GGGI TECHNICAL REPORT NO. 15

The Promise of Green Growth: A Pathway to Prosperity while Achieving National and Global Ambitions

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ABOUT THIS REPORT

Achieving Global Green Transformation is a collection of GGGI flagship reports highlighting the economic foundations of green growth and key approaches for developing green growth policies and plans and for implementing and financing infrastructure within several key sectors.

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Abbreviations

BAU	business as usual
CBA	consumption-based accounting
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CRGE	Climate Resilient Green Economy (Ethiopia)
eCBA	extended cost-benefit analysis
GCF	Green Climate Fund
GGGI	Global Green Growth Institute
GHG	greenhouse gas
Gt	gigatons
IGBP	International Geosphere-Biosphere Programme
IPCC	Intergovernmental Panel on Climate Change
IWI	Inclusive Wealth Index
LT-LEDS	Long-Term Low Emission Development Strategy
MRV	measurement, reporting, and verification
NAP	National Adaptation Plan
NCE	New Climate Economy
NDC	Nationally Determined Contribution
OECD	Organisation for Economic Cooperation and Development
PPP	purchasing power parity
SDG	Sustainable Development Goal
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

Executive Summary

Catalyzing a global green transformation

This century will bear witness to a profound global transformation—and there are critical choices to make in determining what direction that transformation will take. Across the world, countries are starting to rethink their options for long-term prosperity, given rising concerns about the global environment, the need to sustain and protect their domestic environment and natural capital, and the desire to promote robust, inclusive social development. Recognizing that conventional, resource-intensive economic growth can undermine their resource base and social progress, countries are increasingly turning to green growth as their best option for long-term sustainability, social well-being, and economic prosperity.

Executive Summary

Global economic output is approaching a staggering USD 100 trillion per year.[1] Year on year, the world continues to see remarkable advances in science, medicine, engineering, technology, and global connectivity. Yet global economic growth and technological advances have not resulted in progress across the board. Even as 1.1 billion people have escaped extreme poverty since 1990, about 740 million people, 10% of the world population, still live on less than USD 1.90 per day (2011 PPP).[2] Environmental conditions are worsening across the world and have become severe in some cases. Global extinction is accelerating,[3] and the effects of the coming climate emergency are already evident. The last four years have been the hottest on record globally with stronger and more deadly heatwaves, wildfires, droughts, floods, and tropical cyclones, and accelerated melting of polar ice, glaciers, and permafrost.[4] Within this century, a growing number of global environmental risks affecting food, health, livelihoods, energy, and security will undermine the very viability of national economies and societies.

Many countries are already taking substantial action towards a green transformation—across their economies and industries, in cities and rural areas, and at the international level in adopting the 2030 Agenda's 17 Sustainable Development Goals (SDGs), the Paris Agreement on climate change, and other measures. But much more needs to be done. Through green growth, countries are now working towards a new, green transformation that can lead to a brighter, more prosperous, and sustainable future.

Embracing green growth

Green growth is the optimal choice for our future. It is no longer a new concept, and an increasing number of countries have been taking steps to adopt green growth as the primary—and essential—model of national development for the long-term.

The Global Green Growth Institute (GGGI) defines green growth as a development approach that delivers economic growth that is both environmentally sustainable and socially inclusive.[5] GGGI's definition emphasizes that economic growth is of central importance for development and reducing poverty, and that achieving environmental sustainability and social inclusion are equally important and necessary to ensure that economic development is sustainable over the long term.[6]

Underlying the concept of the green growth economy and the Green Growth Index,[7] green growth consists of four fundamental dimensions:

efficient and sustainable use of resources, including energy, water, land, and materials;

protection of natural capital and recognition of the limits of Earth system processes;[8]

green economic opportunities for investment, trade, employment, and innovation; and

inclusive growth which ensures access to basic services and resources, health and safety, social equality, and social protection.[9]

There is no better time to shift to a global green transformation than now, in 2020. The COVID-19 pandemic led to a historic global health crisis leaving a clear mark in the timeline of our generation and causing the greatest economic recession after the second world war. With more than USD 8 trillion injected in recovery packages for reseting the economies, this is the moment to accelerate the green transformation. Which sectors (green vs brown) receive economic stimulus and support from the COVID-19 recovery packages and how these funds are spent will determine to a large extent the future of our planet. Now is the time to build back better and cleaner.

[1] World Bank World Development Indicators (ID:NY.GDP.MKTP.CD; Accessed 2019), https://data.worldbank.org/indicator/ny.gdp.mktp.cd.

[2] World Bank, ***Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle***. (Washington, DC: World Bank, 2018), https://www.worldbank.org/en/publication/poverty-and-shared-prosperity.

[3] IPBES, *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. (Bonn: IPBES secretariat, 2019), https://ipbes.net/global-assessment.

[4] WMO, *WMO Provisional statement on the State of the Global Climate in 2018*, (Geneva: WMO, 2019), https://environmentalmigration.iom.int/wmo-provisional-statement-state-global-climate-2018.

[5] GGGI, *GGGI Refreshed Strategic Plan 2015-2020: Accelerating the Transition to a New Model of Growth*, (Seoul: GGGI, 2017), http://gggi.org/site/assets/uploads/2017/11/GGGI-Refreshed-Strategic-Plan-2015-2020.pdf.

[6] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017.

[7] GGGI, *Green Growth Index: Concepts, Methods and Applications*, 2019, http://greengrowthindex.gggi.org.

[8] As defined by the International Geosphere-Biosphere Programme (IGBP), "The term "Earth system" refers to Earth´s interacting physical, chemical, and biological processes. The system consists of the land, oceans, atmosphere and poles. It includes the planet's natural cycles — the carbon, water, nitrogen, phosphorus, sulphur and other cycles — and deep Earth processes."

[9] GGKP Research Committee on Measurement and Indicators, *Measuring Inclusive Green Growth at the Country Level: Taking Stock of Measurement Approaches and Indicators*, (working paper, Geneva: GGKP, 2016), https://www.greengrowthknowledge.org/resource/measuring-inclusive-green-growth-country-level.

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Key priorities for achieving global green transformation

GGGI has identified critical priorities for the successful transition to a green growth model of development. These priorities result from the direct and growing experience of low-and middle-income countries around the world, which have been pursuing green growth with the support of GGGI and its partners. The prevailing model of economic growth is simply unsustainable over the long term. It incentivizes the exploitation of natural resources and ecosystem services, ignores the adverse global impacts of economic activities, and neglects social equity, gender equality, inclusiveness, and economic opportunities for future generations. The exploitation of the world's natural capital and entire Earth system processes beyond their limits undermines economic performance over time. On the global scale, current national pledges for reducing emissions are still likely to lead to a warming of 2.5-3.0°C and a reduction in economic output by as much as 15-25% by 2100 relative to a world with no warming beyond 2000-2010 levels.[10] There are already countless cases where failure in environmental stewardship has weakened or even decimated local economies. Examples include oil spills,[11] the collapse of fisheries,[12] the adverse health impacts and reduced output resulting from severe air pollution,[13] and the impacts of plastic pollution on tourism-dependent economies.[14] The leading measure of economic performance, gross domestic product (GDP), accounts only for economic transactions without differentiating between activities that positively or negatively affect the environment and human well-being.

At its core, the concept of green growth aims to achieve long-term economic growth, prosperity, and inclusive social development and well-being while maintaining the integrity of natural capital, ecosystems, and Earth system processes. As long as natural resources and ecosystem services are used sustainably, within natural regeneration limits, as inputs (flows) and natural capital (stocks) in the economic system, economic growth and social development can continue long into the future.

The key to ensuring long-term prosperity, and avoiding a decline in economic growth and social well-being, is to progressively decouple economic growth from the depletion of natural capital while continuing to promote socially inclusive development.

Decoupling requires a collective effort to adopt the right policy interventions, technologies, and financing, and increase capacity and collaboration.[15] The degree of decoupling needed depends on the situation in each country and the type of natural capital involved. Nevertheless, globally, many heavily overexploited forms of natural capital, ecosystems, and Earth system processes already require significant attention to ensure long-term recovery and sustainability.

In the past, advanced economies were able to develop quickly during an era of abundant natural resources and high planetary capacity to absorb pollution and waste. However, today's consumption levels push natural resources and the planet's capacity to their limits. Many low- and middle-income countries do not have the option to "pollute now and clean up later." Early adoption of green growth presents an opportunity for these countries to leapfrog and mobilize investments in sustainable infrastructure, avoid infrastructure lock-in, and achieve higher overall socio-economic development. Undoubtedly there are short-term adjustment costs of green growth policies. Stricter standards and limits will cause negative growth in material consumption (e.g. plastic use) in the short-run, however, this

[10] Marshall Burke, W. Matthew Davis, and Noah S. Diffenbaugh, "Large potential reduction in economic damages under UN mitigation targets." Nature, 557 (2018): 549—553, https://doi.org/10.1038/s41586-018-0071-9.

[11] ITOPF, *Technical Information Paper 11, Effects of Oil Pollution on Fisheries and Mariculture*, 2014, https://www.itopf.org/knowledge-resources/documents-guides/document/tip-11-effects-of-oil-pollution-on-fisheries-and-mariculture/; see also ITOPF, *TIP 12: Effects of oil pollution on social and economic activities*, 2014, https://www.itopf.org/knowledge-resources/documents-guides/document/tip-12-effects-of-oil-pollution-on-social-and-economic-activities/.

[12] UNEP, *Global Environment Outlook 6: Summary for Policymakers*, (Nairobi: UNEP, 2019), https://www.unenvironment.org/resources/global-environment-outlook-6.

[13] OECD, *The Economic Consequences of Outdoor Air Pollution: Policy Highlights*, (Paris: OECD Publishing, 2016), https://www.oecd.org/environment/indicators-modelling-outlooks/Policy-Highlights-Economic-consequences-of-outdoor-air-pollution-web.pdf.

[14] Alessi et al., *Out of the plastic trap: saving the Mediterranean from plastic pollution*, (Rome: WWF Mediterranean Marine Initiative, 2018), https://wwf.fi/app/uploads/c/n/h/5gditunbtfhymucbvzdllwd/a4_plastics_med_finale_31may_2.pdf.

[15] International Resource Panel, *Global Resources Outlook 2019: Natural Resources for the Future We Want*, (Nairobi: UNEP, 2019), https://resourcepanel.org/reports/global-resources-outlook.

will be outweighed in the long-run by creating new ecologically sustainable economic activities, products and services (e.g. sustainable packaging) reflected in newly defined green GDP accounts.

Costa Rica, a GGGI Member, presents a compelling example of what a country can achieve in decoupling economic growth from specific environmental impacts. Between 1960 and 2014, while Costa Rica's national GDP increased 100-fold from about USD 500 million to USD 50.6 billion, its national carbon dioxide ($CO_{2)}$ emissions grew at only about one-seventh that rate, from about 0.5 to 7.8 million tons of CO_2. Similarly, between 1990 and 2014, the forest area grew by more than 4% even as economic growth accelerated in that period.

The first key priority is achieving national ambitions. National and subnational green growth strategies, policies, and plans provide an essential foundation for long-term economic and social development, for achieving the SDGs, and for scaling up green business models, financing, and investment. These enable countries to identify key opportunities to significantly improve their long-term economic performance, social development, and environmental and natural resource sustainability. A growing number of developed and developing countries around the world have been using these strategies and plans to shift to greener pathways, such as **Ethiopia**, **Denmark**, the **Republic of Korea**, **Rwanda**, the **United Arab Emirates (UAE)**, the **United Kingdom**, and **Viet Nam**.

These overarching strategies and plans set the stage for fully transforming conventional economies into green economies. They provide structured pathways to make economies stronger, more productive, efficient, and resilient, and to improve social well-being, protect biodiversity, and ensure good stewardship of natural capital. These strategies can set targets for national development objectives, such as the adoption of renewable energy as part of the national energy mix. Strategies can also lay the groundwork for the transition to green business models and for identifying crucial green investment opportunities.

Cross-sectoral and holistic economic planning and policymaking have helped to engage government, private sector, and non-governmental and civil society actors at all stages of GGGI's value chain —planning, policy adoption, and mobilizing investment and financing. Green growth strategies and investments must transcend urban and rural divides and drive agendas that sustain green and resilient rural areas alongside resource-efficient cities. These strategies must also consider that the world is becoming increasingly urban, with 68% of all people expected to live in urban areas by 2050,16 many of whom are moving to smaller cities that lack the capacity for planning and implementation.

Much more needs to be done to support this transition to avoid repeating mistakes of the past and to make use of new technologies and capture green financial flows. In particular, developing countries are counting on green finance as a vital component of the green growth transition and for achieving climate ambitions, such as the USD 100 billion in funding pledged by 2020 by developed countries through major financial mechanisms like the Green Climate Fund (GCF). GGGI works to structure investment projects and mobilize green and climate finance commitments for many of its Members. The organization has mobilized more than USD 2 billion in commitments for green investment projects since 2016. GGGI aims to raise a cumulative total of USD 16 billion in green finance commitment to support its Members by 2030.[17]

The second key priority is achieving a just, fair and inclusive green transformation. Achieving greater social equity and equality can increase economic productivity and generate green jobs. The unprecedented economic expansion of the past 50 years has not benefitted everyone, despite a remarkable reduction in extreme poverty from 36% of the global population in 1990 to 10% in 2015. Achievements in alleviating extreme poverty, measured as people living below USD 1.90 per day, have slowed as the poorest have become harder to reach, often living in rural areas and in countries with violent conflicts and weak institutions, and which are vulnerable to the effects of climate change.[18]

[16] UNDESA, *World Urbanization Prospects: The 2018 Revision Key Facts*, 2018, https://population.un.org/wup/Publications/Files/WUP2018-KeyFacts.pdf.

[17] GGGI, *GGGI 2030 Strategy*, 2019, forthcoming.

[18] World Bank, *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*, 2018.

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A multidimensional definition of poverty that better reflects experienced poverty shows that 23.1% of the world population is, in fact, poor, and two-thirds of the poor live in middle-income countries.[19]

A socially inclusive green growth transition must strive to increase equity within and between countries and across generations, while also striving for full gender equality, supporting the most vulnerable populations, and seizing opportunities to transition workforces into millions of new green jobs. Poverty reduction, gender equality, and social inclusion are critical elements of the new green growth economy, embedded in international climate and SDG commitments. Gender equality and women's empowerment serve to accelerate achievements across all 17 SDGs and are integral to environmental sustainability.[20] Yet, women worldwide have fewer economic opportunities and less political representation than men and currently only contribute 37% of global GDP. While macro-economic policies typically have been gender-blind, gender inequality comes at a high cost. Full gender equality could add USD 28 trillion, or 26%, to global annual GDP by 2025.[21]

Decent and better-quality jobs should grow in a well-managed transition,[22] and investing in green growth in low- and middle-income countries offers greater employment opportunities compared with the current economic model.[23] For example, investing in low-carbon development is projected to generate over 65 million additional jobs globally by 2030[24]. Another study estimates that investing in sustainable agriculture and land use could create approximately 80 million jobs by 2030, of which about 70% would be in Africa, India, and developing Asia.[25] GGGI analysis indicates that by meeting its Nationally Determined Contribution (NDC) renewable electricity targets, **Mexico** could generate around 72% more jobs compared to business as usual (BAU) by 2030.[26] Similarly, **Fiji**, under its most ambitious long-term low emission development scenario, could generate twice as many new jobs by 2050 in electricity, transport, and forestry sectors compared to BAU.[27]

Generating and maintaining public support is also a necessary part of the green transition and is essential to avoid public opposition. A people-centric approach, with decision-making based on societal and not solely economic interests, can build public support and political will to undertake transformational green policy changes. It is important to recognize and reward local communities and indigenous people in managing and safeguarding natural resources and in ensuring access to resources that help sustain livelihoods. **Colombia** mobilized investments under the government's Amazon Vision Program for indigenous peoples' organizations to implement projects that achieve environmental and local economic outcomes. Compensation packages, off-set schemes, and other measures can address concerns that arise as policy reforms affect the poor, women, and other groups disproportionately. **Indonesia** successfully demonstrated this when it launched assistance programs for poor households to offset the impacts of rolling back fuel subsidies. The programs demonstrated better poverty alleviation outcomes than continuing to rely on fuel subsidies that also benefit the rich.[28]

The third key priority is solving the climate crisis. The global climate emergency is one of the defining challenges of our time. Many see it as the single greatest threat to global food security, biodiversity, ecosystems, and coastal cities and communities around the world. The longer countries wait to take significant action, the worse the impacts are expected to be, and the response will be all the more challenging.[29] The transition to green growth serves as a critical, central vehicle for countries to achieve Paris Agreement commitments to limit atmospheric warming and achieve net-zero emissions globally by mid-century. Solving the climate crisis will not be possible without initiating a rapid and immediate green economic transformation.

[19] United Nations Development Programme, and Oxford Poverty and Human Development Initiative, *Global Multidimensional Poverty Index 2019: Illuminating Inequalities*, (United States: UNDP and OPHI, 2019). https://ophi.org.uk/wp-content/uploads/G-MPI_Report_2019_PDF.pdf.

[20] Esuna Dugarova, *Gender Equality as an Accelerator for Achieving the Sustainable Development Goals*, (discussion paper, New York: UNDP and UN WOMEN, 2018) https://www.undp.org/content/undp/en/home/librarypage/womens-empowerment/gender-equality-as-an-accelerator-for-achieving-the-sdgs.html.

[21] McKinsey Global Institute, *The Power of Parity: How Advancing Women's Equality Can Add $12 Trillion To Global Growth*, September 2015, https://www.mckinsey.com/featured-insights/employment-and-growth/how-advancing-womens-equality-can-add-12-trillion-to-global-growth.

[22] International Labour Organization, *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, (Geneva:ILO, 2015), https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_432859.pdf.

[23] International Labour Organization, *Greening with Jobs: World Employment Social Outlook 2018*, (Geneva:ILO, 2018), https://www.ilo.org/weso-greening/documents/WESO_Greening_EN_web2.pdf.

[24] NCE, *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Urgent Times*, (Washington, DC: NCE, 2018), https://newclimateeconomy.report/2018/.

[25] Business and Sustainable Development Commission and Alphabeta, 2016, *Valuing the SDG Prize in Food and Agriculture: Unlocking Business Opportunities to Accelerate Sustainable and Inclusive Growth*, (London: BSCD, 2016), http://report.businesscommission.org/uploads/Valuing-the-SDG-Prize-in-Agriculture.pdf.

[26] Grafakos, S., Senshaw, D., Quezada, D., and Toro A., (2020), *Employment Assessment of Renewable Energy: Power sector pathways compatible with NDCs and National Energy Plans*, Global Green Growth Institute, Seoul.

[27] GGGI, *Fiji Green Jobs Assessment: A Preliminary Study of Green Employment in Fiji*, 2019, forthcoming.

[28] GGGI, *International Institute for Environment and Development, and Green Economy Coalition, Pro-poor, Inclusive Green Growth: Experience and a New Agenda*, (Seoul: GGGI, 2016), https://gggi.org/report/pro-poor-inclusive-green-growth-experience-and-a-new-agenda/.

[29] IPCC, *Summary for Policymakers: Global Warming of 1.5°C* , 2018, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf.

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In order to limit global warming to well below 2.0°C, total emissions must be reduced to net-zero by the year 2050 or earlier, and "rapid and far-reaching transitions" must be initiated in energy, land, urban transport and buildings, and industrial systems.[30,31] This constraint requires all countries to take immediate action to raise ambitions, adopt rigorous and meaningful emission reduction targets. Countries must pursue financing and investment in low- or zero-emissions renewable energy, energy efficiency, transportation, green buildings, sustainable agriculture, zero-deforestation commodities, and waste management, and deeper investment in forests, mangroves, and other carbon sinks.

NDCs serve as a near-term vehicle for climate action, with Long-Term Low Emission Development Strategies (LT-LEDS) providing a path to mid-century by employing increasingly ambitious, practical, and implementable targets and measures. Targets and measures should link to public and private financing and green growth objectives. These important policy measures should be built on solid foundations of governance, institutional and human capacity, and measurement, reporting, and verification (MRV) systems. GGGI has supported more than 15 of its Member countries in revising their NDCs, developing long-term strategies, developing MRV systems, and exploring opportunities for emissions trading.

There are multifaceted benefits to taking climate action. Policies that favor cleaner energy can serve to increase access to energy for those who lack it significantly. Efforts to green the world's transportation systems, which currently consume more than half of all liquid fossil fuels, can improve urban mobility and productivity. A similar global transformation in land use is needed to implement sustainable and circular business models. Such business models protect and efficiently use natural resource stocks and ecosystem services that reverse land and soil degradation, avert biodiversity loss, and increase food security.

Achieving zero-emissions targets is technologically feasible. Technologies for renewable energy, battery storage, electrification of cars, buses, and bicycles, zero-carbon and zero-waste industrial parks, passive houses and buildings, and nature-based carbon sequestration are increasingly commercially viable. **Fiji's** LEDS, developed with support from GGGI, provides a roadmap for achieving rapid decarbonization within 20 years and net-negative emissions starting in 2042. The LEDS will be delivered with domestic and international financing while pursuing an ambitious 4% annual GDP growth rate.

The fourth key priority is accelerating green technology disruptions. Green technology disruptions and smart solutions present critical opportunities to transform economic sectors, advance social and environmental objectives, and deliver key services. A growing number of technology disruptions are poised to help accelerate the green agenda to further the goals of sustainable materials use and improved delivery of energy, mobility, waste management, and other services. Governments should not miss the opportunities these increasingly cost-competitive technologies present. They should use policy and regulatory frameworks to shift investment away from conventional systems and towards solar PV and wind, new energy storage, smart grids, and electric mobility. Innovations in storage technology are reducing cost, increasing grid stability, and paving the way for higher penetration of variable renewable energy sources, like wind and solar. In transportation, disruptive ideas and technologies—such as mobility as a service, autonomous driving, and cooperative intelligent transportation systems (C-ITS)—have the potential to revolutionize the sector and reshape the way we travel, drive, and deliver goods and services.

Similarly, significant efforts are underway to integrate smart, innovative, and green approaches into urban sustainability agendas to support more efficient, affordable, and effective services for all. Disruptive ideas around decentralized solutions ensure broader access to services that are cheaper and ready for implementation sooner. In sanitation, shifting away from centrally collected and treated wastewater systems to a circular economic approach can include converting wastewater and treated sludge into a valuable resource for reuse.

[30] United Nations Environment Programme, *The Emissions Gap Report: A UN Environment Synthesis Report*, (Nairobi : UNEP, 2017), https://www.unenvironment.org/resources/emissions-gap-report-2017.

[31] IPCC, *Summary for Policymakers: Global Warming of 1.5°C* , 2018.

01 THE PROMISE OF GREEN GROWTH

1.1 A new pathway to the future

At no time in history has human civilization simultaneously experienced such great potential for its future and such significant challenges to its sustainability and long-term prosperity. The paths available for humanity to choose are abundant with opportunity and promise but simultaneously present risks and uncertainty. In a way, this paradoxical future is a culmination of the impressive reach of humanity's scientific, technological, and social progress, and its ingenuity, drive, and innovation.

Sustained economic growth is recognized as a critical factor in reducing global poverty levels and making significant strides in the human development agenda, lifting more than 1.2 billion people out of extreme poverty since 1990.[32] Most countries remain committed to strong economic growth, particularly developing countries and emerging economies where about 740 million people, or 10% of the world population, still live on less than USD 1.90 per day (2011 PPP).[33] Economic growth has also stimulated increased gender equality and parity in education and health. Despite this progress much work remains. At a global level, 1.1 billion people still lack access to electricity, 2.6 billion lack adequate sanitation, and 900 million lack access to clean drinking water.[34]

The world cannot continue to maintain healthy and accelerating growth under the current resource-intensive economic model. The prevailing model exploits natural resources at an unsustainable scale and has resulted in massive adverse impacts on the environment, biodiversity loss, dangerous air and water pollution, and global climate change.[35] Our successes have left behind planetary-scale impacts on the world's climate system, imperiled the world's ecosystems and biodiversity, and have pushed the planet's chemical and nutrient cycles beyond their limits. Continued economic growth along conventional pathways even risks reversing much of the world's progress overall and can undermine efforts to tackle poverty.

Humanity's rise has transformed the entire surface of the earth, as described in box 1. But history is not destiny. Past mistakes become learning experiences that inform and strengthen the arc of human development. An emerging economic paradigm—green growth—is the outcome of centuries of experience, and particularly the economic and social development and the environmental protection lessons of the most recent decades. The promise of a better future remains stronger than ever.

Box 1. Destined for succes?

The emergence of human civilization. There is growing scientific evidence that humans have been changing the natural environment in significant ways since the end of the last ice age about 10-12 millennia ago, during the Holocene geologic period. This change began with the sudden decline and extinction of megafauna on every continent soon after humans arrived, most likely as a result of systematic and increasingly efficient hunting techniques. What followed was the agricultural revolution, which transformed wild grasslands and forest landscapes into farms and provided people with a stable and predictable food supply that allowed for the emergence of the world's first cities, kingdoms, and empires. These, in turn, gave rise to industrialization, the Renaissance, scientific inquiry and revolution, and today's technological advancements the pace of which are beyond any pre-industrial farm laborer's wildest dreams.[36]

The arrival of the Anthropocene. During the past 60-70 years, global change has been speeding up in what many refer to as the "Great Acceleration," with exponential growth in human population, exploitation of the planet's land, oceans, and natural resources, energy consumption and infrastructure development, and extensive air, water, and land pollution.[37] The rate of biodiversity loss now exceeds that of prior mass extinctions, the global average temperature has increased by an estimated 170 times the natural rate, and ocean acidification has occurred at the greatest speed in 300 million years.[38] As an era dominated by human influence on the planet, scientists have started to call this a new geological era, "the Anthropocene."[39] It is difficult to predict what further changes the future holds. So far, however, it is clear that the transformation of our planet is occurring well beyond the natural rate of change.

1.1.1 The need for a new development model: the promise of green growth

As outlined in the landmark study on planetary boundaries, the exponential growth of global economic and development activities has the potential to "destabilize critical biophysical systems and trigger abrupt or irreversible environmental changes."[40] Such a dramatic change could be catastrophic to human well-being and life in general. At a fundamental level, the conventional model of economic growth simply does not take these broad risks into account.[41]

[32] World Bank, *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*, 2018; "Poverty," World Bank, updated October 02 2019, https://www.worldbank.org/en/topic/poverty/overview.

[33] World Bank, *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*, 2018.

[34] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 11.

[35] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 11.

[36] Yuval Noah Harari, *Sapiens: A Brief History of Humankind*, (New York: Harper, 2015).

[37] Paul Crutzen, "Geology of Mankind," *Nature*, 415, 23 (2002) https://doi.org/10.1038/415023a.

[38] WWF, *Living Planet Report*, 2018, https://wwf.panda.org/knowledge_hub/all_publications/living_planet_report_2018/, 22.

[39] Paul Crutzen, "Geology of Mankind," *Nature*, 415, 23 (2002) https://doi.org/10.1038/415023a.

[40] Johan Rockström et al., "Planetary boundaries: exploring the safe operating space for humanity," *Ecology and Society* 14(2): 32 (2009), https://www.ecologyandsociety.org/vol14/iss2/art32/; Johan Rockström et al., "A safe operating space for humanity," *Nature* 461, (2009):472-475, https://doi.org/10.1038/461472a ; Will Steffen et al., "Planetary boundaries: Guiding human development on a changing planet," *Science* 347, Issue 6223 (February 2015), https://doi.org/10.1126/science.1259855.

[41] Rockstrom et al., "Planetary boundaries: exploring the safe operating space for humanity," 2009..

Green growth is no longer a new concept, and many countries have been taking significant steps to adopt it as the primary model of national development. A growing number of countries see the green growth economy as the prevailing alternative to conventional economic development.

As announced at the United Nations Conference on Sustainable Development (Rio+20) in 2012, the United Nations General Assembly stated:

> *"We affirm that there are different approaches, visions, models and tools available to each country, in accordance with its national circumstances and priorities, to achieve sustainable development… [We] consider green economy in the context of sustainable development and poverty eradication as one of the important tools available for achieving sustainable development... We emphasize that it should contribute to eradicating poverty as well as sustained economic growth, enhancing social inclusion, improving human welfare and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth's ecosystems."*[42]

1.1.2 Defining green growth

GGGI defines green growth as a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive.[43] This definition emphasizes that economic growth is of central importance for development and poverty reduction and that achieving environmental sustainability and social inclusion are equally important and necessary to ensure that economic development is sustainable over the long term.[44]

In essence, green growth is a pathway to sustainable development.[45] Green growth emphasizes the importance of achieving economic growth, wealth creation, and prosperity at the same time as attaining poverty reduction that is just, fair, and inclusive and ensures the sustainability of and safeguards for the environment and natural capital to the fullest extent possible. Box 2 defines natural capital. Green growth aims to transform wealth creation, natural capital valuation, and resource distribution by utilizing smarter, greener, and more inclusive planning, policies, and investment strategies.[46]

Ideally, a green growth model of development:

- **integrates** economic growth, social inclusion, and environmental sustainability objectives;
- accounts for **national and local development priorities**, contexts, and cultures;
- seeks to protect and increase the productivity of **natural capital and ecosystem services**;
- emphasizes **inclusive**, **equitable**, **gender-balanced**, and **participatory development** and **improved welfare**, in particular, to benefit those in extreme poverty or most vulnerable;
- considers **near-term** and **long-term development** opportunities, objectives, and pathways;
- recognizes the **respective roles** of political leaders, government institutions, the private sector, and civil society;
- mobilizes the use of **new and innovative technologies**, practices, business models, and industries as drivers of green investment and economic growth; and
- promotes **increased resilience** and reduced risks.[47]

Building on the above, this report frames the concept of the green growth economy using four fundamental dimensions of green growth:

- **efficient and sustainable use of resources** including energy, water, land, and materials;
- **protection of natural capital** and recognition of the limits of planetary systems;
- **green economic opportunities**, namely the policy, planning, and regulatory enabling conditions for investment, trade, employment, innovation, and business environment;
- **inclusive growth** with access to basic services and resources, health and safety, social equality, and social protections.[48]

By addressing social and environmental considerations, green growth ensures that economically disadvantaged and vulnerable populations can contribute to and meaningfully benefit from economic development opportunities, and can become more resilient to natural, environmental, and economic risks, including climate change.[49]

In practice, a green growth model of development must ultimately support national and local development objectives and reflect national and local contexts and cultural considerations,[50] even as some sectors and social groups within the economy may experience more significant change.

[42] UNCSD, *Future We Want - Outcome document A/RES/66/288*, 2012, https://sustainabledevelopment.un.org/index.php?menu=1298, para 56.

[43] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 12.

[44] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 11.

[45] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 11.

[46] GGGI, *Green Growth Planning Guidelines*, (Seoul: GGGI, 2016), https://www.greengrowthknowledge.org/sites/default/files/learning-resources/action/Green%20Growth%20Planning%20Guidelines.pdf, 3.

[47] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 13-15.

[48] GGKP, *Measuring Inclusive Green Growth at the Country Level*, 2016. GGGI has adopted four of the five dimensions identified in this GGKP report, listed in box 2, leaving out risks and resilience primarily as a result of limited data and understanding of that dimension.

[49] GGGI, *Green Growth Planning Guidelines*, 2016, 3.

[50] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 12.

Box 2. What is natural capital?

There is no single, internationally accepted definition of natural capital. For the purpose of this report, natural capital is defined as the world's stocks of natural assets. These assets include geology, soil, air, water, and all living things—natural resource, ecosystem services, and planetary systems such as energy and mineral resources, forests, grasslands, wetlands, oceans, fish stocks, biodiversity, and the climate system. It is from this natural capital that humans derive a wide range of services, often called ecosystem services, which make human life possible.[51] In this definition, "air" includes the entire atmosphere. "Water" includes all oceans and marine water bodies, freshwater bodies, and ice systems. "All living things" includes more than just plants and animals, but also microorganisms and large, complex ecosystems, what we commonly think of as "nature".

Box 3. Deciphering "green growth" and "green economy"

The term "green growth" has taken on slightly different meanings for different institutions. Concepts such as green growth, green economy, climate-resilient low emission development, and new climate economy all share a common core objective of promoting economic development or growth, with slightly different emphasis on environmental sustainability and social inclusion.[52] GGGI's definition of green growth attaches relatively equal importance to economic, environmental, and social objectives.

According to the **Organisation for Economic Cooperation and Development (OECD)**, green growth fosters "economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies." The **World Bank** defines the concept as "growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters". The **United Nations Environment Programme (UNEP)** defines a "green economy" as one that leads to "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities."[53]

GGGI relies significantly on the 2016 report issued by the **Green Growth Knowledge Platform**, which GGGI co-hosts with UNEP, in which "inclusive green growth" encompasses five measurable dimensions, or "themes":
(1) natural assets;
(2) resource efficiency and decoupling (addressing productivity, efficiency, preservation of resources, waste management, and use of recycling and renewables);
(3) risks and resilience (the ability to cope with pollution, degradation, natural disasters, and climate change);
(4) economic opportunities (supported through environmental regulation, planning, taxes, and government spending); and
(5) inclusiveness (social welfare considerations, access to environmental goods and services, participation in environmental decision-making, and distributional impacts of environmental policies).[54]

In 2019, **Partners for Inclusive Green Economies**, a consortium of international organizations collectively promoting green growth,[55] described an inclusive green economy as a "thriving economy that delivers the linked economic, social and environmental outcomes sought by the SDGs and the Paris Agreement." This is defined by five key "principles":
(1) well-being;
(2) justice (promoting equity within and between generations);
(3) planetary boundaries;
(4) efficiency and sufficiency (supporting sustainable consumption and production); and
(5) good governance (through accountable and resilient institutions).

Some related concepts are also often included in the green growth model. A "circular economy" focuses on the use of resources and minimizing waste in enclosed economic systems that minimizes waste and pollution, promotes reuse of products and materials, and aims to regenerate natural systems.[56] "Eco-efficiency" is a similar concept which focuses on resource efficiency and resource productivity.[57] "Eco-innovation" refers to efforts to promote sustainability throughout a product's life cycle while increasing performance and competitiveness.[58]

[51] Natural Capital Coalition, *Natural Capital Protocol*, 2016, https://naturalcapitalcoalition.org/natural-capital-protocol.

[52] GGKP, "Measuring Inclusive Green Growth at the Country Level," 2016, 1.

[53] GGGI, *GGGI Refreshed Strategic Plan 2015-2020*, 2017, 11.

[54] GGKP, "Measuring Inclusive Green Growth at the Country Level," 2016, 3-8.

[55] Partners include Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Development Alternatives India, the Global Green Growth Institute (GGGI), the Green Economy Coalition (GEC), the Organisation for Economic Cooperation and Development (OECD), the International Institute for Environment and Development (IIED), Partnering for Green Growth and the Global Goals 2030 (P4G), the United Nations Partnership for Action on Green Economy (UN-PAGE), and the United Nations Poverty Environment Action (PEA, successor to the former Poverty Environment Initiative).

[56] "What is a circular economy?" Ellen MacArthur Foundation, https://www.ellenmacarthurfoundation.org/circular-economy/concept. Concepts similar to the circular economy have included the "functional service economy (performance economy)" (Walter Stahel), "Cradle-to-Cradle" (William McDonough and Michael Braungart), "biomimicry" (Janine Benyus), "industrial ecology" (Reid Lifset and Thomas Graedel), "natural capitalism" (Amory and Hunter Lovins and Paul Hawken), and "blue economy systems" (Gunter Pauli).

[57] UNESCAP, *Eco-efficiency Indicators: Measuring Resource-use Efficiency and the Impact of Economic Activities on the Environment*, 2009, https://sustainabledevelopment.un.org/content/documents/785eco.pdf, 1.

[58] "Eco-innovation," UNEP, https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/responsible-industry/eco-innovation.

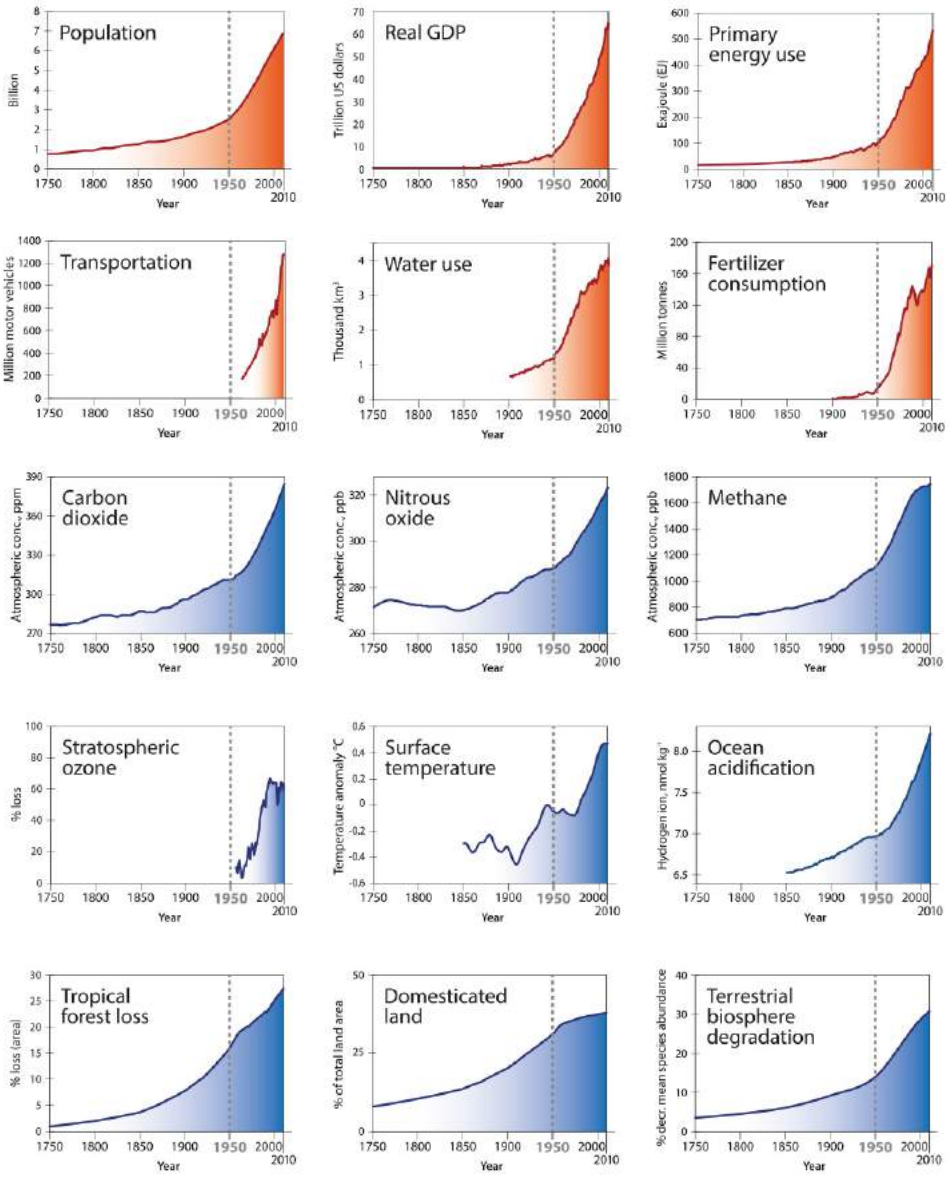
1.2 The urgency for green growth

1.2.1 A world of challenges: global megatrends

As highlighted above, humanity's new rapid and accelerating growth is rooted in a history where nature offered what appeared to be limitless supplies of resources and unlimited potential for growth. But many limits are now being reached or exceeded. According to some estimates, the world economy is currently consuming about 70% more than the earth can naturally sustain, in other words requiring the equivalent resources of nearly 1.7 earths.[59]

As described by the International Geosphere-Biosphere Programme (IGBP) and the Stockholm Resilience Centre, the Great Acceleration, as described in box 1, is defined by a set of 24 global megatrends. Figure 1 depicts a selection of these megatrends.[60] The high correlation between socio-economic and earth system trends point to clear evidence that from 1950 onwards, the shifts in the earth system have been beyond the natural range of variability of the Holocene period and primarily driven by human activity.

Figure 1. Selected global socioeconomic and earth system trends, 1750-2010



Source: IGBP and the Stockholm Resilience Centre

[59] Global Footprint Network, 19 March 2019, https://data.footprintnetwork.org/#/countryTrends?cn=5001&type=BCtot,EFCtot; WWF, *Living Planet Report*, 2018, https://wwf.panda.org/knowledge_hub/all_publications/living_planet_report_2018/, 30.

[60] IGBP, "Planetary dashboard shows "Great Acceleration" in human activity since 1950," Press Release, January 15, 2015, http://www.igbp.net/news/pressreleases/pressreleases/planetarydashboardshowsgreataccelerationinhumanactivitysince1950.5.950c2fa1495db7081eb42.html.

Population. Population growth since the mid-20th century remains the single most significant driver of global change. From about 1 billion people in 1800, world population has grown to about 7.7 billion today, and it is expected to reach 9.7 billion in 2050 and peak around 11 billion by the end of the century.61 The most significant growth will be in Africa, where the total population is forecasted to increase from 1.3 billion in 2017 to 4.5 billion in 2100. By 2100 Asia and Africa are expected to have nearly the same size populations, 43% and 40% of the world total, respectively, while the rest of the world makes up the remaining 17%.[62]

The world is also becoming increasingly urban. By 2050, 68% of the global population is expected to live in urban areas, equating to an addition of 2.5 billion people in cities with 90% of the increase occurring in Asia and Africa.[63] Globally, some of the fastest-growing cities are those with fewer than 1 million inhabitants, and while one out of every eight people live in some 30 megacities worldwide, at least half of all urban inhabitants live in cities of 500,000 or less.[64]

Economy. Aligned with population growth has been exponential growth in the global economy. Between the years 1900 and 2000, real world GDP increased 19-fold.[65] Today, it is approaching a staggering USD 100 trillion per year.[66] The combined growth of human populations and economic development is the primary cause of stresses on natural resources, ecosystems, and planetary boundaries. In recent decades, rapid urbanization, accelerating technological innovation, and global consumption and production have become significant additional drivers of change.[67]

Social Welfare. Global economic growth has, unfortunately, not meant that all people benefit. Despite significant success in reducing the number of people living in extreme poverty, 10% of the world population still lives on less than USD 1.90 per day (2011 PPP).[68] These poor populations are among the most disadvantaged and vulnerable in the world and face heightened risks from social conflict and climate change impacts.[69] Women have fewer economic opportunities and political representation, and while comprising half of the world population, only contribute 37% of the global GDP today.[70]

Environment. Growing populations and economies increasingly depend on natural resources, ecosystem services, and planetary systems for energy, water, food production, timber, and other raw materials. These natural systems and resources also take on more and more pollution and waste and are increasingly converted for economic purposes.

- **Energy** drives the global economy and plays a critical role in supporting social development. Energy demand is growing rapidly, and nearly 1 billion people still lack basic access to electricity, such as in Sub-Saharan Africa and Asia.[71,72] **Transportation** consumes more than half of all liquid fossil fuels, emits nearly a quarter of the world's energy-related CO_2,[73] and generates more than 80% of the air pollution in developing country cities.[74]

- **Air pollution** has become one of the world's most urgent health risks, causing one third of deaths from strokes, lung cancer, and heart disease. The health risks arise primarily from ultra-fine particle pollution (PM2.5) from coal-fired power plants and fossil fuel engines, particularly diesel buses and trucks.[75] An estimated 91% of all people globally are exposed to air that exceeds WHO pollution guidelines.[76] Air pollution is now severe in some of the world's fastest-growing urban areas.[77] As of 2016, air pollution was associated with around 7 million premature deaths, about 4.2 million from ambient air pollution and 3.8 million from household air pollution.[78] Exposure to air pollution was estimated to cost the global economy USD 5.11 trillion in welfare losses in 2013.[79]

- In most regions, **water quality** has worsened significantly in the past three decades, mostly due to organic and chemical pollution from industries, agriculture, and poor sanitation.[80] Although about 1.5 billion people gained access to basic drinking water services between 2000 and 2015, some 2.3 billion people still lack access to **safe sanitation**, and around 1.4 million people die each year from preventable diseases like diarrhea and intestinal parasites.[81] Inadequate access

[61] UNDESA, *World Population Prospects 2019: Highlights*, June 2019, https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html.

[62] UNDESA, *World Population Prospects: The 2017 Revision*, https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html, 1.

[63] UNDESA, *World Urbanization Prospects: The 2018 Revision Key Facts*, 2018.

[64] UNDESA, "68% of the world population projected to live in urban areas by 2050, says UN," News, May 16 2018, https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html.

[65] International Monetary Fund, *World Economic Outlook Chapter V: The World Economy in the Twentieth Century*, May 2000.

[66] World Bank World Development Indicators (ID:NY.GDP.MKTP.CD; Accessed 2019), https://data.worldbank.org/indicator/ny.gdp.mktp.cd.

[67] UNEP, *Global Environment Outlook 6: SPM*, 2019, 6.

[68] World Bank, *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*, 2018.

[69] GGGI, IIED, and GEC, *Pro-poor, Inclusive Green Growth*, 2016, 2.

[70] McKinsey Global Institute, *The Power of Parity*, 2015.

[71] "Energy Access," IEA, 2020, https://www.iea.org/energyaccess/.

[72] "Sustainable Energy for All," Sustainable Energy for All, accessed May 5, 2019, https://www.seforall.org.

[73] GGGI, *G20 Background paper: Green growth to achieve the Paris Agreement*, (Seoul: GGGI, 2019), https://gggi.org/site/assets/uploads/2019/02/GGGI_G20-Background-Paper_FINAL-v2.pdf, 23.

[74] GGGI, *G20 Background paper*, 2019, 23.

[75] "How air pollution is destroying our health," World Health Organization, 2020, https://www.who.int/air-pollution/news-and-events/how-air-pollution-is-destroying-our-health.

[76] "Air pollution," World Health Organization, accessed September 30, 2019, https://www.who.int/airpollution/en/.

[77] "WHO Global Urban Ambient Air Pollution Database, World Health Organization, updated 2016, https://www.who.int/phe/health_topics/outdoorair/databases/cities/en/.

[78] "Air pollution," World Health Organization, accessed September 30, 2019, https://www.who.int/airpollution/en/.

[79] "The cost of air pollution," ENS Clean Air, https://www.ens-cleanair.com/en/the-cost-of-air-pollution/.

[80] Javier Mateo-Sagasta, Sara Marjani Zadeh, and Hugh Turral, *Water pollution from agriculture: a global review: Executive summary*, FAO and IWMI, 2017, http://www.fao.org/3/a-i7754e.pdf, 2.

[81] UNEP, *Global Environment Outlook 6: SPM*, 2019, 12.

to water perpetuates the disadvantages to women and girls, who still bear the burden of carrying water in many developing countries, restricting their access to education and employment.[82]

- The global **demand for material resources** has been rapidly increasing. It is expected to nearly double from 89 gigatons (Gt) in 2017 to 167 Gt in 2060, with the most substantial growth expected in emerging economies and developing countries.[83]

- Increasing **waste management** needs present a growing challenge. The total solid waste produced by cities alone worldwide is expected to grow from about 1.3 to 2.2 billion tons per year from 2012 to 2025.[84] Continued use of unregulated dumps and open burning have serious health, safety, and environmental impacts, compounding waste management challenges. Increasing levels of plastic waste and the rapid spread of microplastics present potential risks to human health and marine organisms.[85]

- Similarly, **chemicals** have had a significant impact on water, air, and land resources worldwide. The world is now in the most chemical-intensive era in history, and the spread of heavy metals, persistent organic pollutants (POPs), and other toxic and carcinogenic chemicals are increasingly elevating threats to human health, ecosystems, and biodiversity.[86]

- Even as the world continues to urbanize, the past 50 years have seen a faster change in **land and marine environments** than any time in history.[87] The extent and conditions of terrestrial, freshwater, and marine ecosystems have declined by an average of 47% from their natural states and many continue to decline at a rate of 4% or more per decade.[88] From 1998 to 2013, 20% of the world's land covered by vegetation showed persistent and declining productivity.[89] Deforestation and forest degradation are responsible for nearly half of the total global greenhouse gas (GHG) emissions from land use.[90] The loss of tropical forests alone released 15% of GHG emissions from 1990 to 2010.[91]

- **Extinction** is also accelerating globally.[92] Out of an estimated 8 million animal and plant species in the world, about 1 million currently face extinction.[93] Humans have caused the loss of about 80% of all wild mammals and half of all wild plants.[94]

- **Agriculture** is among the most intensive uses of land resources, and about half of the earth's habitable land is used for food production, three-quarters of which is for livestock production.[95] To date, agriculture has adversely impacted soil quality, biodiversity, and freshwater availability, and it is the source of about one-quarter of all GHG emissions.[96] Land degradation costs between USD 6.3 and 10.6 trillion annually, or about 10-17% of the world's GDP.[97] Yet agricultural productivity will need to meet an expected 50% increase in food demand to keep up with the world's growing population.[98]

1.2.2 Challenges on a planetary scale: exceeding the limits of planetary systems

Many of these environmental megatrends are global in scale, and their impacts are surpassing the earth's natural ability to achieve balance and equilibrium. Nine critical "planetary boundaries" define the safe operating space for the world's climate system, biosphere and biodiversity, freshwater, and other critical natural systems. These systems are necessary to ensure the vitality and survival of all life on Earth. Exceeding any one boundary can significantly increase the risk of sudden, large-scale, or permanent environmental impacts with devastating societal consequences. As long as human activities do not exceed the biological and physical capacity of the planet beyond these boundaries, civilization could carry on indefinitely on Earth.[99]

However, humanity has pushed four of the nine planetary systems beyond their boundaries.[100] As illustrated in figure 2, global climate change and land system change are at increasing

[82] UNEP, *Global Environment Outlook 6: SPM*, 2019, 12.

[83] OECD, *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*, (Paris: OECD Publishing, 2019), https://doi.org/10.1787/9789264307452-en, 15

[84] GGGI, *Independent Evaluation of GGGI's Green City Strategies*, 2019, https://gggi.org/site/assets/uploads/2019/05/Independent-Evaluation-of-GGGIs-Green-City-Strategies_Goss-Gilroy-Inc_Final-Report.pdf.

[85] UNEP, *Global Environment Outlook 6: SPM*, 2019, 10-11.

[86] UNEP, *Global Environment Outlook 6: SPM*, 2019, 16.

[87] IPBES, *Global Assessment Report SPM, 2019*, 3-4.

[88] IPBES, *Global Assessment Report SPM, 2019*, 3-4.

[89] Nigel Dudley and Sasha Alexander, "Agriculture and Biodiversity: A review," *Biodiversity* 18, no. 2-3 (July 2017):45-49, https://doi.org/10.1080/14888386.2017.1351892.

[90] NCE, *Better Growth Better Climate*, 2014, https://sustainabledevelopment.un.org/content/documents/1595TheNewClimateEconomyReport.pdf.

[91] Richard A Houghton, "The emissions of carbon from deforestation and degradation in the tropics: past trends and future potential," Carbon Management 4, no. 5 (April 2014): 539–546, https://doi.org/10.4155/cmt.13.41.

[92] IPBES, *Global Assessment Report SPM*, 2019, 12.

[93] IPBES, *Global Assessment Report SPM*, 2019, 13.

[94] Yinon M. Bar-On, Rob Phillips, and Ron Milo, "The biomass distribution on Earth," PNAS 115, no. 25 (June 2018): 6506-6511, https://doi.org/10.1073/pnas.1711842115.

[95] UNEP, *Global Environment Outlook 6: SPM*, 2019, 11.

[96] IPBES, *Global Assessment Report SPM*, 2019, 16.

[97] ELD Initiative, *The value of land: Prosperous lands and positive rewards through sustainable land management*, September 2015, https://reliefweb.int/report/world/value-land-prosperous-lands-and-positive-rewards-through-sustainable-land-management.

[98] UNEP, *Global Environment Outlook 6: SPM*, 2019, 11. Approximately 56% of edible food is lost or wasted globally in developed countries, and the remaining 44% in developing countries.

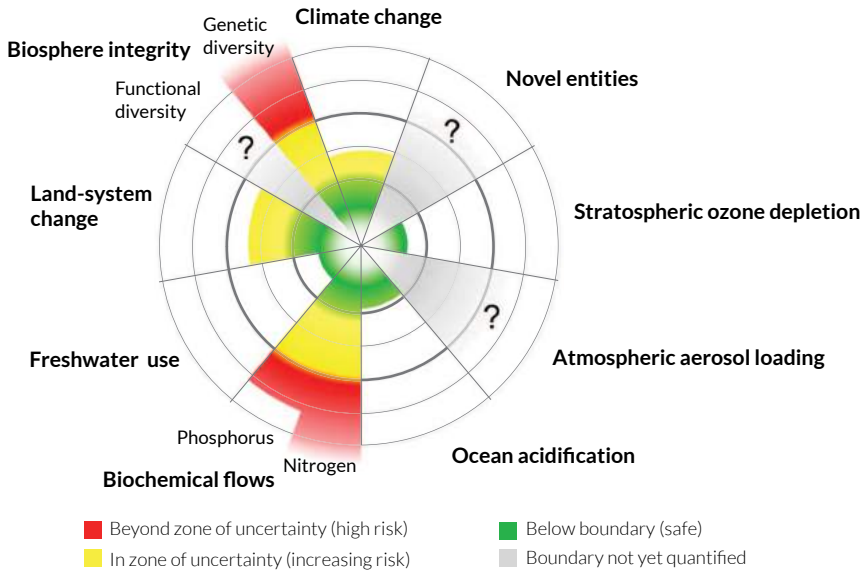
[99] Rockstrom et al., "Planetary boundaries: exploring the safe operating space for humanity," 2009; Rockström et al., "A safe operating space for humanity, 2009, Steffen et al., "Planetary boundaries: Guiding human development on a changing planet," 2015.

[100] Steffen et al., "Planetary boundaries: Guiding human development on a changing planet," 2015.

risk, and biosphere integrity, measured in extinctions per million species-years (E/MSY), and global nitrogen and phosphorus biochemical flows are already at high risk.[101] One noteworthy success for humanity has been to reverse the risks to stratospheric ozone depletion, which is now within stable limits.[102]

Among the nine planetary boundaries, two are arguably the most visible and potentially have the most far-reaching impact on our future—the rapid loss of the world's biodiversity and ecosystems, and global climate change.

Figure 2. The nine planetary boundaries and level of risk



Source: Steffen et al., Planetary boundaries: Guiding human development on a changing planet, 2015

[101] Steffen et al., "Planetary boundaries: Guiding human development on a changing planet," 2015.

[102] Rockstrom et al., "Planetary boundaries: exploring the safe operating space for humanity," 2009.

The challenge of climate change

Many regard climate change as the defining challenge of our time. Since 1950, atmospheric CO_2 has been rising steadily, and recently reached more than 415 ppm.[103] As reported by the Intergovernmental Panel on Climate Change (IPCC), the changes resulting from unabated GHG emissions include: warming of the atmosphere and oceans; sea level rise; decreasing water supply, snow, and ice; species loss and extinction; risks to human health, livelihoods, and food security; and increased intensity of and hazards from extreme weather such as floods, droughts, and storms.[104] Without urgent action to reduce global GHG concentrations, humanity is on a path towards a dramatically changed world.

These changes are already starting to become visible today. Elevated atmospheric concentrations of CO_2 are already causing ocean acidification,[105] and contributing to mass die-offs of the world's coral reefs.[106] When CO_2 levels surpassed 400 ppm 3 million years ago, global temperatures were 2-3°C warmer and sea levels 15-25 meters higher than today.[107] Today, human activities have already caused the global atmosphere to warm by approximately 1.1°C since pre-industrial levels,[108] and warming will likely reach 1.5°C between the years 2030 and 2052.[109] According to the World Meteorological Organization (WMO), 20 of the warmest years on record occurred in the last 22 years, and the four hottest years overall were 2015-2018.[110] The average temperature of the world's oceans is also now at a record high.[111]

The absolute number of climate-related natural disasters registering losses has also been steadily increasing for the past 40 years.[112] The years 2018 and 2019 witnessed deadly wildfires and exceptional heatwaves, droughts, floods, and tropical cyclones.[113] Arctic Ocean sea ice levels are as low as 49% below average during summer months and forecast to reach completely ice-free periods within the next 30 years.[114] In June 2019, the Indian City of Churu, Rajasthan, was the hottest place on the planet with a record high of 50.8°C, and some 90% of the population abandoned areas of Maharashtra State as water supplies were depleted and farmers struggled to survive.[115]

It is widely accepted that people living in developing countries, particularly the urban and rural poor as well as women and children, will be most adversely affected by the impacts of climate change over the coming decades. This could create social stress and unrest domestically, competing pressures on increasingly scarce resources within a country and with nearby countries, and elevated risks of mass migration.[116]

Warming of 2.0°C would result in moderate, high, or very high risks in every natural, managed, or human system, as highlighted by the IPCC. Even a world with a temperature increase limited to 1.5°C would face very high risks to ecosystems, coral reefs, fisheries, and the Arctic region, and high risks of extreme weather events and coastal flooding.[117] Without dramatically reducing emissions, sea levels will rise for the rest of the century to between 1 and 2 meters above current levels,[118] threatening coastal cities and SIDS around the world,[119] and continue rising well beyond 2100.[120]

[103] "Up-to-date weekly average CO_2 at Mauna Loa," Earth System Research Laboratory, NOAA, updated February 23, 2020, https://www.esrl.noaa.gov/gmd/ccgg/trends/weekly.html.

[104] IPCC, *AR5 Synthesis Report: Climate Change 2014*, 2014 https://www.ipcc.ch/report/ar5/syr/.

[105] IPCC, *AR5 Synthesis Report: Climate Change 2014, SPM*, 2014.

[106] UNEP, *Global Environment Outlook 6: SPM*, 2019

[107] NOAA 2018, Rebecca Lindsay, Climate Change: Atmospheric Carbon Dioxide, https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide.

[108] WMO, "WMO confirms past 4 years were warmest on record," February 6, 2019, https://public.wmo.int/en/media/press-release/wmo-confirms-past-4-years-were-warmest-record.

[109] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 6.

[110] World Meteorological Organization, *WMO Provisional statement on the State of the Global Climate in 2018*, 2019, 6.

[111] World Meteorological Organization, *WMO Provisional statement on the State of the Global Climate in 2018*, 2019, 13-16.

[112] "Risks posed by natural disasters," MunichRE, accessed March 15, 2020, https://www.munichre.com/en/risks/natural-disasters-losses-are-trending-upwards.html.

[113] WMO, *WMO Provisional statement on the State of the Global Climate in 2018*, 2019; GGGI, G20 Background paper, 2019, 8.

[114] James E. Overland, and Muyin Wang, "When will the summer arctic be nearly sea ice free?" Geophysical Research Letters 40, no. 10 (March 2013): 2097–2101.

[115] The Guardian, "Indian villages lie empty as drought forces thousands to flee," June 12, 2019, https://www.theguardian.com/world/2019/jun/12/indian-villages-lie-empty-as-drought-forces-thousands-to-flee.

[116] Oli Brown, *Migration and Climate Change*, (Geneva: International Organization for Migration, 2008).

[117] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018.

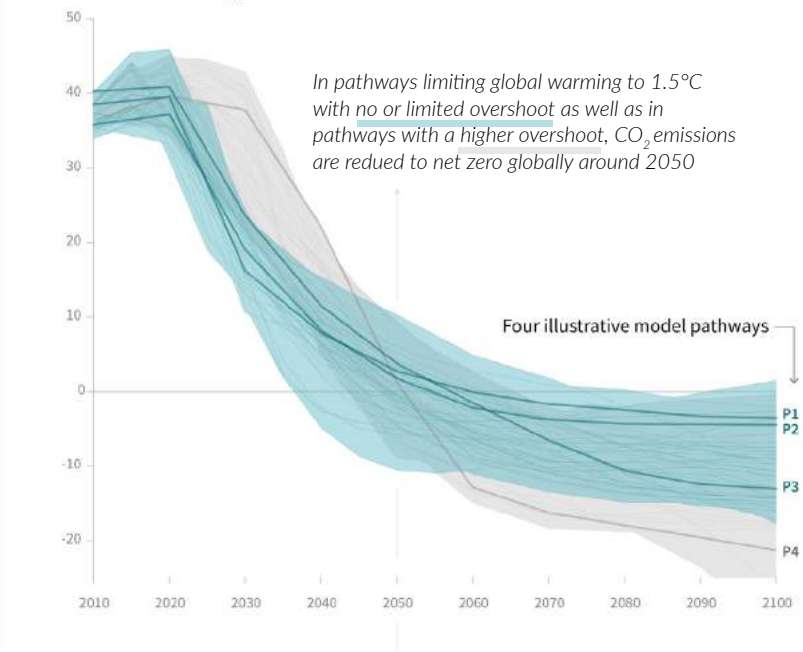
[118] IPCC, *AR5 Synthesis Report: Climate Change 2014*, 2014; Jonathan L. Bamber et al., "Ice sheet contributions to future sea-level rise from structured expert judgment," *PNAS* 116, no.23 (June 2019): 11195-11200, https://doi.org/10.1073/pnas.1817205116.

[119] UNEP, *Global Environment Outlook 6: SPM*, 2019, 6.

[120] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 9.

Adopted in 2015, the Paris Agreement advanced international efforts to seriously address global climate change.[121] Nevertheless, GHG emissions have been steadily rising in recent years, reaching a record high of 53.5 $GtCO_2e$ for the year 2017. The combined national commitments for emission reductions still fall far short of what's necessary.[122]

Figure 3. Peaking of global total net CO_2 emissions and pathways to net-zero in the 1.5°C scenario (billion tons CO_2/year)



Source: IPCC, Global Warming of 1.5°C, 2018

Addressing the climate emergency is becoming increasingly urgent. Achieving either 1.5°C or 2°C scenarios is now a race against time. It will require global net anthropogenic emissions of CO_2 to decline by 45% from 2010 levels by the year 2030 to achieve 1.5°C. Figure 3 illustrates that emissions will need to reach net zero around the year 2050, with similar deep reductions for non-CO_2 gases, followed by net-negative emissions.[123] The sooner this happens, the more likely the world can avoid dangerous climate tipping points and impacts.[124] Meeting these targets will mean "rapid and far-reaching transitions" across all economic sectors in "energy, land, urban and infrastructure (including transport and buildings), and industrial systems,"[125] a dramatic increase in investments in emission reduction measures[126], and additional CO_2 removals during the rest of the century.[127]

[121] UNEP, *The Emissions Gap Report: A UN Environment Synthesis Report*, 2017; IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 17.

[122] UNEP, *The Emissions Gap Report: A UN Environment Synthesis Report, (Nairobi : UNEP, 2018)*, https://www.unenvironment.org/resources/emissions-gap-report-2018.

[123] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 14.

[124] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 14.

[125] UNEP, *The Emissions Gap Report: A UN Environment Synthesis Report*, 2017; IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 17.

[126] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 17.

[127] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018, 20.

1.3 The future of green growth: progressing to a greener world in 2030 and beyond

Countries now have critical opportunities to plan pathways to a different future if they want to achieve the SDGs and avoid broad climate destabilization. This is even more relevant with the large scale deployment of capital for the COVID-19 recovery. BAU is no longer realistically viable or attractive—economically, socially, or environmentally—for many countries, developed or developing. The green growth model of development promises a new, alternative future for people around the world. The decision to adopt the green growth model has the potential to make economies stronger, more productive, to improve social well-being, reduce poverty, expand employment, and protect biodiversity and natural resources while ensuring a sustainable use of natural capital.

To date, more than 20 countries have formally adopted national or subnational green growth strategies, plans, or policies, or have directly incorporated the concepts of green growth or green economy in their national development strategies and frameworks. These green growth strategies provide the necessary overarching frameworks for defining more specific national and sector-focused policies, laws, regulations, and financial resources that are essential to implement green growth actions. Ultimately, these measures fully transform economies sector by sector and ensure environmental sustainability and social inclusion.

Green growth is not a luxury, but the essential choice for countries to collectively meet their development objectives, and to avoid the extreme risks associated with exceeding planetary boundaries. BAU is not an option if the world is to meet its international and domestic goals and obligations, and neither is economic stagnation or declining economic productivity. If all countries of the world are to have a chance at achieving their development objectives, then green growth offers the best answer there is.

In a world built on green growth, countries, cities, industries, and communities embrace the opportunity—and the self-determination—to take global and national sustainable development, social, and environmental priorities seriously. They find pathways that can effectively achieve a global green transformation. This world embraces dynamic and innovative new policies, technologies, businesses, business models, and investments that:

- maximize the use of clean, renewable energy to replace fossil fuels while ensuring high energy security;
- safeguard biodiversity and natural capital, thus protecting forests, grasslands, and oceans, and utilize natural resources efficiently and productively;
- increase food productivity and ensure food security;
- deliver basic services to all people, including access to energy, water and sanitation services, sustainable transportation, and waste management;
- eliminate all forms of air, land, freshwater, and marine pollution;
- dramatically reduce GHG emissions to the point that destabilizing climate change is permanently avoided; and
- ensure an inclusive transition that reaches all people and communities, where all society benefits from and contributes to meaningful change, with new opportunities in education, employment, and livelihoods.

Our species has risen from obscurity to dominating every corner of the earth, and is poised to seize upon a new, inclusive green growth economy for the next chapter of our history with the same ingenuity, drive, and courage. Universally adopting a green growth agenda is far from a lofty aspiration. Chapters 2 and 3 elaborate on how the green growth economy offers the most promising and realistic option for all countries to pursue long-term prosperity.

02 THE GREEN GROWTH ECONOMY: A PATHWAY TO PROSPERITY

2.1 Rethinking the economic paradigm

The prevailing model of economic growth has been the hallmark of modern civilization, creating a world that is increasingly connected, complex, and technologically advanced. But the vast expansion that has been underway since the mid-20th Century has created its risks to future prosperity. The current scale and pace of environmental impact and resource consumption have proven to be unsustainable.

Among the prominent examples of the failures of linear, resource-intensive conventional economic growth pathways include:

- Exceeding planetary boundaries: climate change, biosphere integrity, land system change, and nitrogen and phosphorus biochemical flows;
- Failure to preserve natural capital and ecosystems: air pollution, water pollution, excessive freshwater withdrawals, land degradation, land-based pollution, solid and hazardous waste, and habitat loss;
- Inefficient use of natural resources: forests, agricultural land, water, minerals, and materials; and
- Persisting inequalities—between countries, within countries, and between genders.

Shifting away from and replacing the conventional, resource-intensive model of economic growth with green growth is crucial for ensuring greater long-term economic prosperity and social well-being. Green growth also provides important leapfrogging opportunities for low- and middle-income countries to adopt modern, green, and efficient systems, technologies, and practices. Green growth must replace the linear and resource-intensive conventional model of economic growth, which does not sufficiently account for the harmful effects of unsustainable resource use and pollution on ecosystems and planetary systems.

Green growth provides a critical response to conventional, runaway, unrestricted consumption of resources, overexploitation of natural capital and ecosystem services, and disregard for ensuring social equity, inclusiveness, and economic opportunities for current and future generations. As outlined in Chapter 1, without a clear shift towards a new green growth model for all the world's economies, the world will remain on an unsustainable and potentially dangerous path into the future.

There is an expanding body of evidence demonstrating that green growth is not merely achievable but presents a pathway to even greater economic and social opportunity, and wealth creation. With the right combination of new policies, business models, technologies, and innovations, the green growth economy can exceed the performance of the conventional economy.

Compared to the current linear model of economic development, the green growth economy delivers higher socioeconomic **benefits in the short, medium, and long run. At its core, green growth aims to achieve long-term economic growth, prosperity, and inclusive social development and well-being for all while maintaining the integrity of natural capital, ecosystems, and planetary systems.**

The decoupling paradigm

A green growth economy requires the sustainable, efficient use of resources and protection of natural capital, a decoupling of economic growth and environmental impacts, and a focus on green economic opportunities and social inclusion. Decoupling economic growth from the adverse environmental impacts of economic activity can achieve higher overall prosperity and well-being for all, while keeping natural capital and resource use to sustainable levels and maintaining planetary boundaries. Green growth is the only viable long-term option for sustained economic prosperity.

Protection and use of natural capital and recognition of planetary boundaries are of particular concern in the green growth economy. Conventional economic growth often pays little attention to the overexploitation of natural resources and depletion of natural capital, assuming that resources such as air, land, water, and biodiversity are unlimited. However, green growth requires restraint from all forms of overexploitation and works to preserve planetary systems. All human activity must ensure natural resources are used sustainably as inputs (flows) in the economic system and as sinks to absorb waste from economic activities. Natural capital (stocks) must be protected to allow for the sustainable long-term provision of critical ecosystem services. The green growth economy explicitly includes the environment and natural capital as core elements of a country's wealth and growth potential.

Figure 4 illustrates how declining natural capital stocks and ecosystem services, unsustainable use of natural capital, and allowing the overshoot of planetary boundaries risks economic decline and contraction over time. A leading example of the scale of environmental impacts on the world economy is the projection that failure to address the climate emergency could cause a reduction of global output by 23% by 2100 in comparison to a world without climate change.[128] Serious impacts on infrastructure, ecosystems, lock-in of carbon-intensive infrastructure, stranded assets, and the exacerbation of water stress, food insecurity, and other socioeconomic stresses would ensue.[129]

In addition, depleted resources such as timber stands, minerals, and fish stocks result in costly economic conditions for communities, countries, and the world as a whole. As reported by the International Resource Panel (IRP), negative impacts from

[128] Marshall Burke, Solomon M. Hsiang, and Edward Miguel, "Global non-linear effect of temperature on economic production," *Nature* 527, no.7577 (October 2015): 235-239, https://doi.org/10.1038/nature15725.

[129] IPCC, *Summary for Policymakers: Global Warming of 1.5°C*, 2018.

resource extraction and processing cause more than 90% of global biodiversity loss and water stress and approximately 50% of total GHG emissions.[130] "Sustainability thresholds" refer to what can be considered levels of sustainability for natural capital stocks and ecosystems, the use of natural capital and ecosystem services, and the planetary system. Figure 4 shows how natural capital and planetary systems are now below sustainable levels based on the general, global situation described in Chapter 1. In contrast, as shown in Figure 5, the green growth economy requires that natural capital use must continue at sustainable levels to allow for the economy and social well-being to continue to grow.

Essentially, economic activity relies on the use of natural resources and ecosystem services. To ensure their continued use, it is paramount to ensure that natural resources and ecosystem services can regenerate, and thus function above sustainability thresholds. For non-renewable resources, increasing efficiency, recycling, and reuse can slow their depletion, while innovation and substitution with renewable resources can help sustain existing stocks in the longer term.

The progressive "decoupling" of economic growth from natural capital depletion and the negative environmental impacts, is central to the green growth paradigm. While at times it can be difficult to decouple resource use from economic growth on an absolute level, this is necessary to respect our planetary boundaries.

As countries exhibit unique natural capital endowments and economic conditions, the degree of decoupling needed will depend on the situation in each country, and the type of natural capital involved. Globally, a number of heavily overexploited forms of natural capital, ecosystems, and planetary systems already require significant attention to ensure long-term recovery and sustainability.

Figure 4. Continual decline of natural capital and planetary systems increases risks of contraction or decline of economic growth and social well-being

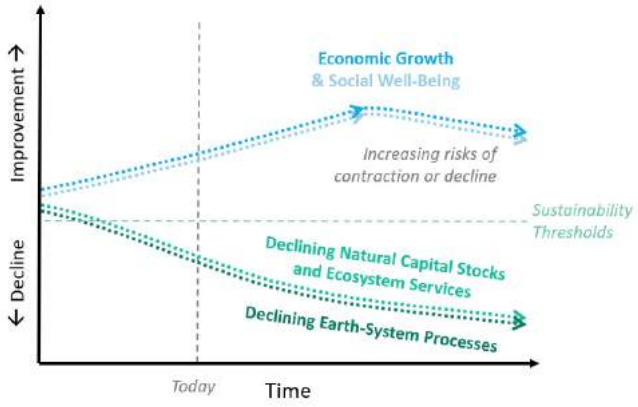
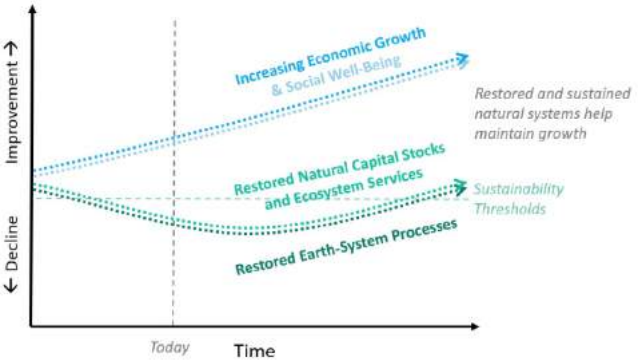


Figure 5. Decoupling of socioeconomic development from the exploitation of natural capital and planetary systems allows for increasing economic growth and social well-being



Source: GGGI

[130] International Resource Panel, *Global Resources Outlook 2019*, 2019.

Capping the consumption of natural resources causes shifts in supply and demand, and thus can result in increased costs on the demand side. To a large extent, this is unavoidable and is essential, since most natural resources are neither endless nor free. Resource limits have already been reached and exceeded in some cases, with highly visible economic and environmental consequences. There are instances where failing to limit supply may result in disastrous outcomes, as it ultimately leads to absolute depletion or degradation of the very resources on which entire industries and economies depend. Without sustainable management of resources, the conventional "brown" economy is susceptible to failure as a result of ever-diminishing returns. Limiting supply to sustainable levels thus ensures the continued availability of resources into perpetuity, and perpetual returns.

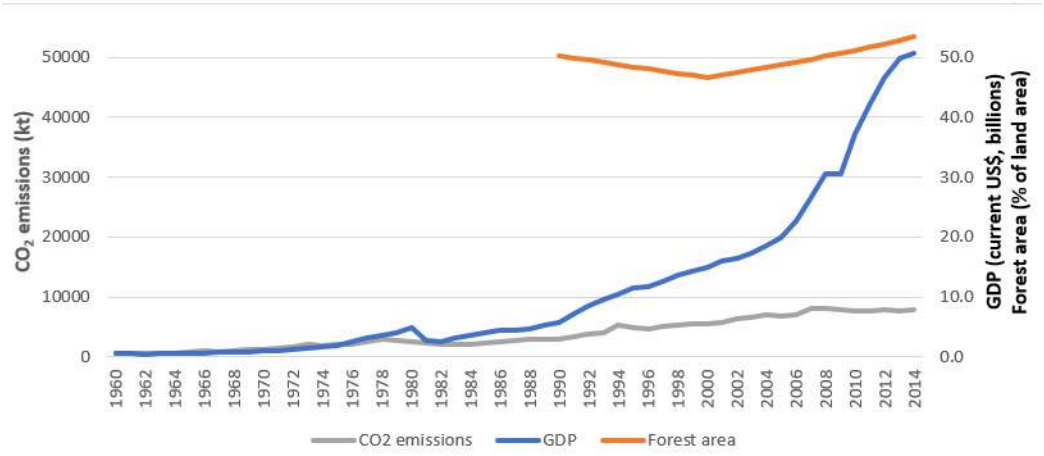
Today, there is clear and mounting evidence that investing in the new green growth economy will deliver higher economic benefits and social well-being. According to the IRP, assuming the right policy interventions, technologies, financing, capacity, and collaboration are in place, even relative decoupling of economic growth from natural capital would boost economic growth by 8%. It would increase global resource productivity by 27% between 2015 and 2060, while still keeping global warming to within 1.5°C above pre-industrial levels and improving the equality of the distribution of economic wealth and access to resources. In this scenario, forests and habitats would be restored to 2015 levels, avoiding the loss of 1.3 billion hectares of forests and natural habitats and add 450 million ha of forests beyond that.

Average economic growth is relatively stronger in low- and middle-income countries (11%) than in high-income nations (4%) in this scenario.[131,132]

The New Climate Economy (NCE) estimates that climate action overall could yield a global direct economic benefit of USD 26 trillion through 2030.[133] Similarly, the OECD predicts that taking climate action along with key economic reforms would result in a slight increase in economic growth in the short run and up to 2.8% additional net growth per year by 2050.[134]

Numerous examples exist of decoupling economic growth from natural capital depletion, where countries have worked to limit pollution or resource extraction while growing their economies. **Costa Rica** presents one compelling example of what a country can achieve, as illustrated in figure 6. Between 1960 and 2014, while Costa Rica's national GDP increased 100-fold, from about USD 500 million to USD 50.6 billion, its national CO_2 emissions grew at only about one-seventh that rate, from about 0.5 to 7.8 million tons. Similarly, between 1990 and 2014, forest area grew by more than 4% even as economic growth accelerated.[135] A study of **India** predicts that adopting circular economy pathways would yield annual benefits of about USD 624 billion by 2050 compared with current trends, about 30% of India's current GDP.[136] Additional country examples are provided in section 2.4.

Figure 6. Decoupling of Costa Rica's GDP (current USD, billions) from CO_2 emissions (kilotons) and forest area (% of land area)



Source: World Bank Data

[131] International Resource Panel, *Global Resources Outlook 2019*, 2019, 29.

[132] International Resource Panel, *Global Resources Outlook 2019*, 2019.

[133] NCE, *Unlocking the Inclusive Growth Story of the 21st Century*, 2018.

[134] OECD, *Investing in Climate, Investing in Growth*, 2017, https://www.oecd.org/environment/cc/g20-climate/synthesis-investing-in-climate-investing-in-growth.pdf.

[135] World Bank, "Costa Rica," Data, https://data.worldbank.org/country/costa-rica.

[136] Ellen MacArthur Foundation, *Circular Economy in India: Rethinking Growth for Long-Term Prosperity*, 2016, https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Circular-economy-in-India_5-Dec_2016.pdf.

The central foundation of the green growth economic model is that it does not diminish or limit the opportunity to continue generating wealth and value. What changes instead is the belief in endless and free consumption of natural resources, which is a practical impossibility. The goal, particularly for low- and middle-income countries, is to achieve economic progress while keeping the use of natural capital at sustainable levels and substantially increasing social well-being.

2.2 The potential of the green growth economy

The potential for green growth arises from increased emphasis on protecting and using natural capital and addressing the hidden ("external") costs of unsustainable economic activity, catalyzing new economic opportunities, and ensuring social inclusion, as described in the sections 2.2.1 to 2.2.3.

2.2.1 Natural capital and planetary systems

One of the fundamental arguments in favor of green growth and against conventional "brown" growth is the sheer size of "externalities," the additional environmental or social costs of production and consumption not reflected in the cost of goods or services. Natural capital is often not safeguarded because it is a "public good" without market value or prices. Under the current economic model, only those natural resources that are "visible" and "tangible" are accounted for as inputs into production processes or products. Critical natural resources ecosystems and ecosystem services that underpin long-term socio-economic viability remain mostly unrecognized. Indeed, many policies incentivize resource extraction without fully accounting for the value of natural capital. The lack of policies, regulations, and incentives to conserve such natural capital stocks can result in overexploitation, known as the "tragedy of the commons,"[137] and inefficient value chains and business operations.

The unsustainable use of natural resources has high costs as they support a wide range of socio-economic activities. Land degradation costs between USD 6.3 and 10.6 trillion annually, representing 10-17% of world GDP.[138] Roughly 40% of the world's land degradation occurs in areas with the highest incidence of poverty.[139] The loss in ecosystem services due to land-use changes between 1997 and 2001 has been estimated at USD 4.3 to USD 20 trillion annually.[140] The total annual economic cost of lost wetlands was estimated to be USD 2.7 trillion during the 1996 to 2011 period, and the annual cost of forest loss is estimated at USD 2-5 trillion.[141] The natural capital impacts of businesses alone cost the global economy an estimated USD 7.3 trillion per year in terms of lost ecosystem services, pollution, and related health costs.[142] Similarly, air pollution is not only an environmental and public health issue but also undermines economic productivity, particularly in low- and middle-income countries. Air pollution results in USD 5.11 trillion per year in health costs globally, and from 1990 to 2013, estimates show that welfare losses nearly doubled, and labor income losses increased by 40% because of air pollution.

In contrast, the evidence increasingly shows that implementing green technologies and policies provides significant economic opportunities.[143] The majority of resource efficiency investments in energy, land, water, and steel result in net savings, all the measures below the value of 1.0 along the y axis in figure 7, where it costs less than USD 1 to yield a USD 1 resource benefit. These investments could generate more than USD 2 trillion resource benefit in 2030.[144]

[137] Garrett Hardin, "The Tragedy of the Commons," Science 162, no. 3859 (December 1968): 1243-1248, https://doi.org/10.1126/science.162.3859.1243.

[138] ELD Initiative, *The value of land*, 2015.

[139] ELD Initiative, *The value of land*, 2015.

[140] Robert Costanza et al., "Changes in the global value of ecosystem services," Global Environmental Change 26 (May 2014): 152-158, https://doi.org/10.1016/j.gloenvcha.2014.04.002.

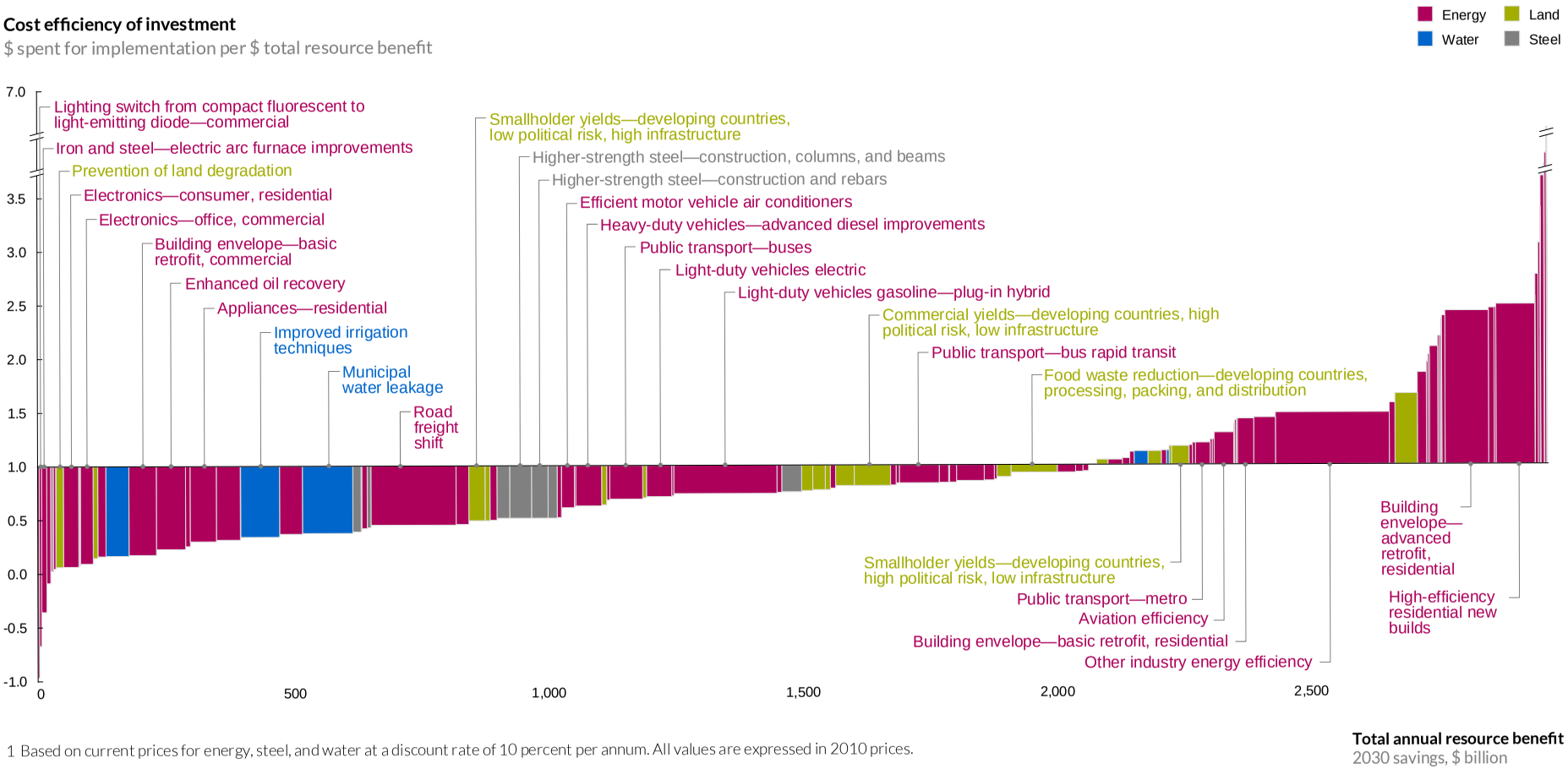
[141] TEEB (2010), The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB.

[142] Trucost, *Natural Capital at Risk: The top 100 externalities of business, TEEB for Business Coalition*, 2013, https://www.trucost.com/publication/natural-capital-risk-top-100-externalities-business/.

[143] UNEP, *Decoupling 2: Technologies, Opportunities and Policy Options*, 2014, http://www.resourcepanel.org/reports/decoupling-2.

[144] McKinsey Global Institute, *Resource Revolution: Meeting the world's energy, materials, food, and water needs*, November 2011, https://www.mckinsey.com/business-functions/sustainability/our-insights/resource-revolution.

Figure 7. Resource productivity gains of various green investments



1 Based on current prices for energy, steel, and water at a discount rate of 10 percent per annum. All values are expressed in 2010 prices.

Source: McKinsey Global Institute, *Resource Revolution*, 2011.

Globally, achieving the 2°C target would only require 5% of additional investment relative to BAU levels, and the energy and fuel savings would fully offset the investments during the infrastructure's lifetime.[145] It would be possible to achieve a global reduction of about 17 $GtCO_2e$ annually simply by implementing all mitigation options with negative abatement costs. Cuts of about 24 $GtCO_2e$ annually, or half of total emissions, are possible through implementing additional mitigation options that deliver multiple and significant co-benefits.[146] With regards to climate adaptation, the Global Commission on Adaptation has reported that investing USD 1.8 trillion globally from 2020 to 2030 in early warning systems, climate-resilient infrastructure, improved dryland agriculture, mangrove protection, and making water resources more resilient, could generate USD 7.1 trillion in total net benefits.[147]

Several major macroeconomic models confirm that resource efficiency pathways will deliver higher economic output than BAU, as shown in table 1.

Further efforts are needed to effectively incorporate natural capital and natural resource depletion in macroeconomic modeling and to reflect the interactions and feedback loops between the economy and natural capital. Such efforts include considering the "rebound effect," or the tendency for resource consumption to go up as a result of increased efficiency and cost savings.[149]

Table 1. Comparison of resource efficiency modeling projections

	UNEP (2011)	Env Linkages -OECD/IEA (2012)	GIFORS (2015)	UNEP (2017)	IRP (2019)
Type of model	System Dynamics	CGE	Macro-econometric	CGE	Multi-model framework including GCE and sectoral model integration
Time horizon	2030, 2050	2035	2030, 2050	2050	2060
Main economic assumptions	Natural capital as part of total factor productivity.	Economic efficiency, market clearing, full employment	Unemployed resources, no market clearing, historical data	Economic efficiency, market clearing, full employment	Economic efficiency, market clearing, full employment
Economic output (Green Growth scenario vs BAU)	16% higher	0.4% higher[148]	5.2% higher	1% higher	11% in low- and middle-income and 4% in high-income countries
Consideration of rebound effect	No	No	No	Yes	No
Consideration of natural capital degradation and resource inefficiency	Yes	No	Yes	No	Partly yes

Source: GGGI analysis

[145] NCE, *The Sustainable Infrastructure Imperative: Financing for Better Growth and Development*, 2016, https://newclimateeconomy.report/2016/.

[146] NCE, *Technical note: Quantifying the multiple benefits from low-carbon actions in a greenhouse gas abatement cost curve framework*, January 2015. https://newclimateeconomy.report/workingpapers/wp-content/uploads/sites/5/2016/04/NCE-technical-note-quantifying-benefits-abatement-cost.pdf.

[147] Global Commission on Adaptation, *Adapt Now: A Global Call for Leadership on Climate Resilience*, 2019, https://gca.org/global-commission-on-adaptation/report.

[148] IEA's New Policies S¬cenario assumes less action and policies towards low carbon options, where global warming would reach around 2.5□C by 2100.

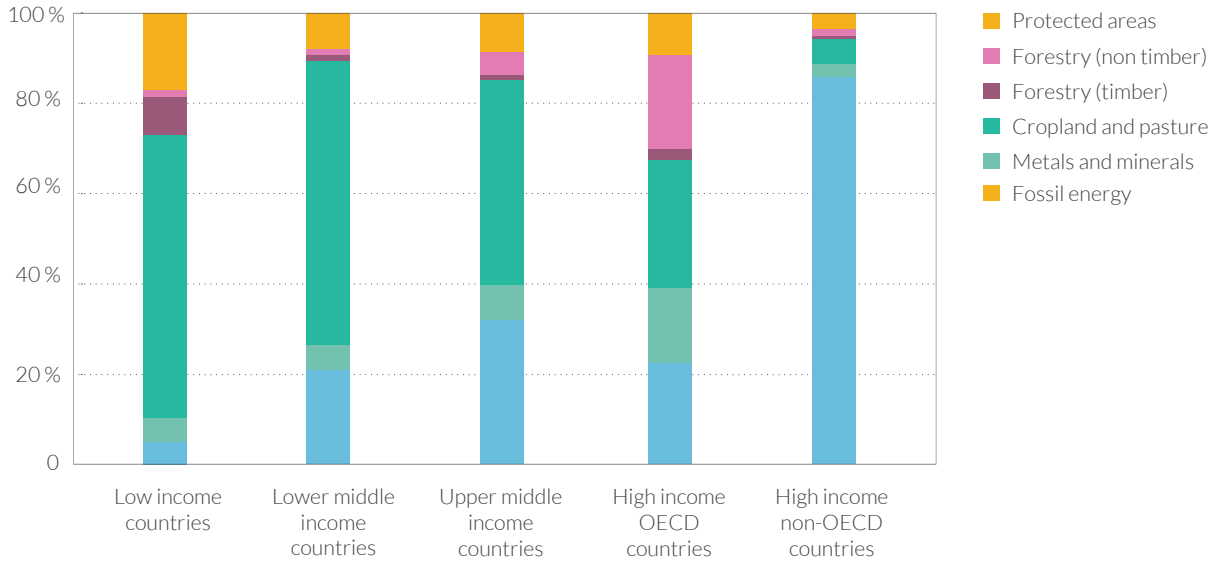
[149] Horace Herring, and Steve Sorrell, *Energy Efficiency and Sustainable Consumption: The Rebound Effect*, (United Kingdom: Palgrave Macmillan, 2009).

Closing the divide between developed and developing countries

Often, there is an unequal divide in the benefits and external costs of resource extraction between the developed and developing world. There are significant differences between countries in the composition of natural capital, as shown in Figure 8. Therefore, countries require different approaches to promote green growth. Low-income countries have high levels of cropland and pastureland, protected areas, and forest lands relative to all other countries. Middle-income countries similarly have high percentages of these land areas, as well as fossil energy resources. High-income countries, on the other hand, have higher levels of managed forests and reduced cropland and pastureland in comparison. These more diversified economies rely less on natural capital and more on non-capital-intensive sectors, such as commercial and financial services.[150] Due to the expansion of international trade, a large share of the economic activities of advanced economies are being outsourced to low- and middle-income countries, increasing pressures and potential impacts on natural resources in these countries. These contrasts make it all the more important to ensure the natural capital of developing countries is adequately protected.

The consequences of environmental or planetary impacts are also unevenly distributed between developed and developing countries. As illustrated in Figure 9, while economic losses and damages of climate-related natural disasters during 1998-2017 amounted to about USD 2 trillion in high-income and upper-middle-income countries, these affected only 0.41% of GDP. Lower-middle and low-income countries face several times the cost in terms of GDP, and the costs of such disasters has been rising.[151] These results underscore the disparity in the ability of high- and low-income countries to absorb climate-related impacts and that climate change has affected countries disproportionally, impacting low-income countries the most.[152]

Figure 8. Composition of natural capital



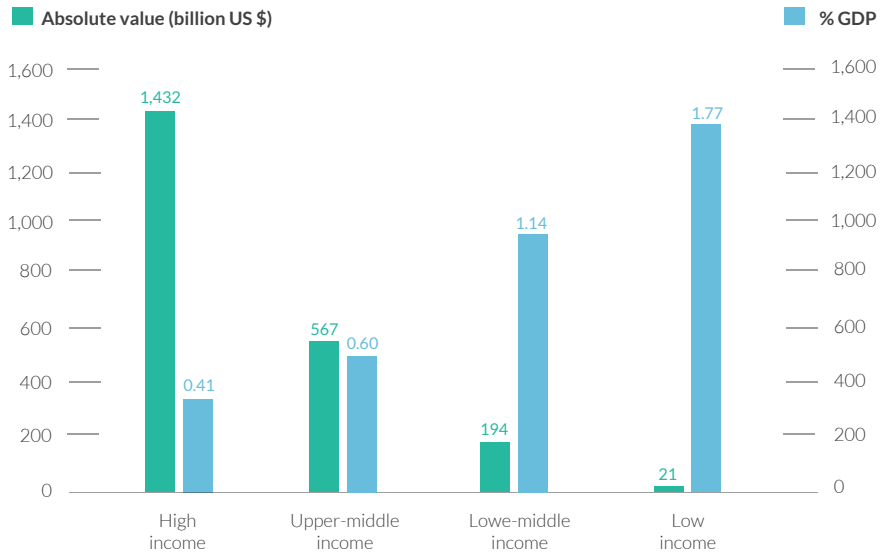
Source: Lange et al., *The Changing Wealth of Nations 2018*, 2018.

[150] Glenn-Marie Lange et al., *The Changing Wealth of Nations 2018: Building a Sustainable Future*, (Washington, DC: World Bank, 2018), http://documents.worldbank.org/curated/en/727941517825869310/The-changing-wealth-of-nations-2018-building-a-sustainable-future; Cohen et al., *The Wealth of Nature*, 2018, https://www.inet.ox.ac.uk/files/webWealthofNature.pdf.

[151] CRED and UNISDR, *Economic Losses, Poverty & Disasters 1998-2017*, 2018, https://www.unisdr.org/2016/iddr/IDDR2018_Economic%20Losses.pdf.

[152] Katharine Ricke et al., "Country-level social cost of carbon," Nature Climate Change 8 (October 2018): 895-900, nature.com/articles/s41558-018-0282-y.

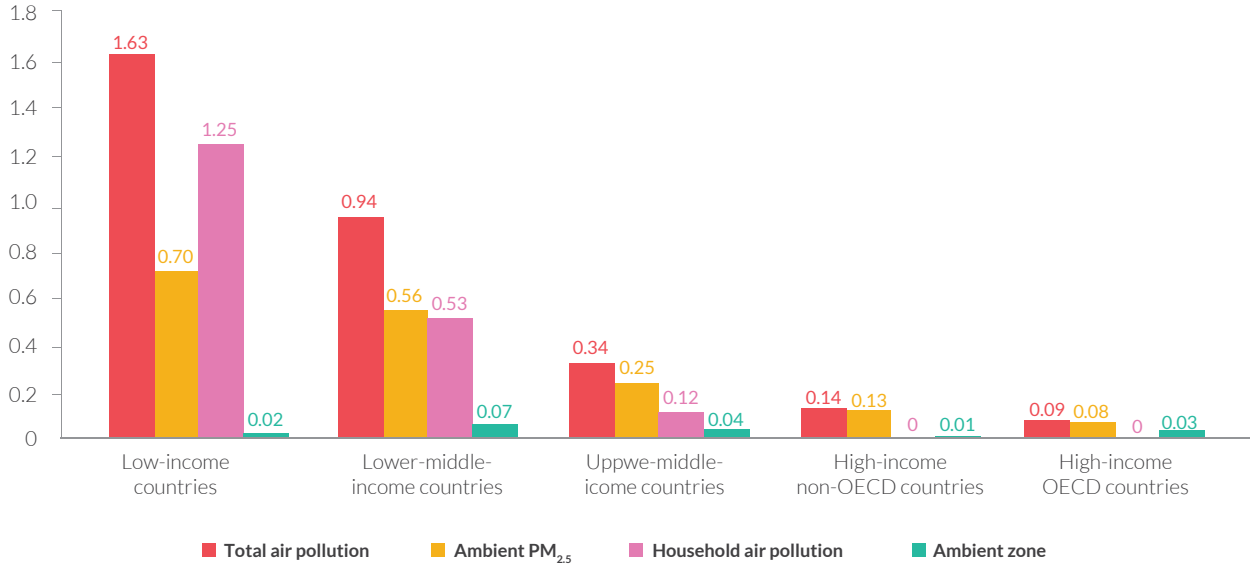
Figure 9. Recorded climate-related disaster losses and GDP losses by income group, 1998-2017



Source: CRED and UNISDR, *Economic Losses, Poverty & Disasters 1998-2017*, 2018.

Similarly, the effects of air pollution are worse in low- and middle-income countries, such as in South Asia and Sub-Saharan Africa, where 1.22% and 1.19% of GDP is lost, respectively, due to poor air quality.[153] Figure 10 illustrates the disproportionate labor losses caused by air pollution in 2015 in different country groups.[154]

Figure 10. Annual labor income losses from air pollution, by income group, 2015 (% of GDP)



Source: Lange et al., *The Changing Wealth of Nations 2018*, 2018.

[153] World Bank, *The Cost of Air Pollution: Strengthening the Economic Case for Action*, 2016, http://hdl.handle.net/10986/25013.

[154] World Bank and Institute for Health Metrics and Evaluatio. 2016. *The Cost of Air Pollution: Strengthening the Economic Case for Action*. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO, https://openknowledge.worldbank.org/bitstream/handle/10986/25013/108141.pdf?sequence=4&isAllowed=y.

Taking the example of climate action, investing in low-carbon and climate-resilient infrastructure presents a lucrative opportunity for low- and middle-income countries to leapfrog by investing in infrastructure that is low carbon and climate-resilient before being "locked in". According to a recent study from WHO, meeting the targets of the Paris Agreement could save over one million lives annually from air pollution alone by 2050.[155] The health co-benefits in monetary value would be approximately twice the cost of climate mitigation policies, with China and India expecting the highest gains.[156]

2.2.2 Catalyzing new economic opportunities

Green investment and innovation

Many low carbon energy technologies are commercially viable. They could generate financial returns during their lifetime, but in many cases, their deployment hasn't taken off due to financial, institutional, behavioral, political, and other barriers. Governments and the private sector must work together closely to create the right conditions to overcome these barriers and accelerate green economic opportunities and technology investments. National and subnational-level policies and regulations are necessary to account for natural capital and to replace policies that hamper sustainable practices, business operations, value chains, and technologies. These are necessary to trigger catalytic shifts in the economy and promote gains in economic productivity, quality of work, and technological innovation.

Developing countries, often less constrained by path-dependency arising from unsustainable production and consumption infrastructures, have the opportunity to leapfrog and create new markets through green investment. As markets in developing countries tend to be underdeveloped compared to those in developed countries, green innovation and the adoption of new technologies can lead to the creation of completely new markets that benefit both the national economy and the environment.[157]

Green jobs

Low-carbon development is expected to generate over 65 million additional jobs globally by 2030 compared to BAU,[158] and simply transitioning to 100% renewable energy globally by 2050 could create a net increase of 25 million full-time jobs.[159] In particular, there is growing evidence in low- and middle-income countries that investing in green growth offers significantly more employment opportunities compared to the continuation of the current economic model.[160] Similarly, an estimated 80 million jobs could be generated through investments in sustainable agriculture and land use by 2030, of which around 70% could be in Africa, India, and developing Asia.[161] Indeed, agriculture, land management, and forestry are the economic foundation of many low-income countries and can offer much better employment generation opportunities than other sectors.

GGGI analysis indicates that by meeting its NDC renewable electricity targets, **Mexico** could generate around 72% more jobs compared to BAU by 2030.[162] **Rwanda**, by meeting the renewable electricity targets under the High Ambition scenario can create 121% more jobs compared to the NDC unconditional scenario by 2030. According to the same study, renewable energy technologies in **Indonesia** can create 2.5 to 3.8 times more jobs per USD invested compared to coal based energy technologies. Similarly, **Fiji**, under its most ambitious long-term low emission development scenario, could generate twice as many new jobs by 2050 in electricity, transport, and forestry sectors compared to business-as-usual.[163] Even local initiatives like composting and recycling could account for a significant number of new, better paid jobs, the potential for improved working conditions, and new revenue streams for local governments. In **Bangladesh** alone, new carbon-reducing solid waste management programs could generate over 200,000 jobs and livelihoods by 2050.[164]

These results are particularly relevant in the context of COVID-19 induced economic crisis and massive jobs losses. Policy makers should "green" the economic recovery packages to avoid to lock in the economy to long term unsustainable development pathways. The speed and ease of implementation of actions are essential for an effective response to the sudden economic shock and job losses. NDCs and countries' green growth plans entail many "shovel - ready" and easily implementable green and climate actions and projects actions and projects that can create many green jobs in the short run, while contributing to long term sustainability and climate objectives.[165]

[155] COP24 special report: health and climate change. Geneva: World Health Organization; 2018, https://unfccc.int/sites/default/files/resource/WHO%20COP24%20Special%20Report_final.pdf.

[156] Anil Markandya et al., "Health co-benefits from air pollution and mitigation costs of the Paris Agreement: a modelling study," *The Lancet Planetary Health 2*, no.3 (March 2018):PE126-E133, https://doi.org/10.1016/S2542-5196(18)30029-9.

[157] Carlos Montalvo, "Sustainable systems of innovation: How level is the playing field for developing and developing economies?" Paper presented at Globelics Conference, Mexico, September 2008, https://www.researchgate.net/publication/325923880_Sustainable_systems_of_innovation_How_level_is_the_playing_field_for_developed_and_developing_economies.

[158] NCE, *Unlocking the Inclusive Growth Story of the 21st Century*, 2018.

[159] Mark Z. Jacobson et al., "100% Clean and Renewable Wind, Water, and Sunlight, All-Sector Energy Roadmaps for 139 Countries of the World," *Joule* 1 (September 2017): https:/doi.org/10.1016/j.joule.2017.07.005.

[160] International Labour Organization, *Greening with Jobs: World Employment Social Outlook 2018*, 2018.

[161] Business & Sustainable Development Commission, *Better Business Better World*, January 2017, http://report.businesscommission.org/uploads/BetterBiz-Better-World_170215_012417.pdf.

[162] Grafakos, S., Senshaw, D., Quezada, D., and Toro A., (2020), *Employment Assessment of Renewable Energy: Power sector pathways compatible with NDCs and National Energy Plans*, Global Green Growth Institute, Seoul

[163] GGGI, *Fiji Green Jobs Assessment: A Preliminary Study of Green Employment in Fiji*, 2019.

[164] Andy Gouldson et al., *The Economic and Social Benefits of Low-Carbon Cities: A Systematic Review of the Evidence*, (Washington, DC: NCE, 2018), https://new-climateeconomy.report/workingpapers/wp-content/uploads/sites/5/2018/06/CUT2018_CCCEP_final.pdf.

[165] GGGI, *Achieving Green Growth and Climate Action Post-COVID-19*, July 2020, https://gggi.org/site/assets/uploads/2020/07/GGGI-Technical-Report-Achieving-Green-Growth-and-Climate-Action-Post-COVID-19.pdf.

2.2.3 Ensuring social inclusion

Inclusiveness in the green growth economy aims at delivering economic prosperity for all and reduces inequalities in the distribution of income and wealth across and within countries, between genders, and across generations.

From 1990 to 2015, the number of people living in extreme poverty, earning less than USD 1.90 per day, declined by about 40%, a reduction of about 1.1 billion people. This progress is mainly due to significant economic growth and increased economic opportunity in low and middle-income countries, particularly in China, India, and Southeast Asia.[166] Efforts to reduce extreme poverty further have slowed down significantly as it becomes harder to reach the most impoverished remaining communities. The poorest are typically found in rural areas, and the most substantial pockets of extreme poverty are in Sub-Saharan Africa and countries suffering from violent conflict and weak institutions.[167] Estimates of global poverty levels reach as high as 23% when using multidimensional poverty measures, which take a country's standard of living and other aspects of welfare into account. This percentage is equivalent to about 1.6 billion people, two-thirds of whom live in middle-income countries.[168,169]

Poverty also persists in developed countries. One in seven children in OECD countries currently lives in poverty.[170] While economic growth has contributed to the reduction in global inter-country inequality, inequality within countries has risen at unprecedented levels during recent decades, threatening societal cohesion and collective well-being. In advanced economies, income inequality has reached its highest levels in the last five decades.[171] Slow improvements in living standards and widening inequalities have led to an erosion of social cohesion in advanced and emerging economies resulting in political polarization and rising populism.[172] These trends can undermine the public demand and political will to carry out reforms required for the green growth transition.

The low number of people who control most of the wealth reflects the cumulative impact of continuous income inequality and lack of effective redistributive policies. In emerging economies and low-income countries, the share of the global top 1% of earners has increased significantly since 2005, reaching 22.6% in the emerging economies of **South Africa**, **Russia**, and **India**.[173]

Empirical evidence shows that inequality is negatively correlated with sustained economic growth and can result in significant reductions in the level and the duration of growth.[174] Policies that aim to redistribute wealth and reduce inequality can thus contribute to inclusive and sustained growth. Therefore it is not enough for the green growth transition to create significant economic opportunities and green jobs. The transition must be inclusive and just.

Gender inequalities are significant barriers to shared prosperity and hamper overall economic growth.[175] Women in all economies have lower participation rates in the labor market, while higher percentages of women are active in informal sectors. Globally, women perform 75% of unpaid care work at the expense of paid labor and political participation.[176] Existing macro-economic policies do not adequately account for the growth potential of women's full participation in the economy. As reported by McKinsey, women currently only contribute to 37% of the global GDP.[177] The gender gap exists in all the world's economies, including in countries performing best on the World Economic Forum Gender Gap Index.[178] The best performing country in this index, Iceland, still has a 12% gender gap in the economy.[179] Fully closing the gender gap could add USD 28 trillion to the global economy by 2025.[180] While macro-economic policies often are assumed to be gender neutral, they can often entrench structural barriers to women's participation.[181] Chapter 3 provides further detail on addressing gender in green growth.

2.3 Rethinking fiscal policy, valuation, and accounting for the green growth economy

2.3.1 Fiscal policy instruments: addressing market failures in an equitable manner

Smartly designed fiscal instruments have the potential to address adverse environmental impacts while catalyzing innovation and new green markets. Smart policy design is also essential for ensuring a wide acceptance of new instruments and supporting the social objectives of green growth.

[166] World Bank, *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*, 2018.

[167] World Bank, *Poverty and Shared Prosperity 2018: Piecing Together the Poverty Puzzle*, 2018.

[168] UNDP and OPHI, *Global Multidimensional Poverty Index 2019*, 2019.

[169] Era Dabla-Norris et al., *Causes and Consequences of Income Inequality a Global Perspective*. (International Monetary Fund, 2015)

[170] OECD, *Poor Children in Rich Countries: Why We Need Policy Action*, 2018

[171] "Inequality," OECD, accessed September 21, 2019, http://www.oecd.org/social/inequality.html.

[172] World Economic Forum, *The 2018 Inclusive Development Index*, 2018, https://www.weforum.org/reports/the-inclusive-development-index-2018.

[173] Era Dabla-Norris et al., *Causes and Consequences of Income Inequality a Global Perspective*. (International Monetary Fund, 2015)

[174] Andrew G. Berg and Jonathan D. Ostry, *Inequality and Usustainable Growth: Two Sides of the Same Coin?* (International Monetary Fund, 2011);. Jonathan D. Ostry, Andrew G. Berg, and Charalambis G. Tsangarides, *Redistribution, Inequality, and Growth*. (International Monetary Fund 2014)

[175] Diane Elson, and Anuradha Seth, *Gender Equality and Inclusive Growth: Economic Policies to Achieve Sustainable Development*, (New York: UN Women: 2019), https://www.unwomen.org/en/digital-library/publications/2019/01/gender-equality-and-inclusive-growth.

[176] McKinsey Global Institute, *The Power of Parity*, 2015.

[177] McKinsey Global Institute, *The Power of Parity*, 2015.

[178] World Economic Forum, *Global Gender Gap Report 2020*, 2020. http://www3.weforum.org/docs/WEF_GGGR_2020.pdf. https://www3.weforum.org/docs/WEF_GGGR_2020.pdf.

[179] World Economic Forum, *Global Gender Gap Report 2020*, 2020. https://www3.weforum.org/docs/WEF_GGGR_2020.pdf.

[180] McKinsey Global Institute, *The Power of Parity*, 2015.

[181] Diane Elson, and Anuradha Seth, *Gender Equality and Inclusive Growth*, UN Women, 2019.

Fiscal policy instruments can effectively address market failures by incorporating the true value of natural capital, ecosystems, and planetary systems in market prices. These instruments include environmental taxes, carbon pricing schemes, and well-designed fossil fuel subsidy reform systems.

Fiscal policy instruments provide a way for governments to successfully catalyze green growth by providing the enabling environment for the private sector to invest in greener products and services. More effective use of tax policies and environmental tax reform can successfully catalyze green growth. Smartly designed taxes on environmental externalities and the use of energy and natural resources can simultaneously drive innovation, increase resource efficiency, and reduce negative environmental impacts. For example, governments may introduce tax-based incentives to support the transformation of existing markets. Such incentives allow commercial, agricultural, and industrial enterprises to invest in innovative technologies or implement new production approaches to improve their resource efficiency and reduce operating costs. Incentives can also catalyze the creation of new green enterprises and markets. The smart design of policy instruments also helps to gain their widespread acceptance. For example, consumers and companies are less affected by increases in the price of energy or raw materials when price signals are stable, including when prices increase in combination with energy and resource efficiency improvements.

In the context of COVID-19 crisis and plummeting oil prices, the use of fiscal policies becomes opportune. Eliminating fossil fuel subsidies and increasing taxes on fossil fuels will provide the right price signals to invest away from dirty fuels, while at the same time will increase government revenue streams. Increased government revenues can be used partly to compensate the poorest groups and partly be reinvested in clean energy and green growth projects. It is essential to incorporate climate change costs in the economic decision making by raising the costs of carbon emissions through carbon taxes or emissions trading schemes. According to IMF, keeping the global average temperature increase up to 2 degrees of Celsius will require a carbon price of about USD 75 per ton by 2030.[182]

In addition to reducing negative environmental impacts, fiscal policy should support the social objectives of green growth. Low-income countries, in particular, need to improve their resource mobilization, tax base, and tax collection systems to support green growth. To date, developing and emerging economies have not sufficiently utilized taxes as a means of redistribution due to their small tax bases, large informal economies, and the low capacity of national tax administrations.[183] With stronger tax systems that lead to higher tax revenues, low-income countries can better support the development or enhancement of social and environmental protection programs, which can help reduce inequality and fairly share environmental protection costs.[38] For example, environmental taxes and other fiscal measures that simultaneously reduce taxes in other policy fields, such as labor taxes can be combined to boost employment. It is also vital to ensure that new fiscal policies support an equitable distribution of resources between different social classes and genders.

2.3.2 Valuation and accounting: recognizing the full potential of the green growth economy

Better valuation and accounting systems, as well as alternatives to GDP, are essential for measuring the full extent of the value of natural capital and social capital in national accounting systems, business models, and planning processes. Several new approaches are available to more effectively measure the value of natural capital, economic prosperity, and well-being, and to utilize consumption-based accounting.

Natural capital valuation

Incorporating natural capital in economic analysis and decision-making through improved methods helps governments, policymakers, and investors understand the consequences of their decisions for overall wealth and long-term prosperity. By measuring changes to natural stocks in national accounting systems, countries can begin to rethink capital investments aimed at increasing short-term profits and instead prioritize long-term economic and environmental sustainability. Natural capital valuation is particularly important in low-income countries, where natural capital accounts for up to 50% of national wealth.[184]

The Economics of Ecosystems and Biodiversity (TEEB) initiative has highlighted the value of biodiversity and ecosystem services not only from a purely environmental perspective but also from an economic one. This initiative is a prominent example of identifying and mainstreaming the value of biodiversity in policymaking, enabling policymakers to address trade-offs and sustainability considerations. Recommended policy mechanisms can include, for example, payments for ecosystem services (PES), eco-certification and labeling, or land value capture instruments.[185]

Alternatives to GDP

There is an increasing realization of the need for better metrics than GDP for measuring economic prosperity, wealth, and human well-being. Fully transitioning to the green growth economy requires a commensurate transition to economic measures that considerably improve upon the outdated and relatively limited use of GDP. GDP measures a country's economic output by aggregating all economic expenditures of its economic activities without differentiating those that improve prosperity and well-being from those that negatively impact them. GDP refers only to financial flows and economic output and fails to take into account

[182] International Monetary Fund, *Fiscal Monitor: How to Mitigate Climate Change*, 2019, https://www.imf.org/en/Publications/FM/Issues/2019/09/12/fiscal-monitor-october-2019.

[183] World Bank, *Poverty and Shared Prosperity 2018: Taking on Inequality*, (Washington, DC: World Bank, 2016), https://www.worldbank.org/en/publication/poverty-and-shared-prosperity-2016.

[184] Lange et al., *The Changing Wealth of Nations 2018*, 2018.

[185] Pavan Sukhdev, Heidi Wittmer, and Dustin Miller, *The Economics of Ecosystems and Biodiversity (TEEB): Challenges and Response*, (Oxford: Oxford University Press, 2014), http://img.teebweb.org/wp-content/uploads/2014/09/TEEB-Challenges-and-Responses.pdf.

any changes to capital stocks, including natural ones, upon which economic activities depend. Perversely, even coping with things that are bad for the planet and social well-being, like rebuilding after a natural disaster, can be counted as "good" for the economy. GDP also does not capture income inequality as it fails to reflect the income distribution among the citizens of a country.

Table 2 sets out numerous proposed alternative indicators to reflect the value of countries' overall prosperity and well-being. Countries can utilize these indicators in the transition to green growth. For example, the **System of Integrated Environmental and Economic Accounting (SEEA)** supports countries in measuring and recording flows of raw materials from the environment to the economy, the exchanges of these materials within the economy, releases of wastes and pollutants to the environment, environmental assets, and economic activities related to the environment. More recently, the **SEEA Experimental Ecosystem Accounting** aims to capture the role of natural capital and ecosystem services as the basis of economic activities and well-being. It supports countries in measuring and recording flows of raw materials from the environment to the economy, the exchanges of these materials within the economy, releases of wastes and pollutants to the environment, environmental assets, and economic activities related to the environment. The **Genuine Progress Indicator (GPI)**, on the other hand, incorporates a range of environmental and social considerations while retaining some of the economic factors already included in GDP.[186] Negative environmental and social factors reduce the level of the GPI while positive factors increase its value. A study of 17 countries found that GPI flattened in the decades following 1975, correlating with the stagnation of social well-being during this period. In comparison, GDP consistently increased during that period, providing a distorted view of national well-being to policymakers, as shown in figure 11 in the next page.

Table 2. Alternatives to GDP

	System of Integrated Environmental and Economic Accounting (SEEA)[184]	Genuine Progress Indicator (GPI)[185]	Wealth Accounting[186]	Inclusive Wealth Index (IWI)[187]
Main	Accounts for stocks and flows of resources in the economy, inclusion of wastes, pollutants, environmental assets	Accounts for environmental and social costs of economic activity, income inequality	Includes economic, natural and human assets to measure comprehensive wealth	Includes economic, natural and human assets to measure inclusive wealth
Types of Capital Included	Natural Capital Produced Capital	Natural Capital Produced Capital Human Capital Social Capital	Natural Capital Produced Capital Human Capital	Natural Capital Produced Capital Human Capital
Limitations	Does not include social factors	No information on stocks of natural assets	Fossil fuel stocks (natural assets) have a positive effect on wealth	Includes both green and non-green types of natural capital, such as fossil fuel stocks

[186] With some adjustments.

[187] United Nations, *System of Environmental-Economic Accounting 2012 Centra Framework*, 2014, https://unstats.un.org/unsd/envaccounting/seearev/seea_cf nal_en.pdf.

[188] Ida Kubiszewski et al., «Beyond GDP: Measuring and achieving global genuine progress,» *Ecological Economics* 93, no. C (2013): 57–68, https://doi.org/10.1016/j.ecolecon.2013.04.019.

[189] Lange et al., *The Changing Wealth of Nations 2018*, 2018.

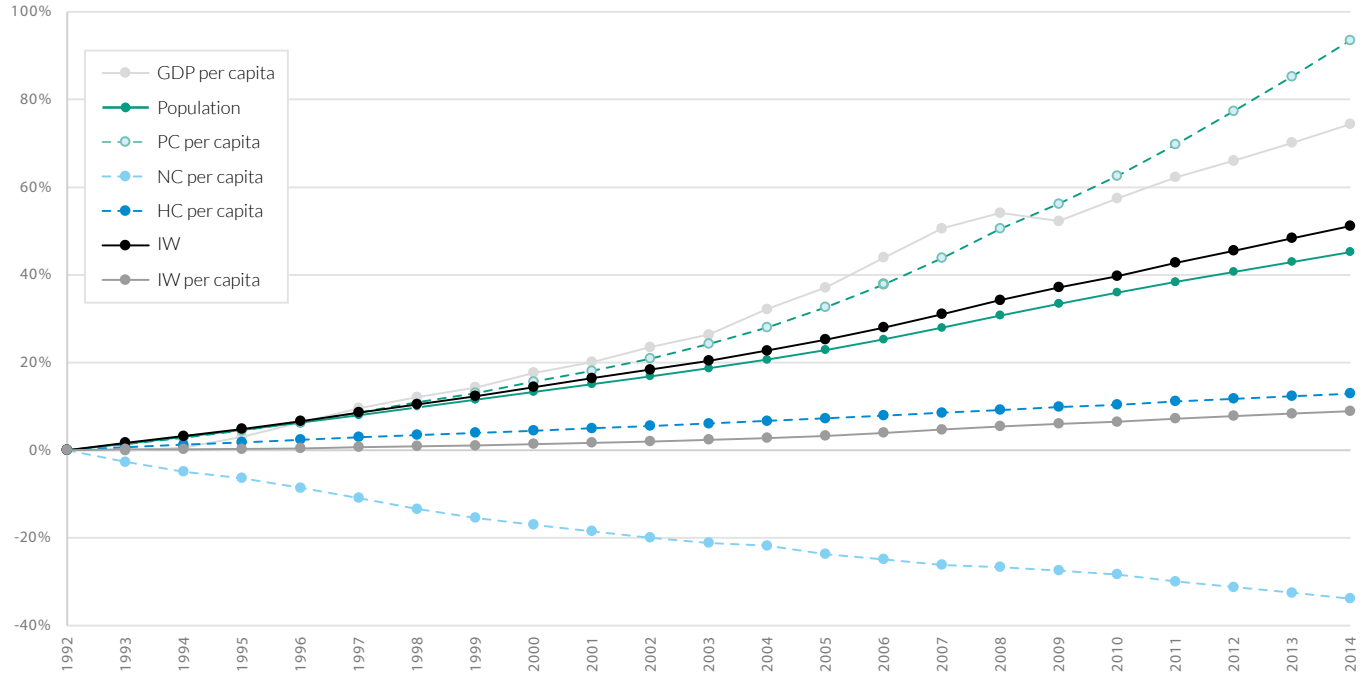
[190] UNEP, *Inclusive Wealth Report 2018: Measuring Sustainability and Wellbeing*, (Nairobi: UNEP, 2018), https://www.unenvironment.org/resources/report/inclusive-wealth-report-2018.

Similarly, the **Inclusive Wealth Index (IWI)** developed by UNEP incorporates values for produced capital, human capital, and natural capital to determine the inclusive wealth of each country.[191] The adjusted IWI incorporates the social costs of carbon damage (set at USD 50 per ton of carbon), oil capital gains and losses, and total factor productivity, a measure of economic productivity.[192] At a global level, human capital represents 59% of all wealth in the IWI, produced capital 21%, and natural capital 20%. While produced capital almost doubled and human capital increased slightly between 1992 and 2014, natural capital decreased by almost 40%, as shown in figure 12.[193]

Figure 11. GDP per capita vs. GPI per capita

Source: Lange et al., *The Changing Wealth of Nations 2018*, 2018.

Figure 12. Trends in global per capita inclusive wealth 1992-2014



Source: UNEP, *Inclusive Wealth Report*, 2018

[191] UNEP, *Inclusive Wealth Report 2018*, 2018.

[192] UNEP, *Inclusive Wealth Index Report 2018: Methodological annex: Frontier approach*, 2019.

[193] UNEP, *Inclusive Wealth Report 2018*, 2018.

Consumption-based accounting (CBA)

CBA, an alternative to production-based accounting, has attracted considerable attention as a tool to measure resource use and GHG emissions embodied in goods and services. CBA models estimate the consumption-based impacts of an economy, referring to the environmental impacts embodied in the production and use of final goods and services. Measurement of the volume of resources, materials, and emissions from trade provides valuable insights into the drivers of resource consumption and environmental pressures. Therefore, by applying CBA, in addition to production-based accounting, governments can account for and track the pressures on resources and the environmental impacts of imported goods and services. CBA and footprint indicators can encourage international collaboration between governments, financial institutions, companies, trade organizations, and others to reduce the environmental impacts of international trade based on an understanding of shared responsibility.

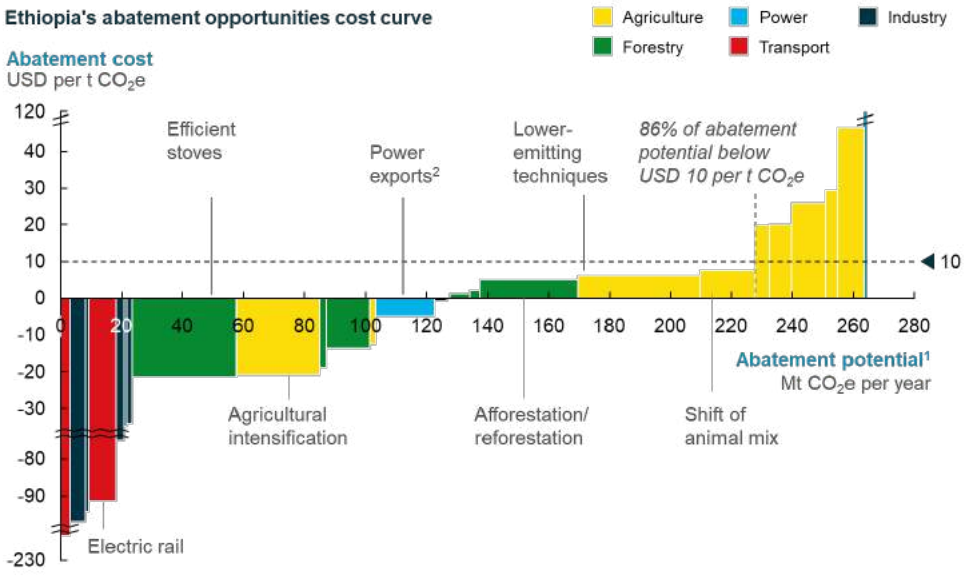
2.4 Case studies: Evidence-based economic analysis and decision-making

Governments are increasingly embracing evidence-based marginal abatement cost and environmental cost-benefit analyses to identify no-cost or negative-cost green growth actions to implement through policies, plans, and investment decisions. Extended cost-benefit analysis (eCBA) and marginal abatement cost analysis methods assess the costs and benefits of projects and are essential methods for prioritizing green growth interventions. The following are case studies from Ethiopia, Indonesia, and Uganda.

Ethiopia. Led by the Office of the Prime Minister, the Government of Ethiopia launched its Climate Resilient Green Economy (CRGE) Vision and Strategy[194] in 2011, which has served as the foundation for several critical green growth policies, including Ethiopia's NDC and five-year economic development plan. GGGI supported the government in conducting the economic analysis underpinning the vision and strategy—the development of a baseline in emissions, together with a BAU and green growth scenario, using a marginal abatement cost curve (MACC), as shown in figure 13. The analysis indicated Ethiopia's potential to reach middle-income status by 2025 while ensuring a net-zero increase in GHG emissions. Almost 50% of the potential emissions reductions result from cost-saving measures across sectors.

Among the projects initiated under the CRGE framework, the government launched the Addis Ababa light rail in 2015 to increase travel efficiency and reduce emissions. The construction of the Addis Ababa to Djibouti railway created about 40,000 jobs. With support from Norway, Ethiopia's afforestation and reforestation program includes developing a REDD+ strategy, creating a new task force, and launching a REDD+ Investment Program that aims for the forestry sector to contribute 8% of GDP and 26 million mtCO_2e reduced or sequestered by 2020. The Ethiopian Electric Power Cooperation (EEPCo) launched the first waste-to-energy facility in the country, processing 350,000 tons of waste per year and generating 50 MW of electricity.

Figure 13. Ethiopia's abatement opportunities cost curve



Source: Ethiopia CRGE, 2011.

[194] The Federal Democratic Republic of Ethiopia Environmental Protection Authority, *Ethiopia's Climate-Resilient Green Economy Strategy*, 2011, https://www.adaptation-undp.org/sites/default/files/downloads/ethiopia_climate_resilient_green_economy_strategy.pdf.

Indonesia. In Indonesia, GGGI undertook pre-feasibility studies to support the government in using extended CBA to assess the environmental and socioeconomic benefits from green growth policy and project interventions of government-led programs and private projects. The eCBA assessed three economic zones in North Sumatera, East Kalimantan, and South Sulawesi and an ecosystem restoration project in Central Kalimantan. Proposed green growth interventions included: solar, biomass, and waste-to-energy power projects to replace plans for fossil-fuel based power generation; certified, sustainable management practices in palm oil and fisheries; reforestation; and new hazardous waste management facilities. Monetary benefits of these interventions were estimated to be between USD 871 million and USD 9.8 billion,[195] providing a strong rationale for investment and measures to eliminate regulatory and policy barriers.[196]

Related macroeconomic modeling based on the system dynamics, supported by NCE and GGGI, suggests that implementing low carbon development policies in Indonesia would yield viable and sustainable long-term benefits. Indonesia's Vision 2045 model[197] simulates specific policies and interventions to reduce energy intensity, shift towards renewable energy, increase the efficiency of energy systems, enhance land productivity, improve food and land use, reduce food waste, and fully enforce moratoria in forests, peat lands, mangroves, and mining.[198] By 2045, these low carbon development scenarios in Indonesia indicate the potential to sustain average economic growth at 6%, achieve per capita income of over USD 18,000 (at 2017 prices), reduce the poverty rate from nearly 10% in 2018 to 0.2%, and increase employment to nearly 97% along with a shift towards better-paid, green jobs. In these scenarios, air quality improves, GHG emissions decline by 41%, and the country's high rates of deforestation decline substantially.[199]

Uganda. In Uganda, Uganda's Economic Policy Research Centre, GGGI, and the NCE jointly conducted an economic analysis based on computable general equilibrium (CGE) modelling and concluded that full adoption of green growth approaches would boost GDP by 10% by 2040 compared with BAU, create 4 million jobs, and reduce GHG emissions by 28%. The investment required to unlock the identified green growth interventions was estimated at USD 1.8 billion annually until 2020. Not all options, however, required additional investment. For example, smarter urban development could reduce overall infrastructure costs by around 11% and improve access to basic services by a third. Current plans already cover 75% of the investment required, of which 44% is expected to come from private sources. In total, an estimated 3% increase in the public budget would meet additional annual investment needs. Overall, these new investments could generate an estimated USD 3 for every dollar invested, even when excluding wider societal benefits.[200]

[195] Depending on certain carbon price assumptions.

[196] GGGI, *Delivering Green Growth for a Prosperous Indonesia: A roadmap for Policy, Planning, and Investment*, 2015, https://gggi.org/site/assets/uploads/2015/11/2015-Delivering-Green-Growth-for-a-Prosperous-Indonesia.pdf and *Costs and Benefits of Investing in Ecosystem Restoration and Conservation: Green Growth Opportunities in Katinga Peatlands*, 2015, http://gggi.org/wp-content/uploads/2016/07/Appendix-3-eCBA-3-Katingan-Technical-Document.pdf.

[197] The Indonesia Vision 2045 model is a system dynamics tool used by the National Development Planning Agency (BAPPENAS) for climate policy analysis.

[198] BAPPENAS, *Low Carbon Development: A Paradigm Shift Towards a Green Economy in Indonesia*, 2019.

[199] BAPPENAS, *Low Carbon Development: A Paradigm Shift Towards a Green Economy in Indonesia*, 2019.

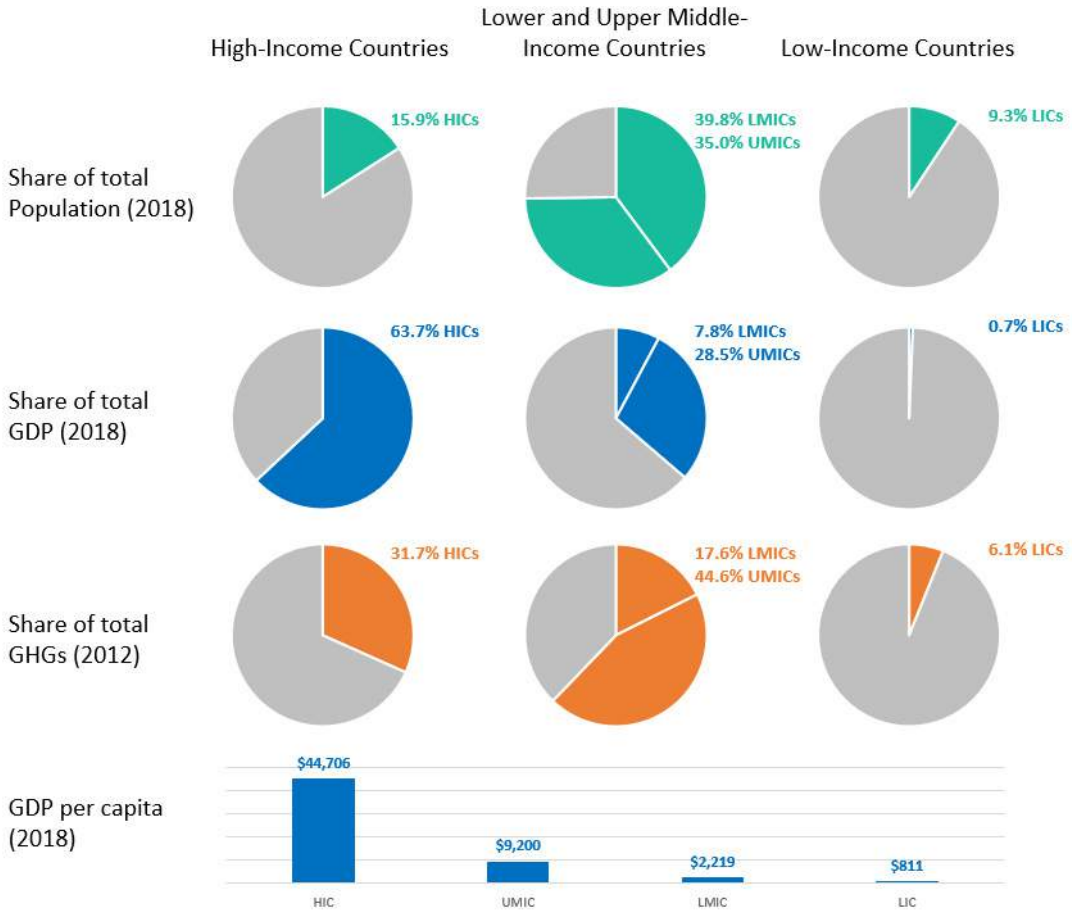
[200] Government of Uganda, *Achieving Uganda's Development Ambition, The Economic Impact of Green Growth: An Agenda for Action*, January 2017.

03 ACHIEVING NATIONAL AMBITIONS AND TAKING AIM AT GLOBAL CHALLENGES

A growing number of countries are turning to green growth to address national development priorities and global challenges like climate change. Maintaining vibrant and sustainable economic growth is a top priority for governments worldwide. Yet, countries have distinctive approaches to the green growth transformation, as shown in figure 14.

More mature, **high-income economies** have undergone relatively early industrialization and have mostly tackled issues of pollution while adopting a range of socially progressive policies. Given the size of their economies, these countries also exert high demand for manufactured and agricultural products from middle- and low-income countries, thus expanding their global footprint. Many of high-income countries possess the resources and growing political will to undertake a green transformation through more efficient and sustainable use of resources, reduced consumption, phased out fossil fuels, and investment in green infrastructure.[201]

Figure 14. Comparison of High-, Middle-, and Low-Income Countries



Source: GGGI, using World Bank data

[201] GGGI, G20 Background paper, 2019, 9.

A growing number of **lower- and upper-middle-income countries** have recently undergone rapid economic growth, often at rates significantly outpacing more mature economies, and now face heavy pollution levels and associated health risks. Many of these countries strive to achieve high-income status, placing increased strains on natural resources, and continue to plan to invest in polluting infrastructure, such as coal-fired power generation and energy-intensive industries. However, middle-income countries have critical opportunities to invest in greener, more sustainable energy, industries, infrastructure, and land-use practices and to avoid stranded assets. Most countries in this group have growing workforces and a rapidly growing, educated middle class with expectations for increasingly progressive social policies.

Many **low-income countries** face significant social and economic development challenges, and their economies are often highly dependent on agricultural production or natural resource extraction. Achieving the SDGs and moving to middle-income status is a high priority. Although these countries have historically had low GHG emissions, they are typically among the most vulnerable to climate change and have far fewer resources and capacity to implement adaptation measures. Due to the lack of existing polluting infrastructure, low-income countries have the most significant opportunities to leapfrog or move directly to clean technologies in developing their economies. They can use green growth as a critical vehicle for creating employment and developing new businesses, infrastructure, and basic services.[202]

For virtually all low- and middle-income countries, achieving economic growth to eradicate poverty and provide decent jobs for the next generation remains the top priority. Green growth provides the only rational development path during the near and long term for economic growth that is sustainable and inclusive, ensures long-term protection and sustainable use of natural resources, and addresses global challenges like climate change. This development path requires shifting economic sectors and investments towards greener infrastructure, industries, technologies, and practices across all sectors.

Today, renewable energy, energy efficiency, sustainable transport, green cities, improved water and sanitation services, and sustainable agriculture and forest management present commercially attractive investment opportunities. For many countries, particularly least developed countries and SIDS, investing in climate change adaptation is also necessary for ensuring prosperity in the long-term.

[202] GGGI, *G20 Background paper*, 2019, 9.

3.1 Rising to global green investment opportunities

The World Bank estimates that financing the green transformation to achieve the SDGs in developing countries requires investments of USD 4.0-4.5 trillion per year, at least double current levels of USD 2 trillion per year in green investment. In comparison, the world's developed economies provide about USD 135 billion in development assistance each year, about 3% of what is required.[203] For many countries, there would be little difference in the cost for these countries to spend on full decarbonization instead of maintaining BAU polluting alternatives throughout the century.[204]

The only sources of funding large enough to close the gap are the world's commercial banks and institutional investors, with a combined pool of capital estimated at USD 225 trillion in 2015.[205] An increasing number of global asset managers, multilateral development banks, export credit agencies, national development finance agencies, global banks, and insurance companies recognize the risk of stranded assets. These investors are starting to divest from unsustainable sectors, such as coal-fired power generation. By the end of 2018, 415 global investors managing a collective USD 32 trillion called for the complete phase-out of coal across OECD countries by 2030.[206] Nine global financial institutions have collectively pledged to invest USD 1.4 trillion in clean energy over the coming decade. Another 40% have adopted formal policies that exclude thermal coal mining, coal-fired power plants, or commit to clean energy finance targets in their portfolios.[207] A range of innovative financial instruments are also becoming available to catalyze new greener investments, such as green bonds, which have grown to some USD 167 billion as of 2018[208] to finance or refinance investments in low-carbon or other sustainability projects.[209]

Despite considerable progress, green investment levels are far from sufficient and need to be—and can be—scaled up dramatically. Governments and civil society must continue to encourage financial institutions to look beyond their near-term horizons and align their policies with the global green growth agenda. There is no shortage of capital to invest in the green

[203] GGGI, *G20 Background paper*, 2019, 39; World Bank, "Maximizing Finance to Power Development," September 28, 2018, https://www.worldbank.org/en/news/immersive-story/2018/09/28/maximizing-finance-to-power-development.

[204] Julie Rozenberg, and Marianne Fay, eds. *Beyond the Gap: How Countries Can Afford the Infrastructure They Need while Protecting the Planet*, (Washington, DC: World Bank, 2019), https://doi.org/10.1596/978-1-4648-1363-4, 1-2.

[205] Business Insider, "Here's what the $294 trillion market of global financial assets looks like," February 11, 2015, https://www.businessinsider.com/global-financial-assets-2015-2. This value includes total estimated global values of public debt securities outstanding; financial institution bonds outstanding; nonfinancial corporate bonds outstanding; securitized loans outstanding; and non-securitized loans outstanding.

[206] Institute for Energy Economics and Financial Analysis, "Over 100 Global Financial Institutions Are Exiting Coal, With More to Come Every Two Weeks a Bank, Insurer or Lender Announces New Restrictions on Coal," February 2019, http://ieefa.org/wp-content/uploads/2019/02/IEEFA-Report_100-and-counting_Coal-Exit_Feb-2019.pdf.

[207] IEEFA, "Over 100 Global Financial Institutions Are Exiting Coal," 2019.

[208] Giulia Rado, "Market Blog #19," Climate Bonds Initiative, January 18, 2019, https://www.climatebonds.net/2019/01/market-blog-19-18-jan-2019-usd1673bn-total-2018-gb-issuance-usd11bn-gbs-dec-18-alone-1st-gb.

[209] GGGI, *G20 Background paper*, 2019, 40.

transformation, real long-term interest rates are relatively low, and there is growing interest in the private sector.

Instead, challenges include identifying bankable and investment-ready projects, shifting away from conventional and well-understood investments to greener, low-carbon options, and the need for innovative financing mechanisms. Finding appropriate green projects that are bankable, or commercially attractive investment opportunities, remains a central challenge and a priority for organizations like GGGI. Project developers in developing countries also often struggle to access the large sums of upfront financing needed.[210]

Developing country governments can remove primary obstacles to investment by lifting policy barriers and providing an enabling policy environment and access to market data. Promoting and applying credit enhancement instruments can reduce risks and make green projects more financially attractive. For example, utility-scale renewable energy investors tend to require a solid power purchasing agreement with a reasonable feed-in-tariff for at least a 20-year period. The adoption of a net-metering policy or lifting regulatory caps on rooftop solar capacity can similarly enable rooftop solar projects.[211]

A related challenge is that investments in developing countries are often considered risky due to foreign exchange risk, immature markets, high transaction costs, foreign exchange controls, the need to introduce new technology, and other factors. Concessional finance, such as development assistance and climate finance, can be used to reduce risks to reasonable levels to attract private investors and to open up markets or introduce new technologies.[212]

GGGI is supporting its Member governments to increase their capacity to access green and climate finance and develop green bankable projects and national green finance vehicles. During 2017-2018, GGGI helped its Member countries mobilize around USD 1 billion in green financing projects to the stage of investor commitment. This included funding from the Green Climate Fund, to which GGGI successfully supported five full proposals valued at a total of USD 200 million. Four of the proposals are direct access, and the GCF Board has already approved the proposals for **Ethiopia** and **Rwanda**, valued at USD 85 million.[213]

3.2 Inclusive transitions to a green growth economy

Chapter 2 makes the case that the transition to green growth must be socially inclusive. Poverty elimination, gender equality, and social inclusion are embedded in international climate and SDG commitments and require attention in national, sub-national, and sector-level green growth strategies and action plans. Social inclusion also entails ensuring support for adequate access to a wide range of services, including health, education, jobs, economic opportunity, energy, mobility, and water and sanitation. The green growth transition should build on the increasing evidence that poverty elimination, gender equality, and social inclusion are integral to achieve environmentally sustainable economic growth. By contrast, failure to achieve people-centric, positive inclusion and to reduce inequalities can undermine progress.

The need for people-centric strategies

To ensure a just and inclusive transition, national, sub-national, and sector-level green growth strategies should include targets and indicators for the participation of women and marginalized communities. It is also crucial to assess how green growth reform may affect different segments of the population differently. This approach needs to be people-centric, with decision-making based on societal and not solely economic interests, in order to build both the public support and the political will needed to undertake transitional green policy changes.

Compensation packages, off-set schemes, and other measures can address concerns that arise as policy reforms affect the poor, women, and other groups disproportionately. For example, **Colombia** mobilized investments under the government's Amazon Vision Program to indigenous peoples organizations to implement projects that achieve environmental and local economic outcomes. The **Indonesian** government's rollback of fuel subsidies was successfully coupled with compensation packages aimed to offset any negative impacts, particularly on the poor.[214] By contrast, failure to account for the unequal distribution of the impacts of fuel tax contributed to a political backlash to the French government's proposals 2019, causing massive protests.[215] These experiences emphasize the importance of ensuring the equal distribution of green growth benefits and a soft landing for workers in fossil fuel industries, and off-sets for communities who are disproportionally negatively impacted by the green transition. Political will for reform rests on its public demand.

[210] GGGI, *G20 Background paper*, 2019, 41.

[211] GGGI, *G20 Background paper*, 2019, 41.

[212] GGGI, *G20 Background paper*, 2019, 41.

[213] GGGI, *G20 Background paper*, 2019, 41.

[214] GGGI, IIED, GEC. 2016. *Pro-poor, Inclusive Green Growth: Experience and a New Agenda*.

[215] Mizan Khan, and Dereje Senshaw, "Aborted Fuel Tax Initiative in France: Its Ramifications for Green Growth," December 27, 2018, http://www.ipsnews.net/2018/12/aborted-fuel-tax-initiative-france-ramifications-green-growth/.

Inclusion of the informal sector in green growth transformations

For the green growth transformation to succeed, it must include the informal sector as part of addressing challenges in both urban and rural economies while creating additional value. According to a recent study, the informal economy supports 13% of the global economy[216] while "two billion of the world's employed population aged above 15 work informally, representing 61.2% of global employment."[217] At the same time, people in the informal economy are the poorest and most dependent on natural resources and the state of the environment. They are more likely to reside in areas vulnerable to climate change.

Given the size of the informal economy in both rural and urban economies, it must play a critical role in the green growth transition.[218] An estimated 75% of waste management globally is carried out through the informal sector. Governments are starting to account for this, such as the municipal government of Vientiane, **Lao PDR**, which is working with support from GGGI to extend waste services to unserved communities through engagement of community stakeholders and informal sector cooperatives.

National economic strategies that take an inclusive approach to formalize informal sectors can improve welfare and increase access to productive services and finance that further enhance the livelihoods of the poor. For example, introducing climate-smart technologies to smallholder farmers while also addressing land tenure, productive assets, and financial services could create a linkage between formality and climate adaptation and mitigation action. In the solid waste sector, there is evidence that government recognition of informal sector actors and the ability of informal sector actors to self-organize create opportunities for inclusive and sustainable transformation of solid waste industries.[219] Bringing more people into the formal economy could lead to improved incomes and benefits, health, and safety standards, while simultaneously widening the national tax base.[220]

Addressing gender in green growth

Gender equality and women's empowerment accelerate achievements across all 17 SDGs and are integral to environmental sustainability. Women's active roles in politics, business, and natural resource management are increasingly associated with improved environmental outcomes.[221] Women also play an essential role in climate change adaptation and mitigation. For example, women are involved in more than 50% of the world's food production,[222] and 48% of economically active women globally and 79% in developing countries work in agriculture.[223] There is growing evidence that addressing gender inequalities at household and community levels leads to better agricultural outcomes,[224] making the inclusion of women vital in transitioning towards green and sustainable agriculture in the face of climate change. Studies indicate that women involved in natural resource management generate more sustainable environmental outcomes, and those in political positions positively contribute to low carbon development and a higher probability of the ratification of environmental treaties.[225]

Green growth planning creates an opportunity to incorporate a "triple bottom line" approach to policy development that includes social and environmental considerations. In **Jordan**, the National Green Growth Plan and forthcoming National Action Plan incorporate gender equality, poverty reduction, and social inclusion targets and indicators in its results framework, which is used to identify a pipeline of green growth investment opportunities. Similarly, in **Mexico**, the Sonora State Green Growth Strategy incorporates gender equality and women's empowerment. With GGGI's support, the government has engaged with the National Network for Women in Renewable Energy to identify ways to close the gender gap in transition to renewable energy.

Gender-responsive green growth policy can also set priorities for public and private green growth investments. Social criteria for financing through national and international green finance instruments and vehicles can further leverage social inclusion. For example, with support from GGGI, the Government of **Vanuatu** has established a National Green Energy Fund (NGEF) to finance off-grid energy solutions towards meeting its target for 100% renewable energy by 2030, which also expands energy access to under-serviced, rural communities. The Department of Women's Affairs is represented on the fund's board. Bringing government departments concerned with gender equality and poverty reduction into green growth decision-making is intended to align inclusive growth objectives better with broader national development plans.

These outcomes can be further leveraged through environmental and social criteria in climate finance beyond conventional safeguards to maximize the creation of social co-benefits. For example, the GCF has issued detailed guidelines for gender mainstreaming of climate projects,[226] which align with its 2019

[216] International Institute for Environment and Development, *Informality and inclusive green growth*, 2016, https://pubs.iied.org/pdfs/17365IIED.pdf.

[217] International Labour Organization, *Women and men in the informal economy: a statistical picture (third edition)*, (Geneva: ILO, 2018), https://www.ilo.org/global/publications/books/WCMS_626831/lang--en/index.htm.

[218] International Labour Organization, *Women and men in the informal economy: a statistical picture (third edition)*, (Geneva: ILO, 2018), https://www.ilo.org/global/publications/books/WCMS_626831/lang--en/index.htm.

[219] IIED, *Informality and inclusive green growth*, 2016.

[220] International Labour Organization, *R206 - Transition from the Informal to the Formal Economy Recommendation*, 2015, https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:R204;
ILO, *Women and men in the informal economy*, 2018.

[221] Esuna Dugarova, *Gender Equality as an Accelerator for Achieving the Sustainable Development Goals*, 2018.

[222] FAO, *The State of Food and Agriculture 2010-2011: Closing the Gender Gap for Development*, (Rome: FAO, 2011), http://www.fao.org/3/a-i2050e.pdf.

[223] Cheryl Doss, "If Women Hold Up Half of the Sky, How Much of the World's Food Do They Produce?" in Gender in Agriculture, eds. Agnes Quisumbing et al., (Dordrecht: Springer, 2014).

[224] Esuna Dugarova, *Gender Equality as an Accelerator for Achieving the Sustainable Development Goals*, 2018.

[225] Esuna Dugarova, *Gender Equality as an Accelerator for Achieving the Sustainable Development Goals*, 2018.

[226] GCF and UN Women, *Gender Mainstreaming of Climate Fund Projects. A practical manual to support the integration of gender equality in climate change interventions and climate finance*, August 2017, https://www.greenclimate.fund/document/mainstreaming-gender-green-climate-fund-projects.

Gender Policy and Gender Action Plan. The GCF's emphasis on safeguards, gender and social inclusion creates important leverage for gender-responsive and socially inclusive investments. Innovative models to create financial incentives for women's empowerment have been developed, such as the UNFCCC Award-winning Women Organizing for Change in Agriculture and Natural Resource Management's (WOCAN)[227] W+ Standard and the gender equality indicators incorporated into the Gold Standard. Similarity, the Gold Standard's Gender Equality Framework aims to provide funders of climate protection projects with a tool to quantify and certify contributions to empower women and girls. GGGI is supporting the government of **Papua New Guinea** on a Climate Resilient Green Growth project, funded by the Australia Department of Foreign Affairs and Trade (DFAT). The project aims to strengthen the capacity to mobilize climate investment funds for green projects at the provincial level. The mobilization of gender-responsive investments is one component of this effort.

Ensuring decent green jobs

Careful consideration of employment shifts is needed to ensure a just transition. As discussed in Chapter 2, the creation of green jobs is at the heart of socio-economic green growth benefits. Ensuring that these jobs are decent and that inclusion is positive, and not detrimental, is paramount to a just transition. Decent jobs require respecting labor rights through living wages, welfare benefits, and health and safety standards. Measures such as new education and (re)training programs, promoting green innovation and entrepreneurship, and ensuring it is easy to do business help to ensure a just transition. Young people should be given a voice and recognized as critical stakeholders.[228]

Careful anticipation of employment shifts is necessary for implementing green transitions. A well-managed approach is necessary to avoid or minimize adverse impacts or risks to workers, communities, and businesses. For example, in the energy sector, a sudden shift of jobs from fossil fuel to renewable energy industries can create public opposition, ultimately impeding an effective transition. However, sectors such as waste management and recycling, remanufacturing and repair, and services are likely to expand as they become more competitive against sectors that rely on materially intensive natural resource use. A well-managed transition, with the right policies in place promoting participation, social protection, and re-skilling, can instead lead to a robust generation of decent and better-quality jobs (Box 4).[229]

Box 4. Policies for a just transition

There are good examples of well-designed schemes addressing the issue of just transition, mostly in connection to the coal sector. In Alberta, **Canada**, revenues from carbon taxes were redistributed to support coal communities affected by the renewable energy transition.[230] Another example in the North America is the establishment of the Just Transition Fund in the **United States**, funded by the Federal Government to support coal sector communities in Appalachia and elsewhere by investing in bottom-up innovation in sustainable economic development.[231] **China** has similarly created a USD 15 billion fund to support retraining, reskilling, reallocation, and early retirement of 5-6 million workers affected by the country's efforts to slow down the construction of coal-fired power plants.[232] **South Africa's** National Planning Commission has recognized an "urgent need for coordinated stakeholder action driven by government to facilitate a transparent decision-making process on the future of coal in South Africa as part of a just energy transition."[233]

3.3 Embracing green growth through national strategies

Many developing countries and emerging economies have a unique opportunity to pursue their economic growth and development objectives in a way that avoids infrastructure lock-in and repeating the mistakes of more developed countries. Countries adopting green growth seek to maximize prosperity, efficiency, and productivity while minimizing the depletion and degradation of their natural resource base and natural capital, minimizing impacts on ecosystems and biodiversity, and promoting social development and inclusion. At the same time, they seek to achieve their SDG objectives and to demonstrate leadership towards achieving critical global commitments such as the Paris Agreement.

An increasing number of countries have explicitly adopted green growth strategies, policies, frameworks, or plans with the help of GGGI and other international development partners. These are long-term economic development strategies that are environmentally sustainable, low-emission, climate-resilient, and socially inclusive. To date, more than 25 countries worldwide have formally adopted national or subnational green growth strategies, plans, or policies, or have directly incorporated the concepts of green growth or green economy in their national development strategies and frameworks. These include, for example, **Burkina Faso**, **Cambodia**, **Colombia**, **Ethiopia**, **Fiji**, **Guyana**, **Indonesia**, **Jordan**, the **Republic of Korea**, **Lao PDR**, **Mexico**, **Mongolia**, **Morocco**, **Mozambique**, **Myanmar**, **Nepal**, **Papua New Guinea**, **Peru**, **Rwanda**, **Senegal**, **Thailand**, the **UAE**, the **United Kingdom**, **Uganda**, **Vanuatu**, and **Viet Nam**. Globally,

[227] WOCAN. "W+ Standard: Meeting Both Climate and Gender Equality Goals," accessed August 4, 2019, https://www.wplus.org/meeting-both-climate-and-gender-equality-goals/.

[228] GGGI, *G20 Background paper*, 2019, 5.

[229] ILO, *Just transition towards environmentally sustainable economies and societies for all*, 2015, https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---actrav/documents/publication/wcms_647648.pdf.

[230] Nick Robins, Vonda Brunsting and David Wood, "Investing in a just transition: Why investors need to integrate a social dimension into their climate strategies and how they could take action," Policy insight, June 2018.

[231] Just Transition Fund, 2018, https://static1.squarespace.com/static/5539909de4b0a710f6a0c926/t/589b591803596e425c2206ca/1486575902115/JTF-ConceptPaper%5B2%5D.pdf.

[232] NCE, *Unlocking the Inclusive Growth Story of the 21st Century: Accelerating Climate Action in Ugent Times*, 2018, https://newclimateeconomy.report/2018.

[233] National Planning Commission (2018) Energy Policy, NPC Economy Series, Pretoria: National Planning Commission, page 13.

more than 65 countries are now pursuing economy-wide green growth policies.[234]

Selected efforts of both developed and developing countries to establish green growth as part of national development policy follow below.

- **The Republic of Korea.** One of the first instances of a country adopting green growth as a national development priority was the Republic of Korea. Its transformation from being one of the world's poorest countries in the 1950s to joining the Development Assistance Committee of OECD, the exclusive club of foreign aid donors, in 2010 is considered one of the great development miracles of modern times. Korea's path to rapid economic growth had locked it into high dependence on imported fossil fuels, rising to as much as USD 140 billion in 2008, and corresponding rapid growth in GHG emissions. After decades of strong growth, the global economic slowdown combined with domestic energy and climate change concerns created an opportunity to rethink Korea's development pathway. President Lee Myung-bak introduced the concept of "low-carbon green growth" to re-stimulate economic growth while addressing various environmental challenges. The government adopted the National Strategy for Green Growth 2009-2050 and invested about USD 100 billion (2% of GDP) in green growth initiatives. In 2009 Korea also announced a target of reducing GHG emissions by 30% by 2020 and passed the Framework Act on Low Carbon Green Growth. This legislation that integrates energy, climate change, sustainable development, urban development, and other laws under a single structure.[235]

- **Ethiopia.** In 2011, Ethiopia adopted its CRGE Strategy with GGGI's support. The strategy serves as a vehicle for achieving middle-income status by the year 2025 while avoiding increasing GHG emissions and unsustainable natural resource use. A conventional development pathway would more than double Ethiopia's total emissions from 2010 to 2030, make it more dependent on fuel imports, and keep it reliant on foreign investment. The CRGE strategy addresses these concerns by identifying and prioritizing more than 60 green initiatives that further Ethiopia's development goals, attract international finance, and cap the country's GHG emissions to 2011 levels. The CRGE strategy envisions: increasing food productivity, farmer income, and food security; reducing emissions; protecting and expanding forests; expanding renewable energy electricity generation; and leapfrogging to efficient transport, industrial, and building technologies.[236]

- **Rwanda.** Rwanda's Green Growth and Climate Resilience Strategy (GGCRS), adopted in 2011, lays out the country's vision of being a developed, climate-resilient, low-carbon economy by 2050. The strategy defines 14 programs of action intended to build and strengthen adaptive capacity and climate resilience. The GGCRS also outlines several short- and long-term actions that address climate change and broad sustainable development objectives, including economic growth, poverty reduction, job creation, gender equality and equity, and sustainability of the environment and natural resources. The strategy provides a framework for mainstreaming green growth into national planning. It includes the following key objectives: energy security and low-carbon energy supply; sustainable land use and water resource management; food security; sustainable urban development; protection of biodiversity and ecosystem services; social protections and improved health; and disaster risk reduction that increases climate resilience.[237]

- **The UAE.** The UAE is another early adopter of the green growth model, from emphasizing science, knowledge, technology, and innovation to maintaining prosperity while preparing for a "post-oil world". With GGGI's support, the UAE's Prime Minister's Office launched the Green Economy for Sustainable Development initiative in 2012, which served as the foundation for its first NDC. The UAE Green Agenda 2015-2030 followed in 2015 as an overarching framework of actions to implement the initiative. In line with its national development plan, the "UAE Vision 2021," lays out five strategic objectives and twelve overarching programs. In the same year, the UAE established the Emirates Green Development Council (EGDC) to coordinate and oversee the implementation of the Green Agenda and collaboration between government and other stakeholders,[238] and adopted a sustainable financing target of USD 10 billion over 10 years.[239] The UAE is pursuing several green innovations, including new clean energy business models, solar-powered public buildings, desalination without fossil fuels, water extraction from the air, pricing reforms to reduce consumption, sustainable fishing, more sustainable spatial planning, and developing infrastructure for electric vehicles.[240]

- **Vietnam.** The Government of Vietnam has embraced green growth through a series of policy measures, including the Vietnam National Green Growth Strategy 2011-2020 (VGGS),[241] adopted in 2012, and the Vietnam National

[234] UNEP, "Green Economy: Towards Greener and More Inclusive Economies," https://www.unepfi.org/fileadmin/documents/greeneconomy_flyer.pdf.

[235] GGGI, Korea's Green Growth Experience: Process, Outcomes and Lessons Learned, (Seoul: GGGI, 2015), https://gggi.org/report/koreas-green-growth-experienceprocess-outcomes-and-lessons-learned/.

[236] The Federal Democratic Republic of Ethiopia Environmental Protection Authority, *Ethiopia's Climate-Resilient Green Economy Strategy*, 2011, 1-3.

[237] Republic of Rwanda Ministry of Environment, *Strategic Programme for Climate Resilience*, December 2017, https://www.climateinvestmentfunds.org/sites/default/files/knowledge-documents/rwanda_spcr_2017pdf.pdf; SDG Partnerships Platform, "Republic of Rwanda - Green Growth and Climate Resilience: National Strategy for Climate Change and Low Carbon Development," https://sustainabledevelopment.un.org/partnership/?p=2253.

[238] UAE Ministry of Climate Change and Environment, *State of Green Economy Report (Second Edition)*, 2016, https://www.moccae.gov.ae/assets/40a8d3c1/green-economy-report-2016.aspx.

[239] UAE Ministry of Climate Change and Environment, *State of Green Economy Report*, 2017, https://www.un-page.org/files/public/uae_state_of_green_economy_report_2017_0.pdf.

[240] UAE Ministry of Climate Change and Environment, *State of Green Economy Report (Second Edition)*, 2016.

[241] Government of Vietnam, "Decision No.1393/QD-TTg on the approval of the Viet Nam National Green Growth Strategy 2011-2020," issued by the Prime Minister on September 25, 2012.

Green Growth Action Plan 2014-2020 (VGGAP) of 2014.[242] The VGGS is considered the main driver of the country's economic development. It includes objectives to: increase macroeconomic efficiency; deploy technologies for climate change adaptation and reduce GHG emissions by 1.5-2% per year until 2030; and improve living standards through green economy actions in industry, infrastructure, employment, and natural capital. The strategy sets targets for GHG emissions intensity, adoption of renewable energy, investment in natural capital, pollution reduction, and wastewater treatment. The VGGAP provides guidelines and a total of 66 priority activities, such as mainstreaming green growth into socio-economic development plans and sectoral master plans, fostering green enterprise development and public-private partnerships, developing clean energy, investing in green buildings and transport, and increasing access to domestic and international financing.[243]

- **Fiji.** Fiji adopted its national green growth policy, A Green Growth Framework for Fiji, in 2014. The policy aims to accelerate "integrated and inclusive" development that strengthens environmental resilience, promotes social improvement and reduces poverty, enhances economic growth, and builds capacity to withstand and manage the anticipated impacts of climate change. The Framework calls for broad reductions in Fiji's carbon footprint and provides the basis for Fiji to reach net-zero carbon emissions by 2050 across all sectors. Fiji's 2015 NDC and 2017 NDC Implementation Roadmap reflect this goal by calling for the conversion of its electricity sector to 100% renewables by 2036, and it is similarly reflected in Fiji's LEDS. The Framework also seeks to promote the efficient and productive use of natural resources, promote stakeholder engagement, and strengthen capacity in environmental stewardship, civic responsibility, and risk management.[244]

- **The United Kingdom.** The United Kingdom's Clean Growth Strategy, released in 2017, sets out the ambition to decarbonize all sectors of the country's economy starting in 2020 and achieve a 57% reduction in GHG by 2032. The strategy aims to maximize the economic and social benefits of reducing emissions. It outlines the economic opportunities arising from a low carbon economy, integrating clean growth as a central part of the country's industrial strategy. The Clean Growth Strategy is implemented through support for innovation, national green finance, and policies to deliver social and economic benefits. More specific actions aim to achieve improved industrial efficiency; a shift to low carbon transport; clean, smart, and flexible power systems; an improved value of natural resources; and continued government leadership in driving clean growth in the country and globally.[245]

- **Colombia.** From 2015 to 2018, GGGI and several national and international partners have worked to support the government of Colombia to implement its Green Growth Mission and produce the national strategy "Colombia towards Green Growth". The strategy considers future economic growth, environmental sustainability, and social development issues to the year 2030. The process involved three phases. Firstly, reviewing international case studies and indicators and conducting a macroeconomic analysis and Green Growth Potential Assessment (GGPA). Secondly, developing a green growth road map focusing on new economic opportunities, the bio-economy, efficient use of resources, and development of businesses and human capital. Thirdly, validating recommendations, indicators, and goals with key stakeholders who included government authorities, the private sector, and academia.[246]

3.4 Achieving SDG and Paris Agreement ambitions through green growth

Given the pace and scale of the climate emergency, all countries must take action to raise ambition and implement policy and investment actions to fulfill the goals of the Paris Agreement and keep global temperatures to 1.5°C. The green growth planning process is a practical approach to develop NDCs and LT-LEDS with broad support across government departments and from other stakeholders and to prepare for a higher level of ambition.

Based on robust analysis, stakeholder engagement, and planning, green growth strategies can provide the fundamental building blocks to integrate climate change in national development plans and formulate NDCs and LT-LEDS. These plans and strategies should include sectoral decarbonization measures that can spur economic growth and achieve key SDGs. NDCs and LT-LEDS can build directly off the participatory planning process and policy framework provided in a national green growth strategy. The critical success factor for these efforts is that they demonstrate the viability of a green growth pathway for a national economy that decouples economic growth from GHG emissions and unsustainable consumption of natural resources.

[242] Government of Vietnam, "Decision No. 403/QD-TTg on the approval of the National Green Growth Action Plan of Viet Nam 2014-2020," issued by the Prime Minister on March 20, 2014.

[243] GGGI, *GGGI Viet Nam Country Planning Framework 2016-2020*, 2017.

[244] Republic of Fiji Ministry of Strategic Planning, National Development and Statistics, *A Green Growth Framework for Fiji*, 2014.

[245] Government of the United Kingdom, "Clean Growth Strategy," Department for Business, Energy and Industrial Strategy, 2017, https://www.gov.uk/government/publications/clean-growth-strategy.

[246] GGGI, *Macroeconomía y Crecimiento Verde: Análisis y retos para Colombia*, 2018. Unpublished draft summary in English by Departamento Nacional de Planeación de Colombia and GGGI, 2018, https://www.dnp.gov.co/Crecimiento-Verde/Documents/diagnostico/Macroeconom%C3%ADa%20y%20CV_Oct26.compressed.pdf.

3.4.1 Achieving the SDGs and national goals

At their foundation, all efforts to promote inclusive green growth work to advance the SDGs and should adhere to national development objectives. In September 2015, 193 countries of the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development and its 17 SDGs. These combined goals are described as "the blueprint to achieve a better and more sustainable future for all" addressing a wide range of global challenges, including poverty and inequality, climate change, sustainable cities and industries, protection of biodiversity and ecosystems, decent jobs and economic growth, and peace and justice. Building on, and distinct from, the Millennium Development Goals (MDGs), the SDGs aim to go further, ending all forms of poverty and calling on all countries—high-, middle-, and low-income—to strive towards greater prosperity while safeguarding natural resources and vital planetary systems.[247]

Implementation of the SDGs is country-led, depends on countries' development priorities, policies, and plans, and aligns to global commitments such as the Paris Agreement and the Convention on Biological Diversity.[248]

Green growth touches on all 17 of the SDGs, although efforts to promote green growth tend to focus on some of the more pressing challenges associated with the first 15 goals, as set out in table 3. Critical conditions, such as natural resource consumption and degradation, access to basic services, or the climate emergency, tend to draw more intense focus as part of the green growth process.

3.4.2 Rising to the challenge of climate change

The growing climate emergency is among the foremost challenges facing humanity and undermining our prospects for the sustainable and prosperous future of all countries. Growing global economic output over the past century has pushed atmospheric levels of CO_2 and other GHGs beyond sustainable levels. Continued emissions threaten to create significant and growing risks to all countries and their economic development, particularly LDCs and SIDS.

The Paris Agreement, which concluded at COP21 in Paris in 2015, presents the world's best prospect to combat climate change and limit global warming to well below 2.0°C and towards 1.5°C. The Agreement has been ratified by 176 counties, comprising 88.2% of total global GHG emissions, and 184 countries have submitted their first NDCs, including all GGGI Member and partner countries.[249] Coupled with the Paris Rulebook, which was finalized at COP24 in Katowice in December 2018, the Paris Agreement provides the overarching framework for countries to take action towards adopting significant emissions mitigation and adaptation measures. As with the SDGs, all climate positive actions can directly align to and support efforts by countries to transition to a green growth economy successfully.

[247] United Nations, "About the Sustainable Development Goals," https://www.un.org/sustainabledevelopment/sustainable-development-goals/.

[248] United Nations, "The Sustainable Development Agenda," https://www.un.org/sustainabledevelopment/development-agenda/.

[249] UNFCCC, "NDC Registry (Interim)," http://www4.unfccc.int/ndcregistry/Pages/Home.aspx.

Table 3. Alignments of SDGs with green growth dimensions

SDGs		Efficient and Sustainable Resource Use	Natural Capital Protection	Green Economic Opportunities	Ensuring Inclusive Growth
	**Goal 1: No Poverty** – End poverty in all its forms everywhere			X	X
	**Goal 2: Zero Hunger** – End hunger, achieve food security and improved nutrition and promote sustainable agriculture	X	X		X
	**Goal 3: Good Health and Well-being** – Ensure healthy lives and promote well-being for all at all ages		X		X
	**Goal 4: Quality Education** – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all			X	X
	**Goal 5: Gender Equality** – Achieve gender equality and empower all women and girls				X
	**Goal 6: Clean Water and Sanitation** – Ensure availability and sustainable management of water and sanitation for all	X	X		
	**Goal 7: Affordable and Clean Energy** – Ensure access to affordable, reliable, sustainable and modern energy for all	X	X		
	**Goal 8: Decent Work and Economic Growth** – Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all		X	X	X
	**Goal 9: Industry, Innovation, and Infrastructure** – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	X	X	X	
	**Goal 10: Reduced Inequality** – Reduce inequality within and among countries			X	X
	**Goal 11: Sustainable Cities and Communities** – Make cities and human settlements inclusive, safe, resilient and sustainable	X	X		X
	**Goal 12: Responsible Consumption and Production** – Ensure sustainable consumption and production patterns	X	X		
	**Goal 13: Climate Action** – Take urgent action to combat climate change and its impacts	X	X		
	**Goal 14: Life Below Water** – Conserve and sustainably use the oceans, seas and marine resources for sustainable development	X	X		
	**Goal 15: Life on Land** – Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	X	X		
	**Goal 16: Peace, Justice, and Strong Institutions** – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	Cross-cutting institutional engagement			
	**Goal 17: Partnerships to Achieve the Goal** – Strengthen the means of implementation and revitalize the global partnership for sustainable development	Cross-cutting institutional engagement			

To meet Paris Agreement objectives, countries must adopt ambitious, practical, and implementable measures that are linked directly to public and private financing and investment sources and mechanisms. Countries must allow for advancing green growth and existing national economic and social development priorities. There are examples of countries, cities, and companies making progress towards transitioning to 100% renewable energy, 100% electric vehicles, and significant shifts to green and decent jobs. Yet overall progress on a global scale remains too slow to meet Paris Agreement targets. Accelerating the transition to a green and circular economy is necessary, and requires a significant redirection of public policy, public finance, and private investments in all countries—developed and developing.

Advancing Paris ambitions through climate action instruments

The Paris Agreement requires all countries to prepare NDCs. It encourages all countries to prepare LT-LEDS and National Adaptation Plans (NAPs) to be communicated to the UNFCCC, built on solid foundations of governance, institutional and human capacity, and measurement, reporting, and verification (MRV) systems. NDCs, LT-LEDS, and MRV comprise the inter-linked building blocks necessary for achieving the mitigation goals of the Paris Agreement and all play a critical role in the green growth transition. Even in countries where emissions are minimal, such as in most LDCs and SIDS countries, the adoption of NDCs and LT-LEDS provide important benefits. They serve as vehicles to advance national development objectives in line with green growth strategies, establish meaningful targets for development actions and adoption of clean technologies and infrastructure, and help attract financing for green investments. It is also essential to engage MICs in these efforts, given the need to significantly shift their rapidly expanding economies towards broad adoption of renewable energy and energy efficiency measures, and sustainable cities and industries, land use, and resource consumption.

NDCs. Countries are working towards key milestones for communicating revised or new NDCs every five years starting in 2020. NDCs provide an important vehicle for establishing national mitigation targets and corresponding mitigation actions, policies, and investments in line with national green growth objectives. It is worth noting that the quality of NDCs completed to date has varied considerably, and there is significant room for improvement in future NDCs. In connection with formal NDCs, many countries have developed or consider developing NDC implementation roadmaps or action plans for achieving the targets and goals outlined in the NDC that describe more concrete measures and steps, often in specific sectors. In 2017, **Fiji**, with support from GGGI, elaborated on an energy-sector NDC roadmap to identify specific strategies to implement the energy targets set in Fiji's first NDC—to increase the share of electricity generated by renewable energy sources from 60% in 2013 to nearly 100% by 2030. The roadmap outlines new policy measures and USD 3 billion in recommended investments for new biomass-based, waste-to-energy, hydropower, and solar PV generation; grid extension, improvement, and storage; demand-side energy efficiency; and promotion of low carbon vehicles, maritime vessels, and planning.[250]

LT-LEDS. While currently voluntary, LT-LEDS provide a structure for planning and implementing comprehensive mitigation actions across an entire economy, typically to the year 2050. Collectively, they also provide a structure to achieve deep decarbonization and climate resilience goals worldwide by mid-century. The Paris Agreement indicates that countries should strive to submit LEDS starting in 2020. As of late 2019, 12 countries worldwide had formally communicated an LT-LEDS to the UNFCCC,[251] and an estimated 40 or so were in preparation. A developing country LT-LEDS can provide a vehicle for green economic development and investment in low- and zero-emission technologies and practices in energy, transport, agriculture, forestry, and waste. LT-LEDS present essential benchmarks for setting shorter-term targets through NDCs and NAPs. As with raising ambition in NDCs, efforts to prepare an LT-LEDS sends a strong message of commitment and concrete action towards achieving Paris Agreement objectives, and present pathways for achieving significant emissions reductions or avoided emissions. **Fiji's** experience provides a compelling example of the value of preparing an LT-LEDS for a SIDS country, as described in box 5.

[250] Republic of Fiji Ministry of Economy, *Fiji NDC Implementation Roadmap 2017-2030*, 2017, https://cop23.com.fj/wp-content/uploads/2018/03/FIJI-NDC-IMPLEMENTATION-ROADMAP_LOWRES.pdf.

[251] UNFCCC, "Communication of long-term Strategies," https://unfccc.int/process/the-paris-agreement/long-term-strategies. To date, 11 mid-century long-term strategies have been communicated to the UNFCCC, namely from Canada, Germany, Mexico, the United States, France, Czech Republic, United Kingdom, Ukraine, Republic of the Marshall Islands, Fiji (developed with GGGI assistance), and Japan. Benin also communicated a long-term strategy, but it does not go to mid-century.

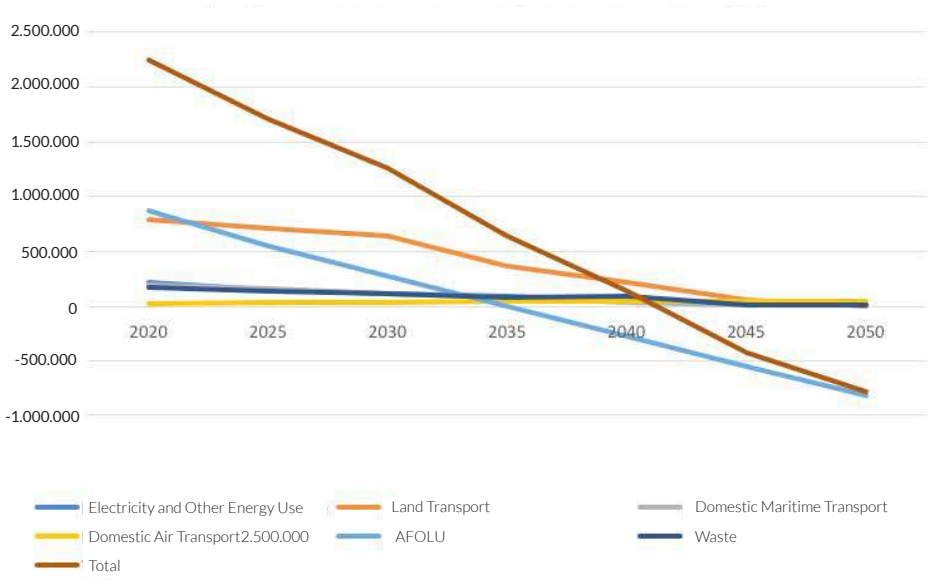
Box 5. Fiji's Low Emission Development Strategy[248]

While Fiji has relatively limited GHG emissions, it has aimed to promote Paris Agreement ambitions as a core national strategy and committed to developing a LEDS in its 10-year National Development Plan. In late 2017, the Fiji Ministry of Economy requested GGGI's assistance in preparing a national LEDS to be delivered as part of the COP23 Fiji Presidency under the Ministry's leadership. Fiji's LEDS included a comprehensive process for conducting a visioning process and stakeholder consultations, preparing economy-wide and sector-specific emission scenarios, identifying priority policies and mitigation actions, and estimating high-level costs for implementing actions identified in the LEDS. Sectors covered in the LEDS include energy (electricity and other energy use, and domestic land, maritime, and air transport); agriculture, forestry, and other land use (AFOLU); waste; and preliminary considerations of coastal wetlands (mangroves).

The LEDS describes four long-term emissions scenarios broken down by sector, including two BAU scenarios (one with and one without external financing), a high ambition scenario, and a very high ambition scenario. All scenarios were based on realistic technologies and actions while planning for continued 4% annual economic growth to the year 2050. Fiji's LEDS, like many others, also addresses: linkages to adaptation and resilience; social, environmental, and economic dimensions of proposed mitigation pathways, such as green jobs and biodiversity; education, capacity building, and awareness-raising activities; and the governance and monitoring and evaluation (M&E) aspects of implementing the LEDS.

The ambitious scenarios detailed in the LEDS are expected not only to decarbonize the economy but also to make Fiji's economy more sustainable and resilient through a variety of co-benefits. Under the most ambitious scenario, as illustrated in figure 15, Fiji could achieve net-zero emissions by the year 2041, after which emissions would increasingly be net-negative, even without considering the high carbon removal value of mangroves. The most significant mitigation of emissions would result from a complete transformation of Fiji's energy sector to 100% renewable energy and the adoption of electric vehicles and maritime vessels.

Figure 15. Projected decarbonization pathways in the Very High Ambition Scenario of Fiji's LEDS (metric tons CO_2e)



Source: Fiji LEDS 2018-2050

[252] Republic of Fiji Ministry of Economy, *LEDS*, 2018, https://gggi.org/report/fiji-low-emissions-development-strategy-2018-2050/.

MRV. As another extension of the green growth agenda, establishing robust and sustainable MRV systems is becoming increasingly important following the adoption of the Rulebook for the Enhanced Transparency Framework (ETF) at COP24 in Katowice in 2018. Systems to enhance transparency in the preparation of national communications, biennial update and transparency reports (BURs and BTRs), and GHG inventories are also important for advancing green growth objectives. Under the Paris Agreement, these reporting systems must work continuously to meet country obligations and play a broader important role in supporting the development and implementation of NDCs, LT-LEDS, and NAPs. A general lack of institutional and human capacity, and data collection and management systems, has meant that many countries have had to conduct MRV work to date at a higher cost and without increasing indigenous capacity, often with reduced accuracy. For these reasons, GGGI and its partners have been responding to requests to strengthen MRV systems and capacity in countries like **Burkina Faso**, **Ethiopia**, the **Marshall Islands**, **Mongolia**, **Myanmar**, **Nepal**, **Papua New Guinea**, **Peru**, **Qatar**, and **the Solomon Islands**.

NAPs. Aligned to NDCs and LT-LEDS, NAPs are a critical component of adaptation planning and target-setting. They are a core consideration in green growth planning, addressing climate risks, and leveraging international climate finance to support adaptation measures. The NAP process enables developing countries to "reduce vulnerability to the impacts of climate change, by building adaptative capacity and resilience" by integrating adaptation into development planning.[253]

3.5 Leveraging transformative disruption and catalyzing innovation

To be successful, countries pursuing a green growth transformation should take advantage of the numerous emerging advances and innovations in technologies, business models, the "sharing economy", and markets, and the role of the private sector and civil society in contributing to and facilitating the transformation to a green future.

A growing number of technology disruptions are poised to help accelerate the green agenda, such as the significant market shift towards renewable energy, which now provides about 26.5% of all electricity globally,[254] and the start of what promises to be a significant shift towards electric vehicles. Governments should not miss the opportunities these increasingly cost-competitive technologies present, and should use policy and regulatory frameworks to transfer investment away from conventional energy and transportation systems and towards solar PV and wind, new energy storage, smart grids, and electric mobility.

Innovations in storage technology are achieving cost reductions, increasing grid stability, and paving the way for higher penetration of variable renewable energy sources, like wind and solar. With GGGI support, **Mongolia** is building capacity in energy storage technologies, and **Guyana** is introducing "smart" meters and systems for expanding solar PV. GGGI's support is also helping countries like **Mongolia**, **Fiji**, **Indonesia**, **Thailand**, and **Vanuatu** to adopt energy-efficient equipment and energy management tools and systems. These tools and systems help to monitor and control the energy consumption profile, analyze the feasibility of energy efficiency investments, and achieve significant energy savings in industrial, commercial, and residential sectors.

In transportation, disruptive ideas and technologies—such as mobility as a service, autonomous driving, and cooperative intelligent transportation systems (C-ITS)—have the potential to revolutionize the transportation sector and reshape the way we travel, drive, and move goods and services. These disruptions also hold the promise of boosting economies and creating new jobs. As such, long-term strategic planning and investments in such disruptions need to be considered along with implementing demonstration projects in the near-term. The emergence of the sharing economy, for example, which facilitates shared access to goods and services, such as in car-sharing and bike-sharing, has been found to support improved efficiency and sustainability. Such sharing can help reduce the total resources or goods needed by consumers, who no longer need to purchase vehicles for their own use, and thus help to reduce pollution and carbon emissions. Studies have shown that vehicle sharing reduces overall vehicle distance traveled and makes zero-emission bicycle use more easily accessible.[255]

Similarly, there are valuable opportunities to integrate smart solutions and innovative and green approaches into urban sustainability agendas, to improve governance, social inclusion, and resource management. Adoption of smarter approaches and systems, including ICT solutions, can support more efficient, affordable, and effective services for all, and provide entry points for private sector investment and engagement. There has been growing interest in recent years in integrated "Smart+Green" solutions for city planning and investment. Smart+Green solutions include a range of new technologies that support smarter solutions in meeting urban sustainability and service delivery goals. These range from basic communication via smartphones to integrated communication and information systems linking people to more effective and responsive services, to sophisticated Artificial Intelligence approaches in the use of Big Data, such as to improve transport networks. In support of resource efficiency, cities need to be responsive and create efficient systems that are informed by real-time data. This can be achieved by integrating information and communications technology where possible.

[253] UNFCCC, *The National Adaptation Plan Process*, December 2012, https://unfccc.int/files/adaptation/application/pdf/nap_overview.pdf.

[254] REN21, *Renewables 2018 Global Status Report*, 2018, https://www.ren21.net/wp-content/uploads/2019/05/GSR2018_Full-Report_English.pdf.

[255] Zhifu Mi, and D'Maris Coffman, "The sharing economy promotes sustainable societies," Nature Communications 10, (March 2019): 1214, https://doi.org/10.1038/s41467-019-09260-4.

Disruptive ideas around decentralized solutions ensure broader access to services that are cheaper and can be implemented earlier on. In sanitation, shifting away from centrally collected and treated wastewater system to a circular economic approach can convert wastewater and treated sludge into a valuable resource for reuse. GGGI is supporting **Cambodia** and **Lao PDR** with this. Solar irrigation is similarly disrupting agriculture in countries like **Uganda** and **Mozambique**, by eliminating diesel fuel use and reducing costs for local farmers.

For low-income countries, the COVID-19 pandemic and the induced health and economic crisis, exacerbate existing challenges and stresses including high debt to GDP ratio, dependence on tourism, remittances and external aid. In the context of low and middle-income countries, GGGI suggests a list of policies and actions for greening their economic recovery plans. The policies and actions range from applying green stimulus priorities and promoting nature-based solutions employment assistance programmes to phasing out coal and fossil fuel subsidies.[256] The COVID-19 economic recovery packages present a great and unique opportunity to build back better, greener and in a more equitable way. While the main objective of the Covid19 recovery plans is to reboot the economy and generate employment and income in the short run, the significant investments that will be mobilized should also address the long term global climate crisis and accelerate the transition to the green growth economy. This is a unique, and probably the last opportunity governments have, by greening the recovery plans, to accelerate green and climate resilient transformational change.

[256] GGGI, *Achieving Green Growth and Climate Action Post-COVID-19*, July 2020, https://gggi.org/site/assets/uploads/2020/07/GGGI-Technical-Report-Achieving-Green-Growth-and-Climate-Action-Post-COVID-19.pdf.

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