CLIMATE FINANCE INNOVATORS

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FINANCING SUSTAINABLE ENERGY ACCESS IN AFRICAN NDCs

ENHANCING AMBITION THROUGH LINKING CARBON MARKETS AND CLIMATE FINANCE

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DISCLAIMER

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PREFACE

This study presents results of a long-term practical engagement of the Climate Finance Innovators (CFI) project on how deeper and broader linkages between carbon markets and climate finance can accelerate climate action in Africa. Conceived at the time when Clean Development Mechanism (CDM) mitigation activities were heavily affected by the downturn of the carbon market while substantial new climate finance commitments were being made and the Green Climate Fund (GCF) was being capitalised, the project set out to explore how Africa's emerging pipeline of CDM activities could benefit from new climate finance sources. A key objective was to identify new funding sources for programmatic activities with high sustainable development impacts that were initiated under the CDM but whose business case had been eroded by the decline in carbon prices. At the same time, the aim was to generate lessons learned about how the comprehensive carbon market toolbox such as baseline and monitoring methodologies could strengthen new climate finance instruments.

The CFI project focuses on engagement with three partner countries, Ethiopia, Senegal and Uganda, which stand out regarding their ambition, regional lighthouse effect and relevance in the climate negotiations. In all three countries, sustainable energy access emerged to be of particular relevance, in the updated NDCs, in the national carbon market portfolios, but also in the funding proposals to the GCF which the CFI project team supported in cooperation with governments. At the same time, the project also works on subregional (Eastern and West African Alliances on Carbon Markets and Climate Finance) and multilateral levels (UNFCCC negotiations), which further underline the relevance of sustainable energy access.

One of the project's flagship activities has been supporting the development of Green Climate Fund applications for selected mitigation activities in the three focus countries. The CFI team project provided and continues to provide technical support throughout all stages of the development and approval process of the funding proposals, including selecting suitable mitigation projects; engaging with programme developers, government representatives and accredited entities in the conceptualisation of the projects; supporting the drafting of the project concept notes and final proposals; as well as interacting with the GCF Secretariat and Board members in helping to secure the approval.

In this context, a crucial achievement of the CFI project has been the approval of the GCF funding proposal for the Senegalese Rural Electrification Agency (ASER) program to deploy 100% solar mini-grids for rural households in 1,000 isolated villages in Senegal. The implications of this achievement are threefold: avoidance of more than 1.1 $MtCO_2$ – contributing to Senegal's nationally determined contribution (NDC), generation of adaptation and sustainable development co-benefits, and contribution towards Senegal's goal to reach 'universal access to electricity' by 2025. Given the co-existence of this project with a CDM-registered Programme of Activities (PoA) implemented by ASER, the project is a prime example of studying the blending of carbon markets and climate finance and how it can work in

practice. Further funding proposals supported in the project promote solar mini-grids in Uganda and solar water pumping in Ethiopia.

This study seeks to capture key insights from these practical experiences gained and lessons learned through the support against the backdrop of African climate and development priorities. By working in partner countries and on subregional levels with a diverse team of experts, project developers, financiers and government officials, the CFI project hopes to distil insights on common challenges and opportunities that can be mobilised by working towards greater linkages between carbon market and climate finance instruments. Such synergies between these two financing instruments are particularly relevant for achieving NDC goals, enhancing sustainable energy access, as well as exploring further the potential for increasing the ambition of those targets.

EXECUTIVE SUMMARY

Africa faces an urgent challenge: 571 million people currently lack energy access on the continent. Projections by the International Energy Agency (IEA) estimate that approximately the same number of people will remain without access in 2030 and on current trends it may take until 2080 to achieve universal access to electricity. While the number of people with access to electricity has increased steadily in the past years, this trend is overshadowed by a rapidly growing population with improving living standards. Part of this rapidly increasing energy demand is being met by expanding renewables, whose deployment costs have been falling substantially over the last decade. However, millions of Africans cope with remaining significant electricity access deficits by remaining underserved or relying on backup diesel generators, especially in rural areas that cannot be easily connected to the grid.

As most investments target grid development, many communities that are out of reach of grid extension have until recently been at risk of being left behind and remaining without power. Yet, off-grid renewable energy solutions have recently matured significantly in terms of technical reliability as well as cost affordability. This opens new possibilities to deliver social, mitigation and adaptation benefits through descentralised rural electrification with renewable energy. Due to still relatively high costs and little market penetration, in particular for mini-grids and productive use applications, there is a need to tailor appropriate policy and financing instruments that can accelerate sustainable energy access in Africa.

This study provides an insight into the current status of sustainable energy access in Africa with a focus on off-grid electricity generated from renewable sources and related climate targets and financing sources. The main aim of the study is twofold: (i) assessing the potential role of carbon and climate finance in financing off-grid sustainable energy in Africa; (ii) exploring how synergies between climate and carbon finance instruments enhances the effectiveness of closing energy access gaps and enabling more ambitious mitigation targets.

Addressing the energy access gaps has been recognised as a policy priority by African Union countries, as part of Agenda 2063, which proposes a sustainable development pathway for the continent. The majority of African countries have also submitted Nationally Determined Contributions (NDCs) that prioritise energy access, with ambitious targets for off-grid energy

access, mostly conditional on international support. Despite the focus on energy access, the energy policies of Sub-Saharan Africa (SSA) countries are often not yet aligned with their NDC targets, with resulting insufficiently tapped opportunities for boosting renewable energy capacity and sustainable energy access. At a global level, after the signing of the Paris Agreement, renewables have been rapidly deployed and risen annually by over double the rate foreseen in the first NDCs. If African NDCs were further aligned with national energy plans that are already in place, this would lead to an ambition increase with respect to renewable energy targets. This matters, not only because of the additional mitigation potential, but in particular because sustainable energy access unleashes the potential for societal transformation that also contributes to meeting other Sustainable Development Goals such as poverty reduction (SDG 1), improved health care (SDG 3), education (SDG 4) and others, in a win-win situation for the climate and rural populations.

Increased and predictable financial flows into the energy sector are, therefore, essential to improve energy access, raise standards of living, and deliver mitigation and adaptation benefits. The IEA estimates that a five-fold increase in investment in the power sector is necessary to ensure reliable, clean and affordable power for all, implying a cumulative investment of more than USD two trillion between 2019 and 2040. Unfortunately, actual investments so far remain grossly insufficient, in particular regarding the off-grid electricity needs of rural communities in low-income countries, as grid-connected power projects continue to attract the majority of financial flows.

While the magnitude of the required investment calls for leveraging all available finance sources, flows of climate and carbon finance remain low and only represent a fraction of the current investments aimed at enabling energy access in Africa. Additionally, the conditionality of many of the NDC targets, and the relatively high costs of sustainable energy access technologies and off-grid power installation suggest that there is an extensive untapped potential for carbon and climate finance contributions. As both carbon finance and climate finance have different strengths and weaknesses, harnessing complementary synergies between these two financing instrument types is a crucial approach to further catalyse improved access to sustainable energy. This study thus aims at exploring how to work towards greater synergies between carbon and climate finance, in terms of conceptual considerations and practical applications, based on a broad assessment of the climate finance and carbon finance landscape and selected regional and country experiences.

Climate finance and carbon finance differ widely in terms of participation requirements and accessibility, their implications for achieving conditional and unconditional NDC pledges, their incentive structures for key stakeholders, as well as the technical expertise required for monitoring, reporting and verification (MRV) of emission reductions in light of host country NDCs. Therefore, these two types of financing instruments, each with its own strengths and weaknesses, and combinations of both, will be suitable depending on the specific circumstances to which they are applied.

In some cases, the first-best option can be blending the two instruments to capitalise on the strengths and complementarity of both instruments to maximise their potential for delivering mitigation actions at the required scale. Benefits of blending might include providing a carbon price signal for driving cost-effective interventions; incentivising the implementation of high-cost measures by tackling various sectoral implementation barriers; and providing access to climate finance to rapidly mobilise mitigation actions.

The key case study of the Senegalese Agency for Rural Electrification showcases these synergies by leveraging the complementarities of the two financing sources in two separate, but related, activities with the common goal of expanding energy access in rural areas and mitigating climate change. In particular, the climate finance project (supported by the Green Climate Fund) managed to capitalise on the experience of a previous carbon finance initiative (from the World Bank Carbon Initiative for Development), for instance by harmonising MRV frameworks between the two supported activities.

Several crucial considerations arise when exploring synergies between carbon and climate finance:

a) **Attribution of emission reductions to different financing sources.** Applying proportional attribution allows host countries to capitalise on carbon markets' benefits while climate finance still supports the achievement of their mitigation pledges. Rising awareness about the benefits of blending and proportional attribution among key actors, especially climate finance providers, and implementing pilot programs could promote the acceptance and resolve uncertainties of this innovative financing approach.

b) **Harmonisation of MRV methodologies.** The robust methodological toolkit that emerged from the Clean Development Mechanism (CDM) constitutes the most important body of knowledge for the MRV of projects and programmes that generate UNFCCC-backed carbon credits. As host country NDCs require Harmonisation of MRV approaches across different types of international support, these methodologies provide the only UNFCCC-approved set of MRV methodologies. This allows climate financing institutions such as GCF to capitalise on existing standardised mitigation outcome calculations and MRV efforts, which also strengthens the results orientation of climate finance.

c) **Monitoring and reporting of sustainable development goals (SDGs) and climate impacts.** Both carbon and climate finance are inherently designed to deliver impacts beyond mitigation including sustainable development and adaptation. Further harmonised monitoring approaches can serve in linking capital with impact.

d) **Additionality of emission reductions.** The range and diversity of additionality approaches adopted by different financing instruments create 'barriers to entry' for prospective project developers and reduce the scope for coordination and blending between different financing sources.

As the NDC implementation phase has begun, climate finance and carbon finance are expected to play a more prominent role in the African energy sector in the coming decade to meet the growing demand for large-scale investments into renewable energy. To harness the full potential of climate and carbon finance and the opportunities that blending the two instruments offers in this context, several considerations are suggested:

- Governments need to have strong climate policies that make the energy sector a priority, with specific attention paid to rural electrification with descentralised renewable energy. This also includes establishing robust institutional frameworks to channel the funds effectively, and making carbon and climate finance core components of the sector policy and planning processes;

- Host country governments and market participants need to develop strong, long-term, and inclusive strategies and capacity building plans for effective blending of carbon and climate finance;

- Climate finance vehicles need to provide clear, transparent, and accessible processes and financial instruments. Proportional attribution when blending carbon and climate finance is essential. The emergence of new digital tools and frameworks for MRV in the international carbon markets offers significant opportunities in this sense;

- Stakeholders need to maintain a forward-looking approach: climate finance and carbon finance necessitate continuous reform and innovation to meaningfully contribute to increased mitigation ambition.

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ACRONYMS

A6.4 ERS	Article 6.4 Emission Reductions
ABM	Adaptation Benefit Mechanism
AC	Alternating Current
AE	Accredited Entity
AF	Adaptation Fund
AFOLU	Agriculture, Forestry and Other Land Use
ASER	Senegalese Rural Electrification Agency
BAU	Business as Usual
BEE	Business Enabling Environment
BOAD	West Africa Development Bank
BTR	Biennial Transparency Reports
CA	Corresponding Adjustments
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
Ci-Dev	Carbon Initiative for Development
CIF	Climate Investment Funds
CFI	Climate Finance Innovators
COP	Conference of Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CPI	Climate Policy Initiative
CSP	Concentrated Solar Power
CTF	Clean Technology Fund
DAE	Direct Access Entity
DC	Direct Current
DLT	Distributed Ledger Technology
EB	Executive Board
EE	Energy Efficiency
EFs	Emission Factors
ERs	Emission Reductions
ERPA	Emission Reductions Payment Agreements
ESMAP	Energy Sector Management Assistance Program
ETS	Emissions Trading Schemes
FCFA	West African CFA franc
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GGA	Global Goal on Adaptation
GoS	Government of Senegal
GST	Goods and Services Tax
GW	Gigawatt
ICAO	International Civil Aviation Organization
IEA	International Energy Agency
IEC	International Electrotechnical Commission
II-AMT	International Initiative for Development of Article 6 Methodology Tools
IoT	Internet of Things
IPCC	Intergovernmental Panel on Climate Change

IRENA	International Renewable Energy Agency
ITMOs	Internationally Transferred Mitigation Outcomes
JCM	Joint Crediting Mechanism
LDCF	Least Developed Countries Fund
LDCs	Least Developed Countries
LT-LEDS	Long Term Low Emission Development Strategy
LUCF	Land use, land-use change, and forestry
KP	Kyoto Protocol
kt	Kiloton
kWh	Kilowatt-hour
MDBs	Multilateral Development Bank
MEM	Modern Energy Minimum
MRV	Monitoring, Reporting and Verification
MtCO2e	Million tons of carbon dioxide equivalent
MW	Megawatt
NA	National Authority
NAMA	Nationally Appropriate Mitigation Action
NIR	National Inventory Report
NDA	National Designated Authority
NDC	Nationally Determined Contribution
PA	Paris Agreement
PoA	Programme of Activities
PSF	Private Sector Facility
PV	Photo-Voltaic
RBF	Results-based Financing
RE	Renewable Energy
REA	Rural Electrification Agency
RMPs	Rules, Modalities and Procedures
SB	Supervisory Board
SCF	Standing Committee on Finance
SD	Sustainable Development
SDG	Sustainable Development Goal
SEforAll	Sustainable Energy for All
SHS	Solar Home Systems
SIDS	Small Island Developing States
SMEs	Small and Medium Enterprises
SoP	Share of Proceeds
SSA	Sub-Saharan Africa
SWP	Solar Water Pumping
TAP	Technical Advisory Panel.
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VAT	Value Added Tax
VCM	Voluntary Carbon Market
VCS	Verified Carbon Standard

1. THE RELEVANCE OF LINKING CARBON MARKETS AND CLIMATE FINANCE FOR FINANCING SUSTAINABLE ENERGY ACCESS IN NDCS

1.1. INTRODUCTION AND BACKGROUND

Despite a rising number of long-term carbon neutrality commitments in updated NDCs, the collective ambition level of Parties' Nationally Determined Contributions (NDCs) pledges falls far short of meeting the objectives of the Paris Agreement to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" (Article 2) and "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century" (Article 4) (United Nations Framework Convention on Climate Change, UNFCCC 2021a). This implies an urgent need to increase the ambition of NDCs between now and 2030 to keep warming well below 2°C or limiting it to 1.5°C. To meet these ambitious goals will require unprecedented financing to fund low-carbon and climate resilient development pathways. This poses a particular challenge to developing countries, as current financial flows fall short in meeting the investment needs to adapt to climate to change and mitigate further rises in temperature.

All NDCs identify the energy sector as a key area for climate action with tremendous investment needs (UNFCCC 2021a). Of the 53 NDCs submitted by African Parties as of November 2021, 73% of the Parties included quantified renewable power targets in their NDCs, 24% of Parties had quantified renewable energy targets for direct heat and transport while 3% included quantified energy-sector wide renewable targets (International Renewable Energy Agency, IRENA 2022). Energy access is at the heart of most African long-term development plans and NDCs of several countries incorporate concrete targets to increase electrification rates, including for rural electrification.

Demand for modern energy services is growing through Africa's expanding economy as well as its young and increasingly urban population. The continent has the potential to chart a more climate-resilient development pathway compared to old industrialization models, as the region is endowed with substantial renewable energy sources. Additionally, many decentralised renewable technologies have recently matured and became sufficiently affordable to enable countries to leapfrog directly to climate-friendly infrastructure (see International Energy Agency (IEA) Special Report Africa Energy Outlook 2019). Providing universal energy access is also at the centre of the 2030 Agenda for Sustainable Development, the Africa Union's Agenda 2063 and national development priorities. Being high on the political agenda, a lot of investment is channelled into energy supply and many initiatives and investors are active on the continent.

Nevertheless, the current momentum in providing clean, affordable and reliable energy is insufficient in meeting Africa's energy needs. Renewable energy investments demonstrated noteworthy resilience in the face of the COVID-19 pandemic. However, the energy access gains throughout Africa are at risk of being reversed, as energy prices have risen as a result of the impacts of the pandemic (IRENA; AfDB 2022) and geopolitical conflicts. Furthermore, energy demand is set to nearly double by 2040, due to population growth, expanding economies and improved living standards, creating the need to ensure the growth of emissions is prevented as demand increases (KfW et al. 2019a). These projections clearly demonstrate that only decarbonised energy systems allow meeting the 1.5°C goal of the PA. Additional investments in modern energy

and efficient power systems are therefore crucial to ensuring that Africa can reap the benefits of renewable energy at the least cost and avoid a potential lock-in to fossil fuel energy.

Less than 10% of annual global energy investments are made through public sources (IRENA and CPI 2018). As a majority of the financing comes from private sources, funding energy access in poor and rural countries has been slow due to the view that such projects are low-return and high-risk investments (Dorman and Ciplet 2020). Moreover, concerns have been raised over the flows of development finance earmarked for energy not reaching the communities with the largest needs (Rai et al. 2016).

The PA provides several financial mechanisms and instruments that can play an important role in financing NDC implementation such as the Green Climate Fund (GCF) and international market-based cooperation as defined in Article 6 of the PA. The GCF has emerged as a major source of climate finance for Sub-Saharan Africa (SSA) since its first project approvals in late 2015, including for enhancing energy access (Dorman and Ciplet 2020). However, the GCF typically prioritizes projects with large emission reduction potential, with little funding flowing towards small-scale energy access projects in poor, rural communities (Rai et al. 2016; Watson and Schalatek 2021). Public climate finance is similarly providing a small portion of sustainable energy finance, though it is widely acknowledged as an important catalyst to leverage additional public and private investments into energy access.

Several Parties have indicated their interest to use market mechanisms backed by Article 6 of the PA to mobilize finance for mitigation in their updated NDCs (Brandemann et al. 2021; Michaelowa et al. 2021a). In the past, carbon markets offered a mixed track record as the Kyoto Protocol's Clean Development Mechanism (CDM) mobilized a considerable activity portfolio and spurred the creation of a methodological toolbox for MRV of climate impacts but suffered from carbon price volatility which undermined investor confidence in CDM projects.

Despite these concerns, the increasing realization around the world that addressing the climate crisis is a priority has led to ambitious NDC targets. Yet, many developing country NDC mitigation targets are conditional on access to financial resources provided through climate finance and carbon finance instruments as well as other support including technology transfer and capacity building (UNFCCC 2021a). This implies the need for an adequate and predictable flow of finance to drive ambition and support the achievement of these NDCs. As such, it is important for host countries to blend different sources of finance for mitigation interventions (without crowding out adaptation efforts) that are complementary, offer flexibility and build upon the accumulated experience and harmonized methodologies from both climate and carbon finance sources. Therefore, it is useful to assess the needs of African countries in financing sustainable energy access, how far climate finance and carbon finance can go towards decentralized renewable energy and energy access projects and the challenges for host countries and project developers in accessing such finance.

The current financial flows from carbon markets and climate finance fall short in meeting the current investment needs for the ambitious PA goals. Innovatively combining several forms and sources of financing, from public resources at the international and domestic level to private resources in both industrialised and developing countries can help close this ambition gap. Historically, climate finance and carbon finance have evolved in parallel. However, there is increasing recognition of the need to mobilize additional investments to finance large-scale activities such as rural electrification of a country, that will require finance from multiple streams.

1.2. OBJECTIVES AND APPROACH

Against this backdrop, the objectives of the study are to:

- Explore how synergies between climate and carbon finance can contribute to financing NDC goals for sustainable energy access in Africa;
- Develop a better understanding of the practical applications of these synergies to accelerate the deployment of off-grid technologies to support energy access based on a broad assessment of the climate finance and carbon finance landscape and selected country case studies;
- Assess the existing financing needs for off-grid sustainable energy access in Africa and the potential of carbon and climate finance instruments to close remaining gaps;
- Provide insights on blending climate and carbon finance as a relevant approach to achieving conditional NDC targets, and potentially enable further NDC ambition;
- Analyse recent policy developments such as the newly adopted Article 6 rulebook and NDC updates and their potential for mobilizing resources for sustainable energy access.

For this purpose, we reviewed literature assessing the energy situation in SSA, NDC submissions and some of the key questions relating to the synergies between carbon finance and climate finance. The information provided in this document draws on a broad range of case studies in focus countries, research, assessments, specifications, guidelines, UNFCCC negotiations support and training modules that were produced by the Climate Finance Innovators project team, as well as further literature and database review.

1.3. OUTLINE OF THE REPORT

To set the scene, Chapter 1 presents the introductory context and the methodology of the study. Chapter 2 proceeds with a brief overview of the status of sustainable energy access in Africa as well as the relationship between energy access and broader sustainable development and national climate policy goals. Chapter 3 illustrates the energy access financing situation, whereby we focus on the role of carbon and climate financing that has gone into the sector in Africa and provide a brief outlook on the role of such financing in the evolving energy and climate policy landscape in Africa. Following this, Chapter 4 highlights the central insights into how synergies between carbon and climate finance are relevant for host countries and market participants such as project developers and investors, including through technical concepts such additionality, MRV approaches, SDG impacts and safeguarding environmental integrity. Chapter 5 synthesizes key findings into conclusions.

2. SUSTAINABLE ENERGY ACCESS IN AFRICA

2.1. CURRENT STATUS

2.1.1. ACCESS TO SUSTAINABLE ENERGY

Sustainable Development Goal (SDG) 7 comprises three pillars: achieving universal access to electricity and clean fuels and technologies, increasing the share of renewable energy in the energy mix, and doubling the rate of energy efficiency improvements (SEforALL 2021a). Sustainable energy is energy that is adequate, reliable, affordable, secure, clean and inexhaustible.

Within the sustainable energy framework, this study focuses on electricity generated from decentralized, renewable sources – specifically, off-grid electricity. While access to clean cooking fuels and technologies is a major concern for SSA governments, as burning traditional biomass is linked to 2.5 million premature deaths per year globally from indoor air pollution and is a contributor to deforestation (IEA 2022); it is electricity access that is most associated with 'productive' gains in income and well-being. In SSA, the national electricity utilities that operate grid infrastructure are widely renewably powered, but more than half the population lack access to them[1]. As opposed to the Global North, the challenges faced in the energy sector are twofold: how to ensure that electricity is 'clean' and 'sustainable' and how to provide access to it for millions of households and businesses currently lacking access.

Hundreds of millions of people in SSA do not have a reliable source of power (Figures 1 and 2)[2]. In the last ten years, electricity access in SSA improved steadily in absolute terms (number of people), albeit unevenly across countries. Nevertheless, since 2019, a rapidly growing population has outpaced progress in energy access, keeping the relative (percentage) level of progress down. Nigeria, the Democratic Republic of Congo and Ethiopia are the three countries with the largest electricity deficit in the world, and SSA accounts for three-quarters of the world's population without electricity (World Bank 2021a). This stems from the lack of both power sources and – as is discussed further below –reliable power. As much as one-quarter of Africa's installed power capacity is not operational, leading to widespread power shortages and blackouts (Mills et al. 2017). Millions of Africans remain underserved or are forced to rely on expensive, polluting diesel generators as backup solutions. In half of the countries in SSA, the installed capacity of backup generators is estimated to be greater than the capacity of power plants connected to the grid (IFC 2019). In the case of diesel and petrol, one out of every five litres in the region is burned in a backup generator (IFC 2019). Average grid electricity losses – technical and non-technical – may be as high as 23%, by far the highest level in the world (Trimble et al. 2016).

[1] Catalyst estimates the figure at around 70% of African households unelectrified. It also flags an important qualifier to the 'renewable-grid' statement, which is the massive reliance on diesel backup, making the electricity sector as a whole 68% fuel-based. See Catalyst (2021)

[2] The terms "electricity" and "power" are used interchangeably.

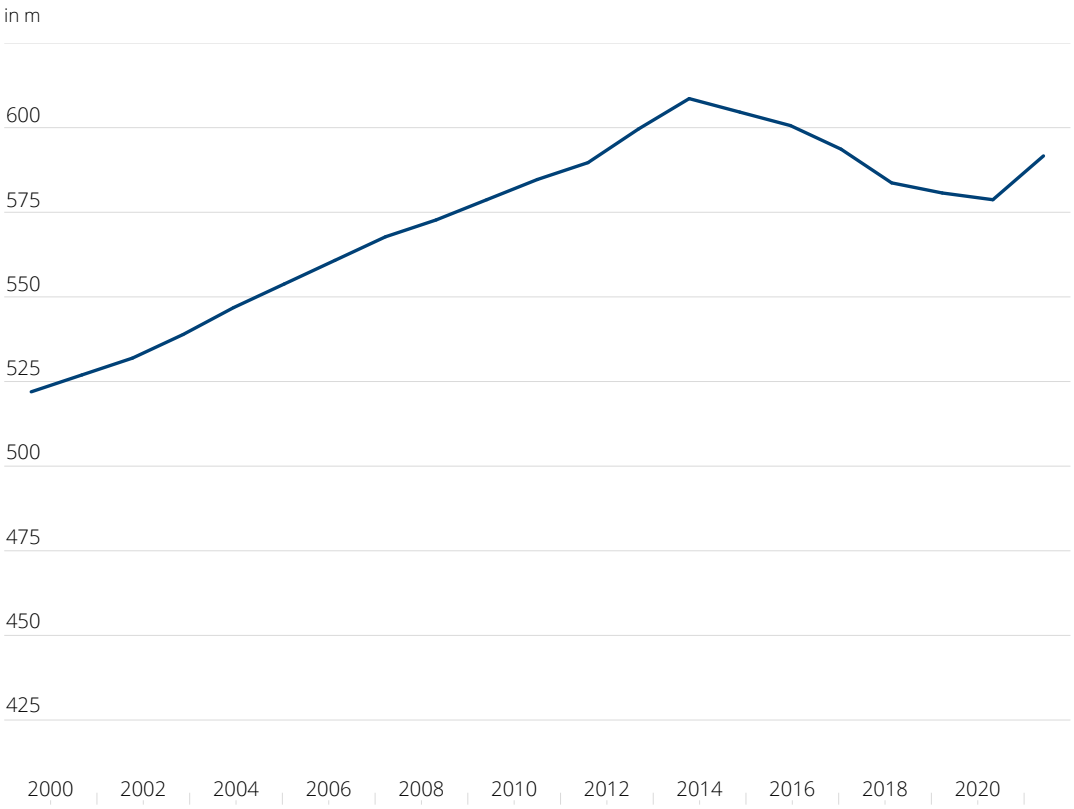


Figure 1: Population without access to electricity in Africa (millions), 2000-2020
Source: IEA (2021)

Since 2020, COVID-19 has severely diminished the financial capacity of governments and development partners to subsidise utilities and other electricity providers and damaged consumers' ability to pay, such that progress in providing access to electricity has reversed by up to 4% since pre-pandemic levels (IEA 2021). The IEA projects that up to 571 million people in Africa will remain without access in 2030 (IEA 2022). Based on current trends, it may take until 2080 to achieve universal access to electricity (Africa Progress Panel 2015). These challenges risk a major shortfall in progress towards SDG 7 and contribute to failures in achieving education, healthcare, and poverty reduction objectives as well. In line with SDG 7 achievement, the Heads of State and Governments of the African Union established in 2015 the 'Agenda 2063', i.e., the African continent's vision of accelerated economic and industrial development and incorporated it in the national planning frameworks of over 30 countries.

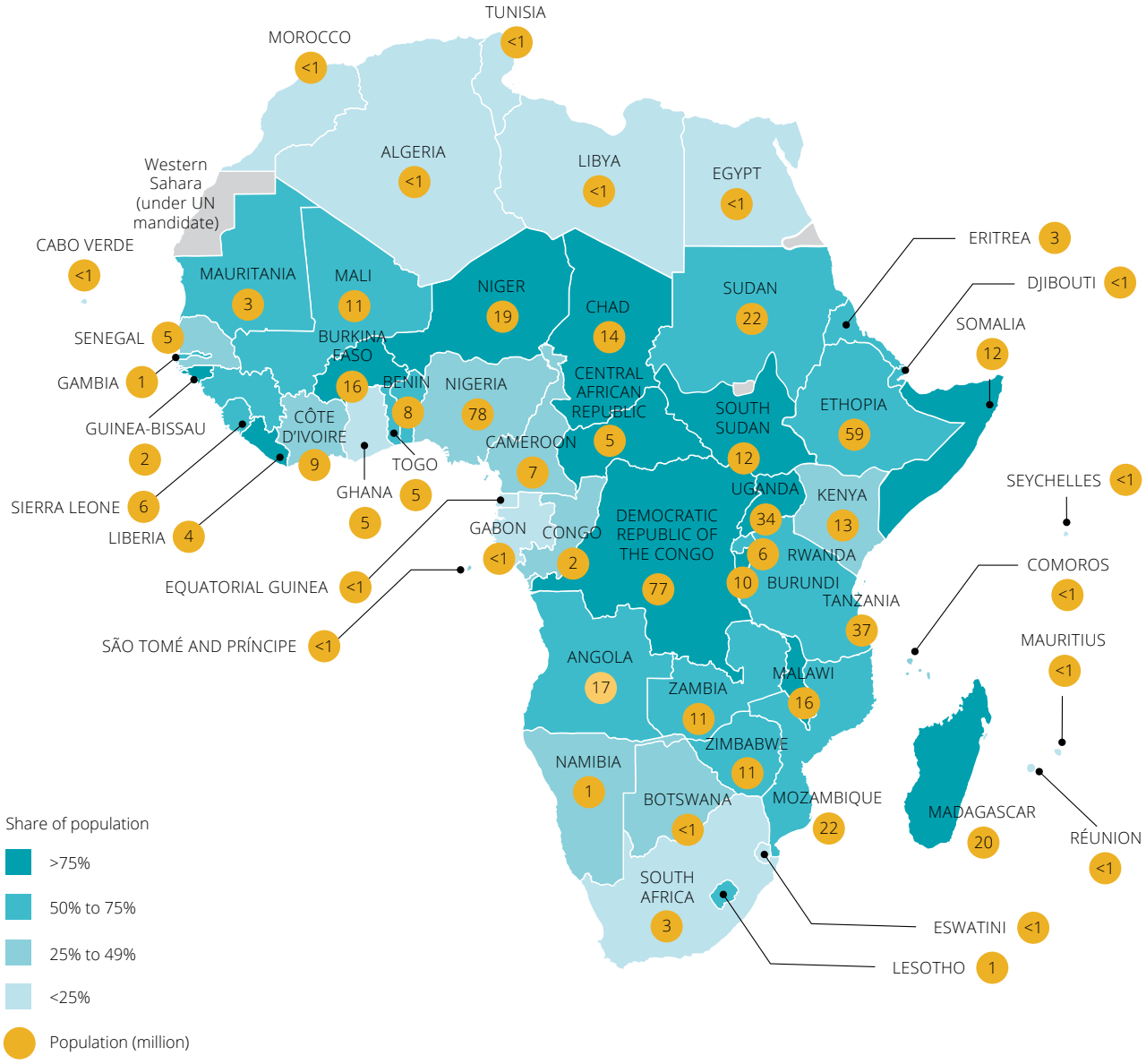


Figure 2: Population without access to electricity in Africa (millions and percentage), 2018
Source: Africa Energy Outlook Report (2019)

Both graphics show pre-pandemic figures, which the IEA projects have reduced.

Low access is at its most basic a result of the high cost of distributing electricity to geographically dispersed populations with low electricity demand and low ability to pay. Government-owned electricity utilities find it economically untenable to extend the grid to settlements far from the capital, and even more difficult to reach 'last-mile' communities. Notably, there is no single definition of 'access to energy'[3]. It is typically considered a grid connection, with electrification data in binary format: connected or not connected. While these are helpful indicators for comparing across countries, the real picture is more complex. For instance, the on-grid/off-grid duality is overly simplistic[4]. Many people live in grid coverage areas but cannot afford the connection fee; in urban areas, some wire themselves informally or have a connection that goes unused for lack of appliances. Millions more are within a short distance of the grid, but the utility has stopped short of bringing power lines to that 'last mile.' Over two thirds of Africa's grids are considered

[3] In IEA (2020) the methodology explanation provides an excellent indication of how difficult 'counting' is, https://www.iea.org/articles/defining-energy-access-2020-methodology

[4] M-KOPA, a leading off-grid solar company, published one of the early papers on more nuanced market segmentation. See https://shellfoundation.org/app/uploads/2018/10/MKOPA-Report.pdf

unreliable, and while millions are connected, many receive unreliable (varying voltage) and/or intermittent (brownout/blackout) power, rendering backup sources necessary (PWC 2021).

Some countries count households as having 'access' if they fall within a few-kilometre radius of the grid. Others count an off-grid power source as a 'connection' and/or disaggregate on- and off-grid statistics. In addition to these on-grid/off-grid nuances, many people 'stack' multiple sources of electricity and lighting, overlapping them in time and purpose. This may occur spontaneously as a household moves up the 'energy ladder.' If connection figures capture only the primary power source, we fail to account for how it is used in conjunction with other technologies. Lastly, connections are typically counted in terms of households, not businesses – rendering an access count more like a proxy for overall coverage, under-counting and effectively ignoring the enormous importance of electricity for small and medium-sized enterprises (SMEs) linked to productive uses (Rockefeller Foundation 2020)[5]. These complexities have two main implications. Rockefeller Foundation indicates that counting is incomplete within countries and inconsistent across them – relevant when considering what a national baseline might be. And, more fundamentally, they mean that any intervention – technological, financial, or behavioural – must dig deeper to understand the specific context if it is to succeed.

In recognition that a connection is not a wholly adequate measurement of quality electricity access, the World Bank created a Multi-tier Framework that offers a tiered (rather than binary) system that considers several parameters of power supply including availability, reliability[6], safety and affordability. Tier 5, the highest, represents near-constant access to a safe and affordable grid connection; Tier 0 users have extremely limited resources (Bhatia and Angelou 2015). Planners can understand better how much of the population has access to a certain quality of power – which matters in terms of its role in enabling development impacts like education, health and economic growth.

How best to provide quality and higher-tiered electricity entails thinking about who in society should bear what costs and benefit from what (private or public) goods. In most of the continent, the national grid is highly subsidised (Chuku and Ajayi 2021) – reflecting a societal value placed on energy as a driver of economic growth as well as an important contributor to an 'adequate standard of living,' which is considered a universal human right (OHCR n.d.) But off-grid communities may need to pay between five and ten times more per kilo-watt hour (kWh) than their grid-connected compatriots for electricity, even though costs for decentralised energy access have recently also begun to decrease. For instance, solar mini-grids have shifted basic customer tariffs down to the $0.5-0.8/kWh range while the lifetime cost an SHS user will pay on PAYGo can be up to $1.5/kWh (Mini-grids Partnership 2020)

The past decade has seen rapid technological advances, falling prices and emerging investment opportunities in the off-grid electricity sector – all of which means electricity access is increasingly likely to be achieved through a strategic (least cost) combination of grid extension, grid densification, and off-grid solutions.

[5] The Rockefeller Foundation estimates that non-household uses account for about 70% of global electricity consumption. The line separating 'domestic' and 'business' uses may be blurred in poor communities where people run small income generating activities from their homes

[6] Reliability is often bolstered by switching from fossil fuels to renewable fuels which may increase resiliency and can reduce service interruptions.

2.1.2. OFF-GRID ENERGY SOURCES

All non-utility power sources are considered 'off-grid'. These sources are defined at least by the combination of the generation technology (e.g., solar PV panels or a diesel engine) and delivery technology (e.g., a wire connection linking a lamp to an outside/overhead distribution cable). Electricity is generated from either fossil energy sources such as coal or diesel that emit greenhouse gases (GHGs) and other pollutants, or from renewable, clean sources such as solar or wind that do not emit GHGs. Generation can further be differentiated between centralised or decentralised sources and be reliant on the use of either large or smaller and modular infrastructure[7].

Worth noting is the difference between the above sources in voltage and the use of battery storage to hold excess electric power. Solar PV produces direct current (DC) electricity that can be used as-is to power low-capacity appliances e.g., light bulbs. For larger capacity, an inverter is required to convert DC to alternating current (AC), which can power a far greater range of appliances. Due to the intermittent nature of renewable energy, most systems include a battery to store electricity, which can substantially increase the cost of power to the end user.

Energy access is primarily a challenge of delivering electricity, once it is generated, to an end user. The most impactful (highest tier) off-grid 'clean' electricity sources are renewably powered mini-grids[8] and stand-alone solar systems[9] (Mini-grids Partnership 2020). Electricity is often used productively to power existing business activities, generate new income or improve the standard of living of populations. Evidence has grown, however, that 'productive use' does not happen organically once electricity is provided (Morrissey 2018) and there is increasing effort by the development community to stimulate the uptake of electric appliances that have potential to build income. Water pumping and irrigation technologies are leading examples offering substantial potential gains. Until today, these appliances have been predominantly diesel-powered, but solar-electric options are becoming increasingly competitive in cost and capacity (Efficiency for Access 2021).

The size of an off-grid system is directly related to the delivery model that can be used. As such, mini-grids are not bought and sold over the counter, while solar home systems (SHS) are typically too small to provide power to multiple users at a rate-per-kWh. The delivery model thus varies according to the ownership and operation of the technology (public vs private); what is being sold (kWh, a product, or an electricity-driven service) and the target market (rural vs urban; poor vs middle income; individual, cooperative or business).

[7] Although solar PV can be used for utility-scale generation, it can also power a small 3W lantern – and any size in between

[8] An isolated electricity generation-and-distribution system that connects anywhere from ten to 1,000 customers to power. The operator sells power (kWh) generated by diesel, solar PV, hydro, biomass, or other sources. There are currently about 5,000 stand-alone mini-grids in the world.

[9] Stand-alone solar systems come in a range of sizes (capacities). They are usually categorised as captive or commercial and industrial – large systems providing power to a single commercial entity such as a farm or manufacturing plant, usually for self-consumption; Component-based solar – a broad category of PV-based electricity systems that are built from component parts assembled on-site to suit the end user's specific needs with built in inverters and battery storage and; SHS – 'plug and play' units that are purchased as all-in-one kits including solar panel, battery, cables and lights or appliances

2.1.3. OFF-GRID POLICY AND REGULATION DEVELOPMENTS

Energy sector policy and strategies present governmental ambitions regarding national electrification (energy access), renewable energy and energy efficiency. A supportive high-level framework in principle would state that 100% electricity access should be achieved through a combination of grid, clean mini-grid and off-grid renewable technologies; identify locations suitably served by each; and link decarbonization with economic growth, including through productive uses of electricity.

In practice, governments are promoting grid and off-grid approaches as part of low-carbon development strategies[10] (IRENA et al. 2021), but there is sometimes contradiction between these stated objectives and other elements of the regulatory framework (see 2.1.4). Off-grid electricity intersects a range of other sectors, with implications for energy access creating the need for policy coherence and integration. This can be achieved for instance by aligning climate change and rural development objectives, and to deploy appropriate financial instruments that allow lower-income groups to access off-grid products and services while recognising the particular impact of electricity access on women and vulnerable populations.

At regulatory level, conducive rules governing the electricity sector are important for achieving energy access objectives. While there is substantial variation across countries, we focus on typical regulations that affect the cost of electricity, protect consumers, and define the parameters for developing and operating a mini grid. As most mini-grid and off-grid solar components are manufactured outside of SSA, regulations focus on post-import activities that affect the cost of off-grid electricity. These centre around:

- The overall **ease of doing business**[11] – e.g., registering a business, transport and logistics, accessing foreign currency, getting a grid connection, land permitting, and more.

- **Subsidies** – nearly all SSA governments subsidise parts of the energy sector, on average by about 33% (Chuku and Ajayi 2021). This can include grid connection, grid kWh rates, diesel fuel and petroleum products including kerosene – but not privately run mini-grids nor off-grid solar. While development partners have sometimes stepped in to fill the gap, this discrepancy sends market signals that can contradict high-level national decarbonisation and electrification goals, as the lower cost of status quo options diminishes unelectrified communities' willingness to pay for clean off-grid solutions.

- **Tax incentives** – such as import duty, Value Added Tax (VAT) and Goods and Services Tax (GST) exemptions or zero-ratings, are in place in many countries for renewable energy and component system parts, albeit with unpredictability in implementation at customs (Githugu 2021). Where there are no exemptions, taxes can add 40% or more to the cost of the system.

Many countries have quality and performance standards in place, particularly for off-grid solar. These function as consumer protection and to level the playing field by (in theory) reducing competition from lower-quality, cheaper product. Standards typically include:

[10] The SDG7 Tracking Report notes that since 2010, policy frameworks to support mini-grid and off-grid systems have evolved more rapidly than those related to on-grid electrification

[11] The World Bank's Doing Business reports were discontinued as of 2021; a new Business Enabling Environment (BEE) project is under development. In the meantime, old country rankings and various other resources are available at *https://www.worldbank.org/en/programs/business-enabling-environment*

- **Product performance standards and labelling requirements** – to signal 'quality' to consumers. Some regulators have their own standards and others have adopted or adapted international ones, including from International Electrotechnical Commission (IEC) and VeraSol. Enforcement is resource intensive.

- **Solar technician certification** – professional certifications denoting levels of technical skill, for installation or repair of solar component systems and mini-grids. These have the benefit of giving professionals industry-wide credentials, though many customers are not aware of them.

Mini-grids are particularly affected by the regulatory environment, such that an unfavourable or non-existent framework can severely hinder development. Some SSA countries have developed mini-grid regulations, but many have not. The main considerations are:

- **Consumer tariff setting** – how much the mini-grid is allowed to charge its customers per kWh. If the regulator allows a 'cost-reflective' tariff a mini-grid operator should theoretically be able to recover its costs and earn a profit. Although most countries – even without specific regulations – are beginning to allow this, in the recent past there have been countries where mini-grids were required, for example, to match the national grid rate (which, as above, is highly subsidised).

- **Grid arrival** – the regulator should, in general or on a case-by-case basis, provide reassurance to a mini-grid developer that if the national grid should be extended to the settlement the mini-grid is serving, there will be due compensation and a clear process for connecting the mini-grid to the utility grid and/or transferring ownership and operational.

2.1.4. SUSTAINABLE ENERGY TARGETS IN AFRICAN NDCS

NDCs play a critical role in the architecture of the PA and the achievement of countries' long-term low-emission development strategies: Countries update their NDC targets submitted to UNFCCC at least every five years, with each successive NDC update expected to be a progression of the previous version and reflect an ambition increase. Furthermore, NDC updates provide an opportunity to align near-term action and medium-term 2030 targets with long-term strategies (LTS) and with the global goals in the Paris Agreement. The urgent need for much higher mitigation ambition is underscored by UNFCCC (2021a), which finds that the sum of NDC pledges presents only an emission reduction of 12% by 2030 compared to 2010. Projecting the emissions path until 2100, a temperature increase of 2.7°C is estimated, which is far from the Paris Agreement goal of limiting global warming to well below 2°C or even 1.5°C.

The implementation of NDCs particularly in host countries is strongly dependent on the extent to which contributions are conditional upon receiving international support. As Pauw et al. (2019) and Greiner et al. (2021) demonstrate, most developing countries made their NDCs partly conditional, and the support required to implement the conditional NDCs far exceeds existing funding pledges and financial flows. Lack of support to meet the conditional targets could have a negative effect on the ambition of future NDCs, as developing countries might lack the means of implementation to be more ambitious (further discussion on NDC conditionality in section 4.1.2).

The PA explicitly identifies international carbon markets under Article 6 as instruments that are primarily intended to help countries achieve their NDCs through international cooperation, and to further increase ambition. Article 6.1 specifically recognises that Parties can engage in

voluntary cooperation to facilitate "... the implementation of their NDCs to allow for higher ambition in their mitigation and adaptation actions..." (UNFCCC 2015). Meeting the long-term goals of the PA clearly requires a substantial increase in the overall absolute emissions reduction targets in most NDCs, alongside scaled up decarbonization across all economic sectors. However, to realize this, clear safeguards against potential risks that could provide perverse ambition incentives have to be put in place (Ahonen et al. 2021).

Most African countries have put forward NDCs that both prioritize sustainable energy access and also request international support for achieving substantial shares of these targets. By November 2021, 53 African countries had submitted at least their first NDCs. As a result of limited methodological guidance on the structure and preparation of NDCs, these submissions remain very heterogenous in their features, containing different target formulations, scope and coverage. Of these, 73% include quantitative renewable power targets (IRENA 2022). On the other hand, only few African countries offer quantitative targets even though rural electrification and/or universal access to energy is typically a key priority, and sometimes even partially included in unconditional targets (see Table 1 and 2 for examples from West and East Africa).

Selected countries	Renewable energy targets	Energy efficiency targets
Senegal 2030: 7% Emission Reduction (NDC) 29,5% Emission Reduction (NDC+) compared to business as usual (BAU)	• Energy sector: 10% reduction in NDC (unconditional) in 2030, 41,2% in NDC+ (conditional) • Universal access to electricity for rural zones in the horizon 2025 • 2030: 235 Megawatt (MW) solar, 150MW wind, 314 MW hydro: 699MW ER injection (NDC) • 2030: +100MW solar, +100MW wind, +50MW biomass, +50MW Concentrated Solar Power (CSP) (NDC+), in addition to NDC: achieving 999MW	• 2030: 800 000 improved cooking stoves per year until 2030 (was 350k in 2016) (NDC) • 1,500,000 improved cooking stoves per year until 2030 (NDC+) • 2030: efficient lightbulbs, household and office equipment, public lightning management: 627 Gigawatt-hour (GWh) energy save, 126,8 MW lower electricity demand (NDC) • 3,402 GWh energy save, 687,9 MW lower demand (NDC+)
Nigeria Updated NDC: 2030: raised ambition 20% Emission Reduction (NDC) and 47% (NDC+) Emission Reduction compared to BAU	• 30% of on-grid electricity from renewable energy, 13GW off grid from renewable energy (both NDC+) • Current energy access developments are happening through other channels than their NDC, including via Nigeria's Rural Electrification Agency (REA)	• 13% population using improved cooking stoves by 2030 (NDC+) • 2,5% per year reduction in energy intensity across all sectors (NDC+)
Ghana 2030: 24.6 Mt CO2e reduction (global, NDC) 39.4 MtCO2e additional reduction, therefore 64 Mt CO2e (NDC+), compared to BAU.	• Low carbon electricity generation; no quantitative objectives are mentioned apart from 4,400 kiloton (kt) Emission Reduction • Scale-up renewable energy penetration by 10% by 2030	• Promotion of energy efficiency in homes, industry and commerce; no quantitative objectives are mentioned apart from 1,900+ kt Emission Reduction reached • Expand the adoption of market-based cleaner cooking solution; no quantitative objectives are mentioned apart from 4,200+ kt Emission Reduction reached
Ivory Coast 28% global Emission Reduction compared to BAU. Note: these commitments appear in Ivory's Coast INDC as their NDC is not published yet. It seems there are no two distinct commitments for the moment, regarding conditional and unconditional contributions.	• 2030: Electricity production: 23% Emission Reduction) • Reach 42% share of renewable energy in electricity mix	• Energy performance/efficiency is mentioned in the industry and building sector, but no quantitative objectives are given.

Table 1: Status of sustainable energy targets in West African NDCs

Source: UNFCCC (2022)

* Unconditional contributions, indicated in the table as (NDC), are what countries can implement based on their own resources and capabilities, while conditional contributions, indicated in the table as (NDC+), need international means of support to be undertaken.

Country	Coverage of energy sector in NDC	Specific interventions related to energy access
Burundi	• Emissions from the energy sector is the second highest with 1 $MtCO_2$ e in 2015	• Install solar mini-grids • Replace 100%, by 2030, all traditional carbonization furnaces and traditional domestic cookers • Support the production and popularization of improved stoves • Strengthen the capacities of technicians for the manufacture of improved stoves
Ethiopia	• The energy sector has a high mitigation potential in the updated NDC next to livestock and Land use, land-use change, and forestry (LUCF) • The energy sector contributes 5% of total BAU emissions in 2030 • Policy interventions could reduce emissions by 2030 to 9.5 $MtCO_2$ eq, in the conditional pathway, which represents a relative emission reduction of 52.5%; and 15 $MtCO_2e$ accounting for 25.5% relative reduction in the unconditional pathway compared to BAU emissions in the energy sector	• Support the production and use of improved cook stoves and electric stoves • Off grid electrification including productive use applications • Electrification of transport
Kenya	• Priority mitigation activities in the energy sector include: • Increasing renewables in the national grid electricity generation mix • Enhancement of energy efficiency across different sectors	• Clean, efficient and sustainable energy technologies to avoid over reliance on fossil and non-sustainable biomass fuels
Rwanda	• The total mitigation potential in the energy sector is estimated at around 4.6 million tCO_2e in 2030 compared to BAU emissions • Use of solar energy for water heating, pumping for agricultural irrigation and off-grid electricity together account for around a quarter of all mitigation from the energy sector	Unconditional measures • Efficient cook stoves: Dissemination of modern efficient cook stoves to 80% of the rural population and 50% of the urban population by 2030 • Use of solar water pumping systems for irrigation within agricultural production to replace diesel pumps Conditional measures • 68 MWp of solar mini-grids to be installed in off-grid rural areas by 2030 • Off-grid and rooftop solar electrification (1,500,000 households to be electrified)
Tanzania	• Has prioritized energy as one of four mitigation sectors in this NDC. • Tanzania would require an investment of approximately USD 160 billion for mitigation activities aimed at achieving 100% renewable energy for electricity, buildings, and industry by 2050.	• Promoting climate-smart rural electrification, including development of micro and mini-grid renewable generation for improved rural electrification.

Table 2: Role of the energy sector in Eastern Africa updated NDCs
Source: UNFCCC (2022)

As NDCs and the accompanying implementation plans require substantial resource mobilization, it is crucial to ensure strategic alignment and greater coherence between all climate finance sources (from both carbon markets, bi- and multilateral financing institutions, as well as private finance). This can be fostered through an understanding of the potential synergies and trade-offs that may help to overcome an existing disconnect between national energy policy and climate policy, as many countries' energy targets remain inconsistent with their NDC commitments. Ironically, and unexpectedly, it is often the NDC that is less ambitious than the national energy target. On the global scale, the pledges in the first NDCs regarding renewable power would translate to an average annual increase of 4% through 2030, or an average 92 GW of added capacity each year. Renewables have been deployed at much faster pace since the signing of the PA, rising annually by 8.6% between 2015 and 2018. This is over twice as fast as foreseen by the implementation of NDCs, adding an average 165 GW of renewable capacity each year (IRENA, 2019a). Moreover, by simply aligning the NDCs in SSA with the national energy plans already in place would lead to a 40% increase in ambition with respect to installed renewable energy capacity by 2030 (IRENA 2019a).

NDC ambition to support limiting temperature increase as encapsulated in the PA can be enhanced through incentivizing mitigation in less accessible abatement options (Warnecke et al., 2018). Harvesting these 'high-hanging fruit' can be incentivized through either climate and carbon finance by targeting technologies and actions such as rural electrification – that are otherwise not accessible for unilateral domestic action to e.g., due to nascent status or novelty and high costs of technologies. Moreover, having domestic NDC targets shifts the incentive structure for carbon market instruments for host countries, since they need to avoid selling the cheapest mitigation options to international carbon buyers. As a result of the higher costs for the remaining mitigation options, the domestic ambition of the host country to reduce its own emissions may ultimately be compromised. This requires national stakeholders in host countries to put in place Article 6 oversight bodies to ensure proposed activities put forward by market participants identify appropriate activities and support raising ambition (further discussion in 4.1.2).

2.2. CHALLENGES AND OPPORTUNITIES IN ACHIEVING UNIVERSAL ACCESS GOALS

The challenges of substantially and sustainably scaling up off-grid electrification are varied. They include a widespread lack of data on demand-side demographics and willingness to pay; prohibitive logistics costs to connect remote areas that discourage companies from operating there; regulatory challenges noted above; low consumer awareness; and, in particular, lack of financing within the entire supply chain, including for end users.

2.2.1. ENERGY ACCESS FUNDING NEEDS

Decentralised off-grid renewable energy sources are the least-cost way to provide power to more than half of the population gaining access by 2030, according to IEA Africa Energy Outlook 2019 Sustainable Development Scenario. Although crucial to achieving universal energy access, off-grid and mini-grid commitments remained largely overlooked in the past years (Figure 3). Estimates of how much a universal energy access by 2030 would cost range widely across different scenarios and projections from USD 20.5 billion to 120 billion a year – substantially higher than current investment levels (IEA 2021 World Energy Outlook, IEA 2019 Africa Energy Outlook 2019, Sustainable Energy for All (SEforAll) and Climate Policy Initiative (CPI) 2020). While it may be difficult to arrive at precise estimate, it is evident that the scale of needed investments is enormous.

Funding for energy efficiency has lagged investments in renewable energy solutions (IRENA et al. 2021) despite its considerable potential in achieving sustainable energy access through efficient cooking solutions, smart metering, transmission efficiency, etc. In their NDCs, some SSA countries outline energy efficiency measures in various sectors such as agriculture or industry, while Cameroon describes energy efficiency as a "national priority". Several countries have introduced energy efficiency standards for electric lighting in West Africa, e.g., Benin, Ghana, Nigeria and Senegal, even though a lack of data and reporting leaves some uncertainty on the progress achieved (ECREEE 2020).

The energy access portfolio of multilateral DFIs continues to be dominated by transmission and distribution and on-grid electrification projects. In 2019, financial flows to the electricity sector slightly decreased compared to 2018, but so did the fossil fuel investment share of this total. 44% of total finance was committed to grid-connected renewables, while 26% was directed to transmission and distribution and 25% towards grid-connected fossil fuel. Energy efficiency, however, continues to be a sector with a minor share of energy finance (figure 3).

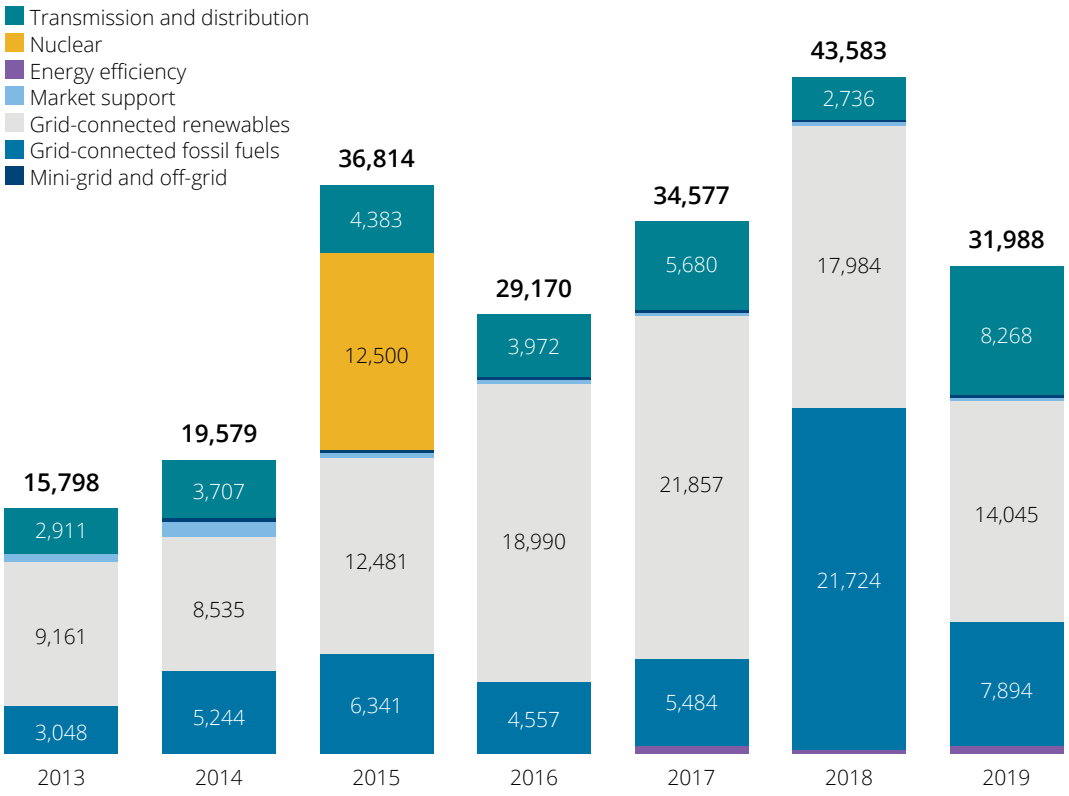


Figure 3 : Finance to Electricity by Sector, 2013-2019 (USD millions) Source: SEforALL (2021b)

These figures show that current financial flows are not even close to covering merely a fraction of projected investment needs for sustainable energy access, as indicated above, which raises the urgent need for further resource mobilization including from new sources of finance, including climate and carbon finance.

2.2.2. POTENTIAL LINKAGES BETWEEN SUSTAINABLE ELECTRICITY ACCESS AS WELL AS CLIMATE AND CARBON FINANCE

Access to sustainable energy and other basic services such as potable water is central to development and poverty alleviation. High dependence on traditional fuels such as biomass fuels for cooking and kerosene lamps for lighting contributes to unsustainable living conditions and high GHG emissions. In rural electrification projects in off-grid areas, fossil fuel consumption is reduced primarily by replacing fuel-based lighting with lighting that adopts new technologies like solar lanterns, PV based systems, LEDs etc (additional examples in table 3). Despite the high investment needs described above, the overarching long term trend is that a broader range of decentralised energy access technologies, including for productive use applications, is maturing and becoming more affordable. The relevance assigned to sustainable energy access in NDCs and LT-LEDS further underlines the political support and long-term perspective expressed by regional governments. Yet, the conditionality of many of these NDC targets, and the still comparatively high costs of sustainable energy access technologies (which need to be understood against the backdrop of continuing high subsidy levels for fossil fuels) draws attention to a potentially pivotal role of carbon and climate finance. If deployed in a well-tailored overall approach of policy and financing instruments, climate and carbon finance can catalyse and accelerate the market penetration of renewable energy also in rural, previously underserved circumstances. This can deliver significant mitigation and adaptation benefits as presented in Table 3 below.

Mitigation impacts	Adaptation impacts[12]
Replacing kerosene lamps for lighting and diesel generators for productive use with off-grid solar	Modular, decentralised electricity solutions offer energy security in case of humanitarian displacement or failure of main utility grid
Displacement of diesel water pumps (mills, other appliances) with solar water pumps (etc.) and replacement of 'flood' irrigation (diesel pumps) with drip irrigation (solar pumps)	Solar water pumping for water and food security, particularly drought resilience – drinking water, crop irrigation, livestock, etc.
Displacement of diesel/petrol transport as electric 2-, 3- and 4-wheelers become more common	Diversification of income streams using productive electric appliances enhances economic resilience
Reduced methane from food waste as off-grid cold chains cut post-harvest losses	Electrification of off-grid health clinics and cold chains, vaccine rollout, preventative and emergency health care

Table 3: Mitigation and adaptation impacts in the off-grid electricity space

A related key question is how these decentralised approaches can be designed for implementation at scale. With support from the Shell Foundation and Rockefeller Foundation, Catalyst recently presented a model for avoiding more than 500 million tons of CO_2 through (a) providing millions of households with first-time (Tier 1) electricity access that is clean, as opposed to a 'dirty' counterfactual, and (b) replacing millions of existing diesel generators with solar (Figure 4).

[12] Efforts should be made to avoid maladaptation as it can exacerbate vulnerability, risks and exposure that are not only difficult to change but also expensive. For instance, solar irrigation and water pumping may have a dramatic impact on sustainable productivity but must be implemented carefully using efficient techniques such as drip irrigation, to avoid depleting local water resources in the long term

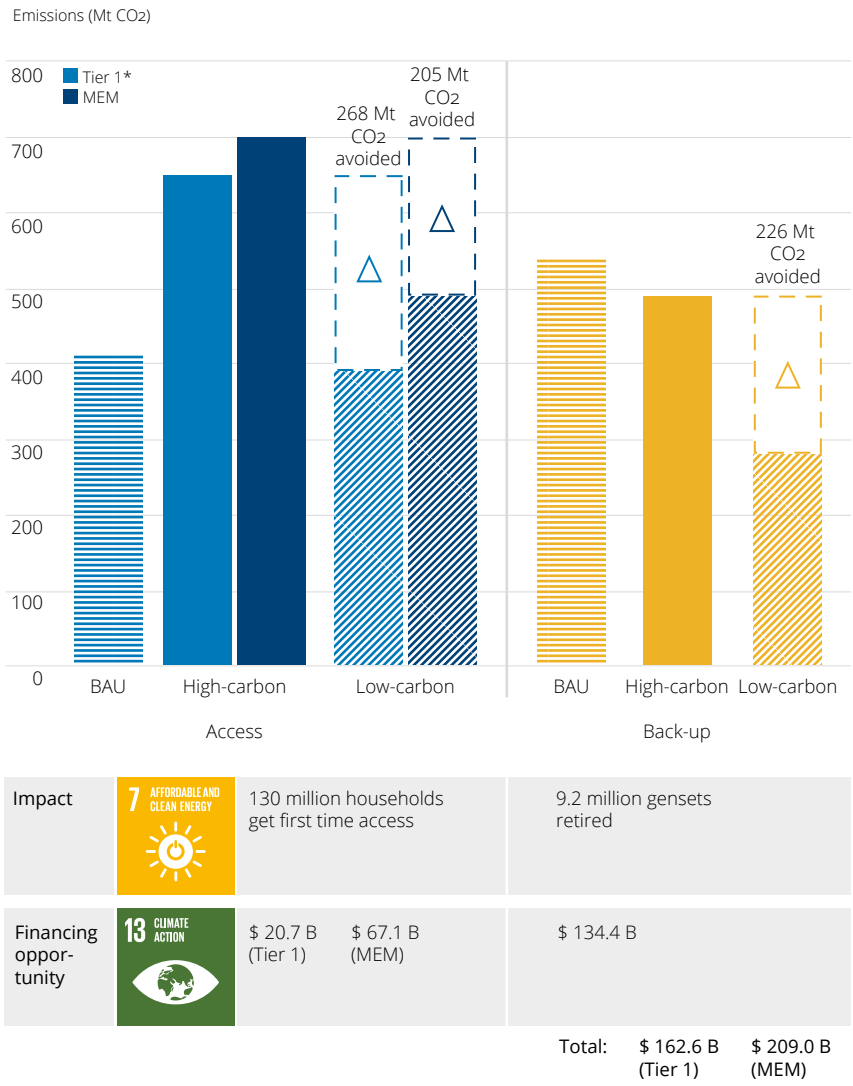


Figure 4: Linking SDGs 7 and 13 in Africa through clean electricity access
Source: Catalyst (2021)

* 'Tier 1' refers to the Multi-tier Framework

In order to be able to access carbon or climate finance, it is important that all relevant participation requirements, including for MRV of climate impacts and other aspects are fully met as per the Paris Agreement and related instruments. A key tool for calculating emission reductions are baseline and monitoring methodologies. To date, over 250 baseline and monitoring methodologies have been approved under the CDM and constitute an important body of knowledge that could be used for mitigation activities more broadly (Greiner et al. 2019). Hence, a harmonized used of such methodologies is a crucial aspect of linking market mechanisms and climate finance that is becoming particularly relevant as countries require consistency for being able to capture and report progress towards their NDC targets.

A methodological challenge for ensuring appropriate incentives for mitigation in MRV methodologies is that the majority of countries in SSA have low levels of GHG emissions per capita. A key reason is that the potential demand for basic energy services is "suppressed" due to barriers such as low income, poor infrastructure and insufficient access to technology. As a result, household energy consumption is constrained by these factors and basic human needs are unmet. In order to capture this problem on the level of baseline methodologies, the concept of 'suppressed demand' has been elaborated in the CDM to describe 'minimum service levels' of a basic need (e.g., lighting, potable water) as a key approach to better accommodate the circumstances of

African countries and LDCs. This concept has an explicitly normative intention as it goes beyond looking at historical baselines but establishes normative development projections for the poorest segments of societies. The CDM has operationalized the issue of suppressed demand in energy access projects, partly as a result of its dual objective of mobilizing mitigation while promoting sustainable development. This methodological innovation evolved as part of a broader regulatory effort to develop simplified and standardized CDM methodologies to reduce transaction costs for project types such as rural electrification, efficient lighting and cook stoves.

Evidently, this concept can only be applied in low-income countries with unmet basic development needs, as it would otherwise undermine the principles and ambition of the PA of achieving a global balance of GHG sources and sinks by mid-century. However, suppressed demand is important for LDCs in order to enable carbon market instruments to support achieving universal access to energy by 2030 even in the absence of historical fossil fuel use.

Going forward, further regulatory and methodological improvements should also cover SDG and adaptation impacts which are imperative in addressing the climate crisis. Methodologies describing adaptation impacts are less developed than for mitigation. However, the Adaptation Benefits Mechanism (ABM) is developing methodologies to quantify, verify and certify adaptation benefits (examples in table 3) that can be tailored to specific contexts including in renewable water pumping technologies, clean cooking, and off-grid electrification sectors (Michaelowa et al. 2017). The ABM has drawn heavily from the Kyoto Mechanisms and particularly the CDM and it has built on multiple lessons learnt from the experiences of the carbon markets including on methodologies for MRV. The GCF has also initiated efforts to develop methodologies for assessing the performance of its portfolio and the effectiveness of the GCF financing (see section 4.6) These methodological approaches and developments may present a necessary building block for assessing the additional climate impacts and co-benefits (adaptation) of mitigation projects.

SUMMARY

This chapter provided an overview of the energy access challenge in SSA in addition to a brief introduction to the off-grid sub-sector and some of the characteristics for a suitable ecosystem for renewable off-grid deployment.

Ensuring access to sustainable energy can contribute to both sustainable development and climate change mitigation and in achieving both SDG 7 and the goals of the PA. Policy clarity and consistency are crucial to enable a stable, sustainable market sector for investment to energy access efforts, and remove barriers to innovative business models. Carbon and climate finance can support the implementation of NDCs, e.g., in realising domestic targets or for supporting the achievement of higher conditional targets proposed by host countries. However, whether the resources directed to support NDCs are legitimate and additional will need to be determined and addressed against NDCs. In order to ensure the integrity of carbon markets, for instance, the optimal situation would be for host country NDCs to comprehensively describe the GHG coverage alongside clearly quantifiable mitigation goals. Carbon and climate finance can further be linked to achieving broader mitigation goals with additional co-benefits as will be described in subsequent chapters e.g., whereby CDM can act as an effective MRV tool to enable credible and transparent results-based payments using climate finance from different sources.

3. THE ROLE OF CLIMATE AND CARBON FINANCE IN CLOSING SUSTAINABLE ENERGY ACCESS GAPS IN AFRICA

As outlined in Chapter 2, sustainable energy access remains a considerable challenge in Africa. As countries set targets for achieving sustainable energy supply for all by 2030, it becomes evident that an unprecedented level of investment will be required for financing electrification projects or clean cooking energy supply to realize these objectives. To realise these ambitious goals, new actors, innovative funding mechanisms and sustainable technologies will have to be designed and implemented at scale. The PA includes both climate finance (Article 9) and carbon markets (Article 6) modalities for international cooperation on climate change. This chapter breaks down the relevance of climate and carbon finance, and critically reviews the overall policy and investment trends, financial flows in the past and possible funding sources from climate and carbon finance to address the sustainable energy access challenge.

3.1. CARBON MARKETS AS A POLICY INSTRUMENT IN SUPPORT OF NDCS

Establishing carbon markets and trading carbon assets are not objectives in themselves, but a means to an end such as achieving NDC goals. For instance, climate policy instruments such as carbon market mechanisms can directly or indirectly stimulate renewable energy deployment, support energy efficiency and foster energy access by providing incentives for reducing GHG emissions or by increasing the relative cost of energy from fossil fuels through carbon pricing.

If implemented appropriately, carbon markets can be an effective and efficient climate policy instrument that facilitates innovation, cooperation and least-cost compliance with climate targets. The Article 6 rulebook recently agreed upon at COP 26 allows countries to cooperate bilaterally through Article 6.2 or through the Article 6.4 mechanism, the successor of the CDM. Article 6.2 allows countries to trade ITMOs to meet their NDC targets, while setting guidance for accounting and transparency purposes for the trade of ITMOs. Article 6.4 enables creating a market mechanism under the authority of Parties to the PA, similar to the previous CDM under the Kyoto Protocol for trading ITMOs. This mechanism resembles the CDM governance approaches, while establishing key principles to ensure climate ambition and environmental integrity if public and private entities cooperate in the financing and transfer of mitigation outcomes (UNFCCC, 2015).

African countries can benefit from Article 6 by mobilizing finance for mitigation to achieve their conditional targets or raise the ambition of the NDC through the ITMO revenues (Michaelowa et al. 2021a). Hence, carbon markets could help African countries develop mitigation projects such as renewable energy projects and help achieve economic viability of modern and sustainable energy investments in Africa.

Due to the normative principles enshrined in the UNFCCC & the PA, carbon market instruments should seek to provide their benefits equitably, and benefit in particular those at the bottom of the pyramid. Yet, the CDM portfolio shows substantial focus on large-scale grid renewable projects. The rapidly decreasing costs driven by targeted policy support and innovation make it feasible for renewable energy to become the backbone of the electricity system and help decarbonize the power sector (IRENA 2021a). As a result of increased economic viability, the additionality

of these activities has increasingly been become questionable. Therefore, it is unlikely that the more stringent eligibility criteria for Article 6 activities, in particular anticipated more robust interpretations of additionality, may render grid-connected renewables outside LDCs as non-additional. (See 4.6 for an in-depth discussion on additionality). In the voluntary carbon market standards, Gold Standard (2021) and Verra (2019) have already adopted rules that exclude most grid-connected wind and solar activities outside LDCs from registration in their standards.

However, CDM rules have also been continually reformed in order to improve access for community-based activities serving households and smallholder farmers that initially struggled to benefit from the CDM due to the dispersed nature and long implementation timelines of such activities, small volume of Certified Emission Reductions (CERs) and high transaction costs. To promote equity and boost participation by LDCs and African countries, programmatic approaches - so-called CDM Programme of Activities (PoAs) - enabled the aggregation of an unlimited number of individual component activities under a single programmatic framework. PoAs thus enable small-scale clean technologies e.g., off-grid renewable technologies in rural areas to receive support from carbon finance. This proved to be crucial to boosting the share of sustainable energy access activities in the CDM portfolio, which took place to a large extent in African countries. While many CDM PoAs have only been registered during a depressed phase in global carbon markets prior to the NDC implementation phase starting in 2021, these programmatic approaches have the potential to aggregate a large number of smaller activities and thus could potentially achieve substantial volumes of GHG reductions as carbon prices have increased markedly. Article 6 of the PA also recognizes the special circumstances of LDCs and SIDS and has emphasized the importance of PoAs and small-scale activities as a priority for CDM transition. Hence, Article 6 will continue to promote such programmatic and project-based activities, which is likely to boost the use of off-grid renewable energy technologies that are still widely recognised as additional due to their higher cost structures and other barriers, compared to grid-connected technologies (UNFCCC 2021b).

Carbon markets can also engage the private sector and accelerate innovation in different economic sectors towards decarbonization. Such innovation can be witnessed in the development of digital MRV tools e.g., the use of digitalisation, such as remote sensing and automation of data transfers, which applies particularly well to electric appliances powered by renewable energy. Such technologies are likely to continue to be supported by baseline-and-credit mechanisms since other carbon pricing instruments, such as emissions trading schemes (ETS), are typically applied in more emissions-intensive industries which are not as widely established in SSA yet. Of the 61 ETS and carbon tax instruments in operation worldwide, covering approximately one-fifth of global greenhouse gas emissions, only one – the carbon tax in South Africa – is located in SSA (World Bank 2021b) while Kenya is considering establishing an ETS (Obulutsa 2021). Only one country in the region – Côte d'Ivoire – references emissions trading in its NDC, while only Côte d'Ivoire and South Africa make reference to carbon tax. Moreover, only seven countries refer to fossil fuel subsidy reforms (Duho 2021).

However, over 34 countries do refer to 'international market mechanisms' and African countries have signed up to a number of international initiatives, notably Ethiopia and Cote d'Ivoire in the context of the Carbon Pricing Leadership Coalition (CPLC n.d.); Ethiopia and Senegal in the context of the G7 Carbon Market Platform (OECD n.d.); and Burkina Faso, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Kenya, Madagascar, Nigeria, Rwanda and Uganda in the context of the Coalition of Finance Ministers for Climate Action (Coalition of Finance Ministers for Climate Action n.d.). It is therefore plausible to expect heightened regional engagement with Article

6-backed crediting mechanisms in the future, and it is likely – based on the CDM & VCM portfolios as well as African NDC priorities – that sustainable energy access will play an important role in such instruments.

3.2. THE RELEVANCE OF CLIMATE FINANCE FOR FINANCING ENERGY ACCESS

Since carbon markets are by no means a silver bullet, further complementary financing institutions and sources are required to help meet NDC targets, including for sustainable energy access. PA Article 9 stipulates that developed country Parties provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the Convention and encourages voluntary support by other Parties. It further recognises the crucial role of public funds and refers to the mobilization of other sources, including private finance. According to the PA's provisions, emission reductions achieved by a host country with the support of climate finance can be counted towards the host country's NDC, thus directly contributing to the achievement of its national contributions under the PA (UNFCCC 2015).

A clear definition of the term climate finance is yet to be agreed on. The Climate Policy Initiative (CPI) produces an influential, annual 'Global Landscape of Climate Finance' report. The CPI defines 'climate finance' rather loosely as any investment cost – infrastructure, equipment, construction and land – incurred by the public or private sectors that supports the transition to a low-carbon, climate-resilient economy. The definition also includes public expenditures, such as concessional loans and feed-in tariffs, that directly support such investment. Thus, investment in, for example, renewable energy or energy efficiency infrastructure is defined as being 'climate finance', even if the motivation or objective of the investment is not specifically climate related.

Climate finance is also generally understood as the "financial flows whose expected effect is to reduce net greenhouse gas emissions and/or to enhance resilience to climate change and climate variability" (Mehling 2021). This broad definition encompasses different and combinable instruments with varying degrees of concessionality, i.e. terms of financing more or less favourable compared to conventional commercial financing (Fuessler et al. 2019a). Examples of these instruments are grants, equity contributions, concessional loans, results-based payments, guarantees, etc. (Fuessler et al. 2019b).

Despite these positive developments, the vast majority of energy sector investment in SSA comes from 'non-climate' sources. The CPI estimates total global climate finance was USD 632 billion in 2019/2020[13] , of which 61% was debt, 33% was equity and 6% was grant finance (CPI 2021). Public sources – domestic and international – account for about half of the total. Approximately 50% of global climate finance supports renewable energy investment and a further 27% supports low-emission transport. Sub-Saharan Africa, which accounts for approximately 13% of the world's population, receives just 3% of global climate finance, or roughly USD 20 billion in 2019/2020 (CPI 2021). Assuming half of this is energy-related, SSA can, as a first-order estimate, be assumed to receive approximately USD 10 billion of energy-related climate finance per year.

[13] i.e., the figure of US$ 632 billion represents the average of the annual flows in 2019 and 2020.

The UNFCCC Standing Committee on Finance (SCF) uses a similarly expansive definition of climate finance as Mehling (2021); i.e., public, and private investment dedicated to adapting to and mitigating climate change globally. The SCF estimates that climate finance in 2016 – its most recent estimate – was approximately USD 680 billion, of which 40% was directed towards renewable energy, 38% towards energy efficiency and 15% towards sustainable transport. Roughly two-thirds were sourced from the private sector (UNFCCC SCF 2018). According to the SCF, in 2016 SSA accounted for approximately one-fifth of climate finance from multilateral climate funds and 8% of climate finance from multilateral development banks (MDBs). A more recent source estimates that, in 2020, MDBs channelled a total of USD 66 billion in climate finance, of which USD 9 billion (or about 14%) was directed towards sub-Saharan Africa (AfBD et al. 2021).

Thus, even under an accommodating definition, climate finance investment in the energy sector in SSA amounts to less than one-fifth of total energy investment in the region. Of the multilateral climate funds, the GCF is by far the largest contributor to the region, accounting for over USD 1.2 billion of investment in the period between 2003-2019 (despite only commencing project approvals in 2015). It is followed by the Least Developed Countries Fund (LDCF, USD 707 million), the Clean Technology Fund (CTF, USD 496 million) and the Global Environment Facility (GEF) (USD 484 million). It should be noted that only a fraction of this funding has been directed toward the energy sector.

In turn, climate finance and carbon finance, considered together, have historically represented just a small fraction of the total energy sector investment in SSA and an even smaller fraction of the investment that is needed to address current energy access and reliability shortfalls. Whether the increased ambition expressed in updated NDCs and the substantially increased levels of carbon transactions and monetary value, which are expected to increase further after having finalized the Article 6 rulebook, enables such instruments to play a greater role in financing sustainable energy access remains to be seen.

3.3. FINANCING THE ENERGY SECTOR IN SUB-SAHARAN AFRICA

Tracking financial flows into the African energy sector is challenging because of limited data availability, the multiplicity of financiers and the different definitions used – often implicitly – by different actors (for example, when distinguishing between operating expenses and capital investment). The terms of many commercial deals – including, incidentally, many Emission Reduction Purchase Agreements (ERPAs) – are confidential and not in the public domain. Finally, there is a risk of double counting: for example, Climate Investment Funds (CIF), GCF and GEF funding that is channelled through MDBs is typically included in MDB climate finance totals, as well as being cited separately by the funds themselves. For these reasons, the monetary amounts cited below should be treated with some caution.

The IEA estimates current energy sector investment in Africa – the entire continent – to be approximately USD 100 billion, or 5.5% of global energy investment. Assuming the pattern of energy investment mirrors that of foreign direct investment (FDI), SSA can be assumed to attract approximately USD 70 billion of this investment.[14]

[14] This is very likely an over-estimate, given the concentration of oil and gas investment – and, indeed, utility-scale wind and solar investment – in North Africa. The FDI breakdown is provided in UNCTAD (2021).

Although most energy in SSA is used for cooking, which accounts for approximately 70% of total final consumption (compared with 10% globally), this largely takes place in an informal market setting, using biomass that is collected for free or is purchased at low cost (UNEP 2019). As a result, the cooking sector attracts little formal investment. Instead, the majority of energy finance – USD 70 billion – is invested in fossil fuels, USD 13 billion in renewable energy, and another USD 13 billion in electricity networks (IEA 2019). While financial commitments to off-grid and mini-grid solutions are increasing rapidly, they currently still represent less than 2% of total electricity finance (SEforAll 2021b).

Energy investment in SSA, particularly in the power sector, relies largely on public finance: state budgets, state-owned utilities, development finance institutions (DFIs) and export credit agencies (ECAs). Domestic taxes and utility charges account for approximately 80% of total African energy spending, three-quarters of which is for operations and maintenance (Yeboah and Bafao 2018). Public and international development finance collectively account for over 90% of the capital committed to power infrastructure (Baumli and Jamasb 2020).

The level of reliance on public funds is highest for large, conventional generation projects and lowest for renewable energy projects. The role of DFIs and ECAs as financiers has been particularly important for large coal-fired generation and hydropower projects, where they account for over half of the funds raised (IEA 2019). The World Bank Group, AfDB, European governments and institutions, and the United States and Japanese governments have provided most of the international public funds used in the SSA power sector in the past decade (Lee and Doukas 2018), with Chinese DFIs playing an increasingly prominent role in recent years (Horn et al. 2019). The three main recipient countries are Kenya, Tanzania, and Ethiopia (Corfee-Morlot et al. 2019).

Investment in the energy sector is low by international standards. To take residential electricity access as a representative example, the finance committed in many SSA countries amounts to less than USD 10 per person without electricity access, compared with USD 170 in India and Bangladesh. In South Sudan, it is 1 cent (SEforALL 2021b). The Democratic Republic of Congo, Madagascar, and Mozambique, where an average of 96% of the population lack access to clean cooking solutions, each receive less than USD one million per year in cooking-related finance commitments – less than 1% of the annual investment needed in each country (SEforALL 2021b).

The annual cost of addressing the region's power sector needs has been estimated at USD 41 billion, including USD 14 billion for new power generation additions (Trimble et al. 2016). The IEA estimates that a five-fold increase in investment in the power sector is necessary to ensure reliable and affordable power for all, implying a cumulative investment of more than USD 2 trillion between 2019 and 2040 (the equivalent of almost 3% of regional Gross Domestic Product, GDP) (IEA 2019). Further, a major reallocation of capital away from fossil fuels towards renewables, transmission and distribution networks, and mini-grids is required (KfW et al. 2020).

In 2020, the GCF approved three projects for just over USD 300 million with a focus on mini-grids. Of this, USD 91.3 million went towards a project in Senegal to mobilize private sector participation in solar-powered mini-grids for 1,000 remote villages. In addition, the GCF approved USD 60 million for equity and co-financing of the Energy Access Relief Fund, a concessional debt fund, open to both electricity and clean cooking enterprises, implemented across nine countries in SSA (REN21 2021). These GCF-supported activities are also illustrative for the regional carbon market portfolio, which emphasises the need to work towards consistency across instruments and financing sources (e.g., in terms of MRV).

3.3.1. LIMITS TO CLIMATE AND CARBON FINANCE

The relatively limited climate/carbon finance flows into SSA energy investment are partly attributable to the same factors that limit investments beyond climate in the region – namely, general barriers to investment in the energy sector such as insufficient market development and infrastructure, opaque regulatory regimes, high interest rates (more than 20% per year in many countries), currency risk, inflation and political instability. In the context of electricity, only half of African utilities manage to recover their operational and maintenance costs, and few can undertake large-scale capital investment (Elahi 2020). Thus, almost half of international public climate finance in the region is confined to just ten countries, notably South Africa (Watson and Schalatek 2021).

But the link between climate and 'non-climate' energy investment is deeper still. Climate/carbon finance cannot truly function in an environment where 'non-climate' finance is constrained:

- **Co-finance**. Climate finance instruments such as the GCF and GEF have explicit co-finance requirements: without sufficient supplementary finance, a GCF or GEF project will not be approved. For example, in the current 4-year GEF programming cycle (GEF-7, 2018-2022), there is a target co-finance ratio, at the overall project portfolio level, of 1:7 – i.e., for every $1 the GEF contributes, it expects to mobilize an additional USD 7 of co-finance. The actual ratio achieved to date is 1:8 (GEF 2021). Historically, the GEF climate change mitigation focal area has out-performed other focal areas (such as biodiversity and international waters), achieving co-finance ratios closer to 1:12 (GEF 2018).

- **Supplementary revenues**. For most carbon finance project-types, and certainly most energy projects, carbon revenues typically supplement traditional revenue streams (for instance, the sale of electricity): carbon revenues may catalyse investments, but they are not typically sufficient on their own in terms of overall investment requirements. Carbon finance thus typically requires 'underlying' finance upon which to build (World Bank Ci-Dev 2016).

- **Past investments**. Pre-existing investment is often a necessary condition for climate finance to be able to operate. For example, the climate logic of building a new wind farm or solar farm may be clear, but this may require an extensive national grid to be already in place (to minimise connection costs). If the pre-existing infrastructure, or associated policy environment, is deficient, climate finance may not be able to play a role (Ye Zou et al. 2016).

There are also reasons unique to climate/carbon finance:

- **Energy sector scale and composition**. The relative importance placed by policymakers on adaptation and the Agriculture, Forest, and Other Land Use (AFOLU) sector in SSA has tended to make the energy sector a lower-priority sector from a climate perspective than it has been in other regions. This issue can be over-stated – after all, 73% of African NDCs contain quantified renewable energy targets (IRENA 2022) – but it is certainly the case that SSA is among the most vulnerable regions to climate change and is responsible for just 4% of global greenhouse gas emissions (and an even smaller fraction – three per cent – of energy-related greenhouse gas emissions) (Savvidou et al. 2021).

  Fifteen years ago, per capita energy consumption in SSA was 30% of the level of South Asia; today, it is 24% and still falling (Africa Progress Panel 2015). Several countries, notably Ethiopia but also Burkina Faso and Sudan, have low-emission national grids, which reduces

the scope for climate/carbon finance investments in grid-connected renewable energy or energy efficiency (Takahashi and Louhisuo 2022). Challenges associated with differentiating between baseline renewable and non-renewable biomass usage also serve to complicate the application of climate/carbon finance to bioenergy projects, which is problematic given that the continent sources almost three-quarters of its final energy consumption from biomass (IEA 2019).

- **Relative lack of cost-effective mitigation opportunities**. There is a lack of large-scale, concentrated sources of emissions in the energy sector that can be reduced efficiently. For example, 43 countries in SSA have grids with less than 500 MW installed – that is smaller than a single power plant in many countries (Africa Progress Panel 2015). The PoA modality under the CDM[15] enables cost-effective aggregation of large numbers of scattered, small-scale emission sources, was making some progress in addressing this 'distributed emissions' challenge. However, the low carbon price prevailing since 2012 has impaired the catalytic role that carbon finance can play (World Bank 2021b).

- **Fragmented climate finance landscape.** There is a bewildering array of climate instruments and mechanisms, all of which have their own (different, complex and evolving) rules and are poorly integrated into beneficiaries' budget cycles, priorities, and systems. This is a barrier for all countries, but especially poor countries that lack the capacity and track-record necessary to access funding (OECD and AfDB 2012).

- **Results orientation in carbon finance** is on one hand a strength, but also a barrier, since carbon finance needs to be complemented by other sources of finance in order to mobilize initial investment requirements upfront. Hence, project-based carbon finance is a revenue support mechanism that supplements traditional revenue streams, such as electricity sales, with additional income from the sale of carbon credits. Carbon finance is thus a means of paying back investment costs which has historically become available only during the implementation phase of an activity. Hence, there is a bias towards less risky carbon projects, especially as carbon prices have fluctuated wildly in the past.

- **Carbon prices have historically been volatile and dependent on climate ambition**. For example, the largest project-based carbon finance mechanism, in terms of global emission reductions in 2020, was the Verified Carbon Standard (VCS), which issued 140 MtCO2e of credits. The CDM issued 74 MtCO2e (much lower than historical levels, owing to political uncertainty about the future of the mechanism), the California Compliance Offset Programme 46 MtCO2e and the Gold Standard 34 MtCO2e (Word Bank 2021b). For the voluntary carbon market as a whole, two-thirds of the credits issued are for renewable energy, energy efficiency and fuel switching projects (Ecosystem Marketplace 2021). Prior to the more recent upswing in demand in global carbon markets, in particular the VCM, such credits attracted prices within a low USD 1-3 range.

  Even the more 'charismatic' projects, which target sectors and communities that offer more comprehensive sustainable development co-benefits, did not manage to attract prices that were 2-4 times higher. As a result, energy-related credits account for only one-quarter of the total monetary value of the voluntary market, or approximately USD 100 million (Ecosystem Marketplace 2021). Approximately 15% of the credits generated in the voluntary carbon

[15] As well as similar programmatic or sectoral approaches under other mechanisms, such as 'grouped projects' under the Verified Carbon Standard

market were from Africa, which suggests that the total value of energy-related emission reductions generated by the voluntary carbon sector in Africa was – very roughly – in the low double digit USD millions.[16]

- In the CDM, the prominence of energy-related credits is lower, at approximately 40%, and the role of SSA – which accounts for just three per cent of expected annual credit issuance – is markedly so (UNEP DTU 2021). Carbon prices for CDM have also been very low, although it is difficult to track primary market carbon prices, in particular for the more charismatic project types described above, which typically fetch higher prices. During the carbon market depression prior to the NDC implementation period and finalization of the Article 6 rulebook, certified emission reduction (CER) prices had hit rock bottom and have only recently picked up again. Therefore, while regulatory reforms boosted African participation in the CDM, it is clear that the mechanism did not manage to deliver substantial resources for financing sustainable energy access in Africa. Even through precise estimate need to be based on assumptions, as a crude, first-order estimate, the total annual energy-related carbon revenue – the voluntary market plus the CDM – in SSA can be taken to be approximately USD 80 million. Even assuming no overlap with the investment activity captured under the USD 10 billion climate finance estimate presented above, carbon revenues have historically represented a small fraction – perhaps just one per cent – of the climate finance channelled through the public and private sectors.

Despite these sobering findings, there is cause for optimism based on the strongly enhanced political certainty on the future role of market mechanisms enshrined in Article 6, combined with the increasing global climate policy ambition expressed both in NDC targets as well as continuing expansion of national carbon pricing instruments, emission trading systems and crediting mechanisms around the world (World Bank 2022). These trends suggest that carbon markets may be able to deliver much higher contributions to financing NDC targets, provided regulatory guardrails and a continued progression in mitigation ambition can contain manage to contain carbon price volatility.

3.4. THE FUTURE ROLE OF CARBON AND CLIMATE FINANCE

There are many developments and uncertainties associated with the operationalisation of Article 6, the evolving role of the voluntary carbon market alongside the Paris Agreement architecture (Kreibich and Obergassel 2019), future replenishments of climate funds (such as the GCF, GEF and NAMA Facility) and the future evolution of the CIF.[17] Nonetheless, it seems reasonable to expect the role of climate/carbon finance to become more prominent, albeit in evolved form, in the African energy sector in the coming decade.

This optimism stems partly from general developments in the energy sector and the fact that large-scale investment, from many sources, will be required. The demand for energy in the region

[16] The figure for sub-Saharan Africa is undoubtedly lower but unfortunately, is not available.

[17] The USD 8.5 billion Climate Investment Funds (CIF) has programmes focused on energy access (the USD 720 million Scaling Up Renewable Energy Programme in Low Income Countries, SREP), clean technology, climate resilience and sustainable forests. The CIF was established in 2008 to channel climate finance through MDBs. It was originally intended to be an interim solution (complete with a 'sunset clause') until a new financial architecture – which eventually took the form of the GCF – could be established and operationalised. However, in 2021, the G7 committed up to USD 2 billion in additional resources for the CIF and it seems likely to continue operating in parallel with the GCF. For a good overview, see Trabacchi et al. (2016).

is growing rapidly. It is estimated to be twice as fast as the global average for the next two decades, driven by population growth, economic growth and urbanisation (IEA 2019). Africa has the world's fastest growing and youngest population, and the number of people living in cities has almost doubled in the past 20 years. Already, the total population of SSA, at 1.07 billion, is roughly the same size as the combined populations of Europe and North America (UN DESA 2019).

At the same time, Africa has the potential of addressing a significant fraction of this demand with renewable energy. According to IRENA (2019b), it is feasible, with appropriate (and markedly higher) investment, for Africa to supply one-quarter of its energy needs with renewable energy by 2030. There is growing interest in cross-border clean energy 'corridors', via which hydro, wind and solar power can be conveyed over long distances to sources of demand (IRENA 2014). In addition, there are ongoing efforts to deepen the four existing regional power pools in SSA, to better manage intermittent renewable energy supply.[18]

At the One Planet Summit in 2017, MDBs, together with members of the International Development Finance Club (IDFC), publicly committed to aligning their investment decisions with the Paris Agreement (AfDB 2017). The World Bank stopped lending to coal-related projects much earlier, in 2010, and extended this prohibition to upstream oil and gas projects at the end of 2019 (E3G 2020). The African Development Bank (AfDB) continues to fund fossil fuel energy projects (on the grounds that they support energy access) but is under sustained pressure to cease (E3G 2021). In parallel, the proportion of AfDB investment allocated to climate finance has increased steadily, from nine per cent in 2016 to 40% today (AfDB 2019). It seems likely, therefore, that MDBs will increasingly reorient their lending activities towards grid-connected renewable energy, which offers the scale of 'deal flow' they require while enabling them to meet climate spending commitments.

In parallel, there is increasing recognition from governments of the positive role that the private sector can play. The single-buyer model, in which the national utility has a legal monopoly on power procurement, is still the norm in SSA (UNCTAD 2017). However, the generation sector is progressively opening up to private sector involvement. There are now 130 independent power producers (IPPs) operating in SSA, over 90% of which started operating after 2000. Although it should be acknowledged that 16 countries in the region still do not allow for any private sector participation in power generation (Africa Progress Panel 2015), and IPPs are not necessarily synonymous with low-emission electricity (some two-thirds of IPP capacity is devoted to fossil fuel plants), IPPs are the principal vector for renewable energy investment in the region (BloombergNEF 2021).

Accompanying – and, to some extent, driving – the growing role of the private sector has been policy reform. As with energy investment itself, this is a geographically nuanced story, reflecting the diversity of the region. When setting policy, governments must confront the realities of high-income inequality – and hence large differences in consumers' ability to pay for energy – as well as considerable differences in energy costs, ranging (in the case of electricity generation) from South Africa and Zambia at the low end to Djibouti and Gabon at the high end (Avila et al. 2017). Thus, several countries – most notably, South Africa – are forging ahead with power auctions and standardised power purchase agreements (PPAs), among other policy instruments, while others cling on to a more traditional, public sector-oriented model (BloombergNEF 2021).

[18] The Southern Africa Power Pool (SAPP), the Eastern Africa Power Pool (EAPP), the Western African Power Pool (WAPP) and the Central African Power Pool (CAPP). Note that the CAPP, founded in 2003, remains relatively undeveloped.

At the risk of over-simplifying a clearly complex policy landscape, the overall energy policy environment of the region can be said to have improved, albeit unevenly, since 2000, in the sense of becoming more supportive of investment (Tomala et al. 2021).

The dramatic fall in renewable energy costs over recent decades is well known and the trend shows no signs of abating (Lazard 2020). Superficially, one might expect this to facilitate climate/carbon finance: falling infrastructure costs open more investment opportunities, particularly for low-income communities who would otherwise not be able to afford the cost of generated power or heat (Practical Action 2019). For climate finance actors with 'transformational change' mandates, such as the GCF and the NAMA Facility, falling renewables costs do represent a potential scaling-up opportunity, enabling them to achieve 'more bang for their buck'.

But the increasing competitiveness of renewable energy also serves to weaken its 'additionality potential': in many circumstances, on-grid renewables now represent more attractive investments than their fossil fuel counterparts, regardless of the catalytic effect of climate/carbon finance (IRENA 2021a). Carbon market mechanisms in particular, which rely on additionality criteria for their environmental integrity (see Section 4.6), already face considerable scepticism about the additionality of at least grid-connected energy projects, and this can only be expected to become a more serious issue as renewables costs continue to fall. Already, carbon standards are phasing out their recognition of offsets generated from grid-connected renewable energy outside of LDCs (Donofrio et al. 2020).

Thus, there is likely to be increasing redirection of carbon finance towards decentralised, off-grid energy investment. This process will be accelerated by the proliferation of digital solutions evident in the sector. Technologies such as mobile phones, pay-as-you-go platforms, and remote diagnostics and usage monitoring are not only transforming the economics of decentralised energy for both consumers and suppliers alike (Lighting Global 2020) but they also offer considerable potential to facilitate – and reduce the cost of – MRV of climate impacts.

To be truly effective and sustainable, climate/carbon finance needs to be deeply rooted in NDC targets, sector policy and planning processes. This is frequently not the case, as such finance is often directed towards site-specific, one-time infrastructure investments – such as power generation facilities – that frequently have a rather distant relationship with overarching policy frameworks. This is a particular problem with carbon finance: the CDM, for example, only credits emission reductions attributable to hardware or equipment usage, rather than policy or regulatory measures, meaning that CDM project developers have little incentive to engage with policymaking. The situation is different for climate finance instruments such as the GCF, the GEF and the NAMA Facility, which often include policy strengthening measures alongside infrastructure investment. Nonetheless, even these instruments cannot escape their project-based roots, in the sense that their interventions are inevitably time-limited (a typical project might be implemented over 5-10 years) and are relatively narrow in scope.

SUMMARY

This brief chapter has been able to provide a snapshot of the complex, and fast-evolving, energy and carbon/climate finance landscape in SSA. Considerable international investment is flowing into the energy sector, albeit with a disproportionate focus on on-grid electricity in a handful of countries. However, this investment is clearly inadequate: Africa faces, and will continue to face, an enormous energy access challenge. Climate and carbon finance represent only a small

fraction of total energy sector investment and an even smaller fraction of total energy sector investment needs. But the distinction between climate and non-climate finance is often not clear or useful: both sources of finance need, facilitate and build on each other, and they are often channelled through the same institutions (e.g., MDBs and UN agencies). There are reasons for optimism that climate and carbon finance will play an enhanced role in the future, but that role will continue to be as a catalyst and complement to other sources of finance. Still, sustainable energy access in off-grid areas is likely to emerge as a key activity type in both climate finance and carbon market instruments, not least due to the rapidly evolving technology landscape for an increasingly wide range of productive use applications.

4. HARNESSING SYNERGIES BETWEEN CLIMATE AND CARBON FINANCE

The previous chapters demonstrated the investment needs and opportunities in the sustainable energy access space, as well specific features of climate and carbon finance. This chapter builds on these foundations and provides a deeper focus on key aspects of the new context provided by the Paris Agreement and its rulebook, which determine how to work towards greater synergies between climate and carbon finance in financing sustainable energy access investments in Africa. Therefore, this chapter aims to capture the governance and participation requirements implications for host countries and market participants when deploying or accessing climate and carbon finance in support of NDC targets. From a conceptual perspective, as well as through case studies from Senegal and Ethiopia, the chapter aims at exploring the rationale for strengthening such linkages, their potential benefits, and some practical considerations of this innovative form of blending various sources of finance.

4.1. COMPARING CARBON FINANCE AND CLIMATE FINANCE FROM THE PERSPECTIVE OF THE HOST COUNTRY AND MARKET PARTICIPANTS

Carbon finance in this chapter is situated largely within the context of compliance markets under Article 6 of the PA, drawing from lessons and experiences from its predecessor, the Kyoto Protocol and its CDM. In contrast to climate finance, carbon finance results from developed countries purchasing mitigation outcomes from host countries, with the intention to use them towards meeting their own NDC targets. Thus, carbon market activities in host countries receive carbon finance flows by selling emission reductions beyond the host country's (unconditional) NDC targets. However, the activities generating emission reductions are often implemented by private sector project participations. This requires a clear definition of the roles and responsibilities of both public and private carbon market stakeholders, which needs to capture the recently agreed PA Article 6 rulebook and related regulatory developments. The following sections compare climate finance and carbon finance regarding their:

- Participation requirements and accessibility for each instrument;
- Incentive structures;
- Technical expertise needed;
- Role vis-à-vis conditional and unconditional pledges in the NDCs.

4.1.1. PARTICIPATION REQUIREMENTS AND ACCESSIBILITY

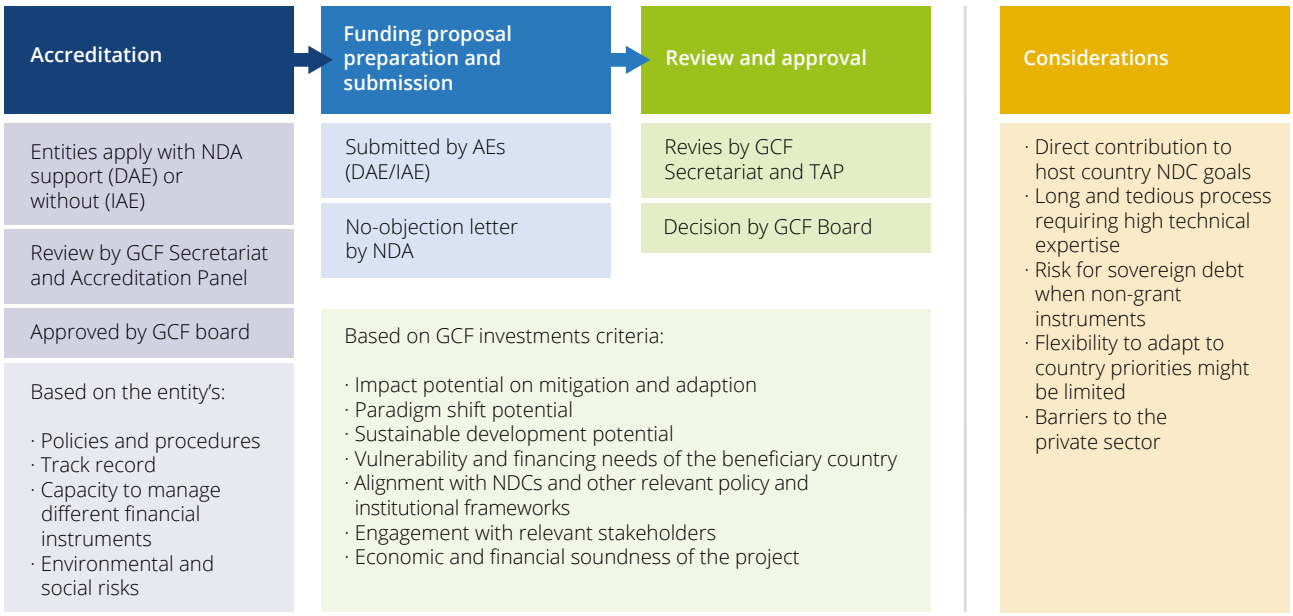
Participation requirements to obtain funding and the role of national institutions differ widely across climate or carbon finance instruments. Yet, due the central role of NDCs, host country governments always have a central role in these processes, which has been accentuated in the case of carbon markets under the PA. Collaboration between the private sector and governments is therefore crucial.

CLIMATE FINANCE — GREEN CLIMATE FUND

Funds from the GCF are channelled to beneficiary countries through Accredited Entities (AE). Subnational, national, and regional public and private entities can apply for 'direct access' accreditation to the GCF with the support from the respective National Designated Authority (NDA) through a nomination letter (GCF n.d. a). International organisations can also pursue accreditation through the 'international access' modality which does not require a formal endorsement of NDAs at the accreditation stage (Mikolajczyk et al. 2016). For entities to be accredited, they need to meet strong fiduciary standards, comply with environmental and social safeguards and demonstrate sufficient capacities for their roles and functions (p. 10, UNDP 2015). Once an entity is accredited, it can submit funding proposals[19] approved by participating host countries, which will be reviewed by the GCF Board – the body that ultimately decides if to approve or reject the submitted proposal based on GCF investments criteria (see Figure 5) (GCF n.d. b).

Figure 5: Attaining climate finance from GCF
Source: Authors

*NDA: National Designated Authority; DAE: Direct Access Entity; IAE: International Accredited Entity; AEs: Accredited Entities; TAP: Technical Advisory Panel.



Barriers to accessing climate finance are high in terms of choosing the appropriate instrument and meeting the requirements for accreditation and funding approval, especially in the case of 'direct access' and private sector entities. While most eligible countries have nominated entities for direct access, only a third of the countries have been successful to obtain accreditation as Direct Access Entities (DAEs) and the number of accredited national entities remains low (GCF 2020). Still, the number of DAEs is higher than International Accredited Entities (IAEs) but DAEs face more difficulties to access GCF financing. As of October 2021, only 23 per cent of the 190 projects count approved by the GCF were by DAEs (GCF 2022a). The disparities between DAEs and IAEs impact country ownership of the GCF project pipeline since DAEs are likely to be more effective in providing host countries with easier and more direct access to resources, linking projects to national priorities, and contributing to low-emission and climate-resilient development (GCF 2020).

Additionally, the GCF has demonstrated a low-risk appetite even though it has been established, designed and resourced to provide grants and concessional lending to support high-impact

[19] Non-accredited entities can submit funding proposals to the GCF through an Accredited Entity.

projects in getting off the ground, which would not go ahead without specialized financial support at rates below market conditions. An evaluation of the GCF's private sector approach concludes that the GCF has channelled limited funding to private sector AEs in the form of grants favoring non-grant instruments such as equity, limiting investments in high-risk/emerging technologies and business models. This ultimately threatens the GCF's catalytic role enshrined in its mandate particularly in supporting host countries to create strong enabling environments for the private sector to invest (GCF 2021a). In addition, when climate finance takes the form of non-grant instruments, it increases the host country's sovereign debt (Kreibich and Brandemann 2021). Carbon finance often addresses this concern because mitigation activities participating in carbon markets are typically operated by private sector agents. This implies that even if the project is debt-financed, the private sector normally bears the financial risk, limiting the risk for the government. However, the government can be affected by market-related uncertainties regarding demand and price (Kreibich and Brandemann 2021).

The GCF has set up the Private Sector Facility (PSF) designed to leverage private investments in climate finance by increasing the financial flows to cover or lessen investors' costs and risks (Mehling 2021). However, high administrative barriers characterized by onerous paperwork, lack of data to support proposal annexes such as feasibility studies, and long duration to secure funding (it takes 228 days on average from funding proposal submission to GCF Board approval) are unattractive to private sector actors due to the risks associated with delays (Climate Focus, Perspectives and Aera Group 2017; GCF 2021a).

CARBON FINANCE — ARTICLE 6 MARKETS

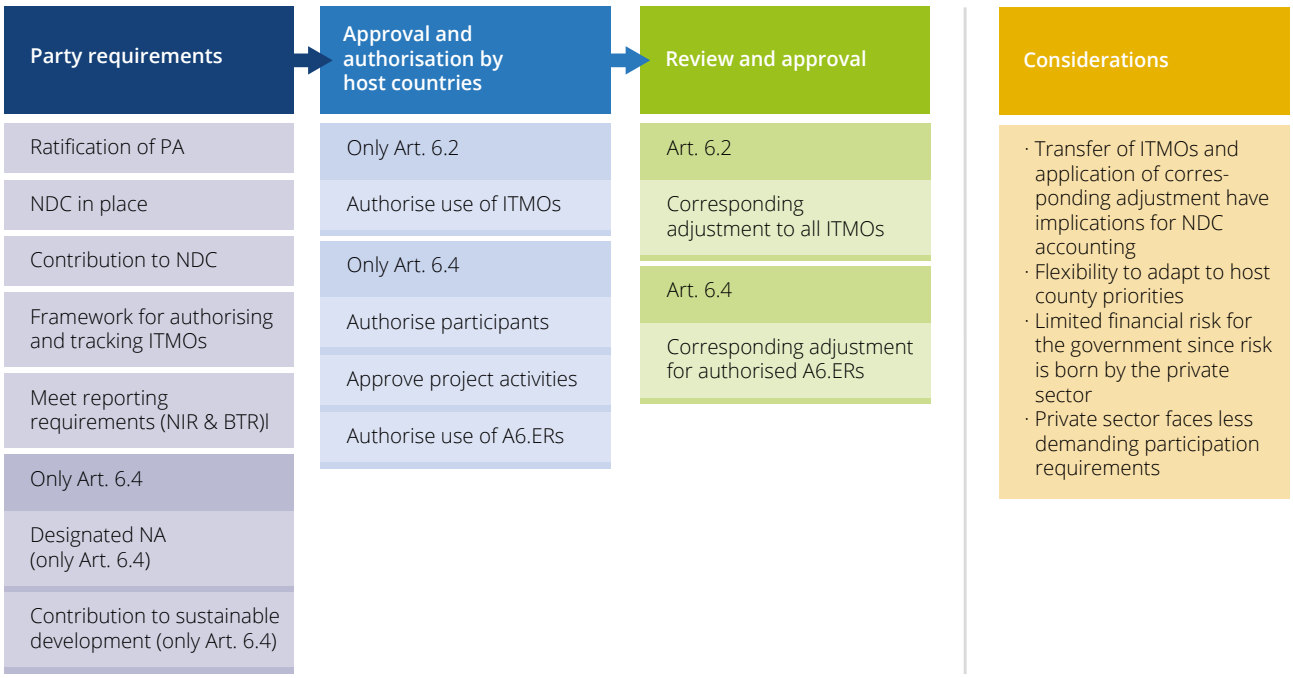
Carbon markets also need to adjust their rules to the new era in which the entire world has NDC targets. Host countries need to establish comprehensive institutional frameworks for NDC tracking and reporting, in which Article 6 plays an important role. In order to preserve environmental integrity, it is of utmost importance to avoid double counting of emissions in buyer and seller country NDCs. Therefore, when countries transfer ITMOs, a corresponding adjustment is required. This means that an equivalent level of emissions must be added to the national annual emissions balance, increasing the host country's reported emissions in the Biennial Transparency Reports (Kreibich and Brandemann 2021). This still holds in the event of acquiring countries cancelling the mitigation outcomes after the purchase, in which case the buyer would not use the ITMOs to meet its NDC targets but to go beyond them (Fuessler et al. 2019b).

Thus, since transferring ITMOs could affect the host country's capability to meet its commitments under the PA, the country needs to decide wisely which mitigation outcomes to transfer. "In this context, the host countries need to ensure oversight and introduce the necessary policy frameworks to serve as guardrails for Article 6 participation of entities wanting to create and sell mitigation outcomes" (Greiner et al. 2020, p.2). However, there are still strong incentives for developing countries to participate in carbon markets, including resource mobilization, in particular the high potential of carbon markets to mobilize private sector financing, but also technology transfer, capacity building, sustainable development co-benefits (Kachi et al. 2020; Kreibich and Brandemann 2021).

Participation requirements for carbon markets under the PA, summarised in Figure 6, require additional institutional capacities and infrastructure in host countries compared to the Kyoto Protocol's CDM, in which the host country did not have own mitigation targets. These include, among others, a framework that authorises ITMOs without undermining the country's NDC

targets and avoiding risks of overselling; infrastructure for application of corresponding adjustments; access to a registry for tracking ITMOs; as well as integrating Article 6 transactions into other NDC-related requirements under the PA, such as MRV infrastructure and other infrastructure necessary for reporting of national inventory reports (NIR) and biennial transparency reports (BTRs). Thus general requirements for participating in carbon markets have been extended and become more complex (see Figure 6 as well as Kreibich and Brandemann 2021).

Figure 6: Participating in Article 6 carbon markets
Source: Authors



Carbon finance thus has more potential to incentivise the private sector if the project abides by the rules of the carbon standard (UNFCCC, national government, or voluntary) and its activity cycle. Nevertheless, project developers need to ensure approval and uthorization by host countries to access carbon markets. These processes have also experienced considerable changes under the PA compared to the Kyoto Protocol era. In the CDM, the Designated National Authority (DNA) authorised and approved participation in CDM projects by granting a letter of approval to the project proponents if participation criteria were met. Under the PA Article 6.4 mechanism, various levels of approval/authorisation exist (see Figure 6), including: (i) approval of activity – whose documentation should cover the relation of the activity with sustainable development and NDC achievement; (ii) authorisation for public or private entities to participate granted by the host country; (iii) explicit authorisation of ITMOs for different kinds of use cases which include NDCs, and other purposes (e.g. ICAO CORSIA, VCM, climate finance contribution claims), which is required for both Article 6.2 and Art.6.4 based transactions.

Due to the early stage of Article 6 operationalisation, the exact implementation of certain features of Article 6.4 concerning private sector participation remain to be seen. For instance, the authorisation of the use of the A6.4ERs by host countries will determine the type of possible claims that can be made when selling A6.4ERs. Additionally, how to levy the new share of proceeds for adaptation of 5%, the monetary contribution related to the scale of the activity or the number of A6.4ERs issued, and the cancelation of 2% of the A6.4ERs issued for delivering overall mitigation in global emissions still needs to be elaborated on a technical and administrative level. Finally, the requirement of applying corresponding adjustments to the transactions, in particular

to Article 6.2 ITMOs and authorised A6.4ERs, might imply additional risks for the private sector by directly affecting project developers that are subject to host government decisions.

IMPLICATIONS AND TRADE-OFFS

Participating in carbon markets and accessing climate finance result in different implications and trade-offs for host countries which need to be considered when deciding to participate and granting authorisations:

- **Accounting towards NDC targets.** Despite the complexity of GCF requirements, host country approval might be potentially leaner compared to engagement in carbon markets since the host country can use the emission reductions achieved with the funding to meet its own NDC targets. By contrast, accessing carbon finance implies transferring emission reductions to the buyer, and, in most cases[20], triggers the need for corresponding adjustments. Hence, when using carbon finance, there is a trade-off for host countries in terms of NDC accounting and host country approval might be potentially demanding since ITMO exports might jeopardise NDC compliance unless host countries provide clear guidance on what type and scale of activity will be permitted for ITMO transfers.

- **Host country priorities and NDC alignment.** Climate finance is at times perceived as less flexible to adapt activities to the host country's preferences as a result of donor priorities in bilateral approaches. Country ownership is a growing feature in climate finance, including the alignment of climate finance with host country priorities. For instance, one of the GCF's investment criteria is country ownership which includes coherence with country policies and strategies, which needs to be confirmed by a no-objection letter from the National Designated Authority (NDA) (GCF 2019). However, challenges remain for projects developed by international AEs and the private sector to fully take into account country priorities, especially in countries with weak climate policy frameworks, a comparatively vague NDC (e.g., that define sector targets but do not break this down to activity level) and with limited capacity/authority of the NDA/focal point to ensure country priorities are considered. This has been particularly the case with the PSF, which is intended to follow a country-led approach but has had limited engagement with countries to ensure alignment between private sector projects and national priorities (GCF 2021a).

  Carbon finance could allow for more flexibility, especially if projects are implemented unilaterally (Kreibich and Brandemann 2021). However, when the host country is not actively engaged in a carbon market project, the private sector can shape the projects' priorities. Moreover, some voluntary carbon standards have historically operated without host country approval, which may need to be revisited given the potential impact on NDC achievement.

- **Host country's sovereign debt.** When climate finance takes the form of non-grant instruments, it increases the host country's sovereign debt. Carbon finance often addresses this concern because mitigation activities participating in carbon markets are usually operated by private sector actors. This implies that even if the project is debt-financed,

[20] According to the Article 6 rulebook agreed at COP26, it could be the case that a party generates emission reductions under Article 6.4 of the Paris Agreement but does not authorise them to be used for another party's NDC or another international commitment. In such cases, the host country would include the emission reductions in its inventory and the corresponding adjustment will not be mandatory. Hence, this is an exception where carbon finance could clearly contribute to the host country NDC achievement (UNFCCC, 2021).

the private sector normally bears the financial risk, limiting the risk for the government. However, the government can be affected by market-related uncertainties regarding demand and price (Kreibich and Brandemann 2021). Moreover, carbon finance is typically also a source of foreign currency, which is often scarce in many host countries.

4.1.2. CONDITIONAL AND UNCONDITIONAL NDC PLEDGES

In contrast to its predecessor, the Kyoto Protocol, under the Paris Agreement, developing countries need to contribute mitigation targets through their NDCs. Even though this is not codified in UNFCCC rules, this has led to the practical development that countries have often established separate targets to be met with domestic resources (unconditional) or with international support (conditional). Concerning the role of climate and carbon finance to support the achievement of the two elements of the NDC, there is a lack of conceptual clarity (Greiner et al. 2021).

While it is unequivocal that conditional pledges depend on some type of international support, there is no clear agreement on the opposite, i.e., the exclusion of these financing sources for meeting unconditional targets. In fact, in their first NDC, some developing countries considered international support as means to (partially) achieve their unconditional pledge (Kreibich and Brandemann 2021). The relation between these targets and carbon markets is even less clear. Some parties understand that carbon finance can be used towards the overall NDC, while others interpret it as only suitable for conditional targets (Kreibich and Brandemann 2021). At the same time, some see the corresponding adjustment as a hinderance for host countries to use carbon markets even to support the conditional elements of the NDC (Fuessler et al., 2019a). A recent analysis of the available updated NDCs from African countries (see Box 1) reveals how countries are developing their own interpretation of conditionality due to the lack of guidance from UNFCCC and the implications this might have for participating in carbon markets (Greiner et al. 2021)

Box 1: Observations on NDC conditionality in African countries updated NDCs and its contribution to Article 6 eligibility

In the absence of clear multilateral guidance and different "nationally determined" NDC features regarding the use of Article 6 for achieving conditional or unconditional targets, countries apply diverse interpretation and approaches to how they plan to use carbon markets to achieve their updated NDC targets.

These approaches can be classified into four categories (Greiner et al. 2021):

1. NDC targets that remain **fully conditional** (e.g., Zambia). This approach can only be justified in the context of LDCs. The eligibility of potential Article 6 activities to qualify for ITMOs is also contingent on activity level eligibility tests.

2. A second category entails a clear demarcation whereby unconditional NDC targets are achieved exclusively with domestic resources and will not lead to international ITMO transactions. **Only conditional NDC elements generate ITMOs**, contingent on additionality tests at activity level (e.g., Ethiopia and Cabo Verde).

3. A third category is a dual approach in which **both unconditional and conditional NDC elements may generate ITMO transfers**, contingent on activity level eligibility tests (e.g., Rwanda and Senegal).

4. Finally, conditional on investments where **conditionality is only applied to costs**, but not mitigation activities (e.g., Kenya). This also requires activity level eligibility tests

As a result of the different interpretations the concept of NDC conditionality alone is considered an insufficient indicator for Article 6 eligibility. More important and meaningful is the identification of the eligibility of activities for Article 6 are activity level baselines and additionality testing that take into the NDCs, but also additional sector policies, targets, and data to ensure environmental integrity.

See Greiner et al. (2021): NDC Conditionality: An analysis of African countries' updated NDCs for a full overview of the various interpretations of conditionality in the first generation of NDCs.

Linked to the conditionality of NDC targets is that carbon finance requires host countries to undertake a set of assessments to identify which activities should be eligible for the sale of ITMOs. From a host country perspective, it is therefore crucial to analyse if activities generating ITMOs are covered by the NDC scope, aligned with national development priorities, and additional to BAU scenarios. This can be achieved through the development of stringent positive lists that specify which technologies/activities would be out of reach for the host country to invest in. The positive list could contain 'high hanging fruit,' which refers to more costly or more complex technologies requiring specialized expertise that may not be available in the host country (Warnecke et al., 2018; Spalding-Fecher et al. 2020). Such an approach would be particularly relevant for the unconditional target to support the host country to avoid selling its 'low hanging fruit' which may lead to 'overselling' that risks achieving NDC targets. Positive lists are also applied in climate finance by public financial institutions for determining low-carbon investment priorities (Germanwatch and NewClimate Institute 2018; Warnecke et al., 2018).

Successful participation of project developers and investors in carbon finance mechanisms benefits from low transaction costs and certainty around carbon investments. By concretely defining the rules for the approval of activities and related positive lists, host countries have the opportunity to provide positive signals to the private sector – project developers and investors alike – to invest in activities that support low-carbon development pathways (Ahonen et al. 2021).

4.1.3. INCENTIVE STRUCTURES

An advantage of climate finance is its flexibility to provide upfront payments to finance the initial investments required for project implementation or RBF, in which case payments are conditional on achieving established targets or generating emission reductions (Strand, 2019). Under carbon markets, payments typically happen ex-post, once CERs are purchased or ITMOs are transferred (Fuessler et al. 2019a). Thus, climate finance can complement carbon finance flows by financing initial investments through up-front payments, for instance, in terms of infrastructure and technical capacities. Capitalising on these synergies has the potential to tackle these barriers commonly observed in carbon finance projects (Fuessler et al. 2019a; Kreibich and Brandemann 2021).

While Article 6 may open opportunities for new technologies to be supported through carbon finance, it will need to be supported by sufficiently high carbon prices over the amortisation period and a willingness of project developers to take risks. The new procedures encapsulated in Article 6 require the project developer to first develop the project and obtain approval for corresponding adjustments (CA) from the host government. Only at a later stage, the host country government will determine the use/claims authorised with the project's mitigation outcomes, representing a potential challenge to project developers. Since project developers finance projects upfront without knowledge of the uses by the carbon buyers, they run several risks, potentially including: (i) not being able to sell the mitigation outcomes if authorisations are not granted by host countries; (ii) selling the mitigation outcomes at a lower value than the initial investment, if selling for other mitigation purposes. Nevertheless, in some cases, buyers of carbon credits offer a certain portion of the contract value upfront to assist with closing the initial capital gap. Additionally, the existence of an ERPA could facilitate project developers to secure a long-term loan, thus, tackling this barrier.

4.1.4. TECHNICAL EXPERTISE NEEDS

Developments in carbon finance particularly in the CDM led to simplified and streamlined MRV toolkit for mitigation projects and programmes e.g., introducing standardised baselines and default values that reduce transaction costs for project developers. Over the CDM implementation period in Africa, the region built up capacities and expertise in the application of MRV methodologies. Even so, the stringent regulatory framework and lengthy time periods for verifying methodologies and validating CER issuances were barriers to CDM market entry, particularly for Africa. This was further reinforced by the limited availability of service providers e.g., auditors in the region to support verification and validation procedures, creating additional costs for project developers to access these services from other jurisdictions, particularly the Global North.

Concurrently, GCF-funded activities still rely on AEs to propose their own approaches to MRV which is coupled with stringent and often inflexible data requirements e.g., historical data to support the climate rationale of projects. This effectively creates bottlenecks within DAEs, as local experts may not always be available, requiring countries to rely on international consultants which further contributes to limiting the accessibility of climate finance for host countries.

4.2. EXPLORING CLIMATE AND CARBON FINANCE SYNERGIES

Historically, these two finance streams have mostly worked independently. However, the emergence of economy-wide NDCs and the current need for resource mobilization and implementation of large-scale interventions is starting to shift the paradigm and encourage innovative forms of financing (Spalding-Fecher et al. 2021).

Blending climate and carbon finance could capitalize on the significant synergies between the two financing streams to maximize their potential for supporting ambitious and long-term mitigation actions at the required scale. Nevertheless, blending is still in its early days and practical experience is limited. Additionally, blending raises a crucial question, i.e., how mitigation outcomes are attributed to each financing source in a manner that guarantees environmental integrity. This section explores the synergies of blending these two financial streams and the topic of attribution within this context.

4.3. THE NEED FOR LINKING CLIMATE AND CARBON FINANCE AND ITS POTENTIAL BENEFITS

Several factors highlight the need and potential benefits of combining the two financing sources:

1. **The magnitude of the required investment calls for leveraging all available finance sources.** Meeting the target of the PA of staying below two degrees warming requires an unprecedented mobilization of resources that climate finance alone cannot meet given the limited availability of public resources (Fuessler et al. 2019a). Financial flows from carbon markets could boost the attainable finance flows for realizing investments in mitigation actions. Still, at their current levels, these two financial streams could not meet the incremental investment needs in the context of the PA (Spalding-Fecher et al. 2021). Hence, maximizing the complementary strengths of these two sources of finance by blending them could be the way forward to mobilize additional resources to finance long-term mitigation actions at scale (Hoch et al. 2018).

2. **A carbon price signal is necessary for driving cost-effective interventions.** Market mechanisms enable allocating resources to the most cost-effective mitigation activities, therefore allowing for global cost savings that would not be realized when solely using climate finance towards mitigation targets. Especially when using public funds, not blending implies the absence of a price signal revealing the real cost of mitigation activities, which might result in over-subsidizing and sub-optimal allocation of scarce public resources (Fuessler et al. 2019a).

3. **Blending can incentivize the implementation of high-cost measures by tackling implementation barriers and potentially increasing carbon prices.** Despite the benefit of using a price signal for driving cost-effective investments, it should not be the sole criteria for selecting mitigation actions. New technologies and mitigation measures in harder-to-abate sectors, which often do not show a cost advantage in carbon markets, can be of utmost importance to meet mitigation targets. In such cases, carbon markets alone are unlikely to suffice to encourage investments, and government interventions by providing climate finance can be essential to overcome implementation barriers of measures in such sectors (Perspectives Climate Group et al. 2019). Furthermore, in practice, the development of large-scale mitigation activities in developing countries faces many other implementation barriers, which can better be tackled with an adequate combination of instruments. These instruments might mix commercial with concessional loans and different types of climate finance, as well as carbon finance (Fuessler et al. 2019a). Finally, leveraging the synergies between carbon and climate finance could potentially increase the demand for mitigation outcomes. The enhanced demand could lead to higher carbon prices, allowing countries to implement actions with higher costs and, thus, increasing NDCs' ambition (Perspectives Climate Group et al. 2019).

4. **Climate finance can mobilize mitigation actions by supporting projects within the market pipeline.** Climate finance can leverage high-quality and investment-ready mitigation activities available in carbon markets by ensuring their results-orientation continuation, as well as by replicating or scaling up these projects (Mikolajczyk et al. 2016).

5. **Blending requires the harmonization of MRV frameworks for activities financed by carbon and climate finance.** This could be accomplished by applying well-tested MRV tools utilised in carbon markets for monitoring mitigation projects supported by climate finance. This approach offers a transparent approach to reporting climate finance projects (linked to

third-party verification protocols implemented by designated auditors) which could strengthen results-based finance. Additionally, it allows for evaluating effectiveness and comparing outcomes of different mitigation actions (Mikolajczyk et al. 2016). On the other hand, it is crucial to consider the burden the potential associated transaction costs and technical challenges this may pose on project developers/AEs, for instance, the need for baseline re-evaluation, or setting up MRV systems with the appropriate levels of complexity. As a result, it is crucial to build local and regional carbon market and climate finance expertise of host countries and the wider carbon market and climate finance ecosystem of actors (programme developers, accredited entities, verifiers, and financial institutions).

Box 2: Blending climate and carbon finance for enhancing sustainable energy access in Africa

In Africa, an annual investment of USD 41 billion to USD 55 billion is required to reach universal access to electricity by 2030, while currently, the annual investment is estimated to be about USD 8 (Chirambo 2018). Maximizing the synergies between climate and carbon finance can facilitate the attainment of this large financing flow.

Energy-related projects usually imply large up-front investment costs for which carbon markets alone do not provide enough incentives. Even for projects with high mitigation potential that are expected to generate significant volumes of CERs and have low operational costs, the large initial investments and the uncertainties associated with the viability of the project in terms of carbon prices and also electricity and fossil fuels prices disincentivize the required market financing flows (Strand 2019). This challenge is amplified in the case of rural electrification in Africa, where up-front costs might be higher due to the geographic dispersion of energy consumers, capital costs, and the mitigation potential of energy access projects might be lower given the low expected consumption levels of these rural, often low-income, households.

In such cases, climate finance can complement carbon finance by de-risking investments from private agents through the reduction of investment costs and the project's dependence on market forces to continue its operation. Still, the extensive climate finance flows required for these projects might need to be justified accounting not only for mitigation benefits but also for adaptation and sustainable development co-benefits neglected by carbon markets.

Thus, climate finance combined with carbon market mechanisms can significantly enhance energy access in Africa by acting as key catalysts for private investments while increasing the synergies between climate mitigation and sustainable development goals.

4.3.1. HOW TO ATTRIBUTE WHEN BLENDING CARBON AND CLIMATE FINANCE

When these two financing sources are combined in the same mitigation intervention, it is crucial to determine the attribution approach, i.e., how mitigation outcomes should be allocated to the different financing flows[21].

APPROACHES TO ATTRIBUTION

The literature mainly discusses two approaches to attribution:

i. **All to the carbon markets approach.** It attributes all mitigation outcomes to carbon finance even when the two instruments are combined in a specific mitigation activity. Hence, mitigation outcomes generated by projects with climate finance support are transferred as ITMOs to buyer countries. In that case, the necessary corresponding adjustment implies that climate finance does not contribute to achieving the host country's commitments. In addition, increasing ambition and scope in future NDCs will become more expensive given the use of lower-cost mitigation opportunities for carbon markets. Under this approach, climate finance will directly subsidize carbon markets (lowering ITMO prices), and markets will lose their capacity to allocate resources to the most cost-efficient mitigation activities (Fuessler et al. 2019a). Additionally, Spalding-Fecher et al. (2021) find that global emissions will increase as a result of blending if all ERs are allocated to carbon markets, infringing on the environmental integrity principle.

ii. **Proportional attribution approach.** This approach attributes to each financial flow what it paid for, avoiding cross-subsidization. Mitigation outcomes paid by climate finance could be used toward the host country's NDC, while buyer countries will obtain the ITMOs equivalent to their financial contribution through the market. Thus, this approach could solve two issues: climate finance providers' concerns on their funding essentially subsidizing carbon markets, and the infringement of environmental integrity (Fuessler et al. 2019a).

The authors conclude that applying proportional attribution is essential when blending occurs and argue that CDM has allowed buyers to claim all ERs from projects which were supported by funding beyond carbon markets revenues. In the context of the PA, avoiding all to carbon market approach and applying proportional attribution is crucial for host countries to meet their mitigation pledges. Only in such a case, blending will capitalise on the carbon market's benefits while ensuring that climate finance flows[21] support host countries' mitigation targets or increase net global mitigation (Fuessler et al. 2019a; Spalding-Fecher et al. 2021).

ATTRIBUTION IN PRACTICE

Given that attribution is in its early days, many practicalities need further elaboration. Still, one can highlight several factors to be considered when attributing ERs in a blended finance context:

- **Timing.** It is recommended to agree on attribution early in the project development process. The attribution analysis can be based on estimations of the total abatement costs, given that the overall financial needs will most likely not be known at this stage. The initial estimates can

[21] Attribution is not necessary if an intervention is composed of various actions that target different sites or groups each receiving funds only from one source. In this case, linking ERs to the financing source is straight forward because there is not real interaction between the climate and carbon finance flows.

be further refined later, following previously established conditions and processes. Still, these initial estimates will serve to inform, on the one hand, carbon market funders on the expected ITMOs to be generated by the project, providing certainty; and, on the other hand, the host country to decide the volume of ITMOs to authorise and the acceptable ITMO price which should not be below the abatement cost (Spalding-Fecher et al. 2021).

- **Scope.** According to Spalding-Fecher et al. (2021), 'attribution analysis should focus mainly on financing streams that support implementation and investment, rather than the smaller funding for activities such as technical assistance and capacity building' (p. iv).

- **Host country role.** It is crucial that host countries set a standardised framework for establishing clear titles on generated ERs, as well as well-defined accounting guidelines for transferring credits and reporting climate financing activities. Only in such a case could environmental integrity be ensured by eliminating the risk of double claiming and double counting (Mikolajczyk and 't Gilde 2020). Additionally, host countries could require to conduct attribution analyses as part of the rules for the authorisation of ITMOs and climate finance contributions (Spalding-Fecher et al. 2021).

4.4. CASE STUDY: THE SENEGALESE AGENCY FOR RURAL ELECTRIFICATION

In 2019, the electricity access rate in Senegal was 70%, with significant disparities between urban and rural areas, being 95% in the former and only 48% in the latter (World Bank 2019). Barriers such as high investment and operational costs, the dispersed location of consumers and their low potential level of consumption hinder electrification in the country (West African Development Bank (BOAD) 2020). The Government of Senegal (GoS) has thus committed to attaining universal access to electricity by 2025. For this purpose, the Government developed a national rural electrification investment program valued at FCFA 690 billion (USD 1.17 billion) for the period 2019-2025, mainly covering investments in grid extension and rural mini-grids ((West African Development Bank 2020).

The GoS appointed ASER as the executive agency for the universal energy access program (West African Development Bank 2020). The Agency autonomously coordinates rural electrification activities under the tutelage of the Ministry for Energy and the Ministry of Finance (ASER 2018; ASER 2020). ASER is in charge of developing the programs, providing financial and technical assistance, encouraging project proposals from private operators, organizing tenders for electricity distribution concessions, supervising installations, and managing the Rural Electrification Fund (West African Development Bank 2020).

To accelerate rural electrification, in 2009, ASER adopted a concessionaire model to grant concessions for rural areas to private investors (The World Bank 2016). Under this concession-based system, Senegal is divided into ten services territories, out of which six have been tendered to private investors and the rest granted to the Senelec (National Electricity Company of Senegal), resulting in a public-private partnership. Within their concession area, operators are responsible for electricity generation, transmission, and distribution. Additionally, operators are mandated to undertake grid extension (West African Development Bank 2020).

The two projects that are the object of this study are led by ASER and contribute to the universal access-to-electricity goal. They were conceived in the context of Senegal's INDC, which defined

strategies and priority actions in the energy sector. As part of the INDC target of reducing 21% of emissions by 2030 compared to BAU (5% unconditional target and 16% conditional), the INDC set the goal of electrifying 392 villages with solar or hybrid mini-grids (unconditional target) and up to 5,000 upon receipt of technical/financial support from the international community (conditional target) (West African Development Bank 2020).

In 2020, Senegal submitted a NDC with an updated target of 29% emission reduction by 2030 compared to BAU, out of which 7% is the unconditional part of the mitigation target, and the remaining 22% is conditional on international support (Government of Senegal 2020).

Box 3: Carbon finance project: Senegal Rural Electrification Program — World Bank's Carbon Initiative for Development

Project objective: The project aims at enabling rural households to access modern electricity systems and thus, substitute/avoid the utilization of traditional energy sources, resulting in the reduction of GHG emissions. The project uses carbon-linked results-based payments to provide subsidies to poor rural households through connection fees vouchers/coupons in the concession areas, making connecting to the grid more affordable. The program attempts to tackle two barriers, which are slowing down the pace and scale of rural electrification under the concession-based system, these are: i) the differentiated tariffs for rural customers depending on if they fall within a concession area or a territory served by Senelec, and ii) the high upfront connection fees mandatory for new customers to the concessionaire, which are not affordable for many potential customers in rural areas (World Bank Ci-Dev 2016).

Components:

Component 1. Connection-fee subsidies to rural households in the concession areas through carbon finance (USD8 million):

This component will provide subsidies in the form of coupons/vouchers (the so-called Jappale coupons) to rural households in the concession areas to reduce the households' connection costs by making the payment of the connection charge affordable to the poor rural population. By removing this barrier to entry, the number of rural households connected to the grid is expected to grow, consequently increasing the electricity demand, and making concessions more viable and sustainable.

The voucher would cover between 20-60% of the connection fee (depending on the service level), while the households will still need to afford the rest of the payment. Poorer households are expected to cover more significant portions of their connection fee, assuming that they will opt for the lower service levels (carbon finance will cover 60% of the fee for the lowest service level and 50% for the second level). Given that the carbon finance payments are results-based following ERs, the vouchers will need to be pre-financed either by upfront funding from World Bank's Carbon Initiative for Development (Ci-Dev), the Government of Senegal, or other sources.

Component 2. Capacity Building for ASER and technical support for designing the voucher scheme (USD282,000):

The project provides a grant for operational and technical support, as well as training to ASER in order to build its capacity as the Coordinating and Managing Entity (CME) of the PoA; monitor and carry out quality control; and implement a monitoring system with data from grid connection and energy consumption. In addition, the grant will support the development of the coupon/voucher scheme through all its phases, including its design, communication campaign, and pilot program.

Financing source: The certified emission reductions (CERs) are issued according to "cumulative use of electricity from a range of sources including grid, off-grid and mini-grid technologies" (World Bank 2016 p.7). The emissions reduction purchase agreement (ERPA) between ASER and the World Bank's Ci-Dev was signed in 2016, committing to the purchase of 660,000 CERs to be generated through the end of 2024. Since May 2018, this Project has been a CDM-registered PoA (BOAD 2020). Additionally, this program is the site of the first Standardized Crediting Framework pilot (World Bank Group n. d.), which aims at participating in Art.6.2 (World Bank Ci-Dev 2016).

Box 4: Climate finance project: ASER Solar Rural Electrification Project — GCF

Project objective: deploy 100% solar mini-grids for rural households in 1,000 isolated villages in Senegal (half of the most vulnerable, least attractive locations to be electrified). The project will enable the electrification of 38,917 rural households within five years by installing 32 MW of solar PV mini-grids, resulting in the avoidance of 1.13 $MtCO_2$ over their technical lifetime and significantly contributing to the universal access to electricity goal set by the GoS.

Co-benefits: In addition to mitigation, the project will provide adaptation and sustainable development co-benefits. The project will support a climate-resilient power system by diversifying its energy supply and consequently making it less vulnerable to disasters and extreme weather events. The project will favour communities' economy by creating employment and therefore improving income levels, which in turn can increase the economic resilience of rural households and reduce migration. Additionally, it will enhance the reliability of water and food chains, health and education services, and social institutions. Finally, the project will enhance gender equality and access to education and information by particularly focusing on women and children.

Financing source: With the support of Climate Finance Innovators and the West African Development Bank (BOAD) as the accredited GCF entity, ASER obtained concessional financing from the GCF. The total financing granted by the GCF amounts to USD 91.3 million and comprises a loan of USD 89.1 million and a grant of USD 2.2 million. In addition, the co-financing amounts to USD 149.2 million, which includes a grant of USD 6.8 million and two loans. The mobilized concessional resources from the GCF will engage private sector local operators with acceptable risk-reward conditions, complementing BOAD co-financing and Senegal's national resources. In addition, the GCF provided a grant for strengthening the capacity of the main rural electrification stakeholders, catalysing access to local financing towards productive and gender uses of energy and facilitating first connection access to the most vulnerable households.

(West African Development Bank 2020).

SYNERGIES OF BLENDING CARBON AND CLIMATE FINANCE IN THE CASE OF ASER

The two previously described projects can serve as an illustration of the synergies between these two financing sources. Given that the counterparty of both projects is the same, i.e., ASER, synergies are realized even if there is no physical overlap between the two projects. The GCF project has managed to successfully align carbon markets and climate finance by applying e.g., aligned MRV approaches in parallel with the previously described ASER's CDM-registered PoA. Synergies are summarized as follows:

1. **Two complementary sources of finance have been successfully leveraged for the common goals of Senegal's rural electrification and climate change mitigation.** As previously explained, these two financial instruments differ in several features, and their suitability depends on, among other aspects, the mitigation action to be implemented. The development of these two projects in parallel allows using the best fit-for-purpose financing instrument in each case. Carbon finance supports connections to the grid in areas where this is a feasible option. By contrast, climate finance supports renewable power generation in isolated villages where grid extension costs would be excessive. The deployment of solar mini-grids still requires an extensive up-front cost which carbon finance could have difficulties meeting.

2. **The climate finance project has capitalized on the previous experience of the carbon finance initiative.** ASER has developed a series of soft skills and relevant experience through the Ci-Dev project, facilitating access to GCF financing. Hence, one can say that the Emission Reduction Purchase Agreement that ASER signed with the WB has laid the ground for the GCF proposal. An example is that the GCF program will implement a voucher system directly inspired by the JAPPALE coupon program of the Ci-Dev project, which will target 'eligible social services and women and youth-led enterprises' (West African Development Bank 2020).

3. **The projects have harmonized MRV frameworks for activities financed by carbon and climate finance.** The two projects use the same CDM-approved methodology for MRV of emission reductions. However, the GCF funding proposal with its CDM-based MRV system clearly delineates carbon finance from GCF support. It, therefore, delivers a solid contribution to transparently blending different sources of climate finance for local climate action (West African Development Bank 2020).

Despite the potential benefits associated with blending carbon and climate finance, several questions and concerns remain. Given the current limited practical experience, climate finance providers might not be aware of its potential benefits and the potential use of *proportional attribution* to avoid concerns about climate finance subsidising carbon markets. Raising awareness among key actors and supporting pilot programs could be the next steps to promote the acceptance and resolve uncertainties of this innovative financing approach. Additionally, these pilots could inform the development of clear rules on attribution, which might be a pre-requisite for multilateral funds to support the combination of the two financing streams and could avoid scepticism (Spalding-Fecher et al. 2021). In addition to a clear definition of blending, practical application examples, and diligent guidelines for the application of *proportional attribution*, clarification on the implications for host countries of using carbon finance in terms of the NDCs achievement is required.

4.5. HARMONIZED METHODOLOGIES FOR MRV OF MITIGATION OUTCOMES

As NDCs aim to be economy-wide and will likely receive support from a range of sources, it is important to ensure consistency across MRV methodologies in support of achieving NDC sector targets. Carbon market mechanisms have been particular accurate in calculating mitigation outcomes since this was important for the environmental integrity of preventing carbon credits that do not represent an actual ton of CO2e reduced or removed.

In climate financing institutions, MRV was historically less strictly and consistently applied. For instance, the GCF approved its first projects in 2015. Despite requiring funding proposals to furnish a broad range of detailed information, including emission reduction estimates, the GCF has not, to date, developed GHG emission reduction methodologies of its own. Instead, Accredited Entities have adopted a range of approaches to estimating mitigation impact, many of them drawn from the CDM, but also from the GEF and from MDB approaches. Although there are signs that the GCF wants to impose greater standardisation on its projects' emission reduction calculations, at the current time only two UNFCCC bodies – the CDM and the GEF – have developed 'official' emission reduction methodologies.

The CDM currently has over 250 approved methodologies to ensure the environmental integrity of the credits issued, covering large- and small-scale mitigation project types[22]. These are unevenly applied, with just 5 methodologies – relating to grid-connected electricity supply, thermal energy production, and methane recovery – being employed by over two-thirds of projects to date (UNEP DTU 2021). The CDM's methodologies are detailed and prescriptive, with some running to more than 30 pages of formulae and instructions. However, the CDM supported only projects and programmes, but not the implementation of policies, technical standards, or consumer awareness campaigns[23].

Given that CDM methodologies were developed prior to the adoption of the PA, the guidance on the new crediting mechanism established by Article 6.4 of the PA includes more ambitious and stringent requirements for methodology design and baseline-setting. The decision outlines the need for conservative and clearly defined baselines that are set based on a best-available-technology benchmark, with a benchmark derived from average emissions of a best-performing comparable context (Espelage et al. 2022). Additionally, more stringency is to be applied to demonstrate the additionality of activities, considering existing policies, and avoid any potential leakage. The decision further allows for activities in LDCs and SIDS to apply a simplified approach to demonstrate additionality.

In contrast, the GEF's approach to estimating projects' ex-ante and ex-post emission reductions has always been more general – framed as 'guidelines' – than the CDM's prescriptive methodologies. As GEF projects support a wide array of interventions[24] in contrast to CDM, GEF emissions reduction estimation guidance is broader and more accommodating of diverse interventions and project types. Historically, the GEF accounted for emission reductions by distinguishing between direct emission reductions, direct post-project emission reductions and indirect or consequential emission reductions (attributable to 'soft' interventions, such as policies and regulations). Acknowledging that estimation of resulting emission reductions is conceptually and practically

[22] As of October 2021: https://cdm.unfccc.int/methodologies/index.html

[23] See, for example, Fuessler et al. (2019c).

[24] Including policies, standards, and codes; institutional strengthening and capacity building; technology transfer; and knowledge diffusion

difficult, the GEF guidelines allow two estimation approaches – bottom-up and top-down – to be employed (ideally together), with a 'causality factor' applied to the top-down approach to try to capture the influence of the GEF project amidst background change and other influences (GEF 2008). To impose greater standardisation and consistency upon GEF emissions reduction estimation, in 2014 the GEF Secretariat produced updated guidelines which included the use of selected CDM tools, including the tool to determine the remaining lifetime of equipment and the tool to calculate the grid emission factor (UNFCCC n.d.)

The GEF provides a good illustration of the challenges associated with measuring the emission reduction benefits of a diverse project portfolio designed and implemented over 3 decades, across different project types, different sectors, different countries, and by different agencies. GEF guidelines provide a minimum level of consistency, but considerable variation is the norm.

To date, there is a remaining inconsistency of MRV approaches across funding sources for mitigation activities, even though CDM methodologies have increasingly been used at least as a reference point. In contexts, in which no carbon credits are being generated, the level of detail and accuracy of CDM methodologies may seem excessive in terms of transaction costs. On the other hand, in particular widely used methodologies have become increasingly standardized and simplified, and especially standardised baselines could be more widely applied in order to ensure consistency in MRV approaches. However, it is also clear that CDM methodologies can only serve as a building block since methodologies need to be enhanced in their climate ambition. Moreover, in the Paris Agreement context, countries are expected to deploy a wider range of interventions beyond projects and programmes to meet their NDC targets (policies, regulations, subsidies, investments, awareness-raising, capacity building, etc.).

4.5.1. DIGITALISATION AS A KEY STRATEGY TO EASE MRV FOR DECENTRALISED APPROACHES

Robust MRV frameworks are a cornerstone underpinning impactful climate mitigation and adaptation action and are instrumental in facilitating access to climate finance and carbon markets. Experience in the CDM and GEF suggests high transaction costs related to MRV of emission reduction impacts. In the context of the CDM, there was also a barrier for the financial feasibility of small emission reduction projects such as distributed renewable energy projects, particularly when carbon prices were low. Conventional MRV relies on manual processing in the various stages of the MRV process and has often been characterized by errors with an impact on the certification and issuance of carbon credits and associated carbon finance flows compromising the integrity of carbon markets.

Reliable data capture and transfer are an integral part of the MRV data collection phase. Data collection in the context of off-grid and decentralised energy solutions is often complex and costly due to the small-scale and distributed nature of these activities. This is further compounded by the difficulties in accessing data in remote areas. Digitalisation can generate significant gains at both operational and impact levels. Such gains can be observed in terms of accuracy, and reduced transaction costs e.g., through reduced or eliminated need for on-site inspections and faster data processing in addition to the information on the sustainable development impacts of a project – throughout the MRV process (Füssler et al. 2019b). The latest advances in digital and information technologies such as smart meters, digital sensors, and the Internet of Things (IoT) can improve the coverage, accuracy, and processing of data for credit issuance while facilitating timely payments for the delivery of these credits (Autenrieth 2020).

Additionally, automated online applications with methodological pre-sets to quantify the impact of emission reductions of the data collected can replace the use of complex and labour-intensive spreadsheets. This would not only increase the efficiency and reliability of impact calculations but can help foster confidence in the outcomes and impacts of projects, especially as international climate finance providers and carbon credits buyers increasingly demand higher levels of stringency in impact assessments and reporting.

The verification stage involves the review and checking of all data collected for integrity, accuracy, and methodology conformity. Often verification is undertaken by independent third-party verifiers who verify emission reductions and potential sustainable development benefits of mitigation projects or programmes on behalf of project developers. Digital innovations such as Distributed Ledger Technology (DLT) / blockchain can further be used to facilitate and accelerate real-time verification allowing for automated quality assurance by building in plausibility and consistency cross-checks to the monitoring data and identifying outliers to enable a greater degree of standardisation (Autenrieth 2020). Mobile payments may also play a role in digital verification by reducing information symmetries such as proof of identification between providers.

4.6. MONITORING AND REPORTING SDG AND CLIMATE IMPACTS OF CLIMATE AND CARBON FINANCE

The importance of harmonized MRV methodologies also extends to further impact dimensions beyond mitigation. This means that carbon and climate finance instruments benefit from MRV frameworks that also integrate tracking and reporting of progress towards the SDGs.

Indeed, the first purpose of the CDM in the Kyoto Protocol was "to assist Parties not included in Annex I in achieving sustainable development[25]" as well as helping industrialised countries to reach their mitigation targets in a cost-effective manner (UNFCCC 1998). However, there was a lack of clear and transparent SD criteria by host countries to support the assessment of projects (Spalding-Fecher et al. 2012). In addition, the CDM was criticised for some projects with negative impacts, including the infringement of human rights (Obergassel et al. 2017, Perez et al. 2016). As a result, the CDM sustainable development tool[26] was developed by the UNEP-DTU under the guidance of the CDM Executive Board (EB) that allowed for a voluntary approach towards SD co-benefits and placed a general attention towards SD (Hultman et al. 2020). Notably, the CDM tool does not mandate the project developers to highlight any negative impacts arising from the CDM projects and programmes (Schneider et al. 2016).

Further issues related to the measuring of SD contributions in the CDM include that the mechanism does not mandate the application of safeguards. Instead, the CDM relies on national law and requires that the host country confirms through a letter of approval that projects support the country's sustainable development objectives. A weakness with the prerogative of the host country to define SD is that this may lead to a 'race to the bottom' due to weak national SD

[25] This was against the backdrop that a global framework on sustainable development such as the SDGs was absent in 2001 when the rules, modalities, and procedures of the CDM were adopted in the Marrakech Accords ((Hultman et al. 2020).)

[26] The approach to co-benefits entails the three basic dimensions of SD that is, the environmental, social, and economic dimensions. Based on these, the SD tool uses a taxonomy of 12 SD criteria and 70 indicators. Project developers update the tool, and a Sustainable Development Co-benefit (SDC) report is generated and publicised on the CDM website. While defined indicators can play a role in monitoring safeguards, negative impacts do not only occur in conditions established in advance of implementation, hence this approach is inadequate to address potential unexpected negative impacts

criteria creating reputational risks for the CDM (Olsen et al. 2018; Michaelowa et al. 2019a). The CDM SD tool also did not put in place any safeguards against adverse impacts or to monitor for (unexpected) adverse impacts after the implementation of the project and whether remedial measures are effective (Olsen et al. 2018; Day et al. 2020; Wissner and Schneider 2022;). Such safeguards, however, have gained in importance in the Article 6 rulebook, but also in the GCF.

In contrast to the CDM, the GCF's Environmental and Social Policy (GCF 2021b)[27] and the Adaptation Fund's Environmental and Social Policy (2013), which are both instruments under the UNFCCC, provide for a large number of safeguards and highlight the mandate for avoiding negative environmental and social impacts. The GCF also articulates extensive provisions for continuous improvement and best practices, stakeholder engagement and disclosure, gender-sensitive approach, harmonised application of environmental and social requirements, labour and working conditions, indigenous peoples, human rights, and biodiversity (GCF 2021b). The GCF further assesses funding activities for sustainable development impact, as defined in the Fund's investment framework. The specific investment criterion "Sustainable Development Potential" requires project activities to describe whether they lead to environmental, social and health, and economic co-benefits.

The Adaptation Fund's Environmental and Social Policy (2013) requires that adaptation projects do not pose negative environmental and social harm and that all environmental and social risks are addressed at the earliest possible stage and monitored and reported on through the life of the project/programme. Furthermore, the policy specifically states that projects and programmes must protect human rights, the rights of indigenous peoples, marginalised and vulnerable peoples, and makes provisions for a grievance mechanism (paragraphs 14, 15, 18, and 34).

The safeguards under the GCF and Adaptation Fund can thus provide guidance for the operationalizing the Art.6 rulebook language on safeguards, which remains relatively generic on sustainable development, but for the first time explicitly mentions human rights, indigenous peoples, the use of safeguards, and even establishes an independent grievance process under the Art.6.4 mechanism (Espelage et al. 2022). This represents a considerable progression compared to the CDM, which requires further elaboration of technical implementation. SD elements are more elaborated in the architecture of the Article 6.4 mechanism than in the cooperative approaches under Article 6.2. Article 6.4 specifically aims to foster sustainable development, and the host country would have to confirm to the Supervisory Body (SB) that the activity fosters SD, acknowledging that the consideration of sustainable development is a national prerogative as in the CDM (UNFCCC 2021b). The SB once constituted will also review the CDM SD tools and safeguard systems and develop similar tools for use under Article 6.4.

The benefits of carbon finance go far beyond mitigation and often simultaneously achieve adaptation benefits. This is important, as the PA also includes a Global Goal on Adaptation (GGA) in Article 7, although the goal is yet to be fully operationalized[28] . The Adaptation Gap Report (UNEP 2021) notes an imbalance between adaptation and mitigation finance (a ratio of 1:3) which has been broadly criticized. At COP26, developed countries were urged to at least double their collective provision of climate finance for adaptation to developing country Parties from 2019 levels by 2025 to narrow this gap. Therefore, COP26 outcomes on adaptation finance

[27] Adopted by the Board in decision B.BM-2021/18.

[28] However, modest success was achieved with the launch of the two-year Glasgow-Sharm el-Sheik Work Programme on the GGA at COP 26 in Glasgow which seeks to enhance understanding of the GGA, including through the development of methodologies and indicators for tracking adaptation action.

put pressure on the GCF, as the largest international public climate finance provider, to both increase funding of adaptation interventions while ensuring their effectiveness.

Market mechanisms also directly contribute to mobilizing adaptation finance. Under the Kyoto Protocol, a levy of two per cent was placed on issued CERs, and the resulting share of proceeds (SoP) was used for administrative purposes and to replenish the Adaptation Fund (UNFCCC 2018). However, when the CDM was affected by low CER prices, resources flowing to the Adaptation Fund were much lower than expected, creating a significant challenge for SIDS and LDCs in need of direct access funding for adaptation. Article 6.6 of the PA requires Parties to ensure that a share of the proceeds from activities under the Article 6.4 mechanism is used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

The SoP was a key priority in finalizing the Article 6 Rulebook for the African Group of Negotiators (AGN) to increase the predictability of long-term funding sources for countries most vulnerable to climate change ahead of COP 26 in view of the imbalance between mitigation and adaptation finance. The AGN pushed for the eventually agreed outcome of a significantly higher five per cent share of proceeds to be levied for adaptation under the Article 6.4 Mechanism that will be complemented by a monetary levy (Espelage et al. 2022). However, a key sticky issue for the AGN is that only a voluntary contribution is demanded from Article 6.2 cooperative approaches (Espelage et al. 2022).

In preparation for the second replenishment period of the GCF, the Fund adopted a new Integrated Results Management Framework Policy (IRMF)[29] which is designed to measure both quantifiable impacts of GCF investments and the GCF contribution to the paradigm shift towards low-emission and climate-resilient development pathways (Figure 7). Considering Africa's need for adaptation and climate resilience, there is a greater focus on identifying adaptation impact. The "*direct and indirect beneficiaries reached*"[30] indicator is indicated within the new framework as one of the four core indicators aiming at quantifying the GCF outcome results level "reduced emissions and increased resilience" and is the only mandatory core indicator focusing on adaptation. The indicator "*direct and indirect beneficiaries reached*" is also used as an indicator for the impact potential of projects (which is one of the Fund's six investment criteria) and is thus used to guide investment decisions and monitor the results of funded projects.

[29] Adopted at the 29th GCF Board meeting in June 2021 (B.29/14) (GCF 2021c)

[30] The core adaptation indicators for all expected adaptation results are the "Total number of direct and indirect beneficiaries" and the "number of beneficiaries relative to total population", disaggregated by gender as agreed at the 8th GCF Board meeting in October 2014 (B.08/07) in the context of "Mitigation and adaptation Performance Measurement Frameworks (PMF)" (GCF 2014), which measure the results of the Fund.

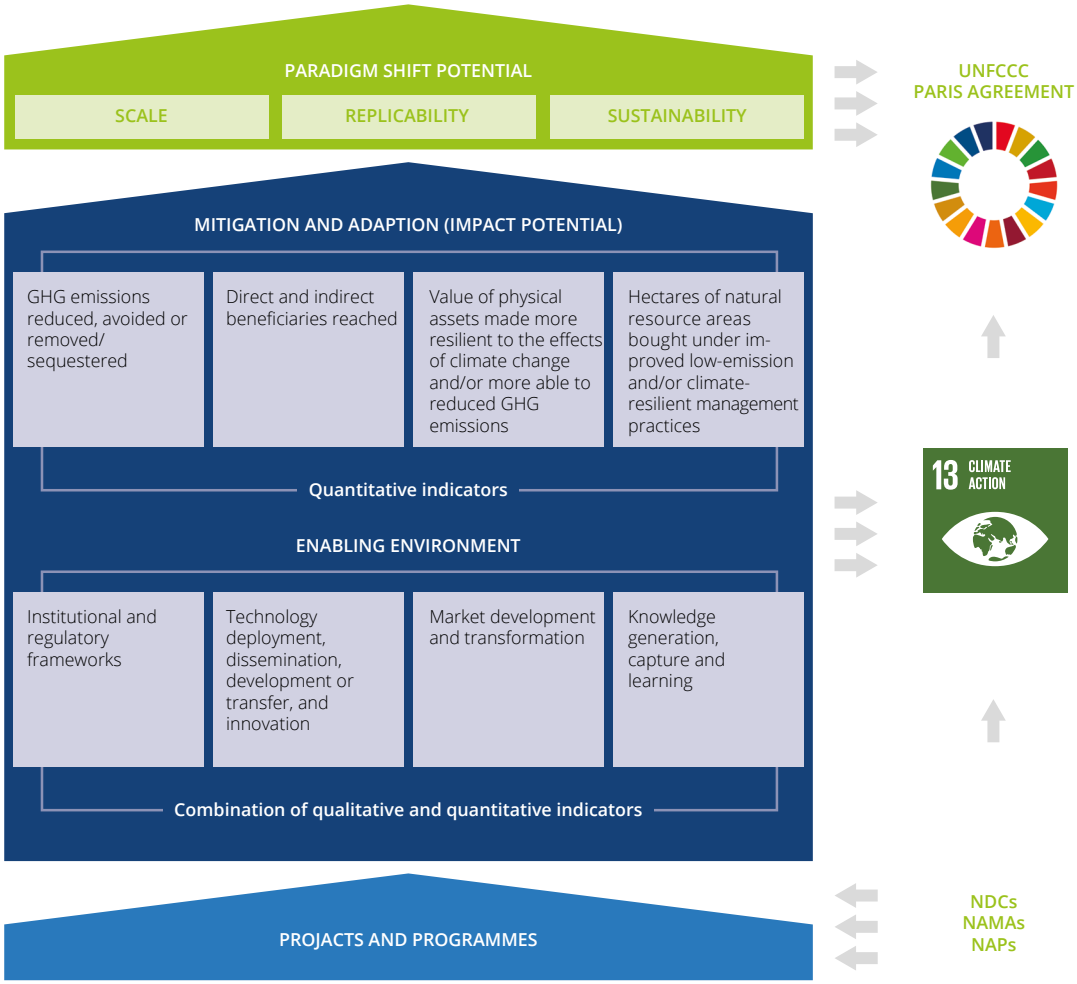


Figure 7: Integrated Results Management Framework results architecture Source: GCF (2021c)

Notably, a key challenge remains in adopting indicators that are appropriate for adaptation at different scales and contextual depth, while enabling enough comparability and aggregation. In a recent GCF evaluation report of the "Adaptation Portfolio and Approach of the GCF", Binet et al. 2021 highlight the inconsistencies in the calculation of the number of direct and indirect beneficiaries of adaptation projects between different AEs. The report highlights three main challenges related to this indicator: i) the lack of a coherent methodological approach leads to very heterogeneous approaches, hindering comparison of projects and leading to overestimation of beneficiaries in some cases, ii) the indicator itself does not provide contextual depth of impact, therefore does not enable enough comparability and aggregation homogenously, and iii) for cross-cutting projects, there is no clear differentiation of beneficiaries depending on whether they receive an adaptation or mitigation benefit[31] (see also Pauw et al. (2020)). Table 4 provides an overview of how different climate funds and CDM integrate SDG and climate impacts in their monitoring and reporting frameworks.

The ABM, developed by the African Development Bank, is a results-based finance mechanism to support adaptation activities by quantifying, verifying, and certifying the social, economic, and environmental benefits of these activities. The ABM is a tool expected to channel finance into small-scale context-specific adaptation solutions. The ABM has established a Methodological Panel with the mandate to develop robust methodologies for the quantification and MRV of the adaptation benefits. These methodologies can further contribute to the development of quantifiable targets

[31] This is crucial given the strong linkages between adaptation and mitigation activities in the energy sector, it is often difficult to differentiate benefits through differentiated adaptation and mitigation logics. (Michaelowa et al. 2018)

and related metrics for adaptation components under NDCs (Greiner et al. 2019). The mechanism is currently in a pilot phase and has piloted methodologies in renewable water pumping technologies, clean cooking, grid extension, watershed management, and off-grid electrification sectors. The ABM further has the potential to create synergy between climate adaptation, mitigation, and sustainable development by attributing a monetary value to various benefits.

Table 4: Integration of SDG and climate impacts in Monitoring and Reporting frameworks
Source: GCF (2021c)

Funds / mechanism review	Existing tools / frameworks	Climate impacts	SDG impacts	Safeguards against negative Impacts
CDM	• CDM methodological toolkit • Sustainable Development Co-Benefits Tool	• Expressed in baseline methodologies. Mostly project-by-project baseline scenarios are used while standardized approaches exist for some project types. • Project developers may select an approved standardized baseline that is applicable to the proposed CDM activity.	• No UNFCCC rules, requirements established by host country and checked in process of providing letter of approval (CDM itself does not specify what criteria should be used). • Voluntary CDM Sustainable Development Tool, only used by few project developers	• No UNFCCC rules, requirements established by host country and checked in process of providing letter of approval (CDM does not specify what criteria should be used).
GCF	• Integrated results management framework • GCF's Environmental and Social Policy including the ESMS • GCF investment framework	• No streamlined methodologies for mitigation. • Projects/programmes may develop a project-specific methodology, or adopt existing, peer-reviewed methodologies and tools e.g., CDM methodologies, new methodologies to be developed under Article 6.4 of the PA, bilateral approaches such as the Joint Crediting Mechanism (JCM), the Gold Standard, the Verified Carbon Standard (VCS). • For adaptation impacts, the GCF has introduced the use of the term 'adaptation benefit'[32] to define the number of direct and indirect beneficiaries reached via adaptation interventions (further disaggregated by gender).	• Results indicators that quantitatively track the outcomes of GCF-funded projects/programmes are aligned with the Sustainable Development Goals (SDGs). • In addition, the GCF investment framework requires AEs to identify the sustainable development impacts of the project, including at least one positive impact (economic, social, environmental, or gender) – with an associated indicator, baseline, and target values, and where possible, disaggregated by gender.	• The GCF has developed guardrails under the GCF's Environmental and Social Policy including the ESMS, to ensure its financial support in developing countries causes no harm to the environment, communities including Indigenous Peoples, and generate co-benefits to the environment and the communities through the GCF and the activities it finances.
Adaptation Fund	• Results-based Management framework • Environmental and Social Policy	• For the funded adaptation projects, expressed in project baselines or reference and adaptation scenarios applied against which progress can be assessed or comparisons made. • Baselines are described by a set of quantitative or qualitative indicators e.g., vulnerability or climate risk. Alternatively, reference scenarios that represent future conditions in the project context in the absence of climate adaptation or scenarios that apply various adaptation measures.	• No streamlined approaches for the tracking or reporting of sustainable development impacts	• The environment and social policy guides that all AF-funded projects and programmes protect or foster human rights, vulnerable groups, youth, biodiversity, natural habitat conservation, and climate change • The implementing entities' annual project/programme performance reports include a section on the status of implementation of any environmental and social management plan, including those measures required to avoid, minimize, or mitigate environmental and social risks • An embedded grievance mechanism requires all implementing entities to have their own grievance or complaint-handling mechanism for people affected by AF-funded projects.

[32] An adaptation benefit is an "outcome derived from a GCF-funded intervention which aims to increase resilience or reduce vulnerability of a specific target system (e.g., communities, ecosystems, local economy) against the adverse effects of climate change when compared to a baseline scenario (GCF 2022)

Box 5 provides a practical example for how climate finance activities can simultaneously deliver impacts on energy access, mitigation as well as resilience and adaptation. Projects such as the one described below benefit from consistent MRV frameworks for climate and SDG impacts, in particular as replication and upscaling may draw on different financing instruments.

Box 5: Climate finance project: Solar Water Pumping — GCF Pipeline (Ethiopia)

Project objective: The project aims at strengthening the adaptive capacity of local rural communities in drought-vulnerable regions in Ethiopia by enabling the extraction of ground water in deep aquifers for agricultural production and drinking. The project to achieve this objective by enhancing the climate resilience of water and energy infrastructure through the deployment of solar water pumping (SWP) of previously drilled deep boreholes designed for use with diesel generators.

Climate impacts: In addition to mitigation resulting from the introduction of SWP and cutting dependency on diesel generators, the project will provide additional adaptation and sustainable development co-benefits. Access to solar PV pumps will enable farmers to irrigate and increase their crop yields, in the face of drought cycles accelerated by climate change thereby enhancing their climate resilience. The project improves the health conditions for targeted beneficiaries through improved access to safe water for drinking and sanitation and food security. Additionally, as climate impacts on water supply and agricultural production in the project regions are projected to disproportionately affect women and children, the project will reduce social inequality by improving the income of the most vulnerable, mostly poor women, by allowing them to spend their time in other productive activities. This is corroborated by IRENA (2016) which mentions that SWP disproportionately benefits women e.g., by reducing the time required to fetch water for food production.

Financing source: The project is supported by the Climate Finance Innovators and the Ethiopian Ministry of Finance as the accredited GCF entity. The project further makes use of CDM-based MRV tools and methodologies to calculate emission reductions resulting from the use and uptake of solar-powered water pumps, replacing diesel generators.

4.7. THE RELATIONSHIP BETWEEN CARBON MARKET ACTIVITIES AND NDCS: REDEFINING ADDITIONALITY

Additionality is a crucial principle for determining the eligibility of a planned activity to access carbon markets. The common use of the concept additionality in the carbon and climate finance communities denotes that an emission reduction is considered to be additional if it would not have occurred in the absence of an intervention. A comprehensive overview of the additionality concept in a carbon finance context can be found in Gillenwater (2021). In other words, the intervention – typically an investment project or programme, but potentially also a policy or a measure in support of NDCs – achieves a reduction in greenhouse gas emissions relative to the BAU scenario. In this sense, the emission reduction can be considered 'real' and can be accounted for accordingly. Furthermore, additionality is important for justifying monetary expenditures: why spend money on achieving an emissions reduction impact that would materialise in the baseline regardless? This is of particular concern in the context of concessional public finance, which has the potential to displace – 'crowd out' – private sector finance that would otherwise have been deployed.

However, there is no universally accepted definition of the term additionality, and difficult as it is to describe succinctly, additionality is even more complex to operationalise. The concept is intrinsically built on a counter-factual: what would happen in the absence of the intervention? This inevitably leads to working with assumptions, which makes it important to prevent gaming of the system, whereby actors may e.g., seek to downplay existing market penetration of the technology in question or exaggerate baseline emissions in order to then claim credit for (supposedly) reducing them.

Different climate finance instruments have tended to develop their own approaches to navigating the complex task of defining and assessing additionality. MDBs for example, each apply their own definition of additionality, typically focused on the risk of crowding out external finance[33] ; the GEF applies 'incremental reasoning'; the GCF imposes additionality and 'paradigm shift' requirements (but does not clearly define either); and the NAMA Facility requires additionality and 'transformational change'. Box 6 provides some examples.

Box 6: Interpretations of Additionality

Global Environment Facility

The GEF has, since the end of its pilot phase in 1994, applied an 'incrementality' consideration to its funding decisions. The GEF is, in principle, intended to fund only the incremental or additional costs associated with transforming a project with national/local benefits into one with global environmental benefits, such as the reduction of GHG emissions: the cost of a GEF-eligible activity is compared with the activity it replaces or makes redundant, and the incremental cost difference is financed by the GEF, with the 'baseline cost' financed from other sources. Over time, however, spurred by inconsistent application of the approach by GEF agencies, as well as a gradual evolution of the GEF climate change focal area away from 'hard' investment towards 'softer' technical assistance, quantitative incremental cost analysis has given way to more qualitative 'incremental reasoning'.

[33] A useful summary of 5 such MDB definitions can be found in Table 2.1 of GEF Independent Evaluation Office (2020).

Green Climate Fund

The GCF Programming Manual refers to additionality in two separate contexts: as a measure of financial 'value-add' relative to the baseline, in order to justify the concessionality of requested GCF resources, and as an assessment of project-related greenhouse gas emissions relative to baseline emissions, in order to ensure that a project offers climate mitigation benefits. In neither case is a specific approach for assessing additionality prescribed, but for emissions estimation the GCF does accept "credible" third-party methodologies, such as those from the CDM, the JCM, or the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. The GCF also requires projects to demonstrate 'paradigm shift' potential, which is loosely defined as a project's ability to catalyse impact beyond one-off investment and, by implication, promote scaling-up or replication of the project's climate impacts. Paradigm shift is, in principle, distinct from additionality: a project can be additional without having much impact or, conversely, a high-impact project may not be additional. Nonetheless, both concepts share the underlying desire to 'do things differently' to achieve climate benefits.

Clean Development Mechanism

In 2004, the first version of the CDM Additionality Tool was published, which included several tests – regulatory, investment, barrier, and common practice – by which to assess the additionality of a proposed project. The Tool has evolved over the years (it currently exists as Version 7), as the CDM EB has responded to contradictory pressures – often very vocal pressures – to both simplify additionality requirements (to facilitate project development, particularly in the context of falling CER prices) and to tighten up additionality requirements (to ensure the CDM's environmental integrity). Thus, the Executive Board has introduced detailed guidance on the calculation of internal rates of return, the cost of debt and conducting benchmark analysis and has introduced default values for the expected return on equity per country and different project types – guidance that was subsequently converted into a formal methodological tool in 2015. In parallel, the EB has introduced a range of approaches – such as standardised baselines, positive lists, and simplified approaches for micro- and small-scale projects – that significantly relax additionality requirements for specific project types

Market mechanisms under the international climate policy regime are designed as a key enabler to help countries to achieve their NDCs while simultaneously supporting an increase of mitigation ambition over time. A key requirement for these mechanisms is environmental integrity, which applies to all approaches under Article 6. Additionality determination has been a highly contentious issue in the context of the Kyoto Mechanisms, especially under the CDM where countries selling carbon credits were not required to have emission targets. The PA, however, requires all countries to define their emission target in their NDCs. Determining additionality must be done in the context of host Parties' NDCs to work towards an increase ambition in mitigation, contributing to the long-term objectives of the PA. At first glance, this appears to offer some hope for simplifying and standardising additionality assessment by implying that any sale of non-additional emission reduction credits requires a country to „make up" for the sale by reducing emissions equivalent to the non-additional credits sold in order to meet its NDC. However, given the current environment, where many NDCs are not ambitious enough and generate "hot air" it becomes crucial to ensure additionality (Michaelowa et al. 2019b).

Unfortunately, determining additionality is not without its own challenges. As NDCs are nationally determined, there is limited guidance on the harmonisation of their features provided by the UNFCCC. For example, it is not obvious how the NDCs conditional and unconditional targets should be considered. Some NDCs have unclear targets or targets that are not denominated in greenhouse gas terms (for example, energy intensity targets), and many NDCs exclude specific sectors: Therefore, additionality always needs to be assessed also at the activity level with tools such as those described above. There is also need to resolve whether an NDC that is not ambitious can serve as a meaningful reference for additionality assessment.

Demonstrating additionality is also administratively burdensome and explicitly exclusionary: during the 'boom years' of the CDM, it was estimated that additionality testing accounted for half of the cost of elaborating a CDM project design document, for example. By contrast, one of the key differences between voluntary carbon market standards and the CDM is that the former typically has a more relaxed approach to additionality. As seen in the cases of the GEF and the CDM (Box 6), additionality is not a static consideration; rather, climate instruments must constantly navigate the competing pressures of environmental rigour versus practical accessibility. Unfortunately, the range and diversity of additionality approaches across climate finance sources have fragmented the climate finance landscape, creating 'barriers to entry' for prospective project developers, and have reduced the scope for coordination, combining, and linking of the different instruments in 'joined up' approaches.

As indicated above, the role of the host country in the CDM was rather limited to approving projects and authorising project participants, while additionality assessments were conducted by third-party auditors and the UNFCCC Secretariat as part of the CDM activity cycle. For Article 6 cooperation, host governments need to undertake a set of assessments to identify which activities should be eligible for exporting ITMOs (Michaelowa et al. 2019b). Host countries further need to analyse how activities relate to NDC targets given that some NDCs have targets that are not clear or not denominated in greenhouse gas metrics (for example, energy intensity targets). Many NDCs also exclude specific sectors; aligned with national development priorities. Due to the need to perform corresponding adjustments of the host country's reported emission balance, activities that do not fulfil these criteria will create a burden for the host country as the government will have to identify alternative mitigation options to achieve its NDC. In addition, activities included in the government budget and planning cycles to be through different funding strategies should not be taken into consideration for Article 6 (Michaelowa et al. 2021c).

The Article 6 rulebook, in particular the rules, modalities, and procedures (RMP) of the A6.4M, clarifies new principles and requirements for the demonstration and assessment of additionality. The RMPs differentiate between the approval of activities and the authorisation of ITMO transfers, whereby the host country has oversight for both and can design domestic standards that need to be met. As described in section 4.1.1 on the redefined role of host countries in approving activities and authorising ITMO transfers under Article 6, host countries may also have a relevant additional responsibility to ensure additionality and the credibility of baselines. This implies that the host country can use the approval process of activities to check how the foreseen approach towards determining additionality aligns with the NDC and LT-LEDS development and implementation processes in the context of the PA's long-term targets (Michaelowa et al. 2022). In addition, when communicating the approaches applied in line with the RMPs to the SB, the host country may mandate stringent approaches to A6.4 activities. As such, the host country can have control over the activities it wishes to promote and that host-country-specific national requirements for additionality to be adopted by project developers are met alongside

compliance with international rules (Ahonen et al. 2021). Notably, this may require that additional capacity building be made available to countries with special circumstances such as LDCs and SIDs in order to be able to take up such a role.

Current methodological approaches for additionality testing are built on decades of extensive efforts by the international expert community, most notably the tools developed under the CDM. However, a discrepancy still exists between the Article 6 decisions and the current CDM methodologies and principles. One approach for addressing this situation is by developing of specific 'Article 6 tools' (Michaelowa et al. 2022). Initiatives such as the International Initiative for Development of Article 6 Methodology Tools (II-AMT)[34] attempt to accelerate these methodological revisions in order to develop tools tailored to Article 6 that can replace the currently used CDM additionality tool. An important new approach proposed by the II-AMT assesses the activity's target additionality, meaning that an Article 6 activity must go beyond the host-country's unconditional NDC, such that if a proposed activity is required to reach the host country's unconditional NDC it is considered to not be target additional (II-AMT 2022). Increasingly, crediting standards and initiatives in the voluntary carbon market are also committing to align their processes with the PA to ensure the integrity of credits generated.

SUMMARY

This chapter has been able to provide an overview of the differences between carbon finance and climate finance. As such blending of the two forms of finance must be synchronised and linked in a way that leads to reinforcement of strengths and avoids time lags, inconsistencies, and duplications.

In the PA context, host countries are expected to play a more central role to ensure their own NDC achievement, and as such, host countries will need a clear and strong mandate addressing substantive issues beyond mere procedural issues, particularly while voluntarily cooperating under Article 6. In addition, other market participants and finance providers will increasingly play a role in providing financing and other technical support in financing energy access. There is also ongoing progress to transform existing CDM market-based methodologies to align them with the rules and requirements of Article 6 of the Paris Agreement and hasten its operationalisation. Capacity building may thus be necessary for these different actors to understand the key challenges and opportunities arising from the blending of carbon and climate finance, such as ensuring environmental integrity, understanding the impacts of corresponding adjustments and additionality.

[34] The Swedish Energy Agency, the Ministry of Environment of Japan, and the African Development Bank supported the concept phase of the International Initiative for development of Article 6 Methodology Tools launched in January 2022

5. CONCLUSIONS

The CDM mobilised a huge pipeline of voluntary mitigation activities in developing countries that had no formal obligation to reduce GHG emissions. Yet, the mechanism suffered from regulatory shortcomings, policy uncertainty regarding its role in the future architecture of the climate regime, and perhaps most importantly, from a lack of demand due to low global emission reduction targets. However, the new climate regime sets a firm foundation for higher mitigation ambition and long-term policy certainty through NDCs, which are expected to regularly increase their targets beyond the previous version. Even so, analysis of the latest NDC updates shows that we are still worlds away from the level of mitigation ambition which the latest IPCC assessment reports urge us to reach.

Both carbon and climate finance are crucial instruments to achieve such objectives. Yet, as past experiences have shown, relevant rules need to be continuously reformed to be able to serve as meaningful drivers of innovation and increased mitigation ambition. Unless countries develop robust strategies that involve all key stakeholders and allow for institutional learning, the significant potential of linking markets and finance to achieve cost-effective mitigation while promoting sustainable energy access in support of the long-term target of the Paris Agreement cannot be harnessed. Hence, cooperation between government representatives, climate finance providers, carbon buyers and market participants is required to unlock this potential. The choice how to use carbon markets, for instance, must be carefully assessed in light of NDCs and sectoral policies e.g., driving mitigation in inaccessible abatement options/technologies to circumvent barriers and, in some cases, using other means of implementation in support of NDCs (e.g., climate finance).

This study has also discussed the importance of consistent and transparent monitoring, reporting and verification of mitigation results for results-based finance or market-based Incentivisation of energy access. We find several challenges particular to off-grid technologies – such as consistent and transparent monitoring reporting and verification of mitigation results in descentralised and sometimes geographically remote areas, as well as challenges common to all carbon market activities including additionality determination. We have also observed significant opportunities in achieving synergies between carbon finance and climate finance thanks to the emergence of MRV tools and frameworks in the international carbon markets, aided by new possibilities emerging from digitalisation.

It is vital to acknowledge the central role of capacity building involving both host governments and market participants and their need to navigate the new, complex participation requirements of the Paris Agreement. This requires continuous learning based on the evolution of the PA Rulebook that provides the context for effectively linking carbon and climate finance instruments to support the diffusion of energy access technologies. Observations from past experiences, including in the CDM, show that it can take years to build sufficient capacities. A crucial approach is to integrate such assistance with the development of practical activities that are consistently monitored, reported, verified, and accounted for as per the new requirements, particularly as countries are only beginning to establish their institutional frameworks for participating in climate finance and carbon market instruments. In addition, climate finance vehicles need to provide clear, transparent, and accessible processes and financial instruments to support the financing of off-grid technologies that support the goal to provide universal energy access. Some countries are more prepared than others to absorb climate finance and utilise the international carbon market mechanisms effectively. Directing climate and carbon finance

toward sustainable energy access benefits strongly from climate policies and institutional frameworks that understand the strength and weakness of both instruments and work towards linkages that leads to more effective implementation. The recent finalisation of the Paris Agreement rulebook and substantial progress in relevant technologies align well to enable countries to identify such linkages that are most appropriate in their specific circumstances. This carries the promise of not only addressing the climate crisis more effectively, but also to support rural communities to transform their livelihoods for a better, more resilient future.

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