



G20 BACKGROUND PAPER

GREEN GROWTH TO ACHIEVE THE PARIS AGREEMENT

January 2019

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Cover photo: Promoting renewable energy options in Taveuni, Fiji

Acknowledgements

This G20 background report was prepared at the request of, and with financial support of, the Government of Japan.

The report benefited from the review and comments of the following GGGI staff members: Lilibeth Acosta, Marshall Brown, Karolien Casaer, Rowan Fraser, Shantanu Gotmare, Jinyoung Kim, Juhern Kim, Peter Okubal, Nicole Perkins, Donovan Storey, Peter Vos and Adam Ward.

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Executive Summary

Climate change is the defining challenge of our time. As set out in the IPCC 1.5 degrees report, rapid and radical decarbonization is critical to limit global warming to well below 2 degrees Celsius and achieve the Paris Agreement. A renewable energy transformation has begun, where all forms of renewable energy are now—or will soon be—cheaper than fossil fuels. In 2017, renewables produced 165 GW of electricity—more than double the year before. Deep decarbonization will require targeting 100% of the renewables in the energy mix: focusing on massive electrification of transportation, electrifying heating and cooling through heat pumps, scaling up energy efficiency efforts, and reversing deforestation and unsustainable biomass use to achieve carbon sequestration in sustainable landscapes. It will also require engaging all stakeholders, including national and city governments, institutional investors, private sector energy users and producers, and civil society.

While there are examples of countries, cities, and companies making rapid progress toward 100% renewable energy targets, 100% electric bus and electric vehicle targets, and growing numbers of green and decent jobs, demonstrating the feasibility of a green growth transformation, overall

progress on a global scale is still too slow to meet Paris Agreement targets. An accelerated transition to a green and circular economy is necessary; however, it requires a serious redirection of public policy, public finance, and private investments in all countries—developed and developing.

For emerging economies, least developed economies, and small island developing states, achieving economic growth to eradicate poverty and provide decent jobs for the next generation remains the top priority. The only development path that can provide economic growth that is sustainable and inclusive in the twenty-first century is the green growth pathway. A number of GGGI member countries have launched national green growth development strategies that demonstrate the decoupling of emissions from growth as feasible.

Investments in sustainable infrastructure, renewable energy, sustainable transport, green cities, and sustainable landscapes are, in many cases, commercially attractive investment opportunities. Green growth strategies implemented economy-wide also present a solid basis for more ambitious NDCs.



In order to scale up and accelerate green growth in developing countries, the following are our top six recommendations:

1. All countries, developed and developing, need to redirect public policy and finance economy-wide to achieve deep decarbonization. G20 countries, cities, and companies should join and encourage others to join initiatives such as the Powering Past Coal Alliance, C40 Zero Emission Vehicle Network, and Climate Group's RE100 Campaign.
2. The G20 countries should ensure successful replenishment of the Green Climate Fund, as climate finance is a key developed country commitment to facilitate deep decarbonization and climate resilience in developing countries. Climate finance will only represent a small share of the total funding required and should therefore play a role in bringing other forms of finance (concessional development finance, domestic public investment, institutional investors, and venture capital) to participate in climate action through blended finance.
3. Effective climate change actions will include decarbonization efforts, such as phasing out fossil fuel subsidies in all forms, introducing forms of carbon pricing, and using a share of the public revenues generated to facilitate a just transition.
4. G20 countries should establish mechanisms, such as expanded credit guarantees and credit enhancements, to enable and increase private and institutional green investments by G20 countries in developing countries. The only source of finance large enough to close the climate finance gap is managed by banks and institutional investors. Therefore, increasing private investment in the green transition in developing countries, including domestic private finance, is critical. Developing country governments need to play a critical role in enabling private investments through targeted government policies, the removal of policy obstacles, public procurement, and public-private partnerships.
5. The green transformation will need to provide hundreds of millions of green and decent jobs, particularly to enhance the role of women in the labor market and provide opportunities for the next generation. All governments can support a just transition through education, (re)training, and the promotion of green innovation and entrepreneurship as well as ensuring that it is easy to do business. Inclusive green growth requires gender equality by providing equal access to resources, such as land, finance, and education. Young people represent a critical position in the green transformation and should be given a voice and recognized as key stakeholders.
6. Civil society and consumers play a key role in the green transformation: directly as conscious capitalists, through green lifestyle choices, and as part of a social movement that encourages governments and the private sector to take action while holding politicians and businesses accountable. G20 governments should champion and support public awareness campaigns in developed and developing countries to increase citizen engagement in the green growth transformation.



Table of Contents

01 Introduction	8
02 Planning for Green Growth	10
03 Renewable Energy Transformation	17
04 Electric Mobility	23
05 Green Buildings and Infrastructure	29
06 Green Employment	35
07 Financing Green Growth	39
08 Conclusions & Recommendations	42
09 References	45



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01 — Introduction

As stated in the Intergovernmental Panel on Climate Change (IPCC) 1.5 degrees report, it is now evident that all countries need to decarbonize their economies as rapidly as possible to limit global warming to less than 2 degrees Celsius (IPCC, 2018). According to the World Meteorological Organization (WMO), with its devastating wildfires and deadly heatwaves, 2018 was the fourth hottest year on record. The last four years also represent the four warmest years on record, and 20 of the warmest years occurred in the last 22 years (WMO, 2018). The United States Fourth National Climate Assessment concluded that the impacts of climate change are already being felt widely, and future climate change will disrupt many areas of life (NOAA, 2018).

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 less than 2 degrees Celsius. The Paris Rulebook, finalized at COP24 in Katowice in December 2018, provides the basic rules required to implement the Paris Agreement. But what will it take to decarbonize economies rapidly enough? Will it be possible to meet the dual challenge of simultaneously (a) adapting to climate change already locked in while (b) still growing economies enough to meet the Sustainable Development Goals, eradicate poverty, and provide decent work to the next generation?

Maintaining healthy and sustainable economic growth is still the top priority for governments worldwide. GGGI supports countries across the world to advance and implement a comprehensive approach to economic development based on a model of green growth. GGGI defines green growth as “a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. It seeks opportunities for economic growth that are low-carbon and climate resilient, prevent or remediate pollution, maintain healthy and productive ecosystems, and create green jobs, reduce poverty and enhance social inclusion” (GGGI Refreshed Strategic Plan 2015–2020, GGGI 2017: p. 12). Climate action is a driver of healthy economic growth and a basis for sustaining this growth in the longer term. As such, climate action—both mitigation and adaptation—is a central tenet to the green economic growth model. Green growth strategies also provide the means to progress a country's national development agenda, with a strong local context and pursuit of joined-up implementation of shared global goals set out in the Paris Climate Agreement, United Nations Sustainable Development Goals, and Sendai Framework for Disaster Risk Reduction. It is the mission of GGGI to support its member countries to achieve a “green growth transformation”—a transformation to make economic growth environmentally sustainable and socially inclusive—and, as part of that, to accomplish deep decarbonization and climate resilience.

While all countries face the challenge of decarbonizing their economies and adapting to climate change, the circumstances of countries vary greatly. **A simplified but useful distinction recognizes three main groups of countries with somewhat similar challenges in the necessary “green growth transformation”:**

- **High-income**, mature economies that have made general progress to overcome pollution and best represent those countries in rapid transition away from fossil fuel use. These countries are still facing major challenges to deep decarbonization, but the transformation is underway. This group of countries also has a high capacity to adapt to climate change.
- **Middle-income**, emerging economies that have known high levels of growth in recent decades and that currently face heavy pollution and related health concerns. Included are countries that still plan to build a significant portfolio of new coal-fired power plants and that have made massive, recent investments in carbon-intensive economic expansion. These are the countries that face the most significant challenges related to stranded assets and possibly the highest costs in the transition. Many countries in this group have young, expanding populations that are looking for employment and continued economic growth. The group also includes leaders in the development and application of certain green technologies, such as solar panels and electric buses, and have the wherewithal to capitalize on green manufacturing.
- **Least developed** and most vulnerable economies that face the most daunting challenge of adapting their economies to climate change and generating green jobs for the next generation. They must also reach middle-income status without increasing their emissions while avoiding greenhouse gas emissions, pollution, and ecosystem destruction. At the same time, these are the countries that stand to benefit most from the green growth transformation as they expand energy access to all and invest in zero-emissions, zero-waste industrial zones and sustainable infrastructure. This group of countries has the best opportunity to generate carbon credits and use the associated revenue flows to drive the green transition.

This paper focuses on the second and third groups—developing countries where GGGI has its primary field experience. A green growth pathway to achieve economic

development is not only necessary to decarbonize and adapt to climate change but is also a commercially attractive pathway, creating a large volume of private sector opportunities and green employment for the next generation.

In 2017, the Organization for Economic Co-operation and Development (OECD) published the report “Investing in Climate, Investing in Growth” for the G20 at the request of Germany, the chair of the G20 at the time. The report concluded that taking climate action at the time, together with economic reforms, resulted in a small growth benefit in the short term, expected to increase to a significant net growth benefit of 2.8% per year additional growth by 2050 (OECD, 2017). Last year, the Global Commission on Climate and the Economy concluded, “We are on the cusp of a new economic era: one where growth is driven by the interaction between rapid technological innovation, sustainable infrastructure investment, and increased resource productivity” (NCE, 2018). The commission estimates that climate action presents attractive investment opportunities that could yield a global direct economic benefit of USD 26 trillion and generate 65 million green jobs, but progress in that direction is nowhere near fast enough (NCE, 2018). In January 2019, the International Renewable Energy Agency (IRENA)’s Commission on the Geopolitics of the Renewable Energy Transformation published a report illustrating how radical the changes are that the renewable energy transformation is forging worldwide (IRENA, 2019).

This report focuses on the challenges and opportunities faced by developing countries that are related to the Paris Agreement,¹ both emerging as well as the least developed and most vulnerable countries. The paper is based primarily on the emerging evidence and experience gained on the ground in GGGI’s 30 member countries² in recent years, complemented by the published results of leading organizations in each of the areas reviewed. First, the report reviews the experience gained in GGGI’s member countries in the development of national green growth plans, NDC action plans and roadmaps, and the low emission development strategy for a small island developing nation. Subsequently, the paper evaluates experience related to the implementation and financing of such green growth plans in a number of high-priority areas—which is critical to the success of the Paris Agreement—including the renewable energy transition, electrification of transportation, green buildings and infrastructure, and green employment. As financing the green growth transition and climate action is critical, issues related to finance are discussed in a separate section. The report concludes with a section on recommendations for the G20, based on the foregoing analysis.

¹ Green growth is not limited to climate change and is also an effective approach to achieve the SDGs and the Sendai Framework for Disaster Risk Reduction; however, that is not the focus of this paper.

² GGGI is an intergovernmental organization founded in 2012 that has, as of January 2019, 30 member countries that ratified its establishment, another 20 countries on the path to joining as members, and staff embedded in member and partner governments in over 30 countries.



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02

Planning for Green Growth

Since its inception in 2010–2011, GGGI has supported its member and partner countries in the development of long-term economic development strategies that are environmentally sustainable, low-emission, climate-resilient and socially inclusive—generically referred to as “green growth strategies.” Based on robust analysis, stakeholder engagement, and planning, these strategies provide the fundamental framework and building blocks to integrate climate change in these countries’ national development plans and formulate NDCs with sectoral decarbonization measures that can

spur economic growth and achieve key SDGs. A number of countries have formally adopted such national green growth plans and mainstreamed this green growth thinking into their national development planning with varying degrees of success. Examples include Ethiopia, Mongolia, Mexico, Indonesia, Jordan, Uganda, the UAE, Colombia, and Laos. The critical success factor of these efforts is that they demonstrate the viability of a green growth pathway for a national economy that decouples economic growth from greenhouse gas emissions and unsustainable consumption of natural resources.

National Green Growth Planning Supports Strong and Ambitious NDCs

Ethiopia's Climate Resilient Green Economy (CRGE) strategy—developed and adopted in 2011 with GGGI's support—is a notable example of how a least developed country has pursued long-term economic growth and development through climate action (CRGE, 2011). The CRGE plan comprised a bottom-up assessment of costed mitigation and adaptation measures that provided the building blocks for its Intended Nationally Determined Contribution (INDC). Consequently, it was the first least developed country (LDC) to communicate its INDC to the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). Measures outlined in the CRGE strategy are used to formulate a practical target of a 64% greenhouse gas (GHG) reduction by 2030, compared to the business-as-usual (BAU) scenario, while pursuing the status of a middle-income country by 2030.

The **Uganda** Green Growth Development Strategy—launched in 2017 with support from WRI-NCE and GGGI—is an example of utilizing a green growth model to realize

multiple goals (UGGDS, 2017). The strategy is serving as a blueprint to realize the Uganda Vision 2040, successive National Development Plans, and Uganda's SDGs while transitioning the country to a green economy. The plan outlines Uganda-specific practices, technologies, policies, and financing mechanisms in growth sectors to facilitate the transition. Moreover, the strategy provides 50 practical and costed measures in six green growth areas—sustainable agriculture, natural capital management, planned green cities, sustainable transport, renewable energy, and cross-cutting interventions—linked to sustainable development of the country. It lays out opportunities that include the creation of more than 3.3 million decent jobs and a reduction of 70+ million tons of CO₂ emissions by 2030. The implementation roadmap offers specific steps and enabling mechanisms to realize the strategy in the next three National Development Plans over 11 years.



The **United Arab Emirates** (UAE) is an example of utilizing revenues from hydrocarbons to successfully develop and diversify its economy. To maintain its long-term economic growth and become a leader in the export and re-export of green products and technologies, in 2012, the UAE launched its Green Growth Strategy under the Prime Minister's Office. GGGI has been supporting the UAE in this endeavor and has supported the development of its National Green Growth Strategy, which served as the foundation for its first INDC submitted to the UNFCCC. The UAE's Climate Change Action Plan 2017–2050, developed in partnership with GGGI, outlines three key climate priorities for the nation: a national GHG emissions management system, national adaptation planning and implementation, and private sector driven innovative economic diversification programs. Identified using a consultative and inclusive process, the plan outlines indicative actions in five-year intervals, up to the year 2050, that are aligned with existing plans, such as the Vision 2021 and Green Agenda.

In **Jordan**, GGGI has supported the government to develop the National Green Growth Plan (Ministry of Environment, 2017) to steer the economy toward a greener paradigm that meets the interlinked challenges of rising greenhouse gas emissions, an insecure energy supply, shortages of freshwater, and strains on social infrastructure from a large influx of refugees. Using foresight and technical analysis, the strategy outlines specific short-term (up to 2020) and medium-term measures in four cross-cutting planning priority areas of green growth, which include transparent governance, green growth incentive mechanisms, integrated planning, and

behavioral shifts. The strategy is designed to contribute toward addressing Jordan's GDP "growth gap": the rate of growth envisioned in Jordan Vision 2025 to meet key SDGs and growth up to 2025 forecast by the International Monetary Fund (IMF). As of 2018, GGGI is also supporting the development of a National Action Plan for Green Growth (2019–2030), which will include sectoral action plans for Jordan's priority green growth sectors: agriculture, energy, waste, water, tourism, and transport. This will be accompanied by a National Green Growth Results Framework with over 70 green growth Key Performance Indicators (KPIs) and a fully elaborated monitoring and evaluation system.

Indonesia, a populous nation and biodiversity hotspot, has all the drivers for strong economic growth in coming decades and is projected to emerge as one of the top five world economies by 2050 (in GDP Purchasing Power Parity) (PWC, 2017). It is of interest to Indonesia and the world that this growth is equitable and clean to provide an improved quality of life for its citizens as well as sustainable in the use and protection of its ecosystems. To realize green growth in Indonesia, GGGI and the government of Indonesia have been working closely with a large portfolio of policy and bankable project initiatives in the past five years. With support of WRI-NCE and GGGI, Indonesia is now developing sectoral implementation action plans to meet its mitigation and adaptation goals and aspirations set out in its NDC. Moreover, the country is embarking on its Low Carbon Development Initiative, which explicitly integrates climate action into all development policy planning processes to achieve an equitable and low-carbon Indonesian economy by 2045.



In a more recent example, from 2015 to 2018, GGGI and a large number of international and national partners worked to support the government of **Colombia** to implement its Green Growth Mission and produce the national green growth strategy Colombia towards Green Growth. The strategy considers future economic growth and environmental and social sustainability issues, up to the year 2030. The process involved three phases: reviewing international case studies and indicators and conducting a macroeconomic analysis and GGPA; developing a green growth road map focusing on new economic opportunities, the bioeconomy, efficient use of resources, and development of businesses and human capital; and validating recommendations, indicators, and goals with key stakeholders (including government authorities, the private sector, and academia) as well as preparing and adopting the final policy document (GGGI, 2018b).

Both wider stakeholder consultation and buy-in, as well as analysis based on relevant quantitative indicators and data, are necessary to support the development of country-specific green growth strategies and action plans. Relevant stakeholder consultations provide a basis to capture hidden barriers to the implementation of measures, reveal the local

know-how of relevant approaches, and incorporate key aspects of the political economy of a country in identifying the best strategy for green growth. Data-driven analysis—based on rigorous approaches—provides the basis for evidence-based discussions and decisions.

GGGI has been supporting countries in their efforts to chart their steps toward green growth, using customized tools, such as the Green Growth Potential Assessment (GGPA), which combines approaches to initiate and support the green growth planning process and provide country-specific recommendations for green growth strategies aligned with NDCs and SDGs. The GGPA is a diagnostic tool and multi-stakeholder consultation process that has proven to be effective to assess green growth priorities. From 2015 to 2018, GGGI applied the GGPA in seven countries, providing governments with policy advice and recommendations on how to address green growth priorities and achieve international commitments, such as the SDGs and Paris Agreement (GGGI, 2018a). Recent experience in applying the GGPA indicates that it is also an effective tool to engage stakeholders across government departments to develop more ambitious NDCs.

Long-Term Strategies Based on Green Growth Planning

Like NDCs, long-term low emission development strategies (LEDS) can similarly build directly off the participatory planning process and policy framework provided in a national green growth strategy. LEDS provide a structure for planning and implementing comprehensive mitigation actions across an entire economy in an effort to help achieve the temperature goals of the Paris Agreement. Furthermore, as noted in the 2018 G20 paper, long-term strategies allow countries to demonstrate that the pathways to meet the temperature goals of the Paris Agreement are achievable. These strategies also show that countries can simultaneously pursue ambitious economic development while dramatically reducing emissions. Furthermore, they can help avoid infrastructure lock-in and stranded assets as well as guide the development of sector-specific NDCs (WRI, 2018).

The LEDS concept dates back to the Copenhagen Accord (COP15), which notes that “a low emission development strategy is indispensable for sustainable development” (UNFCCC, 2009). Although LEDS have never been mandatory under the UNFCCC, the Paris Agreement encourages countries to “strive to formulate and communicate long-term low GHG emission development strategies . . . taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances” (UNFCCC, 2015). As of January 2019, 10 countries, including six G20 countries, had formally communicated long-term strategies to the UNFCCC secretariat, including Canada, the Czech Republic, France, Germany, the Republic of the Marshall Islands, Mexico, Ukraine, the United Kingdom, and the United States (UNFCCC, 2019).

Fiji is in the process of submitting its 2018 LEDS. Following an effort in 2017 to solidify Fiji's INDC through the development of an energy sector NDC roadmap that specified actions to implement the INDC (Fiji, 2015), Fiji requested GGGI's support to develop a low emission development strategy. Developed and launched in 2018, the Fiji LEDS—which GGGI was centrally involved in developing at the request of Fiji's Ministry of Economy—provides a robust example of comprehensive LEDS. The central goal of Fiji's LEDS is to reach net-zero, economy-wide GHG emissions by 2050 while maintaining economic growth through a country-driven participatory process. To develop possible mitigation pathways, the LEDS provide four scenarios for each sector, including conditional and unconditional business-as-usual scenarios and both high and very high ambition scenarios. The process to develop the LEDS included extensive national-level and sector-specific stakeholder consultations; preparation of economy-wide low emission scenarios; and identifying priority policies, mitigation actions, and high-level costing that support the implementation of the LEDS. Emission scenarios were elaborated for each sector, including energy (electricity

and other energy use, land transport, domestic maritime transport, and domestic air transport); agriculture, forestry, and other land use (AFOLU); and waste as well as preliminary consideration of coastal wetlands (blue carbon). The scenarios were then aggregated to build a whole-of-economy emission reductions pathway for each scenario (Fiji, 2018).

Fiji's LEDS ultimately shows that under the Very High Ambition scenario, net-zero emissions can be achieved as early as the year 2041, after which emissions would increasingly be net negative, primarily as a result of transforming the energy sector to be entirely renewable and electric vehicle- and vessel-based and significant sequestration achieved in the AFOLU sector (Fiji, 2018).

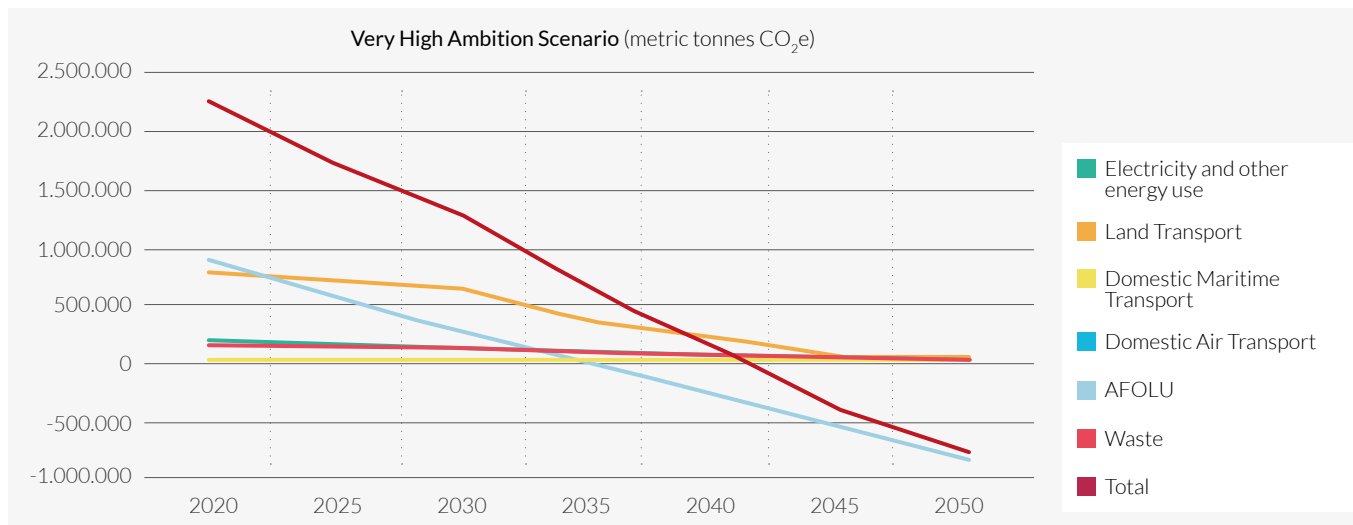
As recommended for many LEDS (WRI, 2018), the Fiji LEDS also consider linkages to adaptation and resilience in Fiji; the social, environmental, and economic dimensions of proposed mitigation pathways; and education, capacity building, and awareness raising as well as the governance and M&E aspects of implementing the LEDS (Fiji, 2018).

Green Growth and NDC Readiness in African Countries

GGGI joined with the African Development Bank (AfDB) Group to conduct an assessment in seven countries — **Gabon, Kenya, Morocco, Mozambique, Rwanda, Senegal, and Tunisia**—on preparedness and driving factors to accelerate green growth from an NDC and SDG perspective in these countries (GGGI and AfDB 2019).

The assessment showed that high-level political commitment (e.g., in the form of long-term vision documents by the highest authority of the land and/or mandatory targets on

climate action and green growth) is a key driver in providing a clear signal to national stakeholders and the international community. While political commitment appears to be increasing in the countries studied, greater effort to secure participation and buy-in of wider stakeholders is required in order to ramp up implementation and deliver on the promises of inclusiveness. A legally established and operational interagency mechanism with a high-level leadership and climate planning and implementation mandate is a good way to facilitate such participation and buy-in.

Figure 1 Projected decarbonization pathways in the Very High Ambition Scenario of Fiji's LEDS

Source: Fiji, 2018.

Such mechanisms can serve as a platform to closer coordination of linked agendas, such as SDGs and NDCs that are often under the jurisdiction of different ministries (NDCs typically fall under the Ministry of Environment and SDGs under the Ministry of Development and Planning). In Rwanda, for example, strong commitment from the highest authority has served as a clear differentiator to drive climate action, and an inter-ministerial coordination mechanism is facilitating a joined-up implementation of NDCs, SDGs, and disaster risk reduction (DRR). Similarly, Kenya's inter-ministerial coordination mechanism—the National Climate Change Council—is chaired by the president and oversees implementation of the National Climate Change Action Plan. To facilitate climate change mainstreaming and implementation, Kenya has a climate change unit in each key ministry.

However, such mechanisms start with horizontal coordination (e.g., across federal ministries), and vertical coordination—across national- and sub-national levels—remains a challenge that requires greater efforts to bring in actors and translate actions at a sub-national level.

Access to financing is an often-cited barrier to scale up climate action. As section 7 will show, traditional development and climate finance alone are not sufficient to realize the low-carbon transition, and private finance must be unlocked. In order to realize this, private sector participation must be incorporated at the start of the planning process—not toward the middle or end, as often is the case. Here, governments, working with development partners, play an active role in enhancing sector awareness of their social responsibility for the NDC and SDGs and associated financial opportunities.

Highlighting such opportunities would require that the climate and green growth visions and strategies be translated to sectoral targets, roadmaps, and costed action plans with timelines. Fiji's roadmap to implement the energy sector goals in its NDC is one such example, where costed mitigation actions are outlined in terms of specific projects across three sub-sectors as well as short-term (2017–2020), medium-term (2021–2025), and long-term (2026–2030) periods (Fiji, 2017).

Realizations of the targets and action plans would need to be accompanied by clear, coherent policy as well as regulatory frameworks and supportive financial incentives that enable the removal of key concerns and barriers to finance access, especially by small and medium enterprises that are the drivers of innovation and job creation in developing countries. Coherency across strategies, policies, and regulations are as equally important as innovative and supporting financing mechanisms, which is evident from an analysis of barriers to private sector participation in an off-grid solar power sector in Mozambique (Baruah and Coleman, 2019).

Innovative financing can be a game-changer in driving the uptake of low-carbon technologies and, in the process, speed up local innovation to drive down costs. By providing affordable financing and incentives and a simplified bureaucratic procedure, Tunisia realized the scaling up of the residential solar water heating sector through the PROSOL program, where the yearly uptake rate reached 80% in early years.

Streamlining climate and development finance mobilization from domestic and international sources and disbursement, in terms of affordable and innovative financing, is required to enhance the effectiveness of limited climate and development finance. Rwanda's green fund FONERWA and Mongolia's Green Credit Fund—described in section 3—are such examples. Since its inception, FONERWA has created more than 130,000 green jobs, provided more than 55,000 off-grid households with access to clean energy, and supported more than 100,000 people to cope with the effects of climate change in rural Rwanda (FONERWA, 2019).

A lack of awareness on climate change and relevant solutions, as well as inadequate technical capacity, is among the key impediments to the required transformative change. Aligned capacity building can address this as shown by Morocco's national competence centre for climate change mitigation and adaptation (4C Maroc). 4C Maroc was set up to implement the NDC and has conducted capacity building and information-sharing activities that target the public and private sectors, banks, journalists, women's cooperatives, and African partners. Among other factors, this enabled Morocco to develop and submit its NDC and facilitate the integration of climate change in sectoral development plans.

Conclusions

Through the development of national green growth strategies, sectoral green growth strategies, NDC roadmaps, and low-carbon long-term strategies, GGGI member countries have demonstrated that it is possible to chart a development strategy that combines low emission, climate-resilient development with the central ambition of all developing countries growing their economies and graduating to

middle-income status. The green growth planning process is an effective approach to develop NDCs that are broadly supported across government departments and other stakeholders and to prepare for a higher level of ambition. Moreover, certain tools, such as GGGI's Green Growth Potential Assessment, have proven to be effective to initiate such a green growth planning process.



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03 — Renewable Energy Transformation

Plummeting renewable energy prices are powering a rapid transition from fossil fuels to renewable energy-based electricity generation. The United Kingdom is rapidly phasing out coal, from close to 50% in 2008 to very little in 2018—in a mere ten-year period. The Powering Past Coal Alliance now has 16 member countries committed to phasing out coal completely by 2030. Germany produced 40% of its energy from renewables in 2018, with over 20% from wind (Carbon Brief, 2019). Moreover, cities are taking a lead in the renewable energy transformation. For example, Canberra expects to source 100% of its energy by 2020, and Copenhagen anticipates being a zero-emission city by 2025 (Go 100%, 2019). The Climate Group's RE100 Campaign has attracted 159 of the world's most influential private sector companies that have committed to switching to 100% renewable energy, with several companies already successful in achieving this target.

Despite this evidence that a global renewable energy transformation has begun, more ambitious GHG emission reductions are needed to limit atmospheric warming to well below 2 degrees Celsius. Analysis shows that, collectively, the first generation of INDCs were not sufficient to reach this goal, and many countries have been criticized for their lack of ambition (Fransen et al., 2017; Tilburg et al., 2018). Therefore, for the new NDCs to be submitted or updated by 2020, current reduction

targets should be strengthened, and more diverse and ambitious strategies should be implemented to meet the targets.

A key question of developing countries is whether they can, or should, take more drastic action in support of global mitigation efforts. GHG emissions are increasing sharply in developing countries, and, consequently, an increasing share of future climate change will originate from the emissions of developing countries. However, developing countries remain reluctant to join the global efforts for GHG mitigation as they have contributed the least to the problem historically and due to concerns over constraining their economic development opportunities. Therefore, it is important to inform them of the green growth potential that can go hand in hand with a transition to a low-carbon economy.

One of the most promising sectors that developing countries can focus on is renewable energy (RE) since it not only contributes to a GHG emissions reduction but also generates economic growth and increases the quality of life of citizens through increased energy access. Indeed, the promotion of RE is one of the most common measures to reduce GHG emissions. Out of 194 parties who submitted their first NDCs, 176 parties have included an increase in the share of RE in their NDCs as a mitigation measure of energy sector emissions (Senshaw and Kim, 2018). RE can help developing countries

meet national development goals, including improving energy security and access and accelerating economic growth by enhancing industrial competitiveness (Hsu et al., 2018). IRENA concluded in its pre-COP24 position paper, however, that the introduction of renewable energy needs to be accelerated six-fold to achieve the Paris Agreement goals (IRENA, 2018b).

At the end of 2016, 130 developing and emerging countries had established targets or policies for RE at the national or state/provincial level (Hsu et al., 2017). Among them, several developing countries have taken particularly effective actions to reduce GHG emissions by expanding RE. These cases provide important examples for other LDC countries to replicate and scale up.

In 2007, **Costa Rica** committed to becoming the world's first carbon-neutral economy by 2021 and set a goal to reach a 100% RE mix (BNEF, 2018). Over the past four years, Costa

Rica has generated 98.5% of its electricity from RE sources, such as large hydro, geothermal, wind, and solar power. Moreover, it can power itself for months at a time, drawing solely on RE, and ran for a record 300 days exclusively on clean sources in 2017 (Irfan, 2018).

Ethiopia was the first LDC to submit its INDC to the UNFCCC secretariat. According to the INDC, it intends to reduce its total emissions by 64% below the BAU scenario by 2030. Also, the country aims to have a nationwide power supply by 2025. Energy-related emissions reductions will be achieved by expanding electricity generation from RE and promoting energy-efficient technologies in the transport, industry, and building sectors. Before formulation of the NDC, Ethiopia revised its national energy policy to align with Ethiopia's Climate Resilient Green Economy (CRGE) energy policy, protecting the country against the adverse effects of climate change (Scott et al., 2018).



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India's RE capacity is expected to more than double by 2022, compared to 2018. Particularly, auctions for contracts to develop power generation capacity will allow solar and wind to represent 90% of India's capacity growth. During a recent solar deal led by Japan's Softbank-led consortium, India demonstrated how solar is economically more viable than fossil fuels, at Rs2.44/unit, which is well below the cost of coal power. Due to these factors, India's growth between 2018 and 2022 is expected to be higher than in the EU (Smith, 2018).

Kenya pledged to reduce GHG emissions by 30% by 2030, compared to a BAU scenario (Johnson et al., 2017). Kenya is recognized as a leader in Africa in developing on-grid and off-grid RE to improve energy access (Fleming, 2016).

Thanks to its huge investment in RE, Kenya's electrification rate increased from 23% in 2009 to approximately 50% in 2016. In addition to the centralized grid expansion by Kenya Power, small-scale or household-level solutions—such as solar lanterns and solar home systems—using innovative financing mechanisms have contributed to increasing electricity access in Kenya (Johnson et al., 2017). This growth is partly attributable to the country's willingness to expand renewable energy and the support of the government. The government of Kenya established the Rural Electrification Authority (REA) in 2006, with the goal to provide all households in rural areas with electricity by 2020. The REA has contributed to electrify public buildings, including schools, health centers, and trading centers (Boampong and Phillips, 2016).

Peru aims to reduce its total emissions conditionally by 30%, against a BAU trajectory, by 2030. Most of the energy sector mitigation options are concerned with electricity generation and use. Peru will increase its share of RE while retaining significant thermal power generation. In addition, transport, industry, and increased adoption of improved cooking stoves are contributing to energy sector emission reductions.

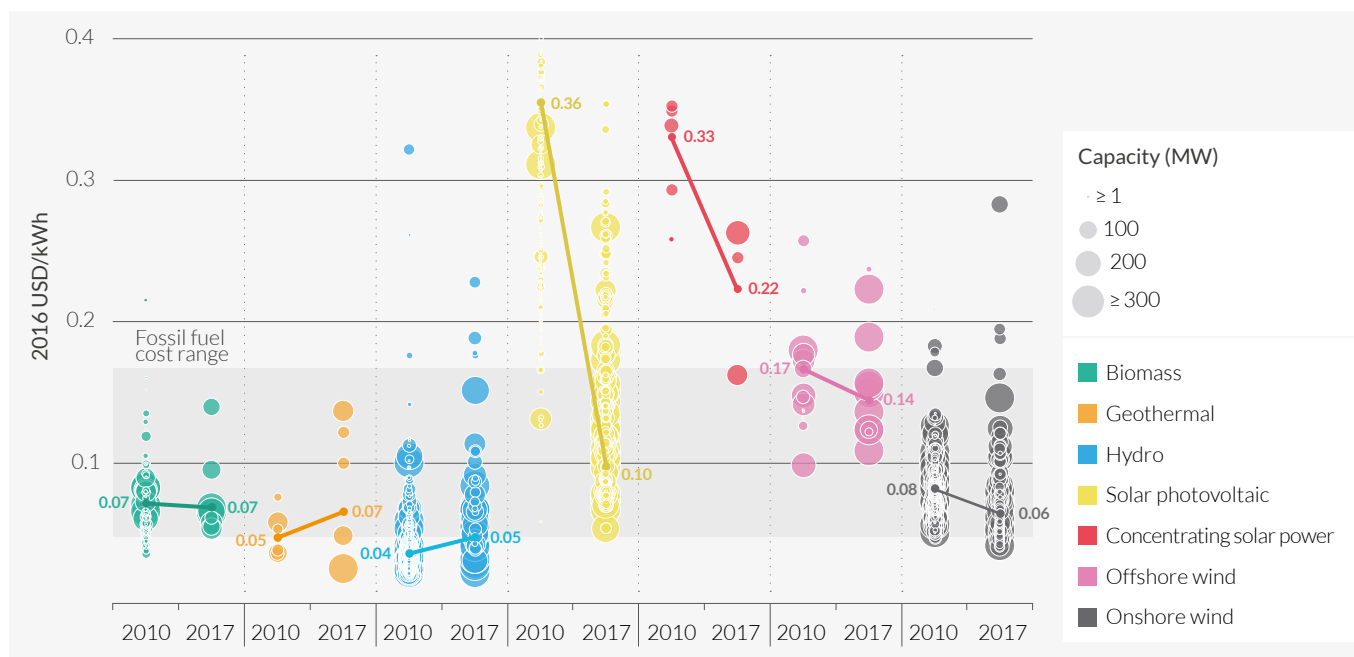
The National Energy Policy includes objectives to promote the development and use of clean energies and technologies and to establish measures for the mitigation of energy-related emissions. The government's energy plan for 2014–2025 anticipates universal access to electricity and 1.2 million households switching to liquified petroleum gas (LPG) by 2025 (Scott et al., 2018).

Opportunities for Accelerating the RE Transition

Raising climate ambition through expanding RE faces both opportunities and challenges. Firstly, cost reductions in RE technologies and the participation of municipalities can significantly contribute to RE expansion. The cost of electricity from RE technologies has fallen steadily. It has become similar to, or less costly than, fossil-based or nuclear power. In 2017, the global weighted average cost of electricity from fossil fuels was between USD 0.047 and USD 0.167 per kWh, and all RE technologies fell within this range, except concentrated solar power (CSP). Particularly, onshore wind has become one of the cheapest RE sources: the global weighted average cost of electricity from onshore wind fell by 23% between 2010 and 2017, to around USD 0.06/kWh.

The cost reduction of solar PV is even more dramatic. The unit energy cost of newly commissioned utility-scale solar PV plants reached USD 0.10/kWh in 2017, which is a decrease of 73% from 2010. Besides, the global weighted average cost of electricity from bioenergy was USD 0.07/kWh, from hydropower USD 0.05/kWh, and from geothermal USD 0.07/kWh (IRENA, 2018b). In this context, actual RE growth trends are exceeding expectations, and the cost-effective potential for RE should be much higher than what is estimated in current NDCs (IRENA, 2018a).

Figure 2 Global LCOE from utility-scale renewable power generation technologies



Source: IRENA (2018).

Another positive trend in climate change mitigation efforts is the participation of diverse actors. In addition to the national-level actions to deploy RE, subnational and private participation has increased. For example, the North Delhi Municipal Corporation (NDMC) in India has collaborated with Ramky Group to build a waste-to-energy plant of 24 MW that will consume 2,000 tons of garbage per day. The Kampala city government in Uganda has partnered with corporates to promote and expand clean cooking technology initiatives. Moreover, in Lagos, Nigeria, a solar start-up and local telecommunications providers launched new programs to make solar energy more accessible and affordable. These examples demonstrate the feasibility and benefits of a low-carbon economy through the various RE-related programs based on public-private partnerships (Hsu et al., 2017).

GGGI has been supporting the planning and implementation of bankable projects to further the renewable energy transformation to achieve renewable energy targets in its member countries. For example, **Fiji** has a target of 100% renewable energy by 2030. GGGI has carried out technical and financial pre-feasibility studies of renewable energy options for two islands—Ovalau and Taveuni islands—in support of the Fijian government objective to displace diesel generation with solar energy. Currently, GGGI is conducting the first full feasibility for the initial 1.55MW solar project as a first phase to achieve 65% of the planned 100% electricity generation from renewables for Taveuni Island; this analysis is replicated for Ovalau Island as the second phase of the solar energy project. GGGI's analysis shows that the best option for these small islands is a combination of solar energy plus batteries for storage. (While GGGI modeled an attractive return on investment, the project is too small to attract private investors and will require concessional finance.) In comparison, in **Indonesia's** Nusa Tenggara Timur

(NTT) province, GGGI conducted a pre-feasibility for the development of solar energy plus batteries for eight small islands. Aggregation of the eight small islands into a single development project raised the scale to 15 MW, and at that scale, private investors were ready to make an investment in the project without requiring concessional finance. The key obstacle in this (and many other similar) cases is that the energy utility in charge is reluctant to enable or promote the renewable energy transition, even though the feasibility studies show that solar energy under these conditions—displacing expensive diesel-generated electricity—is both technically and financially viable, with commercial rates of return. In **Viet Nam**, GGGI has demonstrated through several simple policy changes (such as raising the FiT to the same level as solar) that the sugar industry could install 737 MW to generate 4,300 GWh of electricity—enough for 630,000 households a year—while reducing emissions by 2.7 MtCo₂ and creating over 2,000 green jobs.

In **Guyana**, while the government has a target to transition to 100% renewable energy in the public sector by 2025, current energy production is primarily fossil-fuel based, with an estimated 70–120 MW of diesel self-generation; consequently, the electricity tariffs are very high. Renewable energy has not yet been introduced at scale. GGGI's analysis shows that there is about 20–25 MW of feasible solar rooftop projects targeting the commercial and manufacturing sector. GGGI developed a financial Lease-to-Own model, built a portfolio of 37 companies interested in participating for a total of 14 MW of rooftop solar, and identified both local and international project developers to implement the project on a commercial basis. Furthermore, GGGI supported the government of Guyana on a key policy aspect to remove the existing cap that restricted grid connection as well as scaling up solar PV projects.



Examples such as these show that, in small developing countries, there is a potential to introduce renewable energy on a commercial basis if a sufficient scale can be reached to make projects attractive for the private sector. However, a lack of knowledge and experience in the local market, in addition to policy obstacles, are preventing a rapid transition. Demonstration projects and capacity building at the national and subnational levels are necessary. In larger developing countries and emerging economies, government agencies and energy utilities are experienced in the development of fossil fuel-based energy projects. Often, they have made significant investments in the recent past that are at risk of becoming stranded assets. Consequently, there is resistance and reluctance to engage in the renewable energy transition, even if the national government has renewable energy targets in its INDCs. Accordingly, it is critical to work closely with the utilities to gain their trust and demonstrate the viability of renewable energy projects as part of their energy mix.

Climate finance is intended to catalyze the renewable energy transition, but many smaller developing countries have difficulty accessing climate finance, such as that directly provided by the Green Climate Fund. As one mechanism to lower the barrier to accessing climate finance, particularly for small and medium enterprises in developing countries, GGGI has supported its member countries to develop National Financing Vehicles (NFVs). NFVs simplify access to climate

finance for national actors by channeling bi/multilateral aid, private sector investments, capital markets, and national budgets into the government-led pooling mechanism to implement national development priorities. **Such vehicles—which can receive larger amounts of climate finance and on-grant in smaller amounts with lower transaction costs to local entities—can be established as:**

1. Facilities within the Ministry of Finance, such as the Climate Resilient Green Economy facility in **Ethiopia**.
2. A parastatal entity, such as the **Rwanda** Green Fund (FONERWA) or the **Vanuatu** Green Energy Fund.
3. A fund managed by a national development bank or private bank, such as the **Mongolia** Green Credit Fund.

As a further example, the Renewable Energy and Energy Efficiency Fund (REEF) of **Senegal** is an innovative, national financing vehicle designed with GGGI support—in collaboration with the AfDB and the Senegalese sovereign wealth fund, FONSIS—aimed at accelerating the development of RE projects in Senegal, including rural electrification and energy efficiency. The REEF intends to provide subordinated debt to RE, EE, and solar off-grid projects and aims to address the financial, technical, and institutional barriers that these projects encounter in Senegal.

Challenges to the Renewable Energy Transformation

Significant challenges to rapid RE expansion still exist in many countries. First, there is a persistent lack of information among many governments in countries with a very low renewable energy penetration, despite renewable energy no longer being costly and not threatening grid stability. Combined with a lack of experience in the public and private sectors, many countries, cities, and businesses are unaware that renewable energy can be a commercially attractive investment and can lower the cost of energy to consumers and businesses. Numerous countries still have outdated policies directly forbidding businesses to connect roof top solar to the grid or capping these installations at such a small capacity that it is unattractive to industrial companies or shopping malls. In short, in 2019, information asymmetry creates a tremendous opportunity to accelerate the renewable transition through capacity building and demonstration and pilot projects.

Second, there are key challenges in mobilizing resources for project implementation and a growing need for financial and technical support (Tilburg et al., 2018). To meet the RE targets

contained in NDCs worldwide would require an investment of more than USD 1.7 trillion by 2030 (IRENA, 2018a). However, many developing countries have expressed the need for finance, technology, and capacity building support to implement their NDCs (Fransen et al., 2017). According to a survey conducted by Tilburg et al. (2018), only seven respondents (10%) considered the amount of international financial support received to be adequate, even though international financial and technical support are important enablers of NDC implementation for most developing countries.

In this regard, private investment has become increasingly important, and there is a growing number of new, innovative business models to attract private companies and commercial banks. However, a lack of proven business models and the risk aversion of commercial banks often make private investment difficult. One of the most attractive opportunities is rooftop solar energy in markets where electricity rates are high, or the grid is vulnerable to interruption and businesses use diesel generators as backup. Under these conditions, rooftop solar

is a commercially attractive investment, but for businesses, it means that monthly electricity bills are replaced by a single investment generating energy for 20+ years that is largely cost-free. In other words, it requires capital investments that need to be financed. Solar rooftop financing is not offered by commercial banks in many countries, as they are unfamiliar with the investment, and leasing constructions are often not available. Developing lease or pay-as-you-go business models, combined with commercial or institutional investment, is a critical step to accelerate rooftop solar scaling up.

Blended concessional finance—which is a combination of concessional finance, such as climate finance, with public and/or private investments—is a critical tool to develop utility-scale private sector markets, foster innovation, and crowd in private finance in some of the most challenging settings. However, implementing blended finance in RE effectively requires legal and regulatory frameworks that facilitate private-public partnership, as well as institutional and operational capacities, in order to prepare and run the workable structure for blended finance instruments and manage diverse stakeholder activities successfully.

Third, access to land—either private or community owned—is becoming a clear obstacle to accelerated RE deployment, particularly where projects are perceived to provide few local

benefits. Other barriers to deployment are distrust and the poor local reputation regarding RE projects. This issue is closely linked to weak stakeholder involvement and limited knowledge of the benefits and impacts of new technologies (Johnson et al., 2017). Since solar PV was expensive and unreliable when it was first introduced in Africa, solar PV providers had to focus on building trust with their customers and providing a positive experience through service guarantees (McKibben, 2017).

A fourth barrier for accelerating the deployment and transition to renewables is fossil fuel subsidies or subsidized electricity rates. Currently, there are many developing countries where power utilities that connect rural areas to an (fossil fuel-based) electricity grid extension operate below cost-recovery, mainly due to a subsidized electricity price.

A fifth challenge is weak or lacking policy, legal and regulatory frameworks for deployment, and rapid RE transition. For example, 70% of African countries do not have an appropriate and enabling legal and regulatory environment for promoting and deploying RE.

A final challenge, of course, is the resistance that RE faces from incumbents, such as energy utilities and lock-in as well as stranded infrastructure based on fossil fuel generation.

Conclusions

There is a growing trend for the adoption of policy instruments that support RE deployment. RE (reverse) auctions—usually blended with other instruments—are becoming a common mechanism to help RE deployment in the power sector in both developed and developing countries (IRENA, 2018). Driven by a rapid cost decline in renewables, like solar and wind energy, renewable-based mini-/off-grid systems with a plus energy storage system are becoming more technically and financially viable and replacing fossil-run diesel. Raising ambitious RE targets in the next updates of NDCs in 2020 will be necessary to achieve an RE transformation and long-term climate objectives. Increasing these targets provides an important high-level signal to the private sector, power utilities, and investors and helps to achieve the mitigation actions of countries.

A growing number of countries and subnational jurisdictions, such as states and cities, have adopted 100% RE targets in the medium and long term.

IRENA concluded that 90% of the necessary energy-related emissions reductions to achieve the Paris Agreement can be achieved through a combined, accelerated uptake of renewables and energy efficiency (IRENA, 2018b). Aggressively accelerating the deployment of renewables is therefore a critical element of the green transformation. Electricity produced from low-carbon technologies creates opportunities for low-carbon development in other sectors, such as the electrification of the transport sector and heating and cooling of buildings, as discussed in the following sections.



04

Electric Mobility

As one of the main culprits of global warming, the transport sector currently consumes more than half of global liquid fossil fuels, emits nearly a quarter of the world's energy-related CO₂, and generates more than 80% of the air pollution in cities in developing countries (Dalkmann and Sakamoto, 2011). Moreover, CO₂ emissions from transport could grow to 1.5 to 2.4 times the 2010 levels by 2050 (International Transport Forum, 2012). Under the mounting international pressure to significantly cut GHG emissions following the Paris Agreement and the urgency to improve air quality in urban areas, electric vehicles (EVs) have come to the fore as an effective alternative to fossil fuel vehicles, complementing other sustainable transport interventions, such as modal shifts to public transport, non-motorized transport, and intelligent transportation systems.

The environmental and economic benefits of various types of EVs have been widely reported. To highlight a few such studies, Unnasch and Browning (2000) discovered that the fuel efficiency of battery electric vehicles is, on average, 2.6 times higher than that of comparable internal combustion engine vehicles. The Electric Power Research Institute (2007) concluded that both plug-in hybrid and hybrid electric

vehicles result in 28% to 67% less GHG emissions than similar conventional vehicles. Additionally, Lilienthal and Brown (2007) found that the introduction of plug-in hybrid electric vehicles with a fuel economy of 3 miles/kWh and 25 miles/gallon in the United States significantly reduced CO₂ emissions by an average by 42% per mile driven. Kang and Lee (in press) demonstrated that replacing liquefied petroleum gas (LPG)-powered taxis in Seoul with EV taxis would be economically feasible due to abated CO₂ and air pollutant emissions and savings in operating costs. Finally, Seba (2014) asserted that an EV would require 90% less money on repairs during the lifetime of the car.

According to studies by the Climate Action Tracker, half of all passenger vehicles would need to be electrified by 2050 in order to be compatible with the below 2 degrees Celsius target of the Paris Agreement (Schneider, 2017). Deeper decarbonization through the further electrification of not only passenger vehicles but also freight vehicles would be needed if the 1.5 degrees Celsius is to be pursued. If the zero emissions goal is pursued in the transport sector, it cannot be achieved without electrification of vehicles as demonstrated in GGGI's analysis of Fiji's LEDS (see section 4).

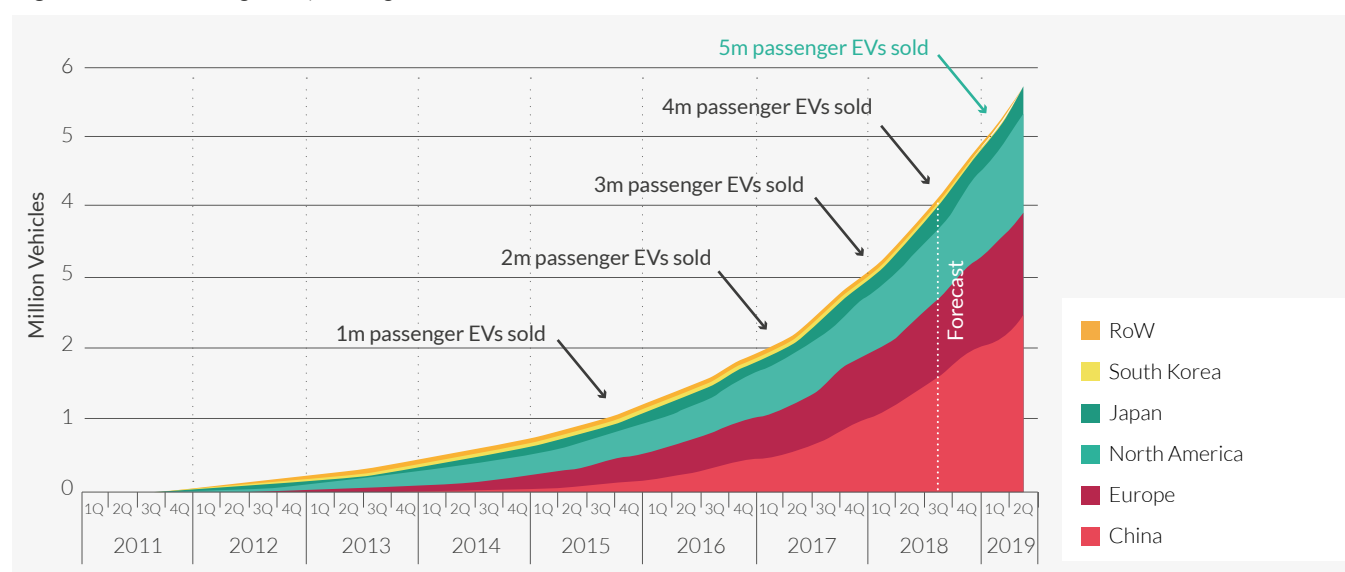
Implementation of EVs Worldwide

Norway and **China** are the leaders in terms of the market share of EVs and the EV market size, respectively. With an EV market share of over 29%, the Nordic country has the highest EVs per capita in the world. In 2016, 40% of global sales of EVs occurred in China, although it has not lifted the share of EVs in the country by more than 1.4% (Schneider, 2017). Norway has introduced a variety of incentives for EVs, including exemptions from several taxes and toll charges, free municipal parking, and access to bus lanes. In China, strong subsidies have been given to local EV brands, and more public fast chargers have been built than in any other country. Other countries—including Sweden, Germany, France, the United Kingdom, Denmark, South Korea, and Japan—have also provided purchase subsidies, tax benefits, and other supporting policies for EVs. Electric mobility has been pushed in India through the Faster Adoption and Manufacturing of

Hybrid & Electric Vehicles in India (FAME) Scheme under the National Electric Mobility Mission Plan, with an aim to convert at least one-third of automobiles on Indian roads to EVs by 2030. Allocation for FAME's Phase I, planned up to March 31, 2019, has increased by USD 126.74 million (INR 895 crore). Phase II has proposed setting up a venture capital fund of USD 70.85 million (INR 500 crore) for the development of a manufacturing base for zero-emission vehicles and their components, taking prototypes to manufacturing, and development of R&D, among others.

According to Bloomberg New Energy Finance, the number of EVs sold worldwide passed the 4 million mark in 2018, and the rate of sales growth is expected to accelerate as can be seen in Figure 3. (Note that only highway driving-capable four wheelers are included in this figure.)

Figure 3 Cumulative global passenger electric vehicle sales

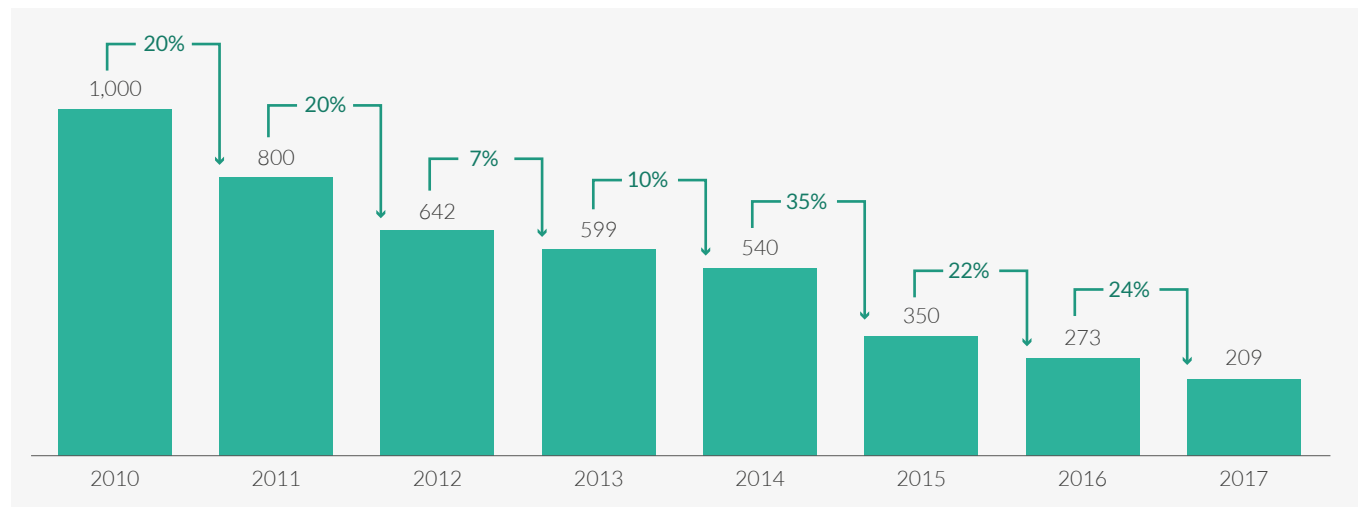


Source: Bloomberg New Energy Finance, 2018.

Sales of EVs have been propelled by two main thrusts, among other factors. The first is political commitment to reducing fossil fuel vehicles on the street. **France** and the **United Kingdom**, for example, have declared that sales of fossil fuel vehicles would be banned starting in 2030 and 2040, respectively. Even in some developing countries where public transportation is not available or popular, governments have signaled their political commitment by providing fiscal incentives for the purchase of EVs. For example, Jordan's Ministry of Finance introduced import tariff exemptions for

fully electric passenger cars. This exemption allowed for near parity between average conventional engines and EVs, rapidly increasing the uptake of EVs in **Jordan** between 2016 and 2018. A rapid reduction in battery costs is also making EVs more cost competitive compared to fossil fuel counterparts. Figure 4 shows the trend of lithium-ion battery pack prices for EVs, and the upfront cost parity between EVs and internal combustion engine vehicles could occur around 2025, when the battery cost is expected to fall below USD 100/kWh.

Figure 4 Lithium-ion battery pack price (USD/kWh)

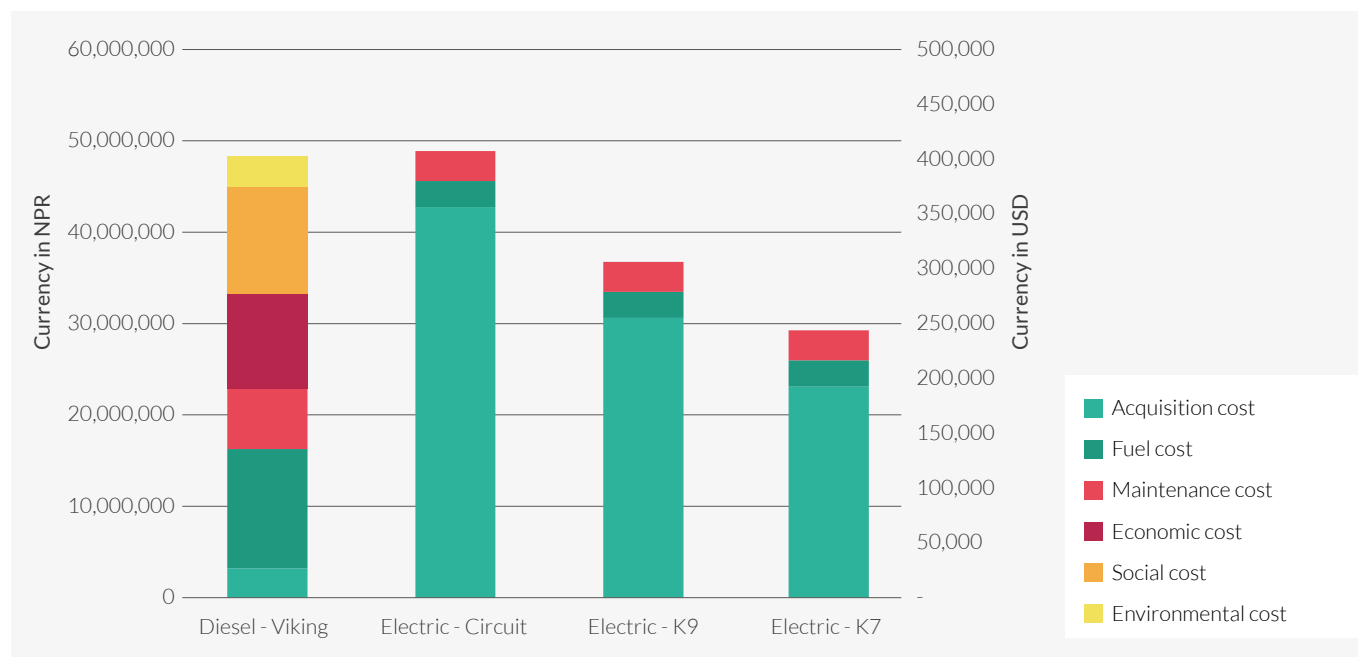


Source: Bloomberg New Energy Finance, 2018.

If operating costs and environmental benefits are taken into consideration, EVs can be much more economical than fossil fuel vehicles. GGGI analyzed total lifetime costs of diesel and electric buses in **Nepal**, and figure 5 shows the clear financial

attractiveness of electric buses. Based on this analysis, a state-owned bus operator in Kathmandu Valley will pilot electric buses in 2019.

Figure 5 Total lifetime costs of bus options

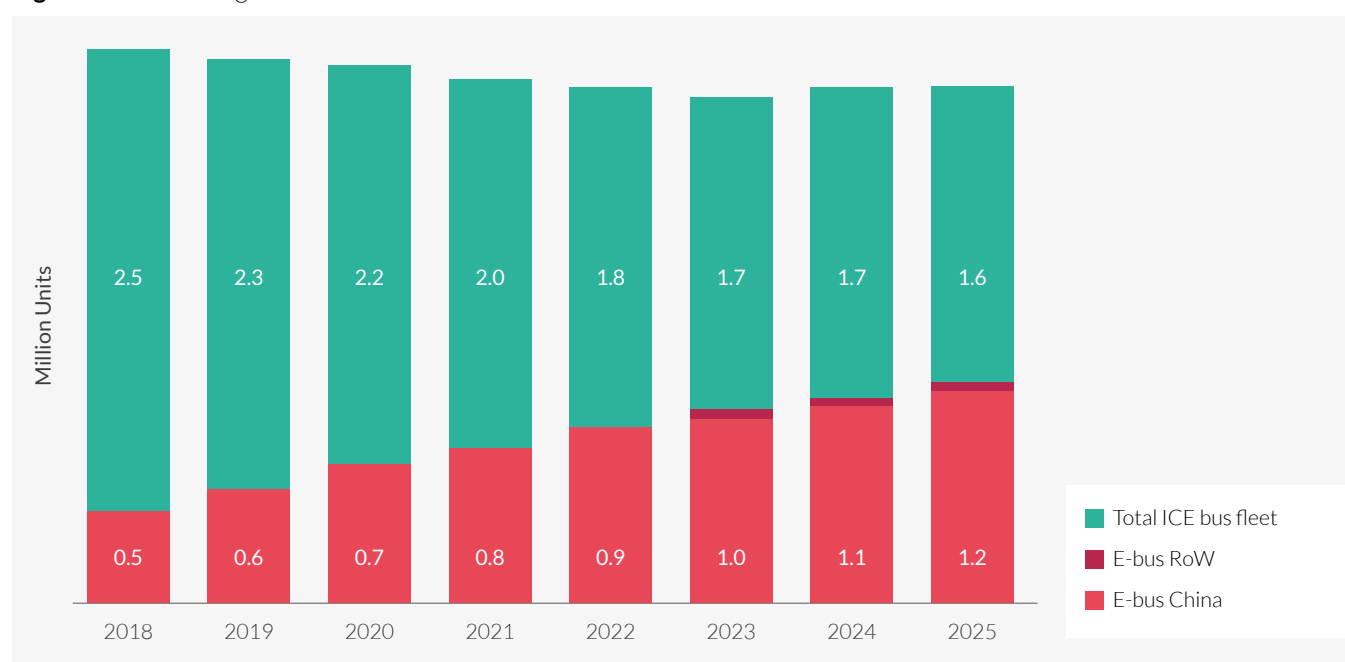


Source: GGGI Analysis.

Bus rapid transit (BRT) is being increasingly recognized as among the most effective solutions to provide mobility services on a cost-effective basis in urban areas, as it provides a high-quality, metro-like transit service at a fraction of the cost of other options. Electrification of high-capacity buses for BRT can also be technically and financially viable as demonstrated in a recent GGGI study for **Jordan**. One forecast shown in figure 6 estimates that the number of electric buses will grow, but mostly in China.

However, uptake of electric buses is also expected to occur in other countries, as their contribution to improving air quality in urban areas is better recognized. For instance, the Seoul Metropolitan Government of the **Republic of Korea** announced in November 2018 that 3,000 electric buses would be introduced by 2025.

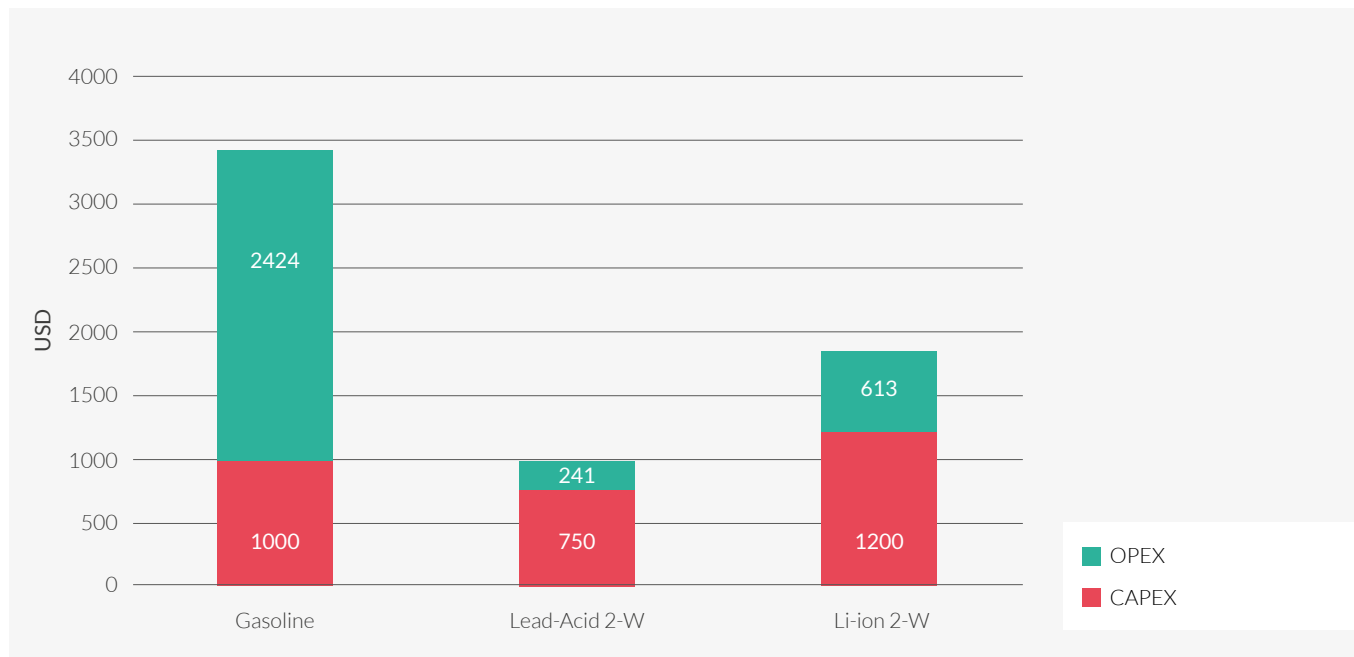
Figure 6 Forecast of global bus fleet



Source: Bloomberg New Energy Finance, 2018.

In many cities in the developing world, where public transport has not been well-established, motorcycles and three-wheelers are heavily used for mobility. In **Laos**, for example, motorcycles accounted for 76% of the total vehicle stock in 2017. Electrification of this segment of vehicles would therefore result in a positive impact on the environment. The prices of low-end electric motorcycles with a lead-acid battery are already on par with those of gasoline

motorcycles, as can be seen in figure 7, and driving ranges of electric motorcycles are sufficient for daily trips made by people in Laos. This implies that the adoption of electric motorcycles in countries like Laos can be easily accelerated if consumers' uncertainty about the performance of electric motorcycles is eased through awareness programs, and affordable financing options are provided to consumers who want high-end products.

Figure 7 Total costs of ownership of gasoline and electric motorcycles in Laos

Source: GGGI Analysis

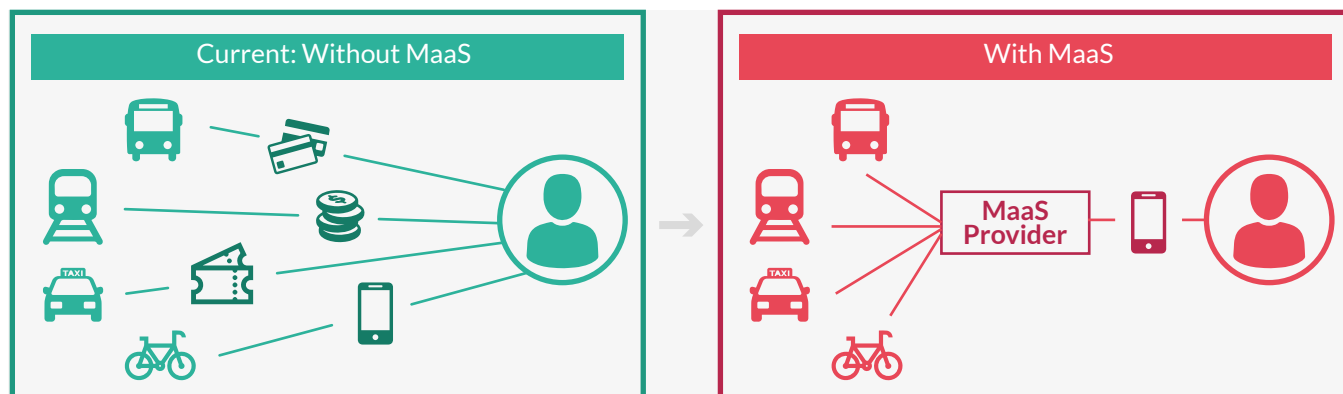
Policy Recommendations

A 2018 assessment of the **Jordan** EV market by GGGI found considerably strong green growth potential in the EV sector but noted several major barriers to implementation. In many cases, governments lack the necessary energy infrastructure, technical expertise, leadership, risk appetite, strategies, policies, and regulations to navigate this new technology. Therefore, as EVs continue to become more affordable (and therefore more popular), governments in developing countries will need substantial support in facilitating market development for commercialized EV charging services. Without access to charging services, uptake of EVs is not as likely, making the business case for the electrification of private transport less attractive. Private sector actors must adapt to the often challenging economic and governance contexts. They should support government institutions in an honest and transparent manner as they work to establish the necessary regulatory enabling environment for investment. Furthermore, international organizations, such as GGGI, must respond by providing government counterparts with high-quality technical analysis and evidence-based recommendations as they attempt to modernize and green their national transport systems through public-private partnership. As described so far, the environmental benefits of EVs are evident, and their commercial competitiveness (compared to fossil fuel counterparts) continues to improve across vehicle segments, from passenger vehicles to buses to motorcycles. The electrification of vehicles is, however,

only part of the efforts—although significant—toward achieving sustainable transport. Electric vehicles will continue to create traffic congestion, and the number of accidents will not decline simply because cars are electric. Accordingly, more creative thinking is needed to find innovative ways to better meet people's mobility needs than the current practice.

One forward-looking idea in this regard is Mobility as a Service (MaaS): the concept of shifting away from personally-owned modes of transport and toward mobility solutions that are consumed as a service (see figure 8.) In practical terms, MaaS aims to integrate public and private transport modes (e.g., public transport, taxi, ride-hailing, car-sharing, bike-sharing, and car rental) and payment methods into a single mobile application service to provide door-to-door, seamless, customized, and on-demand mobility solutions. MaaS—assisted by electric vehicles (and, eventually, autonomous driving) and powered by information and communication technology (ICT)—is anticipated to offer vastly lower-cost mobility alternatives with environmental co-benefits. As urban areas continue to grow and become denser, MaaS could provide an alternative way for people to move in a way that is faster, cleaner, and less expensive than current options. By disrupting the supply side of transport services, MaaS may transform a relatively rigid transport system into one that is significantly more flexible without new large investments.

Figure 8 Concept of Mobility as a Service



Source: GGGI Analysis.

Disruptive ideas and technologies—such as MaaS, autonomous driving, and cooperative intelligent transport systems (C-ITS)—will revolutionize the transport sector and reshape the way we travel, drive, and move goods and services. They are being considered as an integral part of

the Fourth Industrial Revolution in many countries, which can boost economies and create new jobs. As such, long-term strategic planning and investments in such disruptions need to be thought out along with implementing short-term demonstration projects.

Conclusions

Electrified transportation—particularly cars, buses, and motorbikes—have a large potential to reduce GHG emissions and improve air quality in urban areas. Currently, the deployment of electric vehicles is still highly dependent on government incentives—as in Norway, where electric vehicles have reached a 29% market share—but prices are expected to fall below those of fossil fuel vehicles within the next five years. Twenty-six large cities have committed to purchasing only electric buses from 2025, and several countries have

targets to sell only electric vehicles by 2030–2040. Such political commitments toward the proliferation of electric vehicles should be expanded along with initial investments on EV infrastructure by the public sector. Moreover, affordable and sustainable financing schemes need to be devised to support the EV transition, particularly in developing countries. Expanding electrified transportation, once electricity is predominantly produced by renewables, is a key opportunity in the green growth transformation.



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05

Green Buildings and Infrastructure

Since 2011, more than half of the global population has been living in cities. The IPCC stated in its 5th Assessment report (2014) that the urban population is expected to further increase by 2.5 to 3 billion, accounting for about two-thirds of the global population by 2050, with the majority of new urban inhabitants residing in small- and medium-sized cities in the developing world. According to UN-Habitat (2014), 75% of the building stock in developing countries in Africa and Asia will be built between 2010 and 2060.

Cities account for between 67–76% of global energy use and 71–76% of global GHG emissions (Seto et al., 2014). Additionally, the buildings sector is responsible for about one-third of global energy consumption. With a steadily increasing warming climate and growing middle-class in emerging economies, the energy demand for air conditioning is sharply increasing. Moreover, the energy demand for cooling is projected to continue rising, surpassing the energy consumption for heating by 2060 (Isaac and van Vuuren, 2009).

Urban infrastructure—including buildings, energy, transport, water, and sanitation—is one of the most critical sectors to limit the growth of GHG emissions in the long run since the infrastructure built today will remain in place for the next 30 to 100 years.

Regardless of the major infrastructure development over the last years, a lack of basic infrastructure in many parts of the world, particularly in Asia and Africa, remains one of the main global challenges. Around 300 million people in Asia lack safe drinking water, and 1.5 billion lack access to sanitation (ADB, 2017). Globally, nearly 1.3 billion people still do not have access to electricity, the majority of whom live in developing Asia and Sub-Saharan Africa (UNESCAP/ UN-Habitat, 2015). Furthermore, damage of different types of critical infrastructure—due to climate change-induced disasters and extreme weather events—have increased over the last years, causing significant economic losses and casualties (UNISDR, 2015).

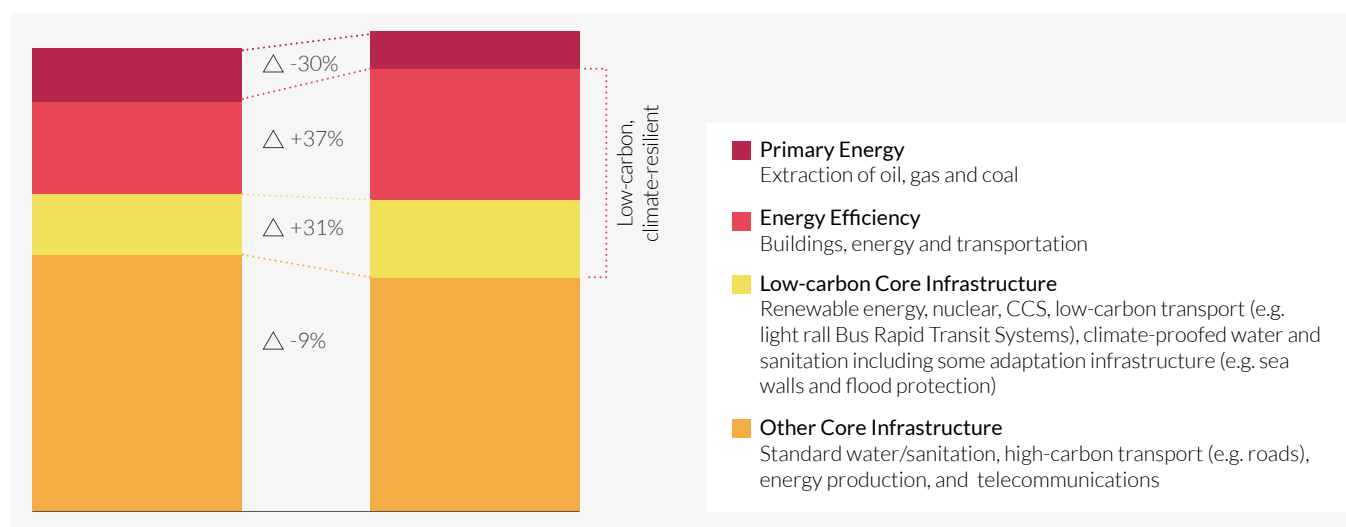
Considering the projected expansion of urban population, it is of critical importance that newly built infrastructure and buildings are low carbon and climate-proof to avoid negative lock-in effects for the decades to come and are developed in a way that generates multiple social and environmental benefits and drives economic prosperity. At the same time, access to basic infrastructure should be a priority, representing one of the most important factors to enhance people's resilience to climate change, particularly the poor.

Opportunities

Urban growth is a key determinant of energy use and carbon emissions across multiple sectors. Moreover, it can also be the catalyst for deploying new low or nearly zero carbon and climate-resilient infrastructure and buildings. The infrastructure that will be built now and in coming years will inevitably lock in the future generations with energy and climate benefits or costs (NCE, 2016). Achieving the 2

degrees Celsius target would only cost 5% more, compared to the upfront investments in the business-as-usual scenario, which would be fully offset by the energy and fuel savings during the infrastructure's lifetime. Therefore, investing in a low-carbon and climate-resilient infrastructure is more economically beneficial in the long run (Bhattacharya et al., 2016).

Figure 9 Scenarios for energy use in infrastructure



Source: Bhattacharya et al., 2016; NCE, 2016.

There is large energy efficiency and mitigation potential, both in new and existing buildings, that can be realized. Green building measures include energy efficiency improvements in technical installations, such as heating and cooling, cooking, lighting and water heating systems, thermal insulation, and the reuse of materials. Existing technical and economic mature technologies and measures in the building sector could reduce global energy use to current levels by 2050 (IPCC, 2014). New building construction and retrofit methods and technologies are becoming financially attractive and even generate net negative costs due to their performance improvements and reduction of operational costs during the lifetime of the buildings (IPCC, 2014). Applying criteria and

standards for sustainable infrastructure and buildings in the design and construction process is far more cost-efficient than a possible later retrofit.

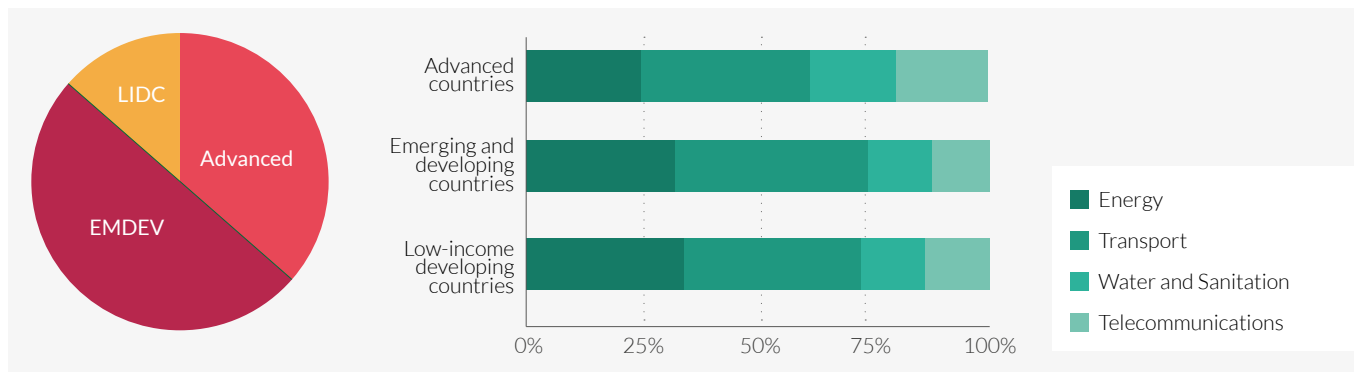
There is compelling evidence that greening the construction and operation of buildings during their life cycle provides multiple benefits that are additional to the energy savings and carbon emissions reductions. According to IPCC (2015), building retrofits, new green buildings, and efficient appliances enhance energy security, increase productivity (for commercial buildings), and create decent jobs. In addition to economic benefits, they also deliver social benefits, such as a reduction in energy poverty, and improve thermal comfort and disaster resilience.

Challenges

Although energy efficiency investments in buildings are, in many cases, commercially attractive and deliver additional socio-economic benefits, real investments are lagging far behind the need to achieve the emissions reductions required to be consistent with the 1.5 degrees Celsius—or even 2 degrees Celsius—targets. While investing in low and climate-resilient infrastructure is economically beneficial in the long run, very high upfront investments are required. According to the New Climate

Economy (2016), investments of approximately USD 90 trillion in infrastructure are needed in the coming 15 years. In low- and middle-income countries, investment needs in infrastructure account for around USD 4 trillion annually, which translates to two-thirds of the total cumulative infrastructure investment needs. With high costs of capital and interest rates, low- and middle-income countries face significant constraints to access funds in capital markets for infrastructure projects.

Figure 10 Projected share of cumulative Infrastructure investment needs by 2030



Source: Bhattacharya et al., 2016.

Moreover, these countries often lack institutional capabilities and stable policy environments to enable, attract, and drive the necessary infrastructure investments from institutional and private investors. Mobilizing resources and raising finance—not only to bridge but also “climate-proof” and “green” the large infrastructure

(investment) gap—is a major challenge for countries and cities of the Global South. The solution requires concerted action of multiple stakeholders—including governmental and non-governmental actors as well as multilateral and bilateral development banks—with close collaboration among them.

Good Practices in Low- and Middle-Income Countries

National and local governments have at their disposal a range of “soft” and low-cost measures they can utilize to direct investments toward low-carbon and climate-proof infrastructure, ranging from building codes and standards to mainstreaming green growth and climate change in urban and land use planning. Various examples of countries and cities in the Global South, including those listed below, demonstrate the use of policy instruments in the buildings and infrastructure sectors. Advancing and upscaling these good practices could contribute significantly toward limiting global GHG emissions and climate proofing our future while delivering additional socio-economic benefits.

Mongolia, under its Green Development Policy and NDC, has prioritized energy efficiency, targeting 20% and 40% reductions in building heat loss by 2030 and 2050, respectively. In 2017, the government of Mongolia adopted the first National Energy Efficiency Action Programme 2017–2020 (NEEAP), developed with GGGI support, with the aim to increase energy efficiency in different sectors, including small businesses and households. One of the key factors of NEEAP implementation is the preparation of bankable energy efficiency pipeline projects and capacity building of energy auditors. Within the framework of this program, the Ulaanbaatar City Mayor’s Office has partnered with GGGI to develop a large project for energy efficiency in the residential sector. The city’s 1,077 Soviet-style pre-cast panel building blocks will be retrofitted, contributing to Mongolia’s climate change mitigation target under its NDC while enhancing energy security and reducing energy costs.

The **Rwanda** Housing Authority (RHA) under the Ministry of Infrastructure, in collaboration with multiple stakeholders including GGGI, recently established the Green Building Minimum Compliance System: the first green building certification scheme developed and applied in Rwanda. The Green Building Minimum Compliance System is a point-based rating system of green building compliance that aims at supporting building owners. Developers select and measure green building indicators based on their applicability to the building type, location, usage, and benefits associated.

Furthermore, the National Roadmap for Green Secondary City Development incorporates guidelines for mainstreaming green growth in infrastructure and urbanization in the country. The guidelines provide requirements and guidance that can be used consistently to ensure that infrastructure projects meet green growth criteria and standards while harnessing positive environmental and social co-benefits. Investments and actions for secondary city development are prioritized based on drivers that accelerate the sustainable urbanization process. In addition, the city of Kigali is currently mainstreaming green growth under the revision process of its Master Plan.

In **Viet Nam**, the government approved the Urban Green Growth Development Plan 2030 and a set of 24 Urban Green Growth Indicators that cities must report on annually. These policies, taken together, outline the key priorities for the country to achieve its green growth and NDC commitments in the urban sector and establish an annual reporting system to track progress against those objectives.



In **Thailand**, a community-driven *Baan Mankong* program, with the support of community architects and an innovative community financing scheme, has focused on upgrading and “greening” a slum, including through low-cost (and local) green building materials (CODI, 2018). Similarly, Development Alternatives in **India** has launched a Mainstreaming Sustainable Social Housing in India project, which is examining the impacts of housing production at a massive scale on India’s environment, economy, and communities in support of the greener and less resource-intensive Housing for All 2022 goal (MaS-SHIP, 2017). Pradhan Mantri Awas Yojana – Gramin

(PMAY-G)—the restructured rural housing scheme with the objective of “Housing for All by 2022”—targets one crore rural households living in kutcha houses/dilapidated houses over the period of three years, from 2016–17 to 2018–19. The Ministry of Rural Development—the nodal ministry in consultation with UNDP and IITs—has developed sustainable housing prototypes for different zones based on climatic conditions, disaster risk factors, local construction materials, and traditional skills. These typologies, detailed in PAHAL-II, showcase technologies that are disaster-resilient and reduce the carbon footprint/adverse environmental impacts.

Policy Recommendations

According to a recent study (UN-Habitat, 2017), the majority of NDCs, 113 out of 164, show strong or moderate urban-related content (i.e., urban actions, priorities, and challenges). Particularly, the most rapidly urbanizing regions of Africa and Asia contain some of the strongest urban content. As it is largely these regions that will experience urban growth in the future, support needs to be provided to address their capacity and finance gaps and ensure the implementation of their NDCs.

Enabling policy environment

An enabling environment, including a strong policy framework and robust institutional capabilities, is key for developing a sustainable infrastructure. In order to deliver policies that attract private investments in infrastructure, countries and cities need to create a stable and predictable policy and regulatory environment, including for public-private partnerships, while simultaneously tackling fundamental issues, such as inadequate planning, corruption, and skills shortages. Furthermore, to ensure sustainability in the long-term, environmental and social sustainability criteria need to be systematically

incorporated in all investment and project planning as well as in government procurement processes. Close and well-coordinated collaboration between different actors—such as national and local governments, development banks, and the private sector—is essential to develop innovative financing mechanisms and demonstrate the “bankability” of such projects and their potential to support green city development.

Finance

Innovative financing mechanisms and a suite of different financial instruments are critical factors to spur investments in bridging the infrastructure gap. Public finance, either from national sources or international development, will play a catalytic role in attracting additional private investments. According to NCE (2017), a large chunk of infrastructure project financing (up to 65%) is provided by public funds. Due to budget constraints, public financing is limited and falls short of meeting infrastructure investment requirements. Therefore, the role of the private and institutional investors is essential to undertake a significant part of these investments.

Mainstreaming green growth in policies and plans

Mainstreaming green growth in plans and policies provides the necessary guidance and enabling environment for stakeholders and investors to undertake low-carbon and climate-resilient infrastructure projects. It is therefore a very efficient and effective way to enhance the actual implementation of green growth interventions. Local governments could incorporate green growth standards and objectives in urban, city master, and land use planning while national governments develop national strategies for green city development by providing guidelines to spur infrastructure investments. Infrastructure projects should incorporate climate parameters in their planning, design, maintenance, and implementation that aim at reducing GHG emissions and climate risk. Furthermore, building codes and standards should also mainstream green growth and climate objectives. Lastly, development restrictions and transfer development rights are instruments that can be integrated into land use planning to restrict development from climate risk areas.

Economic and regulatory instruments

Governments can provide economic incentives aimed at developing and strengthening sustainable infrastructure. These include tax incentives for the utilization of low-carbon building materials as well as energy-efficient buildings and appliances. Economic instruments can also encourage other aspects, such as the use of local raw materials, recycling and reusing materials, and even the training of the local labor force and job creation. At the same time, regulatory instruments that support energy efficiency in new and existing buildings and the use of low-carbon materials in construction—such as minimum performance standards, green labels, and certification—should be mainstreamed into building regulations and design codes. Governments can significantly improve the construction and energy efficiency of buildings in their countries by designing these regulatory policies.

Conclusions

Urban infrastructure is one of the most critical sectors to reduce the use of greenhouse gas emissions since they account for about a third of global energy use. It is technically feasible to construct low or nearly zero carbon buildings and infrastructure, and energy efficiency measures in buildings are often commercially attractive investments. As energy efficiency measures tend to move costs from operational (monthly energy bills) to investment or capital costs, they

are likely to create an upfront financing requirement. Governments can provide economic or tax incentives to consumers and businesses that have proven effective in accelerating the uptake of energy efficiency measures. Once energy production is predominantly renewables-based, the electrification of buildings' heating and cooling and use of heat pumps offer an opportunity for significant greenhouse gas emission reductions.



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06

Green Employment

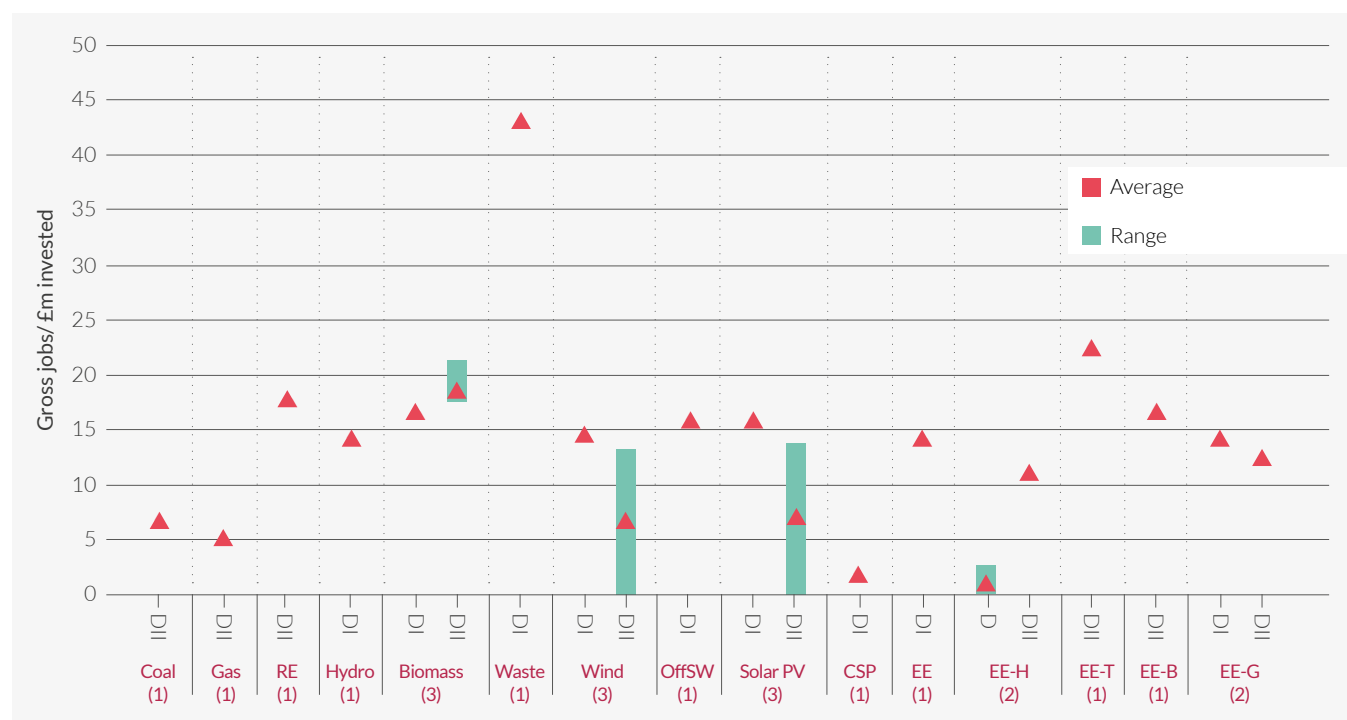
Under the Paris Agreement, countries are expected to revise their NDCs regularly while increasing their ambition. During the NDC revision process, countries can also consider additional benefits and incentives that become available through taking more ambitious action. Identification and assessment of the co-benefits of mitigation actions could be one way to illustrate the importance of setting more ambitious NDCs—not only for limiting climate change but also for delivering multiple additional benefits.

One of the most important co-benefits of delivering the Paris Agreement is employment generation. According to a recent report by the New Climate Economy (NCE, 2018), investing in low-carbon and green growth could generate over 65 million additional jobs globally by 2030, compared to a business-as-usual scenario. The global employment generation in renewable energy is constantly growing, reaching a record high in 2017 of approximately 10 million jobs in total (IRENA, 2018c). Moreover, as costs of renewable energy are plummeting, the number of jobs created per monetary unit that are invested

in renewable energy and energy efficiency is increasing, compared to those in fossil fuel-based technologies (Blyth et al., 2014). In 2017 alone, renewable energy created approximately 500 thousand new jobs—more than all fossil fuel-based sectors combined. Shifting the global energy system to renewables would grow the world economy by 1% by 2050, translating into a total of 29 million jobs in renewable energy (IRENA, 2018c). If we consider additional socioeconomic benefits, such as improved air quality and health and increased access to energy, potential gains outweigh additional costs.

At the same time, we need to consider that while many “green” jobs can be gained during the green growth transition, some jobs will be lost—particularly those in the mining and fossil fuel-based sectors (Gambhir et al., 2018). This development could create social unrest and resistance to change and may ultimately impede the green economy transition. However, a well-managed transition, with the right policies in place and in a participatory manner, could lead to a solid generation of decent and better-quality jobs (ILO, 2015).

Figure 11 Number of jobs per unit of investment



Source: Blyth et al., 2014.

Green Employment – Evidence from Developing Countries

There is growing evidence in low- and middle-income countries that investing in green growth offers much greater employment opportunities, compared to the continuation of the current economic model (ILO, 2018). In developing countries, while the costs of renewable energy and other low-carbon technologies are falling (as mentioned in the energy section), the green growth transition provides an opportunity to leapfrog to a more efficient and cleaner model of economic growth than following the traditional, environmentally destructive economic growth model of industrialized countries. Leapfrogging would enable the countries to avoid the lock-in of a “dirty” energy infrastructure for decades and could also generate more and better-quality employment.

Various studies provide evidence of economic and employment opportunities in a number of low-income countries that are pursuing the green transition. For instance, in Fiji, a recent GGGI (2018c) study estimated that jobs generated under a very high ambitious (VHA) scenario

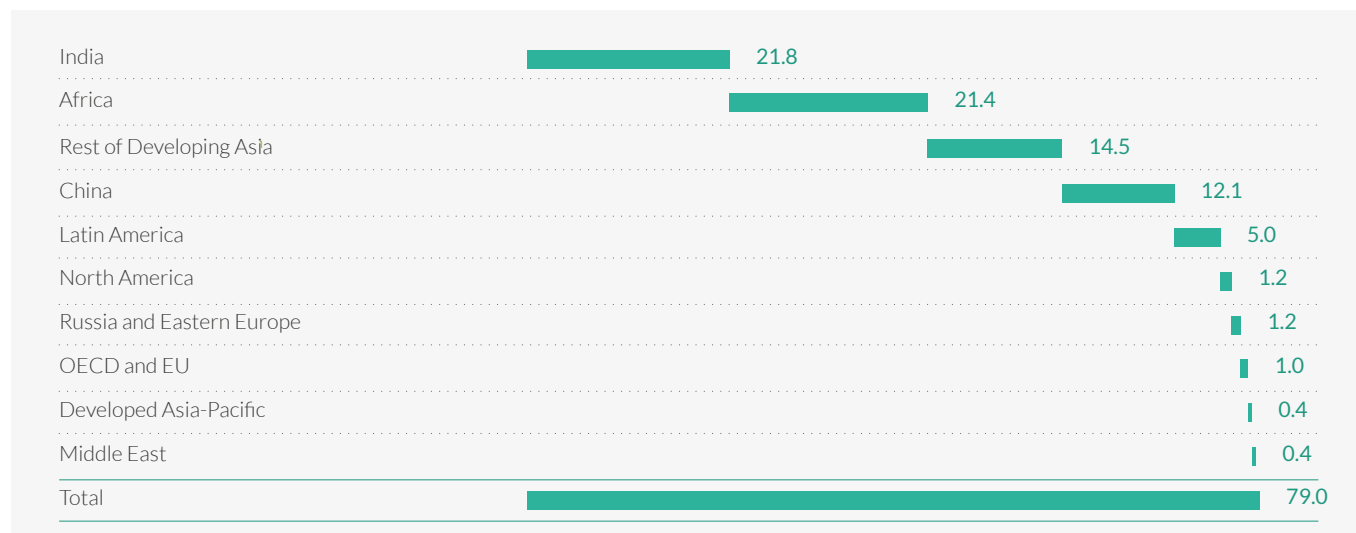
could create 2.1 and 3.2 times more jobs by 2030 and 2050, respectively—mainly in the electricity, transport, and forestry sectors—compared to the business-as-usual scenario (BAU). In Uganda, according to another study of EPRC/GGGI/NCE (2016), the green growth transition could generate 1.3 million jobs by 2020, rising to around 4 million in 2040, compared to the business-as-usual scenario. Investments in new sustainable agricultural activities offer the highest potential of employment creation. In Cambodia, a recent GGGI analysis (2018d) estimated that greening key industrial sectors of Cambodia—food processing, bricks, garments, and electronics manufacturing—through deploying energy, water, and other efficiency technologies, would provide an additional 512,000 jobs while reducing GHG emissions by 3.37 million tons relative to BAU by 2030. This projection supports a strong business case for green growth policy interventions by 2030: Cambodia can gain USD 28.49 billion worth of socio-economic benefits when investing USD 4.24 billion by 2030—approximately 2% of the GDP over the next 10 years.

Agriculture and Forestry as Key Sectors in the Green Growth Transition

Although low- and middle-income countries could take advantage of the opportunity of leapfrogging in the energy sector, even greater employment opportunities appear in other “greening” economic sectors. As the economic base of many low-income countries relies on agriculture and land management, including sustainable forestry, these sectors offer much higher employment generation opportunities

than other green sectors, such as renewable energy and manufacturing (NCE, 2018). Analysis has shown that there are great business opportunities in sustainable agriculture and land use that could generate economic returns of approximately USD 2.3 trillion while employing up to 80 million people by 2030 (BSDC, 2016).

Figure 12 Employment opportunities in sustainable agriculture and land use by 2030



Source: Business Sustainable Development Commission and Alpha Beta, 2017.

Employment in agriculture in low-income countries accounts for about 70% of total employment. Fine et al. (2012) estimate that agriculture can generate about 40% of new employment in the coming years. In many African countries, agriculture is the predominant sector of the economy, accounting for, on average, 25% of Sub-Saharan Africa's GDP and well above this level for many countries (Fine et al., 2012).

According to the Food and Agriculture Organization (2011), climate change poses major threats to rain-fed agriculture, which currently accounts for approximately 60% of the global agricultural output and occupies 96% of Sub-Saharan African, 87% of South American, and 61% of Asian cultivated land. Given the importance of agriculture—regarding income and employment generation, along with its increased vulnerability to climate change—this sector is essential for the green and climate-resilient economy transformation in low-income countries.

Due to the fact that climate change already impacts agriculture and will continue to do so in coming years, upscaling climate-smart and resilient agricultural practices is key to keeping up with the increasing demand for food crops. By investing in such practices in all areas of the agriculture value chain—including inputs, production, food processing, logistics, retail, and disposal—the transformation of the sector is technically possible and economically beneficial. Moreover, it is socially valuable, delivering benefits such as food security, poverty alleviation, and improved health.

The economic importance of forestry is reflected by the sector's annual income of USD 450 billion globally and, more importantly, by its contribution of approximately USD 250 billion per year to the economies of low-income countries. The Global Commission on the Economy and Climate (NCE 2018) estimates that reduced deforestation and forest degradation has a carbon abatement potential of 2.8–7.3 GtCO₂e by 2030,

which equals one-third of the carbon emission reductions needed for achieving the 2 degrees Celsius pathway. According to recent estimates, avoiding further deforestation could generate significant income, of about USD 40 to USD 80 billion per year, as well as make countries more resilient to a changing climate. However, regardless of the sector's high mitigation potential and its economic importance, particularly for low- and middle-income countries, only about 3% of the climate mitigation funds have been transferred to countries responsible for high levels of deforestation (NCE, 2018).

Land restoration to either natural forest or productive use could create significant economic and employment opportunities as well as climate benefits. There are various

examples of great economic benefits and the creation of jobs in the restoration and conservation areas in high-income countries. For instance, in the United States, forest restoration and conservation sectors are generating an annual income of USD 3.8 billion and currently employing 126,000 jobs. These sectors are also highly labor-intensive in South Korea, where they have created eight times more jobs per dollar invested, compared to other green activities (Strand and Toman, 2010). Given the value of the ecosystem services that forests provide to humans, land restoration could also potentially provide many economic and employment opportunities in low-income countries, particularly regulation services such as carbon sequestration, climate regulation, water purification, and flood protection.

Policy Recommendations

Policies should enable and facilitate a just green growth transition. Such a transition should provide alternatives to communities and regions that are largely dependent on fossil fuels through new economic and employment opportunities, education and skills, (re)training, and adequate social security systems. Diversification and regeneration funds must be channeled to affected areas whereas green skills grants and funds could provide the resources for retraining and transferring the necessary skills to affected workers. A close collaboration and coordinated action by different actors—including national and local governments, trade unions, and companies—would be required to codesign the right programs and policies for a just transition to clean energy.

Support for green entrepreneurship and innovation is of critical importance as the success of green start-ups will drive and accelerate the green transition. Governments and international organizations can help green start-ups in different sectors to overcome knowledge, information, and capacity barriers. GGGI's Greenpreneurship is a program that provides support to young green entrepreneurs regarding business model development, training, technical support, and seed funding. Mainstreaming green growth in national incubators and support programs of green start-ups is another effective way to accelerate the deployment of green technologies and practices in different sectors.

As argued above, much larger investments are necessary today in agriculture and land management sectors—including forestry and land restoration, particularly in low- and middle-income countries—considering their great climate mitigation, economic, and employment potential. Innovative financing is needed, combining investments from climate finance and development aid sources as well as the private sector. In addition to supplementary and blended capital flows in a more sustainable, climate-smart agriculture and land use system, existing investments should be targeted to enhance conservation and restoration. For instance, food commodity enterprises and private investors could invest in agriculture under the condition that their activities do not lead to deforestation.

Innovative financing instruments, such as payments for ecosystem services (PES) and REDD+, can be utilized in the forestry sector, considering the numerous ecosystem services that forests provide. In this regard, governments should adopt the right land tenure policies in order to provide necessary incentives for forest and nature conservation and restoration and, at the same time, decent income and employment (e.g., transferring payments to landowners to ensure forest protection and sustainable agricultural practices).



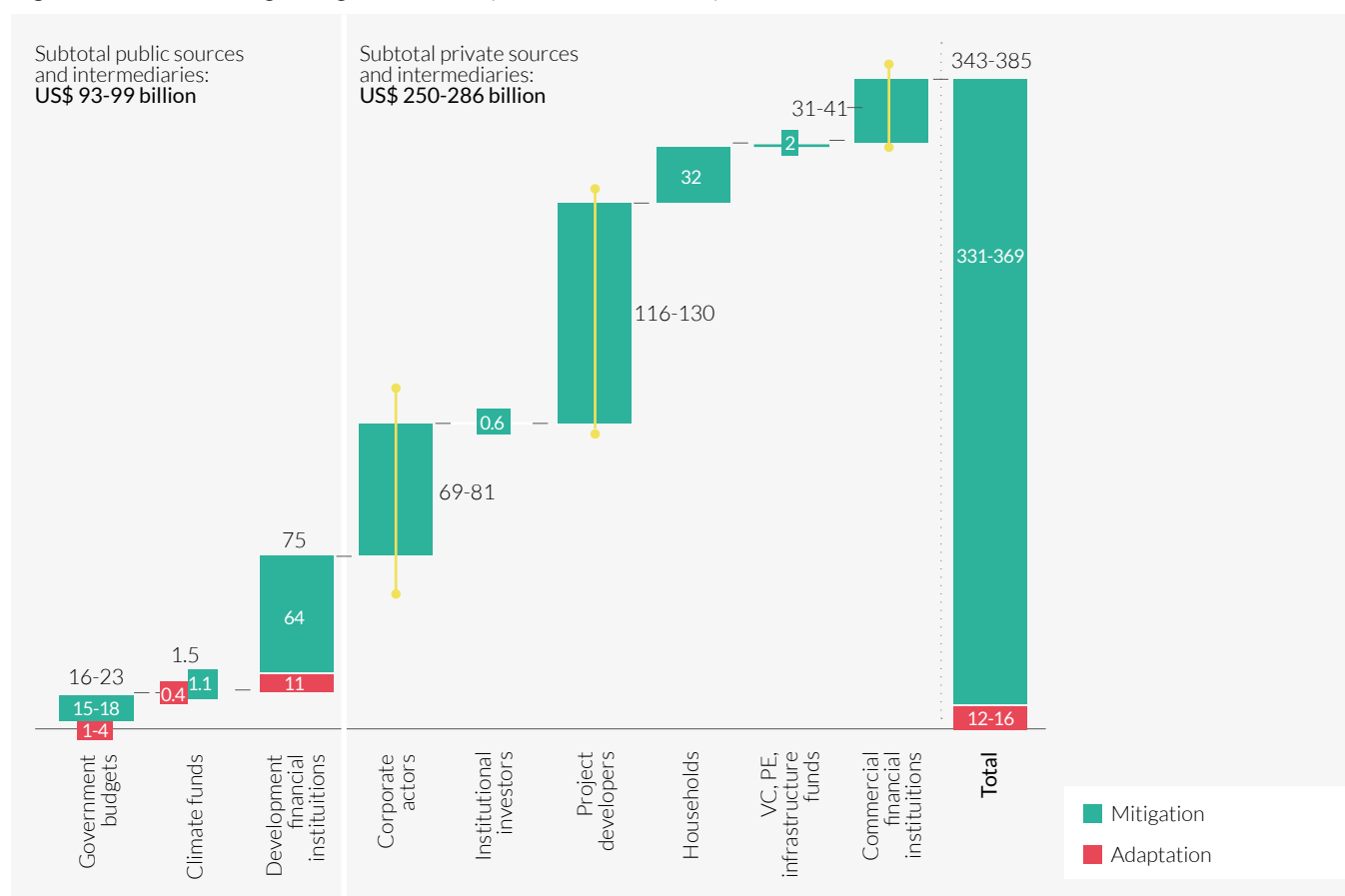
07 — Financing Green Growth

The World Bank estimates that investments of USD 4.5 trillion per year are required to finance the green growth transformation to achieve the Paris Agreement and Sustainable Development Goals in developing countries. However, current investments are only USD 2 trillion per year, of which only USD 135 billion is development assistance. Developed countries are committed to contributing a collective USD 100 billion per year in climate finance, and while it is important that these commitments are realized, it is not enough to finance the gap of USD 2.5 trillion per year. The

only sources of funding large enough to close the gap are the world's commercial banks and institutional investors, whose combined pool of capital is estimated at USD 120 trillion.

The Climate Policy Initiative estimated that approximately USD 364 billion was invested globally in climate-specific project investments in 2011. Private sources of investment dominated, with approximately one-third of overall climate-specific investment originating from project developers. The ratio of public-to-private investment approximately 1:3 in 2011 (see figure 13 below).

Figure 13 Climate change mitigation and adaptation investment by source of finance in 2011



Source: World Economic Forum, 2019.

Green bonds can be used to raise capital to finance or refinance investments in low-carbon or otherwise environmentally beneficial projects. Similar to conventional bonds, green bonds can be issued by a corporate, bank, or government entity. According to the Climate Bonds Initiative and HSBC, the green bond market size has been estimated at USD 174 billion. Institutional investors are often seen as natural buyers of green bonds, given their appetite for investments in low-risk, fixed-income products with long-term maturities. However, institutional investors typically lack the means to gain exposure to the green infrastructure market. A credit-rated and liquid green bond market allows institutional investors to potentially channel deep pools of relatively low-cost capital into green and climate change-related projects.

There is ample supply of long-term finance, relatively low real long-term interest rates, high private sector interest, and obvious benefits. These factors indicate that the investment gap in green transformation infrastructure is not the result of a shortage of capital. The main challenge seems to be difficulties in finding bankable and investment-ready projects. Therefore, the central challenge to finance the green growth transformation in developing countries is to develop bankable projects, or commercially attractive investment opportunities, that suit the needs of these banks and investors.

Policy Recommendations

Advancing such bankable projects or financial vehicles and mechanisms is, to a large degree, the responsibility of developing country governments. They can ensure that policy barriers to investment—identified in many countries as the primary obstacle—are lifted and that there is an enabling policy environment. For utility-scale renewable energy investors, a solid power purchasing agreement with a reasonable feed in tariff for a period of at least 20 years is necessary. For roof-top solar, a net-metering policy or lifting the cap on rooftop solar is proposed. Private investors also need to be able to have access to data and be assured of a stable policy environment.

Moreover, developing country markets are often assessed as risky, due to factors such as foreign exchange risk, immature markets, high transaction costs, foreign exchange controls, and/or the need to introduce new technology. Concessional finance, such as development assistance and climate finance, can be used strategically to reduce such risks to reasonable levels to attract private investors—particularly to open up markets or introduce new technologies.

Barriers confronting the transition to renewable energy in developing countries lie not just with technology innovation costs but also with the challenges of securing long-term affordable finance. Project developers in developing countries often struggle to access the large sums of upfront financing needed. When it is obtainable, the cost of available financing

is usually substantially higher than in developed countries. Consequently, this translates to higher costs for developing renewable energy projects. The use of credit enhancement instruments can mitigate risks and enhance the financial attractiveness of projects. Credit enhancement therefore becomes even more valuable, as policy-makers can use these instruments to increase the financial feasibility for green growth transformation projects.

OECD-DAC data for 2014 indicates that only USD 6 billion of private investments was mobilized through development funding interventions, such as guarantees and credit enhancements. Given the significant need to mobilize and leverage more private investment, this is a key area that could be expanded.

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. In the 2017–18 biennium, GGGI helped its members mobilize over USD 1 billion in green and climate finance for bankable projects to the stage of investor commitment. This includes funding from the Green Climate Fund, where GGGI prioritizes direct access of its members. To date, GGGI has supported five full proposals submitted to the GCF, for a total of USD 200 million. Four of the proposals are direct access, and two of those have already been approved by the GCF Board (for a total of USD 85 million for Ethiopia and Rwanda).

Conclusions

While climate finance can and should play an important role to catalyze low-carbon development and increase climate resilience, it should leverage other sources of finance, both domestic public finance and private sector finance, to the maximum extent possible. It is worth emphasizing that, as a result of the rapid decline in renewable energy costs, renewable energy projects (as the most obvious example)

have become commercially attractive and do not need concessional finance. Although practical experience with renewable energy project development is still lacking in many countries, GGGI can assist in the acceleration of renewable energy deployment through the building of capacity to develop bankable projects in member and partner countries.



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08 —————

Conclusions & Recommendations

Future generations will be defined by how we respond to climate change, and rapid and radical decarbonization is critical to limit global warming to well below 2 degrees and achieve the Paris Agreement. A renewable energy transformation has begun where all forms of renewable energy are now, or will soon be, cheaper than fossil fuels.

Deep decarbonization will require targeting 100% of renewables in the energy mix, and this RE transformation requires action on multiple fronts by a variety of actors. National governments are critical in this process, but city governments play a key role as well, given that over 70% of energy use and an even higher percentage of GHG emissions are urban. The private sector will play a critical role, both in terms of its own adoption of RE and investors as well as in the development and deployment of new RE technologies and electrification of transport, buildings, and infrastructure.

The highest priority for emerging economies, least developed economies, and small island developing states is achieving economic growth to eradicate poverty and provide decent jobs for the next generation. The only development path that can provide sustainable and inclusive economic growth in the twenty-first century is the green growth pathway.

A number of GGGI member developing countries have launched national green growth development strategies demonstrating that decoupling emissions from growth is feasible. Investments in sustainable infrastructure, renewable energy, sustainable transport, and sustainable landscapes are, in many cases, commercially attractive investment opportunities. Green growth strategies implemented economy-wide also provide a solid basis for more ambitious NDCs. While there are important commercial green growth opportunities, the transition to a green growth pathway needs to be accelerated to achieve the Paris Agreement. G20 countries can play a key role in building capacity in developing countries, meeting commitments concerning climate finance, and enabling the engagement of the private sectors of G20 countries in project development and investments in the developing world.

Table 1 provides an overview of the opportunities, challenges, and policies provided in key sectors of the economy that were reviewed in this paper.

Table 1 Overview of Opportunities, Challenges, Policies

Sectors	Opportunities	Challenges	Policies
Renewable energy	<ul style="list-style-type: none"> • Significant cost reduction • Action by multiple stakeholders and actors and at different levels of governance 	<ul style="list-style-type: none"> • Lack of information • Lack of financial and technical support • Access to land • Fossil fuel subsidies • Lack of policy and regulatory framework 	<ul style="list-style-type: none"> • RE auctions • Raise ambition of RE targets • Improve policy and regulatory environment • Removal of fossil fuel subsidies
Electric mobility	<ul style="list-style-type: none"> • Global efforts to reduce GHG emissions in the transport sector • Urgency to improve air quality in urban areas • Rapid decrease in EV prices • Potential to create business and job opportunities in the EV ecosystem • Serve as the backbone of new innovative mobility services • Other environmental and economic co-benefits 	<ul style="list-style-type: none"> • High upfront cost of EVs in some cases • Insufficient charging infrastructure and lack of investments • Auto industry's business-as-usual practices • Consumers' lack of awareness about costs and benefits of EVs 	<ul style="list-style-type: none"> • Strong political commitment to reduce or ban fossil fuel vehicles • Initial investments on EV infrastructure by the public sector • Affordable and sustainable financing schemes to support the EV transition • EV awareness programs for consumers • New innovative mobility services using EVs such as Mobility as a Service
Green Buildings	<ul style="list-style-type: none"> • Many commercially attractive energy efficiency options • High climate mitigation potential (1/3 of global energy use) • Multiple co-benefits, such as lower energy costs, energy security, and better thermal comfort 	<ul style="list-style-type: none"> • Lack of stable policy environment • Lack of institutional capacity • Tenants' and owners' lack of awareness about financial benefits of EE measures 	<ul style="list-style-type: none"> • Improve policy and regulatory environment • Introduction of economic incentives for EE measures • Mainstream green growth in building codes and standards
Infrastructure	<ul style="list-style-type: none"> • Economically beneficial in the long run to invest in low-carbon and climate-resilient infrastructure • In the case of investing in low-carbon and resilient-infrastructure, lock in substantial environmental benefits in the long run 	<ul style="list-style-type: none"> • High upfront costs • Lack of access to finance • Lack of stable policy environment • In the case of investing in energy- and carbon-intensive infrastructure, lock in substantial environmental and economic costs in the long run 	<ul style="list-style-type: none"> • Mainstream green growth in plans and policies • Blended financing (public and private) • Improvement of policy and regulatory environment

Recommendations

In order to scale up and accelerate green growth in developing countries, the following are our top six recommendations:

1. All countries, developed and developing, need to redirect public policy and finance economy-wide to achieve deep decarbonization. G20 countries, cities, and companies should join and encourage others to join initiatives such as the Powering Past Coal Alliance, C40 Zero Emission Vehicle Network, and Climate Group's RE100 Campaign.
 2. The G20 countries should ensure successful replenishment of the Green Climate Fund, as climate finance is a key developed country commitment to facilitate deep decarbonization and climate resilience in developing countries. Climate finance will only represent a small share of the total funding required and should therefore play a role in bringing other forms of finance (concessional development finance, domestic public investment, institutional investors, and venture capital) to participate in climate action through blended finance.
 3. Effective climate change actions will include decarbonization efforts, such as phasing out fossil fuel subsidies in all forms, introducing forms of carbon pricing, and using a share of the public revenues generated to facilitate a just transition.
 4. G20 countries should establish mechanisms, such as expanded credit guarantees and credit enhancements, to enable and increase private and institutional green investments by G20 countries in developing countries.
- The only source of finance large enough to close the climate finance gap is managed by banks and institutional investors. Therefore, increasing private investment in the green transition in developing countries, including domestic private finance, is critical. Developing country governments need to play a critical role in enabling private investments through targeted government policies, the removal of policy obstacles, public procurement, and public-private partnerships.
5. The green transformation will need to provide hundreds of millions of green and decent jobs, particularly to enhance the role of women in the labor market and provide opportunities for the next generation. All governments can support a just transition through education, (re) training, and the promotion of green innovation and entrepreneurship as well as ensuring that it is easy to do business. Inclusive green growth requires gender equality by providing equal access to resources, such as land, finance, and education. Young people represent a critical position in the green transformation and should be given a voice and recognized as key stakeholders.
 6. Civil society and consumers play a key role in the green transformation: directly as conscious capitalists, through green lifestyle choices, and as part of a social movement that encourages governments and the private sector to take action while holding politicians and businesses accountable. G20 governments should champion and support public awareness campaigns in developed and developing countries to increase citizen engagement in the green growth transformation.



09

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The Global Green Growth Institute (GGGI) is a treaty-based international, inter-governmental organization dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies.

GGGI is a trusted advisor to governments in over 30 countries transitioning to green economic growth. GGGI works across country Ministries and Departments to explore the value of green growth opportunities in the context of a country's own growth and to help achieve Sustainable Development Goals and Nationally Determined Contribution commitments expressed under the Paris Climate Agreement.

Working across the thematic priorities of sustainable energy, green cities, sustainable landscapes, and water & sanitation, GGGI results support 6 outcomes critical to achieving SDGs and NDCs: greenhouse gas emission reduction; creation of green jobs; increased access to sustainable services; improved air quality; adequate access to ecosystem services; and enhanced climate adaptation.

GGGI's delivery model combines rigorous technical assistance to governments with green finance mobilization for bankable green growth and climate resilient projects. Our green growth planning work includes: providing sectoral and socio-economic impact assessments to experience, developing and applying practical tools and case studies; developing green growth plans at national or sectoral level; assessing and designing legal and institutional frameworks; providing financial and investment analysis that looks at both investment requirements and potential sources; and developing sectoral and sub-sectoral investment plans and frameworks.

GGGI currently counts 30 Members from developed and developing countries. In collaboration with its Members and other public and private sector partners, GGGI is championing green growth and climate resilience in over 30 countries.