Clean Cooking for Climate Action

Roadmap for National Clean Cooking Programs to Achieve Emission Reduction Targets

CLEAN COOKING ALLIANCE

BERKELEY AIR MONITORING GROUP

CLIMATE & CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

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Executive Summary

Greenhouse gas emissions from burning non-renewable wood fuels for cooking amount to 500 million tons of carbon dioxide-equivalent (CO_2e) per year, representing approximately **2% of global emissions** and a much larger fraction of total national CO_2e emissions in many low- and middle-income countries (LMICs). Clean cooking action is, therefore, critical to averting severe climate change.

Clean cooking interventions have been shown to be among the most cost-effective approaches to reducing emissions, while also offering a multitude of health, gender, and livelihoods co-benefits. Such interventions can also improve air quality, protect forests and biodiversity, and contribute to progress toward the **Sustainable Development Goals** (SDGs), a set of 17 global goals adopted by the United Nations in 2015.

The benefits of clean cooking transitions have been widely recognized. In the lead-up to the 2021 United Nations Climate Change Conference, more commonly referred to as COP26, **67 nations included the cooking sector in their nationally determined contributions** (NDCs), either with distinct aims and targets or as part of broader renewable energy, energy efficiency, and/or forestry goals. Though national commitments to cooking energy transitions as articulated in a nation's NDC can appear monolithic, the pathway to reaching these targets is composed of many component programs involving a range of technologies, fuels, and public and private actors.

A new dimension of each nation's clean cooking transition is the coordination of activities undertaken under **Article 6 of the Paris Agreement**. Governments are now in the position to decide which clean cooking transitions they can manage directly for inclusion toward their NDC targets, and which may be more appropriate to fund through bilateral or multilateral crediting agreements.

While clean cooking programs must recognize and respond to on-the-ground realities, some **best practices** can be generalized. For example, programs that complement existing government plans and priorities and align with a country's broader climate and/or energy goals can start and scale more quickly using shared infrastructure. It is also best practice to set specific, measurable, and feasible program targets with a timeline for program milestones. Referencing International Organization for Standardization (ISO) cookstove standards, adapted to each nation's particular priorities, also ensures transparency and increases the likelihood of international support. Experience supports the use by governments of policy, organizational, and market development strategies to create and sustain a thriving cookstove sector.

Measurement, reporting, and verification (MRV) is a key component of any emissions reduction program. If emissions reductions are not properly assessed and documented, their value as a source of climate funding may not be fully realized. MRV systems for clean cooking interventions require different approaches than for other sectors, as emissions result from many distributed point sources in homes, where patterns of fuel and stove use can vary substantially across regions, user characteristics, and time. MRV may be complemented by the use of **key performance indicators** (KPIs), particularly in the short term while capacity is built. The companion document *Introductory Framework for Measurement, Reporting, and Verification for Clean Cooking Energy Initiatives* further discusses important MRV characteristics in more detail.

Countries seeking a clean cooking transition now have available a broad range of tools and support mechanisms, including finance, to support implementation. This includes traditional donor finance, **results-based finance, climate finance**, and the recent market mechanisms of Article 6 of the Paris Agreement for bilateral and multilateral collaborative activities. Each of these mechanisms may provide new opportunities for funding clean cooking transitions.

In 2021, the Clean Cooking Alliance (CCA) convened the **Clean Cooking & Climate Consortium** (4C) to support LMIC governments to make specific commitments to reduce emissions from cooking in their NDCs and/or associated implementation plans. 4C provides technical support for countries' clean cooking implementation plans as well as developing an MRV framework for climate goals achieved through clean cooking.

This document provides an overview of the benefits of and new opportunities for clean cooking transitions, to assist governments and other stakeholders to maximize uptake. A companion document entitled, *Introductory Framework for Measurement, Reporting, and Verification for Clean Cooking Energy Initiatives* provides a more specific discussion on MRV.

Acronyms

4C	Clean Cooking & Climate Consortium
A6	Article 6 of The Paris Agreement
BAU	Business as Usual
BC	Black Carbon
CCA	Clean Cooking Alliance
CCAC	Climate and Clean Air Coalition
CDM	Clean Development Mechanism
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
COP	Conference of the Parties
EC	Electric Cooking
EEP Africa	Energy and Environment Partnership Trust Fund
EnDev	Energising Development Partnership
GCF	Green Climate Fund
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HAP	Household Air Pollution
ICS	Improved Cookstoves
IRENA	International Renewable Energy Agency
ISO	International Organization for Standardization
ITMOs	Internationally Transferred Mitigation Outcomes
KPIs	Key Performance Indicators
LPG	Liquefied Petroleum Gas
LMICs	Low- and Middle-Income Countries
MRV	Measurement, Reporting, and Verification
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
NDF	Nordic Development Fund
OECD DAC	Organisation for Economic Co-operation and Development's Development Assistance Committee
RBF	Results-Based Financing
SNV	Netherlands Development Organisation
SDG	Sustainable Development Goal
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
US EPA	United States Environmental Protection Agency

Document Purpose

This document helps governments and other stakeholders initiate, expand, or enhance clean cooking initiatives and support their commitments under the Paris Agreement. This document aims to:

1. Highlight the many and multifaceted positive impacts of clean cooking.
2. Identify and showcase a selection of specific and indirect policy commitments in the cooking and household energy sector that governments have made as part of their climate ambitions under the Paris Agreement, through their nationally determined contributions (NDCs).
3. Provide an overview of good practices in program design, and reference best practice examples and design principles.
4. Introduce a toolkit for developing national strategic plans for clean cooking transition that can maximize the potential for international funding.
5. Identify and briefly describe relevant resources.

Intended Audience

This document is intended to benefit low- and middle-income (LMIC) country government personnel and their public and private sector partners engaged in developing and implementing cooking energy transition programs with the goal of reducing harmful climate-forcing emissions. Typically, such professionals are housed within ministries or agencies concerned with energy and/or environment, but colleagues from departments dealing with health, women, small business, social development and related fields may also find this content relevant.

About the Authors

This report was jointly developed by the Clean Cooking Alliance (CCA) and Berkeley Air Monitoring Group (Berkeley Air) with contributions from Independent Climate Consultant Matt Spannagle. CCA is the convener of the Clean Cooking & Climate Consortium (4C), whose mandate is to provide practical guidance to countries intending to include clean cooking programs in their NDCs. Berkeley Air is a member of 4C, which is also supported by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, the Climate and Clean Air Coalition (CCAC), the U.S. Environmental Protection Agency (US EPA), and Stockholm Environmental Institute. The consortium aims to operate in harmony with actors in the broader environment supporting the implementation of NDCs, including the NDC Partnership, United Nations Development Programme (UNDP), the Gold Standard Foundation, the Africa NDC Hub, Energising Development (EnDev), managed by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and the Netherlands Enterprise Agency (RVO), and the International Renewable Energy Agency (IRENA).

Introduction

Clean cooking action is critical to limit global temperature rise to 1.5˚C and avert severe climate change. Clean cooking increases the energy efficiency of cooking by reducing emissions of carbon dioxide (CO_2), the primary greenhouse gas (GHG) emitted through human activities. GHG from burning non-renewable wood fuels for cooking amount to up to a gigaton of carbon dioxide equivalent (CO_2e) per year, representing approximately 2% of global emissions.[1]

The burning of wood fuels makes up an even larger fraction of the total CO_2e emitted in many countries. In Uganda, Rwanda, and Nepal, for example, such activity accounts for more than 50% of GHG emissions. This makes increasing the use of clean cooking solutions critical to achieving climate goals. Successful deployment and utilization of 100 million improved cookstoves (ICS), assuming a mix of more efficient biomass technologies and clean fuels, could reduce annual emissions from wood fuels alone by between 11 and 17%.[2]Further reductions could be achieved with the deployment of more clean stoves and transitions to electric cooking where power is generated renewably.

Transitions to clean cooking solutions generate a host of co-benefits for families, communities, and nations, contributing to progress toward achieving the United Nations Sustainable Development Goals (SDGs). The co-benefits of clean cooking initiatives include reducing air pollution, resulting in lowered health risks (SDG3), reducing time-consuming unpaid care work of women and girls (SDG5), improving access to modern cooking services (SDG7), and lessening pressures on natural resources, which otherwise lead to forest and land degradation (SDG15).

Over the past two decades, many clean cooking initiatives in low- and middle-income countries (LMICs) have been organized by non-governmental organizations or driven entirely by the private sector. Recent examples have demonstrated, however, that when national governments engage in this sector, rapid progress can be made toward climate targets and SDGs.[3, 4, 5] Prioritizing clean cooking can provide tremendous value to governments, supporting a healthier climate and improving air quality, while contributing to a myriad of development co-benefits. With thoughtful planning, national government engagement can radically transform the clean cooking landscape. The Paris Agreement provides an important opportunity to simultaneously improve clean cooking access and mitigate climate impacts.

The Paris Agreement

The landmark Paris Agreement was signed in 2015, with an overall goal (Article 2.1(a)) of: *Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.*

Clean Cooking Impacts

Climate and Environmental Impacts

Clean cooking solutions mitigate CO_2e emissions by increasing the energy efficiency of cooking and burning fuels more cleanly, making cooking less carbon intensive. High-efficiency cookstoves have been shown to reduce fuel use by 30-60%.[6, 7, 8, 9]

Reducing the amount of wood or other biomass fuels burned for cooking or other household energy needs, or increasing the cleanliness of biomass combustion, also abates short-lived climate pollutants such as black carbon (BC), which has a short-term climate impact up to 1,500 times stronger than CO_2. An estimated 44% of anthropogenic BC emissions are attributed to household fuel combustion.[10] BC prevents cloud formation and alters regional weather patterns and rainfall. It remains in the atmosphere for up to two weeks before returning to Earth through precipitation and deposition, creating immediate impacts. Deposits of BC have particularly significant impacts in snowy regions, such as the Himalayas, Andes, and the Arctic, because they darken the surface of snow and ice, reducing their reflectivity (albedo) and accelerating surface warming.

Clean cooking also reduces impacts on forests and the natural environment. Firewood and charcoal used for cooking and heating are estimated to make up 55% of global wood harvest.[11] While most wood fuel harvesting does not lead to large-scale deforestation, removal of branches and twigs for cooking fires degrades forest quality.[12] Charcoal production can have more dramatic impacts, as whole trees are often cleared, and it typically requires approximately five kilograms of wood to make one kilogram of charcoal.[13] Between 27 and 34% of wood fuel harvested globally for all uses is estimated to be unsustainable. By introducing more efficient biomass-burning cookstoves or shifting to clean fuels, clean cooking initiatives abate forest degradation by reducing wood fuel demand and corresponding pressure on landscapes.

Air Pollution and Health

Many climate pollutants are either health-damaging or co-emitted with health-damaging pollutants. The resulting household air pollution (HAP) from these emissions is associated with increased risk of adverse health outcomes, including cardiopulmonary disease, cancer, and pneumonia.[14] The global burden of disease due to HAP is estimated to cause as many as 4 million premature deaths.[15, 16] Such emissions also account for 20% of global ambient air pollution, and substantially more in many regions.[17] Replacing polluting open fires and inefficient stoves with cleaner stoves and fuels reduces emissions and personal exposure, lowering the burden of disease associated with HAP, both directly and through contributions of household emissions to ambient air pollution.

Women and Girls

Throughout the developing world, women and girls are most often primarily responsible for daily food preparation, cooking, and clean-up for their households. In many places, they are also responsible for fuel collection and preparation. In households that depend on biomass fuels for cooking, these activities can require two to eight hours of effort per day, or about five hours on average.[18] The time devoted to these activities detracts from productive, educational and leisure opportunities for women and girls. The introduction of clean cooking solutions can reduce negative health impacts and economic burdens on women and girls. For example, a study conducted in rural Kenya found that daily cooking time was reduced by about an hour after the introduction of an ICS.[19] Participants reported improved well-being, from reduced physical strain associated with collecting wood and tending wood fires to a heightened sense of pride in their cooking and an enhanced sense of flexibility and freedom. Saved time was reinvested in farming, either on their own plot or for wages on a neighboring farm, used to keep the family on schedule, or allocated to the women's own rest and leisure.

Livelihoods

For both men and women, time is also linked to livelihoods. By reducing the time households must spend collecting and cooking using traditional fuels and stoves, clean cooking opens opportunities for increased economic engagement and income-generating activities. These time savings accrue to both men and women, in rural and urban settings, and are greatest when households employ the cleanest and most

advanced technologies and fuels, such as electricity, liquefied petroleum gas (LPG), and biogas.[20] Time savings were estimated at 34 minutes per day (23 minutes for rural populations and 41 minutes for urban populations). Converted into monetized benefits, using a cost-benefit approach[21] ranging from US$0.06/h to US$0.30/h, these time savings result in annual savings per household of approximately US$12 to US$62. In circumstances where opportunities for economic engagement exist, these savings can partially or entirely offset the cost of the clean cooking solution.

Including Clean Cooking in Climate Ambition

Under the Paris Agreement, 196 countries[22] committed to act to reduce GHG emissions to avoid the worst impacts of climate change. These actions are expressed as NDCs, in which countries commit to "unconditional" actions undertaken using their own resources, and "conditional" actions that require international support to deliver more ambitious emissions reductions. Figure 1 below is from Ethiopia's July 2021 updated NDC submission[23] (Figure 3, page 17), and illustrates business as usual, unconditional, and conditional emissions reductions.

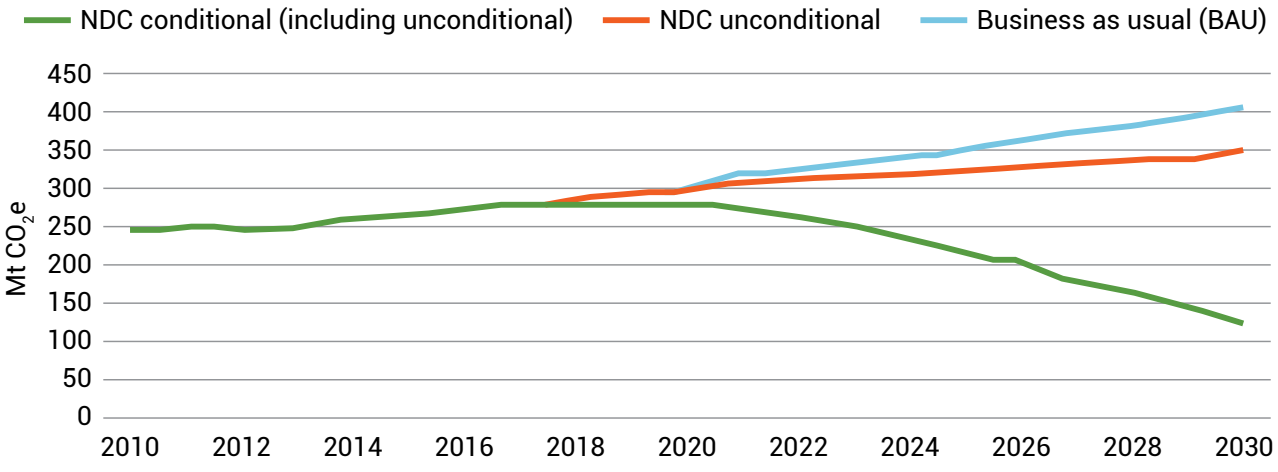
For many LMICs, a substantial share of their GHG emissions is linked to unsustainable use of natural resources, deforestation, and forest degradation directly associated with household energy and cooking. The global imperative to reduce climate-forcing emissions and avoid catastrophic warming can serve as a catalyst for LMICs to focus on cooking energy transitions. Indeed, many governments (see below) have recognized the importance of the sector and are seeking support in implementation and funding by including goals in their NDCs that reference either clean cooking or related priorities.

In the lead-up to COP26, 67 nations[24] included the cooking sector in their NDCs, either with distinct aims and targets or as part of broader renewable energy, energy efficiency, and/or forestry goals (Figure 2).

Countries Explicitly Including Household Energy in Their Nationally Determined Contributions

As countries have updated their NDCs, more have included targets related to adopting cleaner fuels for cooking and heating, among them LPG, electricity, and hydrogen.[25] This is not surprising, as cooking energy interventions are among the most cost-effective approaches to reducing emissions,[26] while also offering health, gender, and livelihoods co-benefits. Further, SDG7[27] mandates universal access to clean cooking solutions to meet human development needs, such that energy access goals are now aligned with the ambitions of the Paris Agreement.

These targeted commitments by governments to the clean cooking sector represent a substantial increase over national government clean cooking programs currently in force. The confluence of the SDG7 clean cooking mandate with the need for ambitious climate action provides an exciting opportunity for nations to initiate savvy programs that build on lessons learned and leverage recent innovations in technology and finance.



Note: NDC conditional represents the combined impact of unconditional and conditional elements

Figure 1: Ethiopia's BAU, unconditional and conditional emission pathways

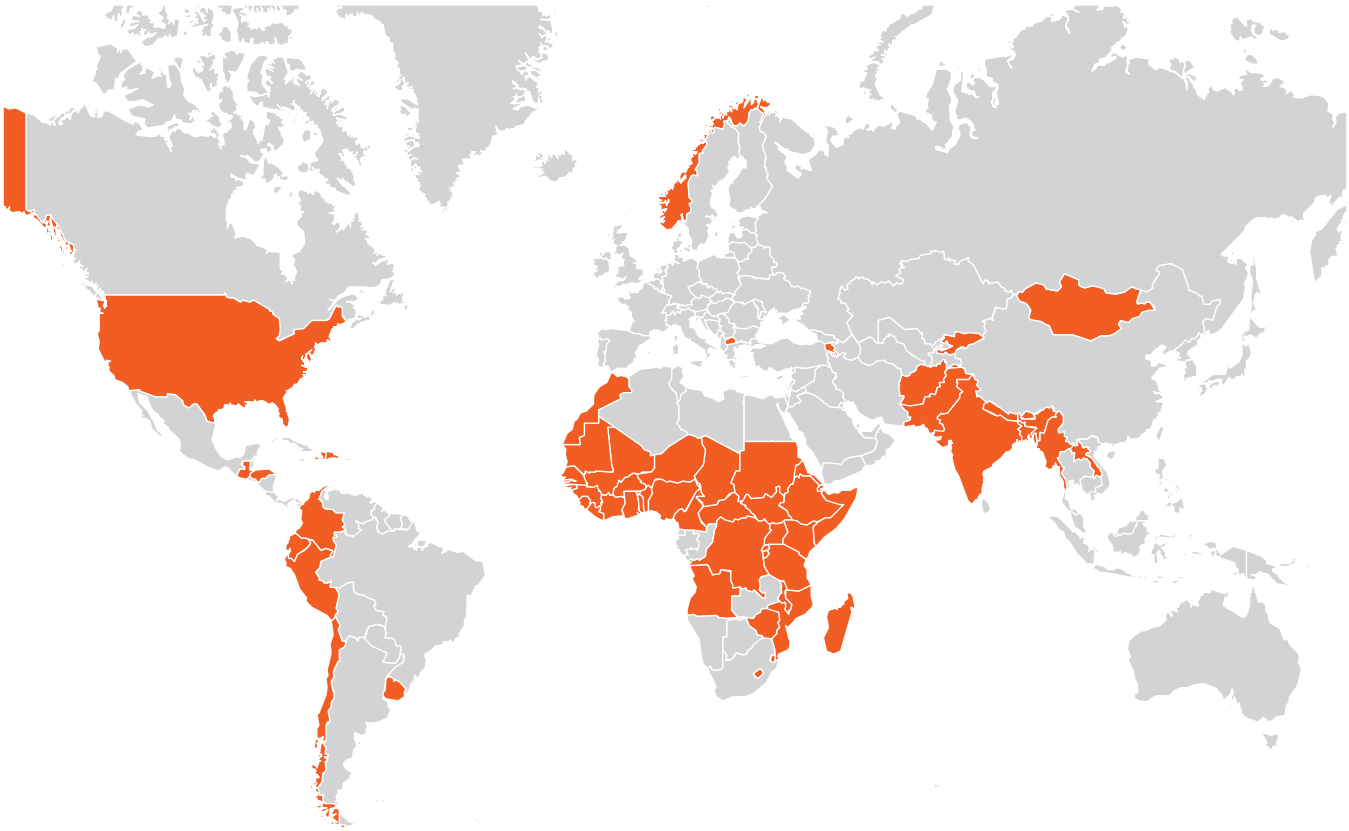


Figure 2: Countries including the cooking sector in their NDCs directly or through sector-adjacent goals.

Verbatim excerpts from the NDCs submitted by governments highlighting ambitious clean cooking targets are showcased below.

Nepal: "Nepal's long-term low greenhouse gas (GHG) development strategy, to be completed in 2021, aims to reach net-zero GHG emission by 2050. Nepal's 2019 National Climate Policy calls for the production and use of renewable energy, including that of hydroelectricity and energy efficient technologies.

Nepal's enhanced NDC targets in the cooking sector are as follows:

1. use primarily electric cooking (EC) in 25% of households by 2030,
2. install 500,000 improved cookstoves in rural areas by 2025, and
3. install 200,000 household biogas plants and 500 large scale biogas plants by 2025.

Combined, these 3 targets will reduce cooking sector emissions by 11% and 23% by 2025 and 2030, respectively. The NDC strives to increase clean energy generation by over 10-fold, from 1,400MW to 15,000MW, by 2030. Finally, the NDC highlights strengthening transmission and distribution infrastructure to increase the quality, reliability and affordability of electricity access and bolster ECs scale-up. Nepal's current (15th) 5-year development plan targets 20% of households using electric cooking by 2024."

Belize: "Achieve a reduction of fuelwood consumption by 27%-66% through replacement of traditional fuels with cleaner cooking options."

Ghana: "2,617 tonnes black carbon avoided in 2030; …charcoal production: 31% reduction in black carbon emissions from charcoal production."

Guinea: "Guinea aims between now and 2030 to reduce final demand for firewood and charcoal by 50% per capita (in urban and rural areas) as compared to 2011, particularly through: organization of local industrial supply chains to enable the introduction of at least 1 million improved stoves; establishment of 5000 wood carbonization units giving a

better charcoal yield; replacement with butane (40ktoe); extension of pilot initiatives to disseminate improved smokehouses and stabilized earth blocks."

Rwanda: "Efficient cook stoves—Dissemination of modern efficient cook stoves to 80% of the rural population and 50% of the urban population by 2030, achieving a more sustainable balance between supply and demand of biomass, and reducing firewood and fossil energy consumption for cooking."

Countries Indirectly Including Household Energy in Their Nationally Determined Contributions

Multiple climate action areas not specific to cookstove programs are nonetheless related and can provide a mandate to build clean cooking into implementation plans. Examples of relevant country commitments that could encompass cooking energy transitions are presented below, with verbatim excerpts from government NDC submissions.

Energy Efficiency

Niue: "Implement energy efficiency through supply side loss reduction, develop energy auditing, equipment standards and labelling, regulatory reform and fuel substitution for transport and cooking."

Uruguay: "Mandatory labeling of energy efficiency in household devices, other household appliances, gas-burning appliances, and wood-burning appliances by 2025."

Air Pollution

Chile: "Reduce total black carbon emissions by at least 25% by 2030, with respect to 2016 levels."

Ghana: "Reduction in indoor pollution resulting from wood fuel usage. Reduction in smoke related respiratory and eye diseases."

Forestry/Biodiversity

The Gambia: "Reduce firewood and charcoal consumption and the overuse of forest resources."

Haiti: "Reduce wood fuel consumption by 32% by 2030."

Uganda: "Reversing the current deforestation trend to increase forest cover to 21% in 2030 is highly ambitious considering that 89.5% of the country's energy needs are currently met by charcoal and firewood."

Cooking Energy Transition Scenarios

Though national commitments to cooking energy transitions appear monolithic as articulated in NDCs, the pathway to reaching these targets involves a range of technologies, fuels, and public and private actors. Urban and rural populations are likely to have quite different pathways from their baseline situation to a fully sustainable cooking energy status. Population sub-groups will transition at different rates and along varying pathways, depending on many factors, such as access to and affordability of cleaner and more efficient cooking technologies and fuels, infrastructure development, public policies, private sector carbon programs, charitable and development activities, and global externalities.

LMICs face the challenge of constructing relevant transition scenarios that incorporate all these factors and leads them to meet clean cooking targets. Some of the best clean cooking solutions for long-term climate sustainability are electricity from renewable sources, particularly in urban areas, together with bioethanol, biogas, and renewable biomass burned cleanly. In the near term, if LPG is affordable, it may have a positive impact on the climate, given its high thermal and combustion efficiencies. [28, 29, 30, 31] When fully adopted to entirely displace more polluting fuels, LPG is also one of the most effective transitional interventions to reduce exposure to HAP.[32, 33]

Considering Paris Article 6 in Cooking Transition Strategies

An important dimension of each nation's cooking energy transition strategy is the coordination of activities undertaken collaboratively under Article 6 of the Paris Agreement (A6), the Agreement's rulebook governing bilateral and multilateral initiatives, including carbon markets.[34]

The Article provides for a variety of mechanisms for carbon markets: Article 6.2 (A6.2) covers cooperative approaches, such as agreements between high-income and LMIC countries; and Article 6.4 (A6.4) outlines a centralized mitigation mechanism, supervised by a UN body, that facilitates private sector investment. Other sections of the document provide guidance on non-market approaches to cooperation.

The Paris Agreement gives governments the authority and responsibility to authorize activities taking place under A6. Where emissions reductions are achieved, a government can generate units, known as internationally transferred

mitigation outcomes (ITMOs), that may be sold to bilateral partners (A6.2), generally as part of broader cooperation, or allocated to other organizations (A6.4), particularly private sector companies, for their own compliance purposes, or for their sale to buyers to generate revenue to invest in further mitigation activities.

Each ITMO authorized represents one tonne of CO_2e emission reduction transferred out of the national account, and one tonne of CO_2e must be added to the national inventory for reporting to the United Nations Framework Convention on Climate Change (UNFCCC) in what is known as a corresponding adjustment. The national inventory ultimately determines whether a country meets its NDC targets. If a government issues too many ITMOs, it risks missing its NDC targets.

Governments must therefore decide which cooking energy transitions they can manage directly for inclusion toward their NDC targets (typically those in the "unconditional" part of their NDC), and which might instead be more effectively funded through bilateral agreements or private sector investments, (typically those in the "conditional" part of their NDC). LMIC governments may need to enhance the government capacity to support registration, authorization, MRV, and credit transfer processes to enable the full implementation of A6.[35]

The use of A6, particularly A6.4, entails payments directly linked to the number of tonnes of CO_2e emissions reductions generated. This financial incentive means data monitoring, quantification approaches, and verification take on greater importance. This is usually referred to as the Measurement, Reporting, and Verification System (or MRV). Further discussion of the process can be found in the companion document to this report: *Introductory Framework for Measurement, Reporting, and Verification: Clean Cooking MRV in the Paris Context*.

Designing Household Energy Interventions

Components and Best Practices for Clean Cooking Programs

Cooking practices are deeply influenced by geography, culture, religion, and personal preferences. No two national clean cooking programs will be identical, and even within national programs, a range of technologies, fuels, and approaches may be appropriate, especially to address the varied energy needs that can occur within a single kitchen (see Technology Adoption and Stacking section below). Clean cooking programs must recognize and respond to available energy mix, infrastructure, geography and other on-the-ground realities.

Nonetheless, certain general best practice guidelines hold true in a wide range of contexts:

- Designing programs that complement existing government plans and priorities and align with broader climate and/or energy goals can start and scale more quickly using shared infrastructure.
- Setting specific measurable targets within each nation's specific context makes programs more feasible (see box below).
- Setting timelines for program milestones and envisioning an end date for program completion maintains focus and momentum.
- Referencing International Organization for Standardization (ISO) cookstove standards (see next section), adapted to each nation's particular priorities, ensures transparency and increases the likelihood of international support.

ISO Standards for Cooking Technologies

Standards for evaluating cooking technologies help ensure devices and fuels perform at levels required to meet climate goals. They also provide consumers with confidence in the quality of the product they are purchasing. The ISO recently published laboratory and field-based standards, which can be used in this application.[36, 37, 38] The standards include guidance on testing stoves for fuel efficiency, emissions, durability, and safety. Most relevant for climate implications are the standards for fuel efficiency, which can be used to benchmark baseline performance as well as potential fuel savings for more advanced cooking technologies and fuels. The ISO emissions guidance focuses on health-damaging pollutants (particulate matter and carbon monoxide). While this is not directly applicable for climate goals, it should still be considered, because health co-benefits are clearly

Elements of Robust Clean Cooking Implementation Targets

Quantity: Specify the target for the scale of technologies and fuels (e.g., 100,000 households).

Quality: Specify ISO Voluntary Performance Targets for efficiency and/or emission (e.g., ISO Tier 3 or higher for efficiency).

Technology: Specify appropriate technology types (e.g., improved biomass stoves, charcoal stoves, electric induction stoves, or the converse "alternatives to wood-energy and charcoal").

Fuel type: Specify appropriate fuels (e.g., biomass, biogas, bio-ethanol, electricity).

Area: Define relevant geographic areas (rural or urban, specific provinces according to biomass use or electrification rates or poverty levels).

References: Specify standards, testing, and labeling.

desirable. Similarly, guidance for evaluating safety and durability can be used to help improve the overall quality of cooking technologies, increasing the likelihood of expanding markets, increasing uptake, and sustaining product use—factors which are also fundamental to achieving reductions in climate emissions.

ISO standards provide a common tool for countries to adopt and implement. Efforts are ongoing to help countries with this process, in support of their household energy programs. Importantly, these efforts require testing capacity with the requisite skills and equipment to conduct the testing. It is not critical for every country to have a laboratory with the highest level of testing capacity as there are already several regional testing centers that can provide these services when needed. Furthermore, the most fundamental capability relevant to climate is testing for fuel efficiency, which requires relatively simple instrumentation and less technical expertise.

User Demand

Robust demand for and sustained use of clean cooking solutions is the intended outcome of awareness-building, accessibility, affordability, availability, and design appropriateness. To achieve a high level of demand for solutions on the market, consumers must be well advised of the value and benefits they provide and be able to afford them or be supported with financing mechanisms to increase their ability to pay. The solutions must be delivered in a way that is relatively easily accessed, available when consumers demand them, and they must be designed appropriately for a broad range of contexts.

Understanding user preferences, behaviors, and constraints is key to achieving these objectives. The CCA is launching a new action research initiative called the User Insights Lab to develop and disseminate new data, tools, and capabilities that enable enterprises, policymakers, and funders to develop increasingly user-centered products and programs.

Although it has not yet been widely used in the clean cooking sector, behavior change communications, also sometimes referred to as social marketing, has been shown to effectively support diffusion of cleaner cooking technologies and fuels.[39] In their review of behavior change communications approaches applied to the cooking sector, Goodwin et al. provide examples of how the approaches could be applied to national programs.[40]

The sector's understanding of critical success factors for these approaches is still evolving, but Goodwin observes that "shaping knowledge, reward and threat, social support, and comparison are the strategies that have been used most often in cooking energy transition programs, usually in combination." More recently, the CCA piloted multiple behavior change campaigns in three countries: Nigeria, Kenya, and Bangladesh. A quasi-experimental evaluation found evidence of effectiveness in achieving intended outcomes, with the behavior change communications boosting awareness in some cases and increasing intention to purchase an LPG stove in others.[41] The study's qualitative findings suggest that interpersonal communications were effective both in helping potential purchasers overcome safety concerns and in empowering women who already owned LPG to use it more often.

A particularly innovative behavior change communications activity included in the CCA pilot was the Kenyan television program, *Shamba Chef*. Created by the Mediae Company, this home makeover television and radio show was designed to promote modern, cleaner, safer cooking methods and improved nutrition in Kenya. It reached approximately 5 million homes in late 2017 and was accompanied by a mobile phone platform called iChef. Exposure to the program was associated with an awareness of improved biomass stoves and aspirations to own an improved biomass stove.[42]

Even when consumer interest is strong, however, the often-high upfront costs of acquiring clean cooking technology, and the ongoing cost of cleaner fuel, can be barriers to access. For this reason, consumer finance is an important program consideration for most bottom-of-the-pyramid consumers. Clean cooking solutions often fall through the gaps of traditional commercial finance, either because the loan size is too small, or traditional interest rates are too high. Some common consumer finance options for clean cooking include installment payment plans, employer payroll deductions (for larger employers who can purchase bulk orders for employees to pay back over time), community savings groups (micro-savings groups that pool savings for members to finance acquisitions), microfinance institutions, mobile payments and bank apps that provide pre-approved loans to customers for clean cooking products,[43] and pay-as-you-go business models.

Technology Adoption and Stacking

While technology and fuel performance and user demand are critical to successful clean cooking and climate programs,

sustained user adoption is an equally important factor in ensuring impact. Households rarely transition all activity to a new stove immediately.[44] It is common instead for families to use more than one stove concurrently, a practice known in the sector as "stacking." From the climate perspective, any reduction in polluting emissions is a win, yet stacking can significantly reduce both the cost-effectiveness and the co-benefits of national programs. In particular, expected decreases in health risks may not be realized, as the relationship between emissions reductions and health benefits is not linear, meaning even a small amount of biomass use can significantly diminish the health benefits of adopting clean fuels.[45, 46]

The rationale for stacking varies across contexts, but several common factors have been observed by researchers. The most universal driver of stacking is improving the match between the energy need—cooking, water heating, or space heating, for example—and the technology's capabilities.[47, 48, 49, 50, 51] Even in very modest kitchens, it is not unusual to see a range of "appliances" meeting varied household needs. For example, this could include two sets of three stones to support cooking in two pots simultaneously, fire pits designed for roasting tubers in the fire embers, or large outdoor fires configured to heat quantities of water. In more affluent homes, specialized appliances may be used to complete specific tasks efficiently, much as they are in the Global North: electric cookers to make rice or boil water; solar stoves or retained heat cookers to simmer legumes or stews; and gas stoves to reheat leftovers or takeaways. The fit between household needs and technologies promoted through national programs can be improved by engaging target populations early and often in program design, through such approaches as user-centered design.[52]

Households also stack energy technologies and fuels when the cost of clean fuels is out of reach, or when they are not reliably available. Both factors can lead households to supplement with their baseline stoves or use them as back-up.[53, 54, 55, 56] Lack of access to required maintenance or repair services may also play a role in stove stacking.[57] Finally, safety concerns, particularly regarding LPG, can also lead to stacking. In some cases, only certain members of the household feel empowered or safe operating the clean fuel technology, while others continue to use baseline cooking options.[58, 59]

Given the prevalence of stacking, program implementers are encouraged to acknowledge, research, and incorporate the practice into their planning and development of clean cooking initiatives. Shankar et al. offer seven guidelines for clean cooking system design, many of which are echoed in other analyses and publications:

1. Minimize exposures to hazardous pollutants and other threats to physical safety.
2. Minimize capital and recurrent costs of total household energy needs.
3. Mitigate potential interruptions to affordability and physical access to intervention fuels.
4. Understand local conditions and needs, promoting local participation in program design.
5. Support multiple appliances that respond to specific, locally relevant household energy needs and enable the cleanest possible "stack."
6. Understand the customer experience over time (i.e., customer journey).
7. Continually monitor progress and implement improvements.

By incorporating the realities of stacking from the outset, clean cooking programs are less likely to be derailed by unrealistic targets or milestones based on exclusive adoption of cleaner technologies and fuels.

Measurement, Reporting, and Verification

MRV is a key component of any emissions reduction program, whether it is designed to contribute to an NDC target or create tradable assets under the A6 framework. Particularly in the latter context, MRV is the engine that generates value. If emissions reductions are not properly estimated and documented, their value as a source of climate funding may not be fully realized.

MRV systems must be aligned and consistent with national inventory reporting of the host country to ensure no divergence between project-level reporting (and potential credit exports via ITMOs) and national tracking toward the NDC. Whatever strategy is developed for implementation, it is important to ensure sufficient resources and capacity for MRV such that the actions undertaken can properly reflect the emissions reductions achieved.

Due to the importance of MRV for demonstrating progress and securing financial resources, a companion document: *Introductory Framework for Measurement, Reporting, and*

Verification: Clean Cooking MRV in the Paris Context should be referred to for background and detail on MRV approaches and requirements.

Setting up an MRV system for household energy transitions can require substantial effort depending on the experience of the responsible party. Given that building an MRV system may take some time, the Paris Agreement allows for a simpler approach in the short term, in which key performance indicators (KPIs) may be applied.

Key Performance Indicators

KPIs are relatively simple measures that demonstrate progress toward NDC targets. When clean cooking programs make up a portion of a country's unconditional commitment under the Paris Agreement, they may be tracked in terms of programmatic indicators (such as number of households with ICS) rather than in emissions reductions. This approach is credible since the resulting emissions reductions will be captured in the national inventory, though the inventory cannot (and does not) attribute a particular amount of emissions reductions achieved to the ICS installed. Monitoring KPI progress in the short term may allow countries to build the infrastructure to formally estimate CO_2e reductions in the longer term.

KPIs may be used nationally to demonstrate progress on an NDC and potentially as the basis for A6 transactions. However, if a host government proposes to use them under A6—and therefore to transfer the corresponding ITMOs out of its national inventory—the host government must have a robust understanding of the relationship between the KPIs and emissions reductions, to assess their impact on the national inventory and plan the projected future emissions pathway to 2030. A host government and a partner ITMO purchasing government may agree to transfer a set number of ITMOs (and hence tCO_2e to be correspondingly adjusted in seller and buyer inventories) per KPI, or for reaching KPI milestones. These proxies must be conservatively set to avoid excess transfer from the host country and overshooting the NDC target. Such approaches are new to host and buyer governments and have not yet been explored in depth. Nonetheless, they offer an alternative approach to higher transaction cost approaches.

More detail on potential use of KPIs and relevant data sources is discussed in the companion document: *Introductory Framework for Measurement, Reporting, and Verification: Clean Cooking MRV in the Paris Context*.

Further Considerations for Program Design

The need for programs that support transitions to clean cooking exists across a wide range of environments and populations around the globe. Nonetheless, quality programs often share some universal success factors. In addition to aligning with the country's broader climate goals, programs that complement other government priorities and allow key ministerial personnel to find synergies with existing portfolios are more likely to find the resources and momentum needed to launch and scale clean cooking initiatives. Further, programs must be feasible and achievable within a given country's context. They must recognize and respond to on-the-ground realities, such as the available and potential energy mix and infrastructure, as well as geography and religious or cultural differences. Feasibility must be balanced with addressing the needs and desires of the target population(s) and distributing resources equitably. Finally, market infrastructure development, including quality standards and labeling schemes, is also critical so that producers and consumers alike can identify and have confidence in quality products.

National programs should be well supported by research. Landscape analysis can help set initial program parameters and targets that are clear, specific, and measurable. Investigations to understand consumer requirements and preferences are also critical and may open opportunities to include clean technologies that address "niche" cooking needs (e.g., rice cookers, electric kettles) that can decrease residual dependence on polluting cooking practices. Laboratory and field testing of household technologies and fuels in accordance with standardized ISO protocols ensure that appliances are capable of delivering expected benefits. MRV methodologies allow programs to monetize their results and create sustainable funding streams, and impact evaluations can generate insights and lessons learned to support continuous quality improvement.

As noted above, closely matching the design of clean cooking initiatives to the needs of the target population is critical to success. A program designer will want to understand local conditions to design a program that addresses market barriers and potential specific to the context. While there are many ways to segment target populations, one framework especially relevant to cooking energy transitions is to characterize households based on location and baseline fuel type. The following tables provide some examples of targeted considerations and suggestions for rural and urban/peri-urban fuel groups.

Target Population: Rural Biomass Users

Population Characteristics	Program Design Consideration
Livestock owners	• Can Behavior Change Communications build familiarity and comfort with household biogas systems? • Can biogas service options be expanded to improve digester maintenance and cooking gas management?
Remote rural households	• Can last-mile infrastructure be improved to allow for LPG or ethanol delivery? • Can the grid be expanded and improved in rural areas, possibly using mini-grids? • Can import tariffs on mass-produced biomass stoves be reduced?
Bottom of the pyramid	• Can import tariffs on mass-produced biomass stoves be reduced? • Can new finance mechanisms be developed, such as lending circles, microloans for bundled appliances to facilitate energy transitions? • Can targeted subsidies, such as vouchers and results-based financing (RBF)[1] make energy transitions accessible? • Can training and support be provided to create fuel businesses offering briquettes or pellets made from biomass waste streams?

Target Population: Urban Dwellers Using Charcoal and/or Raw Biomass

Population Characteristics	Program Design Consideration
Access to LPG as transitional fuel	• Can Behavior Change Communications address safety concerns? • Can small, pay-as-you-go containers reduce up-front costs of energy transitions? • Can policies be implemented to address lease and transport prohibitions against LPG?
Access to ethanol	• Can policies be implemented to earmark supply for household energy use? • Can product designs be optimized for easy fuel management? • Can Behavior Change Communications improve familiarity and comfort?
Access to electric grid or mini-grid	• Can incentives be used to improve home wiring to accommodate cooking appliances? • Can electric cooking appliances address "niche" cooking needs to decrease residual dependence on polluting cooking practices?
Bottom of the pyramid	• Can import tariffs on mass-produced biomass stoves be reduced? • Can new finance mechanisms be developed, such as lending circles, microloans for bundled appliances to facilitate energy transitions? • Can targeted subsidies, such as vouchers and RBF energy transitions accessible? • Can training and support be provided to create fuel businesses offering briquettes or pellets made from biomass waste streams?

1. An umbrella term referring to financial support provided to a program or intervention after pre-agreed results have been achieved and verified.

Clean Cooking Transition Strategy Toolkit for Governments

This section provides an overall roadmap for developing strategies to realize clean cooking transitions, followed by further discussion on particular aspects of strategy development. The following section provides examples and references of relevant tools and resources available to governments.

Developing Fundable Strategic Plans

An overall approach to developing a strategic plan (or roadmap) attractive to international financial support in the context of the Paris Agreement includes the following steps:

1. Set ambitious, high-level targets that are adopted from or align with the NDC.[60]
2. Identify and collate relevant national policies supporting clean cooking targets, and any policies that may confound or be disincentives for clean cooking transition.
3. Take stock of existing government programs and policies and current capacity to implement MRV and expand progress toward targets.
4. Identify gaps and weaknesses that may require external support.
5. Identify and map opportunities for support relevant to the national context, differentiated by:
    a. Any additional or planned national resources that can be brought to bear, as new resources, or through building more effective implementation (or removing barriers or disincentives) through synergies between policies and programs of different ministries.
    b. Donor/grant traditional support of the Organisation for Economic Co-operation and Development's Development Assistance Committee (OECD DAC) explicitly as climate support or development assistance.
    c. Climate finance within the Paris context, including grants, loans, and financial assistance, this may include RBF.
    d. Assess the potential for A6 for bilateral use and the private sector.

The four potential opportunities for support relevant to the national context outlined above are almost always linked. They can be researched, identified and mapped separately, but considered together to ascertain the best combination and structure. For example:

- Grant financing under OECD DAC will be much more likely to be secured if additional national resources can be shown to be contributed.
- Any loans or agreements for RBF should be facilitated with grants (usually in the proportion of 1-5% grant to loan value) that ensure sufficient capacity and oversight to effectively implement loan programs. RBF typically uses KPIs (see above) to assess progress, and trigger payments.
- Market mechanisms, including A6, should target hard to achieve emissions reductions to ensure any authorized ITMOs are additional and do not risk missing NDC targets. They should be combined with grant-based assistance to build MRV capacity and entail maximum leverage of private sector innovation and investment.

Having mapped and considered opportunities, a strategic plan can be developed showing what, where, how, and when clean cooking transition can be achieved, the impact (in emissions reductions and human development) that will be achieved, and the resources (and resource gaps) necessary to realize the plan.

The Paris Agreement provides an obligation for action, a framework for cooperation, and an expectation for the provision of finance from developed countries. Having ambitious goals and a viable strategic plan will make LMICs attractive destinations for donor finance and engagement. The realization of clean cooking transition, using advances in technology and best practice programs, can be accelerated using new tools and expectations under the Paris framework.

Delivering the Strategy

While national governments play a central role in adopting and implementing national clean cooking strategies, investing in infrastructure, establishing regulations, and ensuring equitable access to clean cooking solutions, they face competing development priorities that must be addressed with finite resources. Further, no single government agency, office, department or ministry may feel ownership over clean cooking, or responsibility for moving the agenda forward.

Dedicated staff seconded to, or embedded within, a relevant government ministry, agency, office, or department that exclusively focus on the issue of clean cooking can help circumnavigate these obstacles. International non-governmental organization program staff have sometimes taken on this role in particular countries, whether through secondment or other mechanisms. Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and the Netherlands Development Organization (SNV) have been especially effective in providing technical assistance and guidance to government staff under the Energising Development Partnership (EnDev).

More systematically, the CCA has recently developed the Clean Cooking Delivery Units Network that will establish and support Clean Cooking Delivery Units. Each Delivery Unit will typically comprise two to ten individuals within government responsible for developing and implementing a comprehensive clean cooking transition plan. The Delivery Unit will serve to elevate the clean cooking agenda within relevant ministries and coordinate across ministries, secure budget allocations and mobilize international funding and private sector investment to support clean cooking access, oversee large-scale programming, promote strong regulations and standards, liaise with private sector and industry, and coordinate among global and local advocates of clean cooking.

Having staff within government departments dedicated to promoting clean cooking initiatives, whatever the model, helps ensure clean cooking remains a priority, and doesn't fall through the cracks because it lacks a champion within any particular ministry.

Policy Options

Given that cost barriers for consumers are a significant challenge to transitions to clean cooking solutions, and that these transitions generate positive externalities for governments in the form of diminishing the health impacts and environmental harm associated with pollutants, governments may look to policy mechanisms in the form of subsidies, taxes, and tariffs to support these transitions.

While there exist concerns that subsidies will distort the market for clean cooking solutions, there is little empirical evidence of this.[61] In fact, the opposite has been observed; subsidies can enable adoption by consumers who never would have adopted the technology without them, and who may continue to use the technology if/when the subsidy is removed. This is especially helpful when the new technology is unknown and not yet proven to be a worthwhile investment of limited household budget. Financing of stoves and free trials can also help address this initial adoption hurdle.[62, 63]

That said, energy subsidies, particularly for clean fuels, tend to primarily benefit urban and wealthier consumers,[64, 65] so to better reach the poor, subsidies must be targeted, and must also be substantial enough to enable the targeted poor to afford the clean fuels or technology. Relatedly, electricity tariff pricing can be structured to account for and support transitions to electric cooking, so a bump in usage generated by the transition to electric cooking, which can nudge consumers out of the affordable rate for basic access, does not make that option unaffordable. In Uganda, for example, the Ministry of Energy and Mineral Development launched a special "cooking tariff" at the end of 2021 as a strategy for displacing charcoal fuel. This declining block tariff structure charges domestic consumers less per unit of energy consumed beyond a set monthly threshold, so cooking with electricity becomes less expensive than using charcoal.[66]

Whether clean cooking technologies and fuels are produced domestically or imported, taxes can increase their cost and further impede consumer uptake. Making domestic clean cooking products tax-exempt is another way governments can make the products more accessible to consumers.

Many LMICs lack access to domestically produced clean cooking technologies, however, so the exempting improved and clean cooking technologies from import taxes (via tariffs and duties) is another important step to increase accessibility. Governments have little to lose in offering such exemptions, as taxes on clean cooking technologies and fuels generally produce little government revenue and significantly impede transitions to clean cooking.[67, 68]

Private Sector Support and Market Development

A sustainable, scalable clean cooking industry requires a strong pipeline of investable companies that can deliver solutions that meet the needs of the market, robust demand for those solutions among end users, and an enabling environment that provides conditions for companies to be commercially viable. Elements of the enabling environment important for the success of a clean cooking industry include policies and regulations conducive to company innovation and profitability, efficient flows of information about demand and supply in the market, and sufficient levels of public and private capital to support the transition to scale.

Achieving a strong pipeline of investable companies requires an enabling environment supportive of both entrepreneurship and of organizations seeking to build the capacity of clean cooking companies. For example, the CCA's Venture Catalyst program provides clean cooking companies with grants and technical assistance to develop new products and business models, grow their capabilities, and expand their operations within and across countries.

A critical input in supporting the ability of clean cooking companies to scale is the availability of the right kind of capital at the right time. Risk-tolerant concessional capital in the form of grants is crucial to support innovation and company startup. Firms also need access to working capital to support operations by, among other methods, engaging in carbon markets and RBF. Affordable sources of debt and equity are necessary to support company growth and expansion. CCA has supported the design and launch of the Spark+ Africa Fund, a US$50 to US$70 million debt, equity, and quasi-equity fund designed to invest in scalable clean cooking companies, and which aims to achieve initial commitments from a variety of private and public investors in 2022.

Another program that supports market transformation is the "Promotion of Climate-Friendly Cooking: Kenya and Senegal," funded by the Green Climate Fund (GCF) and the government of Germany and implemented by GIZ. The project is scaling up the EnDev achievements in these two countries and has three objectives:

1. Transform markets for (ICS) to promote market growth independent of official development assistance by 2030.
2. Reduce emissions by 6.47 Mt of CO_2e during the five-year project period and by 25 Mt of CO_2e by 2030.
3. Support governments in achieving their NDC targets.

The program follows a two-pronged approach, working on the supply side to expand production and distribution of ICS and to create investment opportunities, and on the demand side to create awareness and readiness for ICS adoption and usage. The program features "professionalization kits" that provide physical tools and machinery, along with managerial, financial, safety, and technical support to help a business transform from its current operational level to the next level. It also addresses distribution challenges through marketing support, training, equipment, and incentives for a range of market intermediaries active in both urban and rural markets. On the demand side, the program will focus on raising awareness among consumers of the benefits of ICS and changing behaviors on a large scale. These campaigns will have nationwide reach, potentially with different messages for urban and rural consumers, and will be supplemented by regional and local events and activities to address the most relevant drivers of, and barriers to, ICS adoption in each location.

The program aims to raise market growth rates in Kenya from 5% at baseline to 36% during the project period and sustain growth at 10% thereafter. In Senegal, the aim is to raise the baseline market growth rate of 2% to 24% during the project period sustain growth at 11% after the program ends.

Opportunities to Access Funding and Technical Support

Article 6 Opportunities

A6 of the Paris Agreement provides for market mechanisms, which may open up new opportunities for funding cooking energy transition programs: A6.2 covers cooperative approaches, such as agreements between LMICs; A6.4 outlines a centralized mitigation mechanism for activities between non-governmental entities supervised by a body created by the Parties; and Article 6.8 guides non-market approaches. At the COP26 meeting, the Parties adopted several decisions to operationalize carbon markets under A6:

- A6.2: guidance for bilateral or multilateral agreements to create ITMOs, including crediting mechanisms, and linking to emission trading systems.
- A6.4: rules, modalities, and procedures for a multilateral crediting mechanism (to be known as "A6.4M"), which will be a successor to the Clean Development Mechanism (CDM), a United Nations-run carbon offset scheme allowing countries to fund GHG emissions-reducing projects in other countries and claim the saved emissions as part of their own efforts to meet international emissions targets. The CDM was empaneled under the prior Kyoto Protocol.
- A6.8: agreement to create a work program.

Cookstove projects have been popular on voluntary market carbon registries, and they were also an important element of the CDM. This suggests they will continue to play a significant role in activities under A6.4. Activities that fall under A6.2 and A6.4 will require robust measurement, reporting and verification approaches. A6.4M is mandated to manage the transition of existing CDM projects to the new mechanism. CDM activities can transition to the A6.4M upon approval by the host country (request by 2023, approval by 2025), if they comply with A6.4M rules. (Projects registered after January 1, 2013 are grandfathered, and credits generated from these projects can be counted toward the country's first NDC). The UNFCCC has already issued a new version of the AMSIIG biomass cookstove methodology and a companion publication on baseline values used in prior CDM cooking energy projects.

Result-based Financing for Co-benefits

RBF is increasingly viewed as a critical mechanism for funding achievement of the SDGs,[69] including those related to the clean cooking sector.[70] A recent review of 10 major RBF cooking energy programs in Africa and Asia[71] found that investment volume ranged significantly from US$266,000 to EUR2 million invested by The Energy and Environment Partnership Trust Fund (EEP Africa), a clean energy financing facility hosted and managed by the Nordic Development Fund (NDF) with funding from Austria, Finland, NDF and Switzerland. The programs were divided into those that focus specifically on rural households without access to electricity and those that focus on low-income households, regardless of their degree of urbanization. The review also found that most RBF programs utilize a range of technologies and fuels, using inclusion criteria derived from the World Bank's Multi-Tier Framework.[72]

The bulk of RBF activity to date has involved ICS; however, newer programs are taking the opportunity to direct RBF to cleaner cooking solutions. For example, the Government of Sweden has launched the Modern Cooking Facility for Africa with an initial investment of SEK 275 million (~EUR 27.8 million) to support energy access and develop new markets for the clean cooking sector in the Democratic Republic of the Congo, Kenya, Mozambique, Tanzania, and Zambia. This RBF facility aims to provide financing for private sector actors dedicated to the development and scale-up of high-tier clean cooking solutions, such as sustainably produced bioethanol, liquid biofuels, biogas, electric cooking solutions, and solid sustainable biofuels, such as pellets and briquettes. In addition, CCA is launching a Results Based Finance Accelerator to streamline and expand the use of RBF for clean cooking. The Accelerator will establish and lead an innovation and applied research agenda, develop cost-effective, reliable verification methodologies and promote RBF's impact, credibility, and innovation.

Climate Finance

The GCF is the world's largest climate fund, mandated to support LMICs raise and realize their NDC ambitions toward low-emissions, climate-resilient pathways. Developing

countries lead GCF decision-making, which allows them to turn NDC ambitions into climate action. The Fund operates through a network of more than 200 international and national commercial banks, multilateral, regional and national development finance institutions, equity funds institutions, United Nations agencies, and civil society organizations. The Fund has supported cooking energy transition projects in Bangladesh, Kenya, and Senegal (see Private Sector Support and Market Development section above).

Founded in 2012, the NAMA (Nationally Appropriate Mitigation Actions) Facility mobilizes financing from multiple European national and multilateral agencies to support innovative projects that reduce emissions in sectors and countries with strong potential for replication and catalytic impact. These "NAMA Support Projects," which are selected through periodic open calls, must be driven by the commitment of national governments and embedded in their national frameworks to combat climate change, while also incorporating significant involvement from the private sector. To date, the facility has supported cooking energy transition projects in Guatemala and Uganda. To recognize and support countries that present an ambitious update of their NDCs under the Paris Agreement, the NAMA Facility's most recent calls have focused on the critical links between enhanced climate action and green recovery from the impacts of COVID-19. More information is available at the NAMA Facility website.

The Climate and Clean Air Coalition (CCAC) helps partners and stakeholders create policies and practices that will deliver substantial reductions in short-lived climate pollutant emissions. The CCAC's Household Energy Hub brings together CCAC partners and interested parties under the co-leadership of Ghana and the United States to achieve objectives outlined in its Household Energy Engagement Strategy.[73] Calls for proposals will provide the opportunity to fund activities aligned with the Engagement Strategy. Organizations interested in participating in the Household Energy Hub should email the CCAC Secretariat.

Clean Climate Alliance and the Clean Cooking & Climate Consortium

In 2021, CCA convened the Clean Cooking & Climate Consortium (4C)—a group of partners including the United States EPA, the UNFCCC, the CCAC, and Berkeley Air Monitoring Group—to support LMICs in making specific commitments to reduce climate emissions from cooking in their NDCs and/or associated implementation plans. This implementation roadmap and the companion guidance document introducing an MRV framework for cooking energy transition programs[74] are the 4C's initial offerings.

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