adjust common behaviours.

47 Circo (n.d.). Creating business through circular design. Retrieved from: https://www.circonl.nl/english/.
48 Li, H. (2019). Cross-laminated Timber (CLT) in China: A State-of-the-Art. Journal of Bioresources and Bioproducts, 4(1), 22–30.
49 HWZ International (n.d.). HWZ International. Retrieved from: https://www.hwzinternationalsa.co.za/en/ competition/.
50 Eco Log Homes (n.d.). Eco Log Homes. Building a greener future. Retrieved from: http://ecologhomes.co.za/.
51 Bertram, N. et al. (2019). Modular construction: From projects to products. McKinsey & Company Report. Retrieved from: https://www.mckinsey.com/industries/ capital-projects-and-infrastructure/our-insights/ modular-construction-from-projects-to-products.
52 Modulex (n.d.). Modulex. Modern Method of Construction. Retrieved from: https://modulex.in/.
53 https://www.biomimicrysa.co.za/
54 ReTUNA: https://www.retuna.se/english/
55 Recycling Perks: https://recyclingperks.com/

The **business case** for circular business models can be summarized as being based on **five drivers**: (1) companies can access new and expanding markets; (2) increase profitability along the value chain; (3) stay ahead of standards and regulations; (4) increase productivity and technical capacity; and (5) also attract investors. There are benefits of working closely together with stakeholders along the value chain; to build awareness of challenges and risks, develop shared gains, and embark on joint problem solving. By being less dependent on specific market segments (by accessing new markets) and optimizing the business strategy (high productivity, minimal waste emergence, efficient use of resources, high employee engagement, enhanced technical capacity), those businesses which employ circular models can show higher **resilience**.

While the largest impact will be achieved through innovative policies, bottom up solutions promoted by businesses can inspire other private actors. Many companies around the world have already started to embrace opportunities described in these seven key elements and moved ahead with innovative circular solutions. Specific guidance on this subject can be found in UNEP's Eco-innovation Manual, and have been moved ahead by companies in various countries.[56]

Integration of resource efficiency and climate change mitigation actions in the context of the 2030 Agenda on Sustainable Development

The SDGs guide the 2030 Agenda for Sustainable Development. The objective of transitioning to a circular economy is reflected across a range of SDGs and in specific targets. Those SDGs include those on reducing poverty, improving food security, water quality, access to clean energy, economic growth, innovation, sustainable consumption and production, sustainable communities and climate action. Enhancing circularity contributes to mitigating climate change under SDG 13, and achieving national commitments under the Paris Agreement. In the Goal on energy the targets 7.2 and 7.3 on increasing the share of renewable energy and the rate of improvement of energy efficiency respectively both support the transition to a more circular and resource efficient economy.

Analyses have indicated that ten of the SDGs can only be achieved if consumption efficiencies for land, water, energy (fossil fuels and biofuels), can be increased[57]. Overall it can be shown that 49 of the 169 targets in the SDGs, located in a total of 13 Goals, are contingent upon the shift to sustainable consumption production patterns. While this is the stated objective of SDG 12, the references to enhancing resource efficiency and changing consumption and production practices in other sectoral goals underlines the fact that achieving a more resource efficient, sustainable and circular economy is a central and ubiquitous challenge addressed by the 2030 Agenda. This fact is illustrated briefly with reference to clusters of SDG targets that support the transition to a more circular and low carbon economy in the key sectors of food and agriculture, industry and infrastructure.

Targets 2.3 and 2.4 of the Goal on ending hunger and achieving food security are about increasing agricultural productivity and ensuring sustainable food systems. Both these targets are about enhancing resource efficiency and reducing environmental impacts, including GHG emissions, from agricultural production. Those targets in turn imply the need for more efficient use of water reflected in target 6.4 of the Goal on water, the achievement of which can increase the resilience of food systems and lower GHG emissions from them too. Enhanced energy efficiency, and alternative production methods which require less fossil fuel inputs and tend to increase soil carbon levels, are both objectives of sustainable food systems that contribute to target 7.3 in the Goal on energy and 13.2 in the climate Goal. Target 12.3 on halving food loss and waste by 2030 will make very substantial contributions to GHG emission reductions if achieved, while also enhancing the supply of available food to enhance food security and nutrition. Taking action to achieve

56 http://unep.ecoinnovation.org/wp-content/uploads/2017/07/UN_Environment_Eco%E2%80%94i_Manual-1.pdf
57 https://www.un.org/sustainabledevelopment/sustainable-consumption-production

all the foregoing targets also contributes to target 13.2 on integrating climate change measures into national policies, strategies and planning. Policies and actions for the foregoing targets also contribute to targets 15.1 and 15.3 on, respectively, sustainable use of terrestrial and freshwater ecosystems and restoring degraded land and soil. Both of those are targets which in turn offer climate change mitigation gains.

Target 1.5 on building the resilience of the poor in vulnerable situations and reducing their exposure to shocks including environmental ones, implies action for more efficient and cleaner industrial production and associated infrastructure. This objective is also reflected in the target 3.9 on air, soil and water pollution as well as 6.3 on improving water quality and increasing water recycling. As in the case of the food and agriculture sector, targets 7.2 and 7.3 on energy both contribute to circularity and lower GHG emissions in the industrial sector and will also be key elements in achieving sustainable industrialization as required by target 9.2. The upgrading and retrofitting of industries and infrastructure to make them more resource efficient and cleaner (less polluting), established as target 9.4, will also enhance more circular flows of resources and reduce GHG emissions. All the foregoing targets will contribute to targets 12.2 on sustainable management and efficient use of resources and 13.2 on integrating climate change measures into policies, strategies and planning.

Setting out these targets as clusters underlines the fact that enhancing resource efficiency and circularity represents a systemic approach to reducing GHG emissions as well as a range of other negative impacts on the environment and global prospects for human development. The specificity in the targets provides more guidance to policy makers on what is required and, in the case of these clusters of targets, shows important commonalities of purpose that can be reflected clearly not just in policies, but also in investments, business practices and consumer choice. While the SDGs themselves provide the “macro” framework for action, the real potential for integration of this agenda for action is to be found in the targets. It is proposed that when revising their NDCs countries look more deeply into their larger and more resource and carbon intensive economic sectors, to determine how they can seize these opportunities while also raising their ambition on implementing the Paris Agreement.

Conclusions and Recommendations

There is an urgent need for a more holistic approach and broad multi-stakeholder collaboration to create the integrated policies required for transition to a low carbon society. These policies must be designed holistically to include vulnerable communities and all segments of the population, which implies careful socio-economic planning in combination with environmental and resource efficiency policies. This paper shows how climate change mitigation objectives can be supported by the transition to a circular economy and provides an initial roadmap and some analytical tools and policies to enable governments to kick-start this transition.

Mapping material and energy flows and their related impacts in national economies enables countries to identify new and more integrated opportunities to reduce GHG emissions, across all economic sectors and extending beyond national borders too. More efficient use of natural resources, cleaner and more efficient production and processing of goods and better informed, more responsible consumer choice and lifestyles can together make an enormous additional contribution to GHG emission reduction. The policies required for low carbon development and circular economy essentially reinforce each other and make full use of the opportunities of GHG emission reductions in all sectors of an economy, including at sub-national levels. Integration of these policies also contributes to more sustainable livelihoods for producers, built on more efficient, safe and resilient value chains. Making this transition does imply re-skilling work forces and re-directing current public and private investments which also shape production processes and markets.

The Sustainable Consumption and Production Hotspots Analysis Tool (SCP-HAT) provides a desk-top analytical tool for countries to determine the resource and pollution intensive hotspots associated with their current production and consumption patterns. This enables countries to determine which sectors of their economy are the primary sources of GHG emissions and provides an initial indication of the potential for

their reduction. The SCP-HAT is being applied to guide revision of NDCs in approximately ten countries at this time, and the tool is also undergoing a revision to refine its analysis of GHG emissions by sector and to enable a more disaggregated assessment of reduction opportunities. The Circular City Scan is a similar tool to be applied at city level, which includes assessment of sectoral GHG emission reduction opportunities.

The following sectors are key to the economic development of all countries and provide substantive and extensive opportunities for climate change mitigation: the buildings sector, the industry sector, notably the sub-sectors of plastics, textiles and electronics, the tourism sector and the agriculture and food sector. There are also specific opportunities at the city level for the transition to a low carbon and circular economy which require actions at that level of governance, infrastructure and organization of value chains.

In the building sector use of alternative materials in construction, including recycled materials, more intensive use of buildings and enhanced energy efficiency can be combined to reduce GHG emissions from the sector by 50 percent to 80 percent. Value retention processes in the industry sector, including remanufacturing, refurbishment, repair and direct reuse can enable very high efficiency in value retention while providing a holistic approach to re-design value chains, and reducing GHG emissions by 79 percent to 99 percent, depending on the sector. Based on current growth trends the plastics sector could account for 20 percent of oil use by 2050, making this sector critically important for climate change mitigation. A combination of plastics design for reuse and recycling, material substitution and recycling can dramatically reduce emissions, with some bio-based alternatives creating opportunities to remove carbon from the atmosphere. While the textile industry is labour intensive and of critical economic importance for many countries, it entails high resource use and is set to increase its GHG emissions by nearly half by 2030 based on current trends and production models. However, re-design and recycling textiles, innovation in synthetic fibre production and changes in wet processing and laundry practice (during the use phase) can be combined to reduce this growth trend. Whereas it is estimated that in 2016 nearly 45 million tonnes of e-waste were generated globally, secondary raw materials in that waste is worth 55 billion Euros. Promoting reuse, recycling and lifetime extension of electronic products, together with reducing hazardous and climate related chemicals in these products all reduce the sector's contribution to GHG emissions.

Whereas GHG emissions related to air travel in the tourism sector will continue to rise, a circular, value chain approach within the sector enables important emission reductions to be achieved. This can happen through more efficient use of energy and water, and more local sourcing of food for tourists. Roadmaps for low carbon development and more resource efficiency can be developed at the destination level, enabling sectoral leadership for increased collaboration on GHG emission reduction across the broader local and national economy. On current estimates the food sector as a whole (production, processing and consumption) contributes approximately 37 percent of global GHG emissions. Policies and actions along the food value chain can substantially reduce these emissions. Such actions include, promoting sustainable agricultural production, promoting urban and peri-urban farming, reducing food loss and waste, designing food systems to deliver healthy and sustainable food and promoting behaviour change for more sustainable diets.

Cities represent an important geographical and jurisdictional location in which to enhance GHG emission reductions from a more resource efficient and circular local economy. This opportunity is growing steadily with the increasing urbanization of human populations around the world and is one that is further enhanced by the shorter value chains which can be created with more scope for creating circular material, resource and product flows. Integrated approaches to urban planning and design and linking key sectors by means of resource and energy flows, creates important opportunities for efficiency and circularity. Food value chains for urban consumers based on urban and peri-urban agricultural production also create substantial opportunities to create circular and sustainable food systems, with lower GHG emissions.

Demand side measures to enhance NDCs and increase GHG emission reductions generally deserve more attention from policy makers and enterprises seeking to lower their emissions. A range of policy actions as well as public – private partnerships can enhance climate benefits through the transition to a more resource efficient circular economy. Sustainable and circular public procurement focusing on closing energy and material loops within value chains supports value retention and scales up the market for resource efficient and climate friendly products. A growing range of circular procurement actions and policies in the energy,

tourism, industrial and food sectors offer substantial GHG emission reductions which can be replicated or scaled up. Provision of more accurate consumer information on sustainability aspects of products can support behavioural change of producers and consumers and increase demand for sustainable products in specific sectors, such as buildings, food and tourism.

Extended Producer Responsibility (EPR) requirements work well in certain markets, promoting material recovery at end-of-life and more sustainable packaging. Economic measures (taxes/levies) have moved consumers to purchase reusable plastic bags and regulations in the form of bans are relevant for certain products, especially where sustainable alternatives are available. These measures often need to be complemented by policies and incentives to create markets for recycled materials and increase the use of secondary materials over virgin materials. Extended Producer Responsibility (EPR) has incentivized the private sector to make resource efficiency and circularity gains through eco-design and take-back schemes for their products in various countries. End-of-life (EoL) management has often been the weakest link in efforts to establish sustainable value chains and EPR measures directly address this stage of product life cycles.

UNDP is supporting the Government of Lao PDR to develop circular and low carbon business opportunities and strategies through measures that can trigger transformational change in key economic sectors. The following three circular business opportunities have been identified to decouple the growth in economic activity of the country from GHG emissions and stop the current gradual decrease in resource efficiency.

1. Promote Lao PDR as resource hub for recycling and remanufacturing.
2. Promote circular resorts to advance ecotourism through material substitution for sustainable construction.
3. By linking the energy sector with circular agricultural opportunities, business opportunities can be created through the introduction of agricultural use of hydropower reservoirs.

The private sector has a key role to play in the transition towards a circular and low carbon economy. Private actors can accelerate this transition by developing and implementing circularity-based business models, incorporating sustainability throughout their operations based on life cycle approaches and cooperation with partners along the value chain. Consumption of renewable, recyclable or biodegradable resource inputs and/or employing closed loop approaches, product lifetime extension and sharing production platforms, can all be key elements of such models. Offering products as a service and developing multi-sided platforms with at least two customer segments to reduce the length of value chains can be key features of such circular business models. By working closely together with stakeholders along the value chain businesses can make more efficient use of resources, reduce GHG emissions while also enhancing the resilience of their value chain.

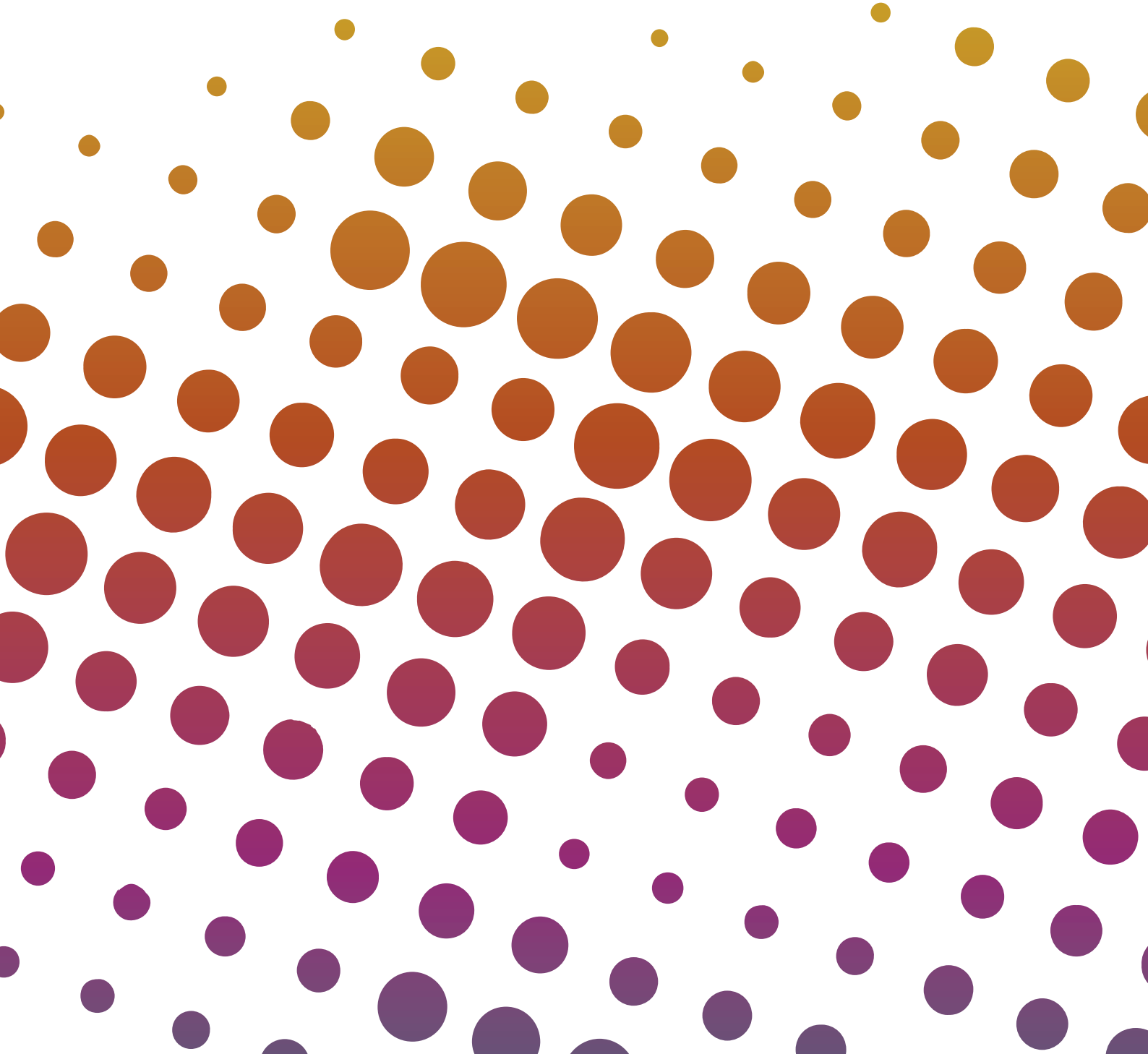
Eco-innovation is critical to establishing circular business models and requires a set of measures to be enacted by businesses and public authorities to support the development of such models. Those measures are: use of alternative, more sustainable materials in production; regulation or dis-incentivizing use of non-renewable resources; prioritizing the use of renewable and regenerative resources in production; providing support to scale up existing, innovative and circular businesses and value chains; using waste as a resource and production factor; fiscal and other forms of support for more circular business models; collaborating to create joined value; and incorporating digital technology for example to enhance the scale of collection of recyclable material.

Clusters of specific SDG targets drawn from a range of goals provide initial clear guidance for designing and integrating policies that substantially reduce GHG emissions by taking measures that enhance resource efficiency and circularity across national economies. This point is illustrated with reference to the food and agriculture, industry and infrastructure sectors, but is applicable to all the productive sectors of the global economy. It is recommended that national authorities undertake a more specific exploration of the opportunities for policy integration on this critical interface between natural resource use and climate change mitigation and consider how the most significant among them can be embedded in their revised NDCs.

In order to achieve low-carbon societies, integrated circular economy solutions are needed which require broad multi-stakeholder collaboration at national, regional and local levels. Furthermore, there is a key role for collaboration amongst international development partners. A strategic collaboration among these

partners will ensure that the best available and holistic solutions are offered to developing countries to support their transformational journeys towards a net zero carbon emissions by 2050. UNDP and UNEP are already supporting countries to identify, develop and implement circular economy solutions that involve public and private sector stakeholders. However, the urgent need for enhanced actions to achieve the ambitious Paris Agreement targets requires even more efforts from all stakeholders and development partners to provide developing countries with the support they need.

Under UNDP's Climate Promise, UNDP and UNEP are joining forces to offer support through a strategic partnership on circular economy to: (i) develop circular policies that leave no one behind; (ii) design circular economy business models that encourage innovation and engage systematically private sector actors; and (iii) facilitate access to finance to scale-up implementation of innovative solutions. These joint activities will support countries to enhance the ambition of their NDCs. Concrete entry points for the UNDP-UNEP collaboration on circular economy under UNDP's Climate Promise are outlined in this paper, which provides the basis for a wide roll-out of this collaboration across the Climate Promise countries over the coming months.



UNDP NDC Support Programme

United Nations Development Programme (UNDP)
304 E 45th Street, New York, NY 10017
www.ndcs.undp.org
@UNDPClimate

UNEP Economy Division

1 rue Miollis - Building VII
75015 Paris - France
www.unep.org

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