A STANDARDIZED CREDITING FRAMEWORK FOR SCALING UP ENERGY ACCESS PROGRAMS

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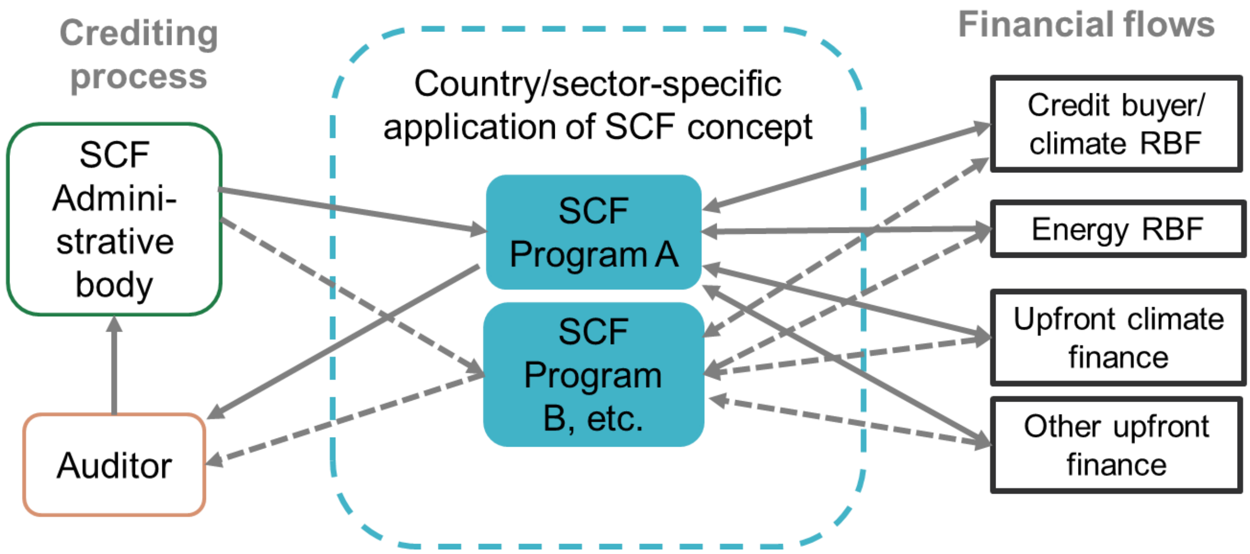
List of acronyms

ASER	Senegal Rural Electrification Agency
CCER	Chinese Certified Emission Reduction
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
Ci-Dev	Climate Initiative for Development
CMA	Conference of the Parties serving as the meeting of the Parties to the [Paris] Agreement
CME	Coordinating and Managing Entity
CMP	Conference of the Parties serving as a Meeting of the Parties (to the Kyoto Protocol)
CO_2	Carbon dioxide
COP	Conference of the Parties (to the UNFCCC)
CPA	Component Project Activity
DOE	Designated Operational Entity
EB	Executive Board (of the CDM)
ETS	Emission Trading Scheme
EU	European Union
GCF	Green Climate Fund
GHG	Greenhouse Gas
ICAO	International Civil Aviation Organization
IMM	International Market Mechanism
JCM	Joint Crediting Mechanism
Kg	Kilogram
kW	Kilowatt
kWh	Kilowatt hour
LDC	Least Developed Country
MRV	Monitoring, Reporting and Verification
MWh	Megawatt hour
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organization
ODA	Official Development Assistance
PAF	Pilot Auction Facility
PDD	Project Design Document
PoA	Programme of Activities
PV	Photovoltaic
RCC	Regional Collaborating Centres
RE	Renewable Energy
SCF	Standardized Crediting Framework
SHS	Solar Home System
SIDS	Small Island Developing States
SUZ	Special Underdeveloped Zone
tCO_2	Tonnes of Carbon dioxide
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

This study proposes a Standardized Crediting Framework (SCF) as a new approach to crediting emission reductions for energy access, which goes beyond the current Clean Development Mechanism (CDM) Programme of Activities (PoA) model, has lower transaction costs and encourages private sector engagement in energy access investments. It is a concept developed to support the transition of the CDM project pipeline to the new regulatory environment of the Paris Agreement while enabling greater reform. The SCF would bring together many of the key reforms proposed for the CDM in recent years, and allow a wide variety of program proponents to earn emission reduction credits for implementing energy access activities. It would support greater private-sector engagement by providing simplified, predictable approaches to crediting for energy access, and allowing private sector developers to focus their MRV efforts only on issues that are relevant for their business (e.g. number of consumers and quality of service). An SCF program[1] could be supported by a variety of public and private financing sources in both the preparation and implementation phases, but would focus on clear incentives for private sector engagement with crediting for energy access. Because multiple SCF programs could operate within a single country or sector-specific application of the SCF concept ("country-specific SCF application"), he credits generated would provide results-based payments directly for a wide variety of energy access activities undertaken by implementing organizations such as private sector project developers, NGOs and suppliers of devices and hardware (Figure ES 1).

Figure ES 1. Structure and actors in a country-specific SCF application



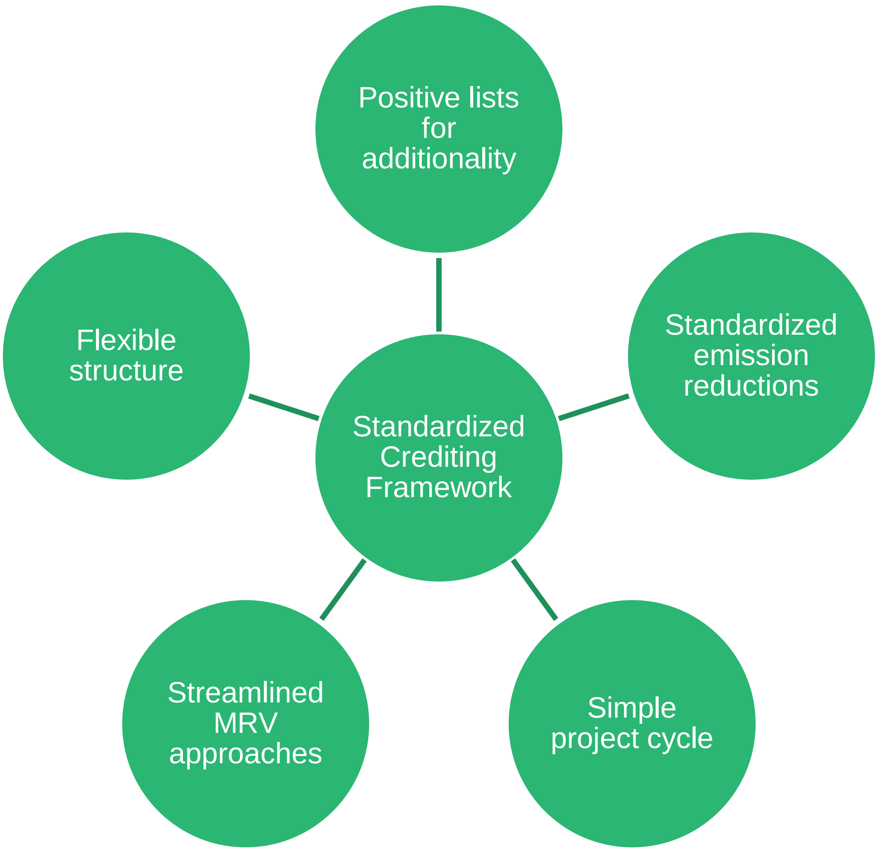
Note: dashed lines show similar relationships with additional SCF programs in the same country, since there may be multiple independent SCF programs in one country.

[1] The term "SCF program" refers to any activity or group of activities implemented by a single project proponent within a given country and sector. The "country-specific SCF application" used in this refers to the use of the SCF concept in a specific country and/or sector could have many SCF programs, each of which could include many individual units, household connections or investments. Some country-specific applications could also have only one SCF program, if, for example, the program was a national grid electrification initiative that was initiated and fully managed by a government agency. Stand-alone projects could also be implemented, and these are included in the term "SCF program" for the sake of brevity.

Compared to existing crediting under the CDM, the SCF would have more comprehensive geographic coverage, flexibility, and simplified approaches to project cycle, baselines and monitoring (Figure ES 2). By addressing the barriers faced by energy access CDM programs in these areas (e.g. limited flexibility, complex methodologies, narrow scope of methodologies) the SCF concept could therefore impact energy access on a much larger scale than the CDM has been able to through both PoAs and project activities.

Previous research funded by the Climate Initiative for Development (Ci-Dev) of the World Bank has highlighted both the need for CDM reform to support energy access and also the need to address financial, institutional and business model needs, to catalyze much larger scale impact on energy access. This current study and proposal builds on and consolidates those efforts, as well as other policy proposals for simplifying and streamlining the CDM. The proposed simple and robust design of the SCF goes hand in hand with the focus on energy access technologies, and methodological approaches based on consumption of energy services (i.e. as opposed to the larger scale supply of these energy sources). By developing the concept of an SCF initially for energy access, and activities that would be considered automatically additional, greater simplification is possible while still ensuring environmental integrity. Similar standardized approaches could be possible in other sectors, although which elements are included would depend on the technical and financial characteristics of the technologies covered (e.g. the potential to create positive lists for additionality).

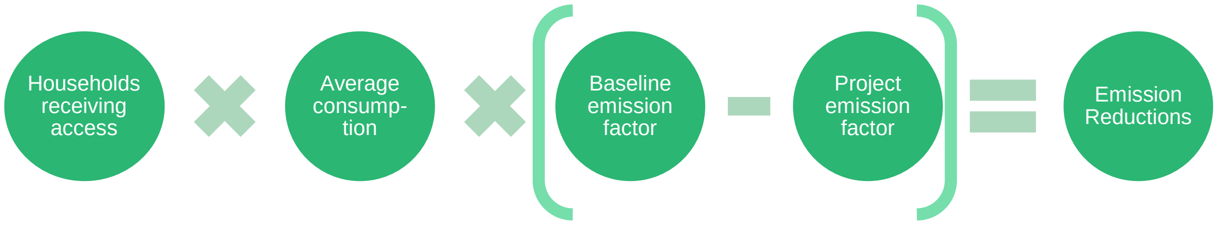
Figure ES 2. Key elements of the Standardized Crediting Framework



Standardizing emission reductions

A key element of the SCF would be moving towards standardizing the emission reductions from each unit or household in an energy access program. This simplified approach to emission reductions would, in principle, be based on the *number of households receiving access*, *average consumption of energy services*, and the difference between the *baseline and program emission factors*, although the detailed calculations would vary by technology (Figure ES 3).[2] Program proponents would only be *required* to measure the number of households receiving access under their interventions. For the other parameters, national or international default factors could be made available. Program proponents could still *choose* to monitor some of these directly, if they felt that this would be advantageous (or if national default factors were not yet available in their country). This would provide flexibility for private sector participants, while potentially reducing transaction costs significantly. In a case where all of the parameters other than the number of households was based on national and international default factors, the total emission reductions could be calculated each year based solely on the number of households or devices within the program. This would be similar to the current approach for solar LED lamps under the CDM, where emission reductions are based on only the number of operational units in place and an international default emission reduction factor per unit.

Figure ES 3.Concept for calculating standardized emission reductions for an SCF program



Simplifying the project cycle

The monitoring process for SCF programs would track the number of operational units or connections each year to establish the program boundaries. The tracking of all units would eliminate the need for "including" a group of units, as with CPAs under the current CDM PoA model. This simplifies the project cycle when compared to CDM PoAs. In addition, the SCF would build on earlier proposals for streamlining the project cycle by eliminating the validation step, and rather combining verification of the project design and project performance into a single ex-post third party audit of program performance and compliance. Initially, the programs would be "listed" based on the information in a simplified listing template that would clearly state the technology requirements for eligibility under a country-specific SCF application. An example of the simplified listing template is presented in Annex A. A full third-party audit would happen during verification (Figure ES 4). Once listed, the program would initiate a monitoring program to collect data annually to determine emission

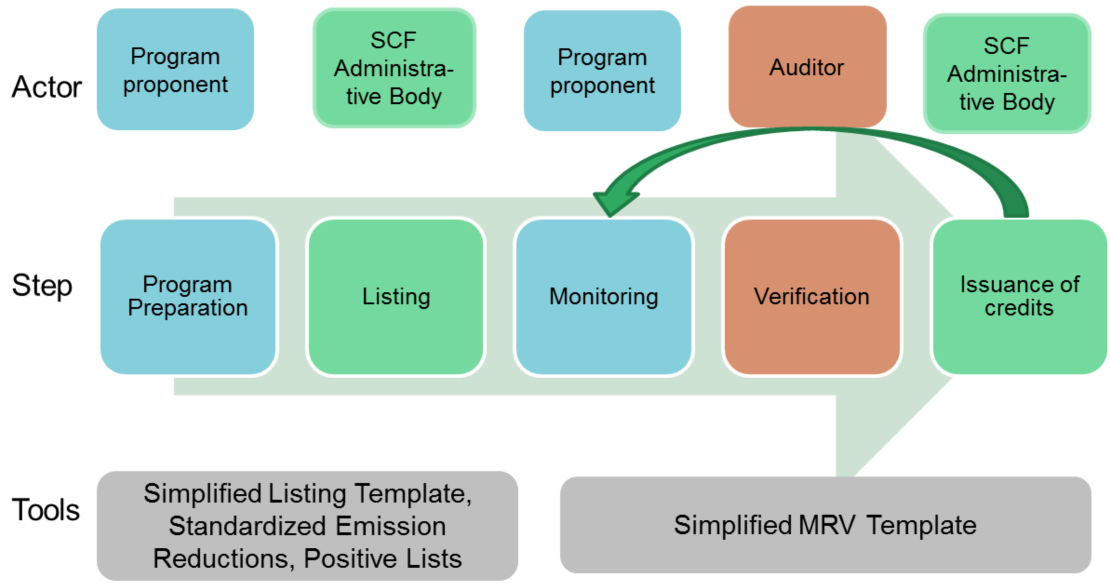
[2] For example, for electrification, the number of households would be the number of new connections or off-grid systems, while the average consumption would be for electricity consumption. For cooking, the number of households would be the number receiving clean cooking technologies, while the average consumption would be fuel used for cooking.

reductions, which would in turn be verified by a third-party auditor before credits were issued. The crediting period would start at the time of listing.

Streamlined approaches

The SCF would incorporate other streamlined approaches presented in previous studies, such as reduced need for site visits during validation and verification, use of local experts for auditing, faster timelines for checking documentation, tiered accuracy requirements, and calibration requirements appropriate to the country. The simplification of documentation would lend itself to greater digitization of forms, building on the current work in this direction under the CDM and other crediting systems. Finally, the SCF would provide for a positive list approach to additionality for grid electrification, based on either country status (e.g. LDCs, SIDS), current low electrification rate, or stagnating progress on electrification.

Figure ES 4. Project cycle, actors and tools under the Standardized Crediting Framework



Future innovations: aggregated MRV

The SCF concept developed in this report combines the reform ideas to the CDM proposed over the recent years. It does not however depart from the CDM's underlying private sector driven approach that allows multiple entities to develop programs in the sector independently. Going beyond that model, the SCF could also be expanded to an aggregated approach with a stronger role of the national government. In the aggregated approach, the SCF would focus on national programs and the MRV focal point and recipient of the credits would be the government. The government would be responsible for monetizing the emission reductions and passing on the incentive to private sector investors. Monitoring of the emission reductions would cover the entire relevant population and be based on sectoral energy access performance data.

Contributing to the new carbon market mechanisms

Integrating the SCF into the evolving regulatory framework for market mechanisms under the Paris Agreement is a question of process. A key component of this process is the actual piloting of the SCF in order to test the ideas and establish lessons learned. To road test the SCF, one or preferably several pilot programs could be undertaken that apply the concept to a set of eligible technologies (electrification and device markets) and selected host country, sponsored by climate finance donors. While drawing upon the experience of the CDM, the pilot programs would however take place outside the UNFCCC framework, so a pilot country-specific SCF application would not require authorization by the UNFCCC institutions. The flows of financing and evidence of emission reductions achieved would be subject to bilateral or multilateral agreement among the providers of results-based climate finance, program implementers and relevant host country institutions. In the development and implementation of the pilot country-specific SCF application, the relationship between the crediting program and the host country's NDC pledges should also be clarified. The pilot activities would also provide an opportunity to explore financial arrangements to blend public and private financing for energy access. The importance of ODA in both financing energy access projects and leveraging capital from other sources cannot be overlooked. Implementing agents need access to capital *before* they can create businesses at scale, which poses a structural challenge for results-based payments. ODA is therefore often one of the first sources of capital committed to energy access projects, so this should be integrated into the financing of the pilot program.

Major impact on replication and expansion of the Ci-Dev portfolio

For the current Ci-Dev portfolio, the SCF would provide a possible pathway for a post-2020 transition from CDM to new mechanisms. In addition, the potential for replication of Ci-Dev programs in additional countries under a model such as the SCF would be considerable, given the reduced program development costs and time required by applying standardized and streamlined approaches to baselines, additionality and MRV at the aggregated level. The case study of applying the SCF concept to a national electrification program presented in this report demonstrates the potential for the SCF for that group of technologies. Additional case study analysis in device markets (e.g. approaches under a country or sector-specific SCF application for cooking) would be useful to understand how the needs of these energy access markets may be somewhat different.

Several broader market conditions would be important for the SCF to succeed. First, based on the assumption that the significant component of the funding of an individual SCF program would come from monetization of carbon credits, there must be demand for those credits, and at higher prices than carbon markets have provided in recent years. Because of the small emission reductions per household in energy access activities and the higher initial costs of many low carbon technologies, higher carbon prices are needed to have a material impact on the viability of these investments. Second, energy access programs will need improved access to *upfront* financing, including concessionary financing. The importance of this cannot be overemphasized, because purely results-based payments will not remove the fundamental financing barriers for most energy access programs. Finally, the institutional requirements for a successful country-specific SCF application should be explored in more detail because of the additional potential roles of government – either as a source of default parameters in the emission reduction calculations, or overseeing and approving the work of private sector actors to develop these parameters. A plan of action for capacity building should be put in place alongside the proposal for a new crediting approach for energy access.

1. Introduction

Initiatives that enhance the access to modern energy services to date have received limited benefits from the Clean Development Mechanism (CDM). A recent study for the World Bank (Spalding-Fecher et al., 2015) reports that among the thousands of registered CDM project activities, less than 70 projects address energy access, with just under 2 million Certified Emission Reductions (CERs) projected per year, which is <only 0.1% of expected CERs (Fenhann, 2015). This includes cook stoves, off-grid solar technologies, solar water heating, other renewable energy mini-grids and grid extension. With the advent of CDM Programmes of Activities (PoAs) energy access projects have been catching up, although the impact of the CDM on this project category remains modest. As of February 2016, 84 energy access PoAs had been registered under the CDM, with projected CERs of more than 12.3 million per year from the Component Project Activities (CPAs) included so far, or approximately a third of the global PoA pipeline (Fenhann, 2016). Given that PoAs can grow to many times the size of the initial CPA with which they are registered, this is a significant increase in scale. The goals of the international community, as set forth in the "Sustainable Energy for All" programs and the Sustainable Development Goal for energy access, however, are to reach hundreds of millions of people without access to modern energy services in the coming decades, so the CDM is so far not a tool that has had a major impact on that goal.

The decision of Parties to the Paris Agreement to include an international crediting mechanism in the new climate agreement opens up further possibilities for supporting energy access. For example, the new international mechanism under Article 6.4[3], often dubbed the "sustainable development mechanism" (SDM), could potentially increase the scope and scale of crediting and utilize simplified approaches to monitoring, reporting and verification (MRV). This mechanism will inevitably build on the experience of the flexible mechanisms such as the CDM and JI, as will the debates on other cooperative approaches under Article 6. The negotiations in the next few years on the modalities and procedures for new mechanisms therefore provide a window of opportunity to advocate for rules that support energy access programs in receiving carbon finance.

In parallel to carbon markets, funding directed through climate finance[4] instruments has increased in recent years, following the 2009 pledge of industrialized countries to mobilize $100 billion per year to assist developing countries with mitigation and adaption to climate change. The Green Climate Fund (GCF), for example, has by now signed agreements for $6.8 billion of the initial $10.3 billion pledged to start funding adaptation and mitigation.[5] The UK International Climate Fund, Global Environmental Facility, Clean Technology Fund, and

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[3] Article 6 also includes the provision for bilateral or multi-lateral cooperation (i.e. Article 6.2 & 6.3) that would be outside of an international/global mechanism supervised by the Paris Agreement parties as a whole.

[4] We define "carbon financing" as contracts for payment for CERs or similar emission reduction units, with most of this payment being made only after the emission reductions have been verified and the units being utilized by the purchasing country toward compliance with their emission reduction obligations. "Climate finance" refers to donor finance earmarked as climate finance, which is typically provided upfront rather than only after the achievement of results, and is not provided in exchange for tradable crediting units. In this study "climate finance" is used to cover both upfront contributions as well as payments for results achieved, where the main "result" (but not the only measured one) is GHG mitigation and, even if tradable units are issued as evidence of this impact, the mitigation impact does not affect the purchasing country's emission reduction obligations.

[5] http://www.greenclimate.fund/contributions/pledge-tracker

German's International Climate Initiative also have billions of dollars dedicated to mitigation finance.[6] These funding streams are likely to include energy access. The GCF, for instance, has defined a performance indicator of "Number of households, and individuals (males and females) with improved access to low-emission energy sources"[7]. While the GCF may include results-based payments, the initial focus has been on grants, loans, guarantees and equity.[8] Such climate finance could potentially address the needs for upfront finance for energy access programs seeking to utilize crediting mechanisms, if the various financial resources can be properly packaged. This means that new crediting frameworks need to be compatible with climate finance instruments.

Previous research funded by the Climate Initiative for Development (Ci-Dev) of the World Bank has highlighted both the need for CDM reform to support energy access and also the need to address financial, institutional and business model needs, to catalyze much larger scale impact on energy access (Greiner et al., 2015; Spalding-Fecher et al., 2015). This current study builds on and consolidates those efforts, as well as other policy proposals for simplifying and streamlining the CDM. The objective of this study is to develop a new approach to crediting emission reductions that goes beyond the current CDM PoA model, has lower transaction costs and encourages private sector engagement in energy access investments. This Standardized Crediting Framework (SCF)[9] would be a crediting approach building on the experience of the CDM, but focused on energy access and initially being piloted outside of the UNFCCC. In the medium term, it could inform the negotiations on new market mechanisms and could eventually become part of those mechanisms. The SCF should accommodate different business models and different technology areas for energy access. The SCF should include standardized approaches to monitoring energy access programs, and utilize national or regional default factors wherever possible. Part of the analysis behind the SCF relates to how to reduce complexity, transaction costs, and uncertainty for energy access programs seeking carbon and climate finance.

To understand the context for the SCF and the types of programs that it must encompass, the next chapter outlines the key characteristics of the Ci-Dev portfolio of energy access programs, as well as other example of access programs under the CDM. This is followed by a synthesis of the main issues and barriers faced by energy access programs seeking carbon financing, particularly in many of the poorest countries, and which should be addressed by the changes the country-specific SCF applications would implement compared to the current CDM. The different components of the SCF are then presented in chapter 4, and tested against a case study energy access program in chapter 5. Chapter 6 explores possible future innovations in MRV and aggregated approaches. Chapter 7 then discusses the next steps for implementing the SCF concept, while Chapter 8 explores the value of the SCF concept for the Ci-Dev pipeline.

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[6] http://www.climatefundsupdate.org/

[7] http://www.greenclimate.fund/documents/20182/46529/5.3_-_Performance_Measurement_Frameworks__PMF_.pdf/60941cef-7c87-475f-809e-4ebf1acbb3f4

[8] http://www.greenclimate.fund/ventures/funding

[9] In this report, "the SCF" refers to the concept of the SCF, a "country-specific SCF application" means how this concept could be application in practice between an individual host country and one or more partners.

2. Key characteristics of national energy access programs supported by carbon finance

Creating a more successful system for crediting energy access first requires an understanding of the types of projects and programs that are currently being developed to support energy access. Energy access programs, including those in the current Ci-Dev pipeline, span a wide range of initiatives but include three broad categories (Spalding-Fecher et al., 2015):

- **Household-level devices and systems** mainly cover cook stoves, biogas systems, solar lanterns, and solar home systems or kits;
- **Community-level systems** include decentralized village power systems (SHS), or mini-grids, that provide electricity to areas unserved by the central network. Mini-grids may use a range of technologies, including simple diesel generators, hydropower, biomass or solar photovoltaic (PV). These businesses may have as few as 10 customers or serve several thousand connections, but generally use systems of 30 kW to 500 kW;
- **Grid extension** involves a national utility and connection to a national or regional grid.

In practice, there may be substantial overlap among these three categories, for example, with national electrification programs including community level systems and even solar devices. This chapter looks at the key characteristics of different types of programs, based on the Ci-Dev pipeline and the literature on energy access, and highlights the characteristics of those programs that are particularly relevant for crediting.

2.1 Overview of Ci-Dev portfolio

Energy access programs can be classified by the technologies that they include as well as by the end-uses they service. The analysis presented here covers the 16 programs currently in the Ci-Dev pipeline as well as two additional programs. The additional programs were included to cover different stages of development (i.e. one is well into issuance of CERs) and different business models (i.e. the other is a primarily public sector model for solar home systems, in contrast to the private sector models). The two additional programs are shown indicated with grey text in Table 1.

Table 1 shows the diversity of the programs, and how many of them include multiple technologies. The programs focused on electricity also typically cover multiple end uses.

Table 1. Ci-Dev potential pipeline and additional energy examples: technology area coverage

Program	Technologies		End Uses	
Uganda Rural Electrification	Grid Extension	Mini-Grid, SHS	Lighting, charging	Refrigeration, entertainment, communication
Mali Rural Electrification	Grid Extension	Mini-Grid, SHS	Lighting, charging	Refrigeration, entertainment, communication
Senegal Rural Electrification	Grid Extension	Mini-Grid, SHS	Lighting, charging	Refrigeration, entertainment, communication
Mozambique off-grid RE rural electrification		Mini-Grid, SHS	Lighting, charging	Refrigeration, entertainment, communication
Nigeria Community Solar		Mini-Grid, SHS	Lighting, charging	Refrigeration, entertainment, communication
Ethiopia Off-Grid RE	Solar Lanterns, SHS & other Pico-Solar		Lighting, charging	
Kenya Solar Lighting	Solar Lanterns, SHS & other Pico-Solar		Lighting, charging	
Rwanda DelAgua	Improved cook stoves	Water Purifier	Cooking	Clean water
Madagascar Ethanol	Improved cook stoves	Alternative fuel	Cooking	Clean water
Rwanda Inyenyeri	Improved cook stoves	Alternative fuel	Cooking	
Clean Cook stoves in Ghana	Improved cook stoves		Cooking	
Ethiopia Biogas	Biogas		Cooking	
Kenya Simgas	Biogas		Cooking	
Burkina Faso Biodigesters	Biogas		Cooking	

Note: programs in grey text are not part of Ci-Dev pipeline
Source: project documentation provided by Ci-Dev; interviews with project developers

Table 2 provides additional details, explaining which technologies are included, the CDM methodologies applied, and the status of the program. Half of the programs are registered under the CDM, with two of those already issuing CERs (one of which is in the Ci-Dev pipeline). The other half have mostly not even started validation, so are more conceptual or in the midst of program design. While many of the programs are led or supported by established CDM project developers, some are also housed in national agencies (e.g. development bank, energy agency).

Table 2. Ci-Dev potential pipeline and additional energy examples - additional information

Program	CDM Status	Developer	Technologies	Methodologies
Uganda Rural Electrification	registered	REA (Rural Electrification Agency)	Solar home systems (SHS) and grid extension/intensification	AMS I.L, AMS III.BB
Mali Rural Electrification	pre-validation	AMADER (Mali Household Energy and Rural Electrification Development Agency)	SHS, mini-grids, grid extension, solar lanterns	AMS III.AR, AMS III.BL
Senegal Rural Electrification	pre-validation	ASER (Senegalese Rural Electrification Agency)	SHS, mini-grids, grid extension solar lanterns	AMS III.BL, AMS III.AR

Program	CDM Status	Developer	Technologies	Methodologies
Nigeria Community Solar	pre-validation	ICIMI	Standalone/mini-grids solar PV, micro concentrated solar power	AMS I.F, AMS I.L, AMS III.BB
Ethiopia Off-Grid RE	at validation	Development Bank of Ethiopia (DBE)	Solar lanterns and SHS	AMS I.L, AMS III.AR
Kenya Solar Lighting	pre-validation	ClimateCare	Solar lanterns	AMS III.AR
Rwanda DelAgua	issuing	South Pole Carbon	Efficient wood cook stoves	AMS II.G
Madagascar Ethanol	registered	Green Development AS	Ethanol cook stoves	AMS I.E
Rwanda Inyenyeri	registered	Inyenyeri – A Rwandan Social Benefit Company	Biomass gasification stoves	AMS.II-G
Ethiopia Biogas	at validation	Development Bank of Ethiopia (DBE)	Household biogas digesters, ethanol cook stoves and improved cook stoves	AMS I.E
Kenya Simgas	registered	SimGas B.V.	Biogas digesters (farm waste and organic waste models)	AMS I.E, AMS I.I, AMS III.R
Burkina Faso Biodigesters	registered	SNV Netherlands Development Organization	Biogas digesters	AMS I.E
Mozambique off-grid RE rural electrification	at validation	FUNAE (National Fund for Energy)	SHS, micro-hydro mini-grids	AMS I.L
Clean Cook stoves in Ghana	issuing	ClimateCare	Improved charcoal cook stoves (ICS)	AMS II.G

Source: project documentation provided by Ci-Dev; interviews with project developers; UNFCCC documentation

2.2 Key characteristics of access programs relevant to a crediting framework

Given the diversity of energy access programs that can seek carbon or climate financing, the question is whether there are clusters of program types that are comparable enough to face similar barriers in the process and benefit from similar innovative approaches to crediting and financing. Table 3 presents an analysis of the key attributes of these programs that may be relevant both to their success as energy access programs and the challenges they may face when seeking carbon and climate financing. These attributes include:

- *Dispersed units*: almost all energy access programs consist of large numbers of small units, which adds to the cost and complexity of measurement and monitoring. Even mini-grids with only a few plants can have large numbers of consumers, which can add complexity to monitoring the demand from these different connections.
- *Geographic area*: programs that are national in scope have greater opportunities for utilizing national level default factors or other standardized approaches, as suggested in earlier literature as possible CDM reforms

- *Many CPA actors*: programs with many different implementing agencies and actors are more complex, and need clear definitions of roles that align with the capacities and interests of the actors.
- *Private sector engagement:* all of the Ci-Dev programs explore different approaches to leveraging greater private sector participation in energy access investments, whether through direct subsidies, market transformation or supporting new financial mechanisms.
- *Private sector leadership*: programs with devices tend to be led by private sector developers, who may initiate multiple activities in parallel in a given country, and explore the use of different technologies and business models.
- *Multiple methodologies (meths), technologies, and end-uses*: programs that currently must use multiple methodologies, apply multiple project technologies, and cover multiple end-uses could benefit from greater consolidation of methodologies and MRV requirements.
- *Least developed countries (LDC)*: a major focus for Ci-Dev has been to support program development in low income countries, which includes LDCs. LDCs, and even low-income countries, however, tend to have greater challenges with public and private sector capacity and could face greater barriers to accessing carbon finance.
- *Similar PoAs in host country*: where there are multiple PoAs for a given technology in the same country (e.g. several solar lighting PoAs in one country, with different project developers), there may be potential synergies in baseline and MRV from some form of collaboration. At the same time, this should not limit the participation of many private actors or constrain their business models.
- *Positive list:* where some technologies are considered automatically additional under the CDM rules, there is much greater scope for the project cycle and methodological simplification that would reduce transaction costs and time delays (see Greiner et al., 2015).

Table 3. Analysis of key characteristics of energy access programs

Program	Dispersed units	Geographic area	National govt role?	National govt as CME?	Many CPA actors?	Private sector invol-ved?	Multiple meths?	Multiple technologies?	Multiple end-uses?	LDC?	Similar PoAs in host country	Positive list?
Uganda Rural Electrification	All except grid	National	Y	Y	Y	Y	Y	Y	Y	Y	0	all except some grid*
Mali Rural Electrification	All except grid	National	Y	Y	Y	Y	Y	Y	Y	Y	0	all except some grid*
Senegal Rural Electrification	All except grid	National	Y	Y	Y	Y	Y	Y	Y	Y	0	all except some grid*
Off-grid RE rural electrification in Mozambique	Y	national	Y	Y	N	N	N	Y	Y	Y	0	Y
Nigeria Community Solar	Y	national	N	N	N	Y	Y	Y	Y	N	0	Y
Ethiopia Off-Grid RE	Y	national	Y	Y	Y	Y	Y	Y	Y	Y	0	Y
Kenya Solar Lighting	Y	national	N	N	N	Y	N	N	Y	N	5	Y
Rwanda DelAgua	Y	national	N	N	N	Y		Y	Y	Y	0	Y
Madagascar Ethanol	Y	national	N	N	Y	Y	N	Y	Y	Y	0	Y
Rwanda Inyenyeri	Y	national	N	N	N	Y	N	N	N	Y	2	Y
Clean Cook stoves in Ghana	Y	national	N	N	Y	Y	N	N	N	N	4	N

Program	Dispersed units	Geographic area	National govt role?	National govt as CME?	Many CPA actors?	Private sector invol-ved?	Multiple meths?	Multiple technologies?	Multiple end-uses?	LDC?	Similar PoAs in host country	Positive list?
Ethiopia Biogas	Y	national	Y	Y	Y	Y	N	?	N	Y	3	Y
Kenya Simgas	Y	national	N	N	N	Y	Y	?	N	N	4	Y
Burkina Faso Biodigesters	Y	national	Y	N	Y	Y	N	N	N	Y	1	Y

*grid extension is only automatically additional where (i) total project (CPA) size is less than 20,000 tCO_2e per year in emission reductions and in LDCs, or (ii) total project (CPA) size is less than 60,000 tCO_2e per year in emission reductions and grid electricity is 100% renewable.

Note: dark green shading is used to highlight programs driven by government authorities, as opposed to largely private-sector driven programs. Light green shading is similar public programs for cooking.

Source: project documentation provided by Ci-Dev; interviews with project developers; UNFCCC documentation

The highlighting in Table 3 shows how, broadly speaking, there are two clusters of energy access programs within this group (and this group also reflects the larger body of CDM PoAs focused on energy access). The first cluster is the programs focused on electrification (highlighted in dark green). These programs are housed within government, with a public sector CME, cover multiple approaches to delivering electricity (and therefore use multiple methodologies), and tend to be the only such activity in the country, which covers the entire country. This is linked in part to the fact that electricity distribution is a natural monopoly, and most developing countries have a state-owned vertically integrated electricity company or at least a public monopoly on grid power transmission and distribution (Banerjee et al., 2008; Winkler et al., 2011). In some cases, however, the government agency may play more of an “aggregator” role for different electrification activities, with actual implementation being driven by the private sector responding to a government incentive scheme. Rural electrification is a high priority for most developing countries, and requires government intervention to provide incentives for private sector participation, given the high costs and risk involved. The exception to this in terms of technology is the Ethiopia and Burkina Faso biogas programs (highlighted in light green), which are national government programs for household devices (although in Ethiopia this essentially competes with other private-sector driven PoAs in the same country). At the same time, the programs often encompass community scale technologies (e.g. mini-grids), and the business models even allow for many different owners and operators of such systems without a broader national policy framework. Within the Ci-Dev pipeline, these programs are also all in LDCs.

The second cluster of programs focus on household devices and systems. These are all private sector driven, focused on single end-uses and only one or two technologies, with fewer actors to coordinate because they may include a technology supplier as a principal partner. Because the project developers are outside of government, it is common to have multiple PoAs for the same technology in one country, all operating independently. As discussed earlier, on one hand this means there is an opportunity to reduce the costs and burden on individual program developers by utilizing national default values and standardized emission reduction factors. On the other hand, the developers may also be reluctant to share sensitive information with their competitors or may not be willing to wait for government to provide national level data.

3. Issues for energy access programs utilizing CDM PoAs and carbon-linked results-based financing

As mentioned in Chapter 1, energy access programs have struggled to get registered under the CDM for many years, and have only recently seen more success as a result of, but not just limited to, improvements in the CDM rules covering energy access and the development of Programmes of Activities (PoAs) instead of only allowing individual project activities. This chapter provides an overview of progress made under the CDM for energy access and the remaining challenges that energy access programs face in accessing carbon-linked results-based financing (RBF) (see **Error! Reference source not found.**). The emphasis is on the barriers that could be addressed through simplifications and streamlining as part of the implementation of a standardized crediting framework. While many studies cite high transaction costs, long delays in program approval by the UNFCCC, and uncertainties all along the project cycle (Gadde et al., 2011; Greiner et al., 2015; Platanova-Oquab et al., 2012; Spalding-Fecher et al., 2012, 2015), the purpose of this chapter is to explore why the costs are high, what causes the delays, and what creates uncertainty.

3.1 CDM reform relevant for energy access to date

As elaborated in the recent Ci-Dev CDM MRV study (Greiner et al., 2015) the CDM has undergone significant transformation over the past years with the aim to enhance its contribution to sustainable development and energy access. Many reforms have been initiated by the CDM-EB and the CMP that cater to the needs of small and micro-scale technologies and take into account the context for investment. While the CDM started out as a generic mechanism that did not differentiate among eligible countries, increasingly preferences for Least Developed Countries (LDC), Small Island Developing States (SIDS) and underrepresented regions have been introduced. These reforms have already taken effect, and, along with the focus of European Union (EU) demand on programs in the poorest countries, have led to an increasing share of African programs in the overall PoA pipeline. Key reforms include, inter alia:

- The introduction of the PoA approach, which caters especially (although not exclusively) to the needs of small- and micro-scale technologies. This approach allows the implementation of emission reduction measures over time at a large number of small sources;
- Automatic additionality for selected technologies and program sizes. This reduces the burden for demonstrating additionality for a wide array of diverse project situations (see section 4.2);
- Recognition of and guidelines for the consideration of suppressed demand in CDM methodologies;
- Procedures for the development of standardized baselines;
- Default values for selected baseline variables across many methodologies, including the fraction of non-renewable biomass. These reduce the burden of assessing diffuse emissions in dispersed geographical areas;
- Operational simplifications for PoAs, including the possibility of bundling the monitoring of several Component Project Activities (CPAs) in one monitoring and issuance effort (i.e.

"batched issuance") with an unlimited number of batches per monitoring period, guidance on multi-country PoAs, and sampling simplifications;

- Operational simplifications in the CDM project cycle, including allowing validation of the monitoring plan after registration and the approval of some post-registration changes by DOEs, at the discretion of the program developer;
- The CDM Loan Scheme to make project development loans available for countries with 10 or fewer registered CDM projects;
- Creation and setting up of support structures through the Regional Collaboration Centers (RCCs).

While the reform of the CDM is not a linear process and depends on the changing priorities of the actors involved, many recent reforms have aimed for the simplification and streamlining of the CDM.

3.2 Capacity of CMEs and allocation of tasks

One of the challenges in the CDM, and particularly with large and complex energy access programs, has been a mismatch between the responsibilities for emission reduction monitoring and the interests and capacities of the key actors.

The key responsibility for emission reduction monitoring is with the project developers, which for many energy access programs may be private or non-government entities that are not connected to the government. Their core business and competency is providing energy access products and services, and not monitoring of emission reductions. Time and effort spent on emission reduction MRV may actually distract them from their core mission of improving the performance of their energy access business offerings. Project developers, as well as the purchasers of emission reductions, also have an incentive to over-estimate the mitigation impacts from energy access. Over the years, much of the improvement of the CDM rules has been to prevent inflation of emission reductions and to prevent non additional projects entering into pipeline, while also reducing the time and effort required to monitor and verify emission reductions. Despite the efforts toward simplification, the need for extensive "checks and balances" in the MRV process has resulted in a complex system with high demands on project developers that do not have access to national or sectoral data (e.g. historical energy mix of rural households). This has led to higher transaction costs, resulting in smaller projects in particular moving away from the CDM. Small project developers particularly struggle to free up sufficient time from teams to engage in emission reduction monitoring tasks and so may be excluded from accessing carbon finance.

National governments have rather limited responsibilities under the CDM. At the start of a program they must review the documentation and provide formal approval of the contribution to sustainable development in the country, but they have no further role in project implementation. They do, however, have a strong interest in monitoring emissions reductions, particularly now that this will be related to monitoring progress under their nationally determined contributions (NDCs). In addition, they may have access to sectoral data on energy access trends, typical household energy consumption patterns, and national utility plans and achievements – all data to which most private project developers would not have access. At the same time, national government agencies overseeing the CDM generally do not have the capacity to monitor emission reduction development on a continuous basis, because they may not know the current performance of new technologies in the field, particularly if there are many different actors involved in the activities on the ground such as providing electrical connections, improved cooking devices and other energy access equipment.

3.3 Interactions with domestic policies

A supportive enabling environment – including national and sectoral policies – is important to the successful implementation of energy access programs (ESMAP, 2013; IFC, 2012; Spalding-Fecher et al., 2015). This can include cost-reflective tariffs for off-grid power, removing import duties on energy access products, and clear rules on grid access for renewable energy technologies. When a program benefits from certain national and sectoral policies however, it may lose its eligibility to gain carbon credits under the CDM (even though some CDM tools may still be useful for accounting for emission reductions). One example is the treatment of policies that “give comparative advantages to less emissions-intensive technologies over more emissions intensive technologies”, or so-called “E-minus” (“E-“) policies. The CDM Executive Board (EB) has ruled that E- policies implemented after November 2001 could essentially be ignored when constructing the baseline, although the implications for additionality assessment are not clear and are addressed on a “case-by-case basis” (Spalding-Fecher, 2013). This could mean that the introduction of a feed-in tariff for renewable energy, while not being included in the baseline development, might have to be included in the investment analysis as part of additionality assessment. If the feed-in tariff makes the project financially viable, then it is no longer eligible for registration under the CDM[10]. For the energy access programs in the Ci-Dev pipeline, however, this issue is unlikely to arise because the technologies are almost all considered automatically additional and the baseline scenario is specified in the methodology. The exception is grid electrification, which is discussed in more depth in chapter 4.2.

3.4 Data needs and transaction costs

Previous studies have noted the complexity and significant time requirements for complying with the modalities and procedures for registering project activities and PoAs and for issuing CERs (Arens et al., 2011; Greiner et al., 2015; Spalding-Fecher et al., 2012, 2015). Particularly in an environment where the market for carbon credits suffers from persistently low prices, many program developers have decided to stop monitoring and issuing their credits and not to register new programs as CDM PoAs (Warnecke et al., 2015). The cost of registering, monitoring and issuing is simply not worth the potential carbon revenue.

Interviews with project developers and previous literature on this subject (Greiner et al., 2015), have highlighted the following concerns, among others.

- Concerning program design and registration

[10] This might not be the case, however, the feed-in tariff was funded by carbon revenue, since, in this case, the carbon revenue would be providing the necessary incentive to make the project viable.

    - Different types of emission reductions are addressed by different methodologies. Integrating these into one program is therefore time consuming and prone to error[11];
    - Some methodologies require extensive collection and analysis of data which are outside of the program developer's knowledge or area of expertise;
    - The response times from both DOEs and the EB Secretariat are often considerably longer than the targets set in the UNFCCC procedures
- Concerning monitoring and issuance:
    - Overly stringent accuracy requirements by DOEs, in particular in the absence of general guidance on accuracy by the EB;
    - Overly stringent calibration requirements by DOEs, in particular in the absence of general guidance on calibration by the EB;
    - Superfluous monitoring requirements that increase costs but do not have a significant impact on the emission reduction calculations;
    - Complex sampling requirements;
    - Overly bureaucratic and lengthy procedures for post-registration changes[12];
    - Requirements to submit documents (licenses, agreements) that don't exist in the project country;
- Concerning the specific rules of PoAs
    - Redundancies of monitoring efforts between parallel programs on the same subject in the same country.

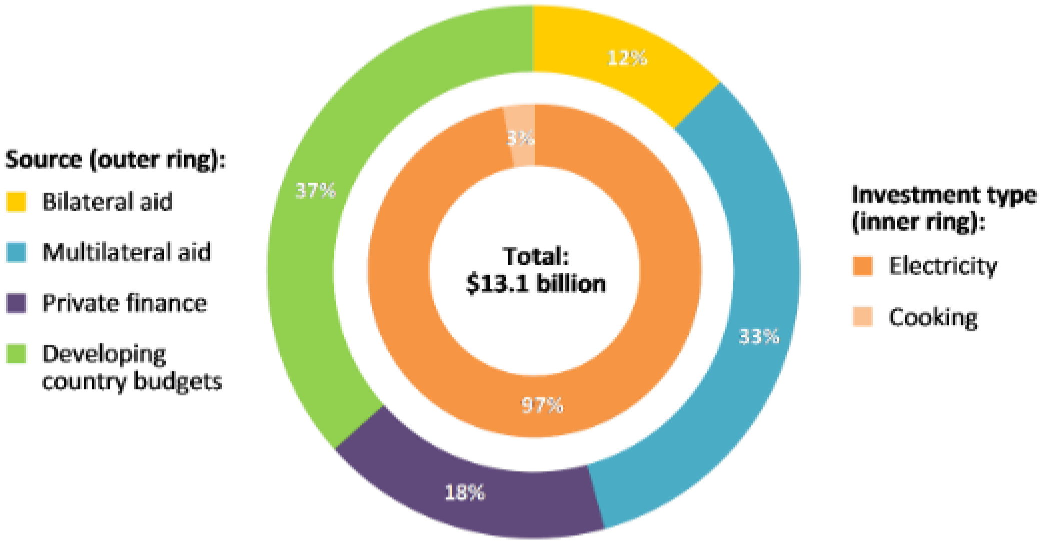
3.5 Compatibility with ODA

The study on energy access business models undertaken by Carbon Limits for Ci-Dev in 2015 (Spalding-Fecher et al., 2015) highlighted the need to exploit the synergies between different forms of project funding and financing, including CDM, results-based financing (RBF) approaches, RBF outside of climate finance (e.g. in the energy sector), and more traditional project financing for energy access. This conclusion reflects the current situation where multiple sources of capital, including public financing, are usually required for energy access projects to succeed. In 2013 an estimated $13.1 billion in capital investment worldwide was directed to improving access to electricity and clean cooking facilities. This capital originated from a variety of sources: developing countries' own budgets, 37%; multilateral organizations, 33%; private investors, 18%; and, bilateral aid 12% (Figure 1).

[11] The SimGas Biogas PoA provides an example of this: https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/BZVSOCK5G9WDEQF3A7TRMYJ2IPHU0N/view

[12] This was addressed by EB87, Annex 3. Available at: http://bit.ly/1XccC2B

Figure 1: World energy access investment by type and source, 2013[13]



As seen from Figure 1, governments remain an important source of financing for energy access, and, as a result of many countries opening up their energy sectors, private sector finance is starting to play an increasingly important role in financing energy access. Despite the increasing role of government and private sector finance, however, official development assistance (ODA), through bilateral or multilateral channels, continues to be an essential source for many energy access investments, amounting to 45% of total capital investment in energy access projects in 2013. Development assistance is typically provided in the form of loans at concessional rates and is particularly important in providing loans to projects deemed too risky by the commercial banking sector. ODA also plays a critical role in leveraging financing from other sources. For example, the European Union has committed €3.5 billion ($3.9 billion) for power sector investments with the intention that it should leverage more than eight times that amount, or €30 billion ($33 billion)(IEA, 2015). Similarly, the US Power Africa initiative has achieved financial closure on 4 GW worth of projects, involving $9 billion of commitments from government and aid sources, to leverage more than double that amount in private investment ($20 billion)[14].

The importance of ODA in both financing energy access projects and leveraging capital from other sources cannot be overlooked, not only with respect to the amount of capital involved, but also *when* that capital is made available. Access to business capital is one of the most important issues in energy access, particularly to dramatically scale-up. Implementing agents need access to capital *before* they can create businesses at scale, which poses a structural challenge for results-based payments. ODA is therefore often one of the first sources of capital committed to energy access projects, and as noted above, is key to leveraging other sources of capital.

The use of ODA for CDM projects has, however, faced challenges. The Conference of the Parties (COP) has emphasized that “public funding for clean development mechanism

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[13] http://www.worldenergyoutlook.org/resources/energydevelopment/energyforallfinancingaccessforthepoor/,

[14] https://www.usaid.gov/powerafrica

projects from Parties in Annex I is not to result in the diversion of official development assistance [ODA] and is to be separate from and not counted towards the financial obligations of Parties included in Annex I"[15]. This decision resulted from the concern that ODA should not be used to support CDM projects if this results in financial resources earmarked for the sustainable development in developing countries being diverted instead to help donor countries in meeting their own climate mitigation commitments (Yamin and Depledge, 2004). In other words, donors should not simply re-allocate public money so they deliver the same financing but now receive carbon credits in return, or purchase carbon credits directly with funds originally earmarked for ODA, since this could divert scarce resources from other development priorities.

The guidance from the COP has been translated into rules for disclosing information on any public funding (i.e. not only ODA) for a CDM project activity in the project design document (PDD). Importantly, the current CDM Project Standard (version 9) does not bar projects from receiving public funding, but states that, "In cases where public funding…is involved, project participants or the coordinating/managing entity shall provide an affirmation obtained from [the funders] that such funding does not result in a diversion of official development assistance, is separate from, and is not counted towards the financial obligations of those Parties"[16]. The affirmation usually takes the form of a letter from the funder(s) which is provided in annex 2 of the PDD. Where public funding is involved, the DOE is required to validate that a letter of affirmation from the funder is provided confirming that the funding in question does not result in a diversion of ODA. This could, of course, include letter(s) from climate finance donors.

[15] 17/CP.7, preamble

[16] http://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20150225165159970/reg_stan01.pdf

4. Elements of a standardized crediting framework for energy access

4.1 Concept of the SCF

Based on the major issues discussed in the previous chapters, the concept of a SCF for energy access would have the following characteristics to address the challenges in the current crediting system:

- Capacity of CMEs, or more specifically, the allocation of tasks in relation to monitoring capacity will be addressed through simplification of reporting requirements and standardizing most of the monitoring parameters at the national level;
- Interaction with domestic policies will be addressed by focusing on technologies with clear automatic additionality, so that it is not necessary to evaluate the impact of existing policies on those particular technologies;
- Data needs and the related transaction costs for monitoring will be reduced by using more standardized approaches to monitoring, implementing additional proposed simplifications to the MRV system, and simplifying the project cycle;
- Compatibility with climate finance will be addressed by not having any specific requirements on tracking financing sources.

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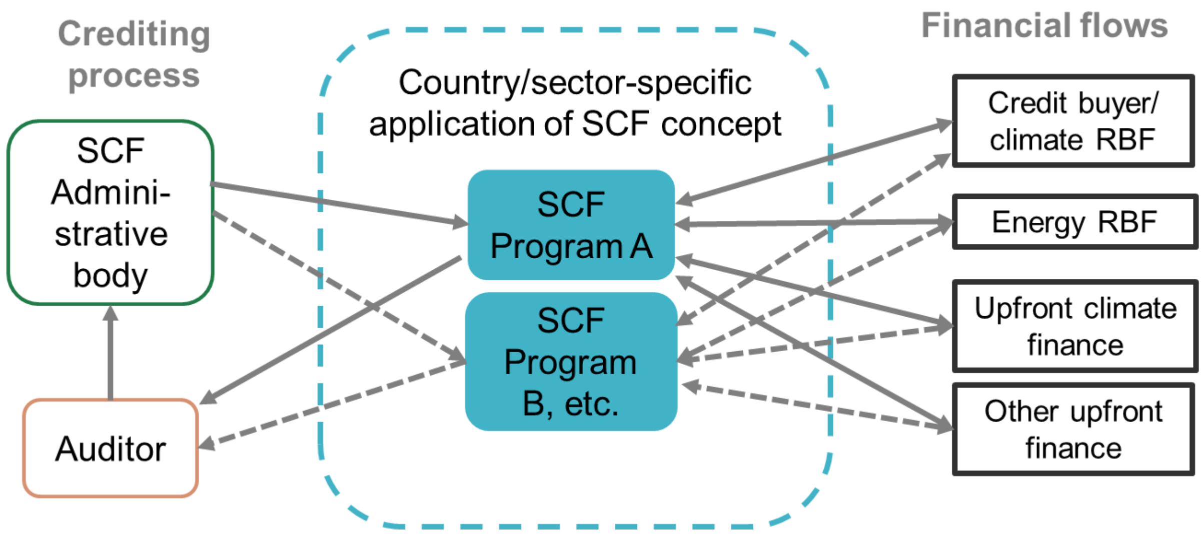
The SCF therefore brings together many of the key reforms proposed for the CDM in recent years. The SCF approach would support greater private-sector engagement by providing a simplified, predictable approaches to crediting for energy access, and allowing private sector developers to focus their MRV efforts only on issues that are relevant for their business (e.g. number of consumers and quality of service). Country-specific SCF applications would allow a wide variety of program proponents to earn emission reduction credits for implementing energy access activities. An individual SCF program[17] could be supported by a variety of public and private financing sources in both the preparation and implementation phases, but would focus on clear incentives for private sector engagement with crediting for energy access. Because multiple SCF programs could operate within a single country or sector-specific application of the SCF concept ("country-specific SCF application"), the credits generated would provide results-based payments directly for a wide variety of energy access activities undertaken by implementing organizations such as private sector project developers, NGOs and suppliers of devices and hardware (see Figure 2). Compared to existing crediting under the CDM, the SCF would include more energy access technologies within a given program, provide greater flexibility, and introduce simplified approaches to project cycle, baselines and monitoring (see Figure 3). Simplified approaches mean less administrative and technical budget on both CMEs and other actors involved in development

[17] The term "SCF program" refers to any activity or group of activities implemented by a single project proponent within a given country and sector. The "country-specific SCF application" used in this refers to the use of the SCF concept in a specific country and/or sector could have many SCF programs, each of which could include many individual units, household connections or investments. Some country-specific applications could also have only one SCF program, if, for example, the program was a national grid electrification initiative that was initiated and fully managed by a government agency. Stand-alone projects could also be implemented, and these are included in the term "SCF program" for the sake of brevity.

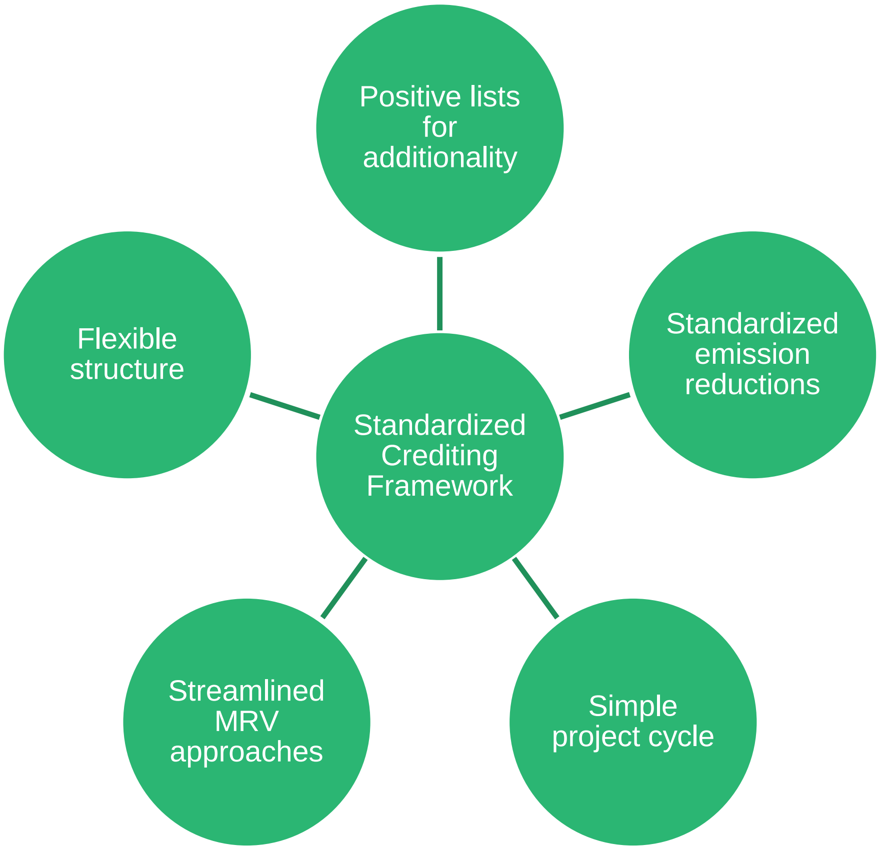
crediting programs. In essence, more of the methodological work is done by the bodies overseeing or administering the SCF, so that less is required from the DMEs. This also reduces transaction costs and opens up the potential for wider participation by more energy access entrepreneurs. As discussed below, the simplified project cycle could also improve the financial attractiveness of energy access programs, by allowing the interventions to generate credits earlier. Finally, the combination of all of these reforms and streamlining creates a more transparent and low risk system, which can boost investor confidence and increase private sector engagement with the scheme.

Figure 2. Structure and actors in a country-specific SCF application



Note: dashed lines show similar relationships with additional SCF programs in the same country, since there may be multiple independent SCF programs in one country.

Figure 3. Key elements of the Standardized Crediting Framework



Upfront financing is another crucial success factor for energy access programs. Combining upfront financing with ex-post payments for emission reductions, which could include pre-financing to monetize some of the ex-post payment agreement, could make carbon crediting schemes a powerful tool to boost energy access programs and is explored in a parallel study for the World Bank

The proposed simple and robust design of the SCF goes hand in hand with the focus on technologies and approaches that are accepted under project-based crediting standards as automatically additional and where the role of suppressed demand is acknowledged. The approval of several baseline methodologies for energy access in recent years under the CDM has provided baseline emission factors that reflect suppressed demand, while the positive list approach to additionality in many standards has generally applied to end-use energy access technologies (i.e. the connections and household-scale systems, as opposed to larger scale energy supply). Of course, the concept of an SCF could be developed for other sectors and technologies. For those where automatic additionality is not currently accepted under the CDM, either there would need to be a strong argument for new positive lists or the framework would need to include other approaches to demonstrating additionality.

The design of the SCF explained in this chapter would build on the experience of the CDM, in particular that of PoAs, but would also go beyond those rules in important ways. The proposed SCF could provide a vision for the structure and operation of future market mechanisms that build on the experiences of carbon markets to date.

4.2 Additionality and positive lists

Almost all of the technologies included in the energy access programs reviewed here (see Table 2 to Table 3) fall under the “positive lists” in the current CDM rules. These technologies are considered automatically additional due to their unit size or their energy source. The positive list for technologies included in the tool for “Demonstration of additionality of small-scale project activities” is shown in Table 4, while the positive list for the tool “Demonstration of additionality of microscale project activities” is shown in Table 5. The first tool essentially covers cook stoves, solar home systems, solar water heating[18], solar lighting, renewable mini-grids up to 15MW and hybrid mini-grids with less than 3000 tCO_2 emissions reductions per year[19]. Because this classification is based on technology and unit size, it could potentially apply to any total size of an SCF program within a country-specific SCF application.

Table 4. Technologies considered automatically additional under the tool “Demonstration of additionality of small-scale project activities”

Renewable energy (up to 15 MW, grid or off-grid, all end users)

- Solar PV and solar-thermal electricity generation
- Off-shore wind
- Marine technologies (e.g. wave and tidal)
- Building integrated wind turbines or household roof top wind turbines (unit size =< 100 kW)

Renewable energy (up to 15 MW, off grid only)

- Micro/pico-hydro (unit size =< 100 kW)
- Micro/pico-wind turbine (unit size =< 100 kW)
- PV-wind hybrid (unit size =< 100 kW)
- Geothermal (unit size =< 200 kW)
- Biomass gasification/biogas (unit size =<100 kW)

Distributed technologies for households/communities/SMEs (off-grid only)

- Aggregate size up to SSC threshold (15 MW, 60 GWh or 60 $ktCO_2$ emission reductions) with unit size =< 5 per cent of SSC thresholds (i.e. =< 750 kW, =< 3 GWh/y or 3 $ktCO_2e/y$)

Rural electrification using renewable energy

- In countries with rural electrification rates less than 20%

Note: SSC=Small Scale CDM; Numbers in left hand column continue from previous table.
Sources: Tool for “Demonstration of additionality of small-scale activities” (version 10.0)

[18] Only for solar water heating without grid electrical backup

[19] This would be a mini-grid of several thousand households.

Table 5. Projects considered automatically additional under the tool "Demonstration of additionality of microscale project activities"

Based on country (LDCs, SIDSs)
• Renewable energy up to 5 MW • Energy efficiency up to 20 GWh savings per year • Other small scale CDM projects (Type III) up to 20 $ktCO_2$ emissions reductions per year
Based on unit size and consumer (households, communities, SMEs) (i.e. any country)
• Renewable energy of any size as long as unit size is less than 1500 kW • Energy efficiency of any size as long as unit savings are less than 600 MWh per year • Other small scale CDM projects (Type III) of any size as long as unit savings are less than 600 tCO2 per year
Based on host country designation of special underdeveloped zone (SUZ)
• Renewable energy up to 5 MW • Energy efficiency up to 20 GWh savings per year • Other small scale CDM projects (Type III) up to 20 ktCO2 emissions reductions per year
Based on designation of a technology by the host country
• Grid connected renewable energy specified by DNA, up to 5 MW, which comprises less than 3% of total grid connected capacity
Based on other technical criteria
• Off-grid renewable energy up to 5 MW supplying households/communities (less than 12 hours' grid availability per 24 hours is also considered "off-grid")

Note: LDCs = Least Developed Countries, SIDSs = Small Island Developing States, SME = Small and micro enterprises, DNA = Designated National Authority.
Sources: Tool for "Demonstration of additionality for microscale activities" (version #)

The small-scale tool does not, however, include grid electrification or solar water heating in grid-connected households, because the connectivity of an electricity grid means that the households are no longer using independent units or systems. For grid electrification to qualify under the current positive list for "microscale" activities (Table 5), the activity would need to be in a Least Developed Country (LDC) or Small Island Developing State (SIDS), or entirely within a Special Underdeveloped Zone (SUZ)[20]. The CDM rules also imply that the total size of the activity is relevant for assessing additionality, because the micro-scale guidelines are limited to project activities that reduce emissions by less than 20 $ktCO_2$ per year for this type of activity. To include simplified approaches to grid electrification under the SCF, therefore, it would be useful to have other methodological approaches for automatic additionality. Alternative options that could be used for assessing the additionality of grid electrification programs include the following:

- Penetration rate: grid electrification programs in countries with rural electrification rates below 20%[21] are considered automatically additional;

[20] For solar water heating, the limit of 20 GWh in electricity savings would apply, which would be in excess of 7,000 households, based on "PoA 8855: Solar Water Heater Program in India"

[21] The 20% threshold for rural electrification comes from the "Methodological tool: Demonstration of additionality of small-scale project activities" (version 10.0), where it is used to determine whether renewable energy-based electrification with isolate units is automatically additional. This number is arbitrary, however, but also quite conservative. For example, in 2013 eighteen Sub-Saharan countries had rural electrification rates above 20% but many of these were still LDCs and Low Income Countries with very limited resources and infrastructure (e.g. Mozambique, Senegal, Swaziland, Togo, Sudan).

- Geography: only grid electrification programs in LDCs and SIDS are considered automatically additional [or possibly programs in LDCs, SIDS and Low Income Countries];
- Recent trends: grid electrification programs in countries where the rural electrification rate has increased by less than X% over the past Y years are considered automatically additional;
- For programs that do not fall within the scope of a positive list, the following options can be considered:
  - Require that the programs demonstrate barriers preventing implementation, possibly with using similar approaches as the barrier demonstration for SSC projects under the CDM or a similar tool;
  - Apply a standard discount to the emission reductions that reflects the possibility of a baseline scenario with increasing electrification.

Adding requirements such as those included in the last point would obviously increase the complexity (and subjectivity) of applying the SCF in a given country and sector. They may be necessary, however, to ensure the environmental integrity of the country-specific SCF application, if there is a possibility that electrification programs in lower middle and upper middle income countries with current rural access >20% could potentially be implemented without carbon financing (i.e. would not be fully additional).

4.3 Standardized emission reductions

One of the main challenges that energy access programs have faced, as discussed earlier, is that implementing agents do not necessarily have the capacity or access to data needed to meet all of the UNFCCC monitoring requirements. While they may have good data on project performance (e.g. consumption, technologies implemented, share of operational systems), this may not be the case with data related to the baseline (e.g. historical consumption levels and technology choices, efficiency of pre-project or alternative technologies). Even for project performance, monitoring actual consumption at sub-sets of households can be cumbersome, inaccurate and time consuming. The innovations in the SCF would build upon the standardized baseline experience under the CDM, moving from this to standardized emission reductions (i.e. incorporating standardized project emissions where appropriate).

Under a country-specific SCF application, key data on baseline technologies and baseline emissions factors for a variety of program proponents would be standardized at a national level, either directly by the government or by government approving the data submitted by other organizations. Some parameters could even be standardized internationally, across multiple countries applying the SCF concept. This would include some standardization of MRV, by allowing multiple programs to use national sampling data (i.e. data collected by government authorities, or collected by existing program proponents and aggregated by government) as default parameters. This is similar to the government role in the establishment of standardized baselines (SBs) under the CDM, except that some data relevant to project emissions could also be collected to allow for simpler calculation of total emission reductions (i.e. and not only baseline emissions).

For the parameters where national default factors could be used, the national government would either collect or review relevant data – possibly in collaboration with existing program proponents – and arrange for verification of this data, after which the default factors and parameters would be made available to all programs. The program proponents would continue to be responsible for collecting data on the performance of their installations, devices or consumer base, and would combine this data with the national default factors to prepare their monitoring reports to be submitted for verification. Some parameters could also be fixed at the global level by the SCF, similar to the default factors included in CDM baseline and monitoring methodologies.

The simplified approach to emission reductions would, in principle, be based the *number of households receiving access* (e.g. electricity, cooking devices, lighting devices), *average consumption of those energy services* (e.g. kWh, cooking energy/fuel use), and the difference between the *baseline and program emission factors* (Figure 4), although the detailed calculations would vary by technology. Program proponents would only be *required* to measure the number of households receiving access under their interventions. For the other parameters, national or international default factors could be made available, although program proponents could still *choose* to monitor some of these directly, if they felt that this would be advantageous (or if national default factors were not yet available in their country). This would provide flexibility for program proponents, while potentially reducing transaction costs significantly. In a case where all of the parameters other than the number of households was based on national and international default factors, the total emission reductions could be calculated each year based solely on the number of households or devices within the program. This would be similar to the current approach for solar LED lamps under the CDM, where emission reductions are based on only the number of operational units in place and an international default emission reduction factor per unit.

Figure 4.Concept for calculating standardized emission reductions under the SCF

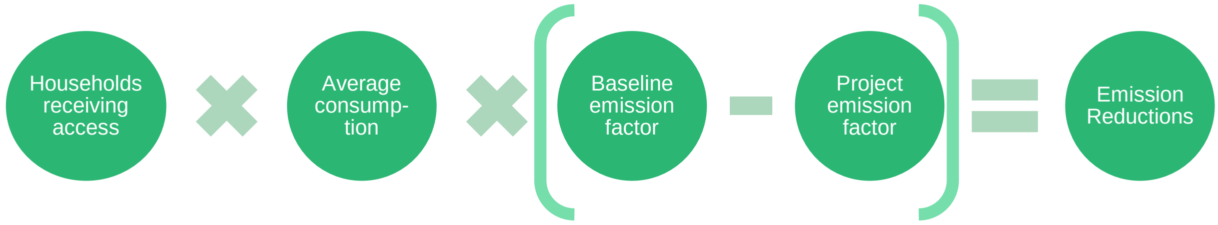


Table 6 shows how the emission reductions might be standardized for grid electrification interventions. In the example of grid electrification, if average household electricity consumption, the mix of baseline technologies (e.g. what type of service the households had prior to grid connection), emissions per baseline technology (e.g. mini-grid access or fossil fuels only) and the grid emission factor all used national and international default factors, then program proponents would only have to monitor the number of households with working connections (see example in Chapter 5).

Table 6. Standardizing emission factors: grid electricity example

	Households receiving access	Consumption	Baseline emission factor components	Project emission factor

		kWh/household by category	Mix of baseline technologies % of households	Emissions per baseline technology tCO2/MWh	Grid emission factor tCO2/MWh
International default factor	X	X	X	R	X
National default factor	X	O	O	X	R
Program-specific factor	R	O	O	X	X

Key: R = required, O = optional; X = not allowed

While the details of the parameters and calculations would vary by technology, the principle would be the same – provide national and international default factors wherever possible to reduce the costs for program proponents and to improve consistency in MRV across programs.

Table 7 lists examples of the monitoring and data collection parameters that could be measured at a national level. The data could be collected and prepared by the national government (or an organization mandated by government, or at least approved government), verified by an auditor and made available to programs through the SCF administrative body in a given country, similar to the process of establishing national Grid Emission Factors through the standardized baselines process, or specifying the fraction of non-renewable biomass on a national level[22]. In the table, the parameters in plain black text should *only* use national default factors, while those in blue text could be sourced from *either* national default factor or program-specific parameters. Green bold text indicates values that could have international default factors instead of national ones, or possibly both as an option, but would not be measured at the program level.

Table 7. Baseline and monitoring parameters that could be measured at national and international level

	Solar lighting	Water purification	Electrification	Cooking
Pre-project parameters	Adjustments to default emission reductions per unit	**Average volume of drinking water per person per day** **Efficiency of the water boiling systems replaced** Proportions/fraction of baseline fuel type Fraction of the population relying on water boiling in absence of project	Mix of baseline technologies Solar availability Average existing mini-grid emission factor **Emission factors of baseline technologies**	Fraction non-renewable biomass Annual quantity of woody biomass used (pre-program) **Efficiency of baseline device**

[22] https://cdm.unfccc.int/DNA/fNRB/index.html

	Solar lighting	Water purification	Electrification	Cooking
Monitoring parameters	Share of operational systems for given product/ model	Leakage[23]	National grid emission factor Average consumption of specific consumer types	Leakage Program stove efficiency[24] Average project device loss in efficiency[25]

Note: Plain black text is for parameters that would *only* be monitored by government, while blue text is for parameters where government would provide data but program proponents could still choose to do their own monitoring. Green bold text indicates values that could have international default factors rather than national ones.

Taking cooking appliances as an example, the government or a mandated organization could be responsible for testing baseline technologies available in the market to determine their efficiency, both at the start of the program and periodically during the lifetime of the program. This could also facilitate learning and dissemination of best practices across the sector. A government agency might also coordinate a dedicated team of experts conducting field tests such as kitchen performance test (KPT) and water boiling test (WBT), if this was still needed for new project technologies. Alternatively, for some products and technologies default factors for efficiency might be made available internationally in the SCF methodologies.

The program proponents would continue monitoring the performance of their intervention, including the number of units installed/sold, and they might choose to measure consumption or even the mix of fuels replaced (Table 8). Again in this table, the parameters in black text might *only* use program-specific factors, while those in grey text might be sourced from either national or program-specific monitoring. For program proponents, focusing on only these parameters that are most relevant for managing their business and serving their customers would free up time and resources to invest in expanding their reach or improving their level of service.

Table 8. Baseline and monitoring parameters that would still be measured by program proponents

	Solar lighting	Water purification	Electrification	Cooking
Pre-project parameters		Proportions/fraction of baseline fuel type	Mix of baseline technologies	

[23] Leakage regarding non-renewable woody biomass: Although program developers might use global default factor of 0.95 (i.e. 5% of the emission reductions are discounted due to possible increased use of non-renewable biomass outside of the project boundary), this parameter could also be calculated based on actual measured national level data.

[24] This parameter could be set at a global or regional level as well, whereby an entity such as the GACC would provide verified efficiencies of specific stove models on the market, which would then be endorsed by at a national or regional) level, as is currently the case with fNRB and data from the Food and Agriculture Organization (FAO).

[25] Similar to stove efficiency, the rate of decrease in efficiency over time could be based on verified testing values at a global level rather than linear decrease until 20% at the end of project devices' lifespan.

Monitoring parameters				
	Number of units distributed Share of operational systems for given product/ model	Population serviced by project activity Quantity of purified water (per year) Number of operating project devices	Number of operational connections/ units Emission factor for project mini-grid Average consumption of specific consumer types	Number of operating program devices Program stove efficiency Average project device loss in efficiency Project emissions due to cultivation of biomass[26]

Note: black text is for parameters that would *only* be monitored by program proponents, while blue text is for parameters where program proponents could choose to do use national default factors.

Using national or international default factors raises the question of how often these values should be updated, and how current the data must be. Under the CDM, this has been discussed in the context of standardized baselines[27]. A similar approach could be adapted for the national parameters (e.g. efficiency for a given model of stove might not need to be updated often, although new models would require new testing).

As a result of eliminating the overlap in monitoring campaigns, the total costs of MRV for a set of programs in one sector in a country should decrease. Individual program proponents would immediately see the costs of operating monitoring campaigns decrease while some activities are allocated to the national government or its designated agency. Funding of the monitoring tasks by a national government, as well as technical assistance, however, will need to be arranged.

National default factors may turn out to be more or less conservative than parameter values established by individual programs, but there is no way for an individual program implementer to know this without undertaking detailed program-level monitoring. Program proponents would therefore evaluate, based on their experience, the savings in MRV costs from using national default factors versus the probability that conducting their own monitoring could increase the number of credits awarded to their program.

4.4 Simple project cycle

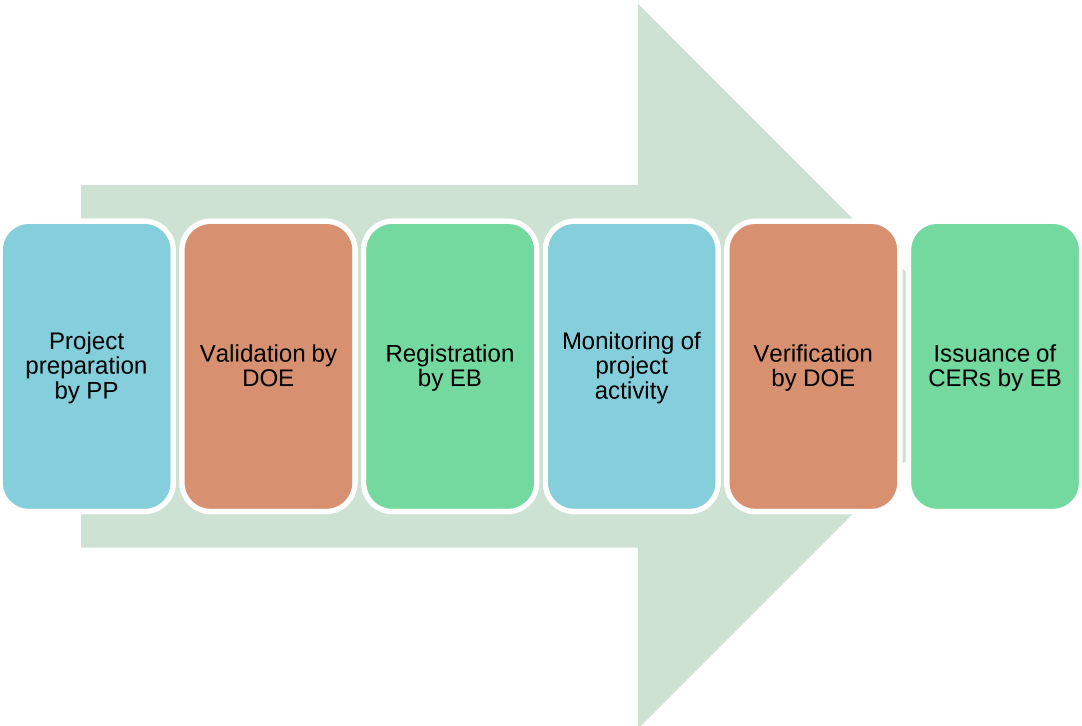
The monitoring process for programs under a country-specific SCF application would track the number of operational units or connections each year to establish the program boundaries. The tracking of all units would eliminate the need for “including” a group of units, as with CPAs under the current CDM PoA model. This simplifies the project cycle when compared to CDM PoAs, where DOE input is needed for the inclusion of each new CPA (Figure 6). In addition, the SCF would build on earlier proposals for streamlining the project cycle by combining the validation and verifications steps into a single ex-post third party audit of program performance and compliance. Initially, the programs would be registered or

[26] This parameter is applied to a project or program with a dedicated source of biomass – some components of this parameter could eventually be calculated at a national level.

[27] “Standard: Determining coverage of data and validity of standardized baselines” (ver 01.1) http://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20140303103011788/MethSB_stan01.pdf

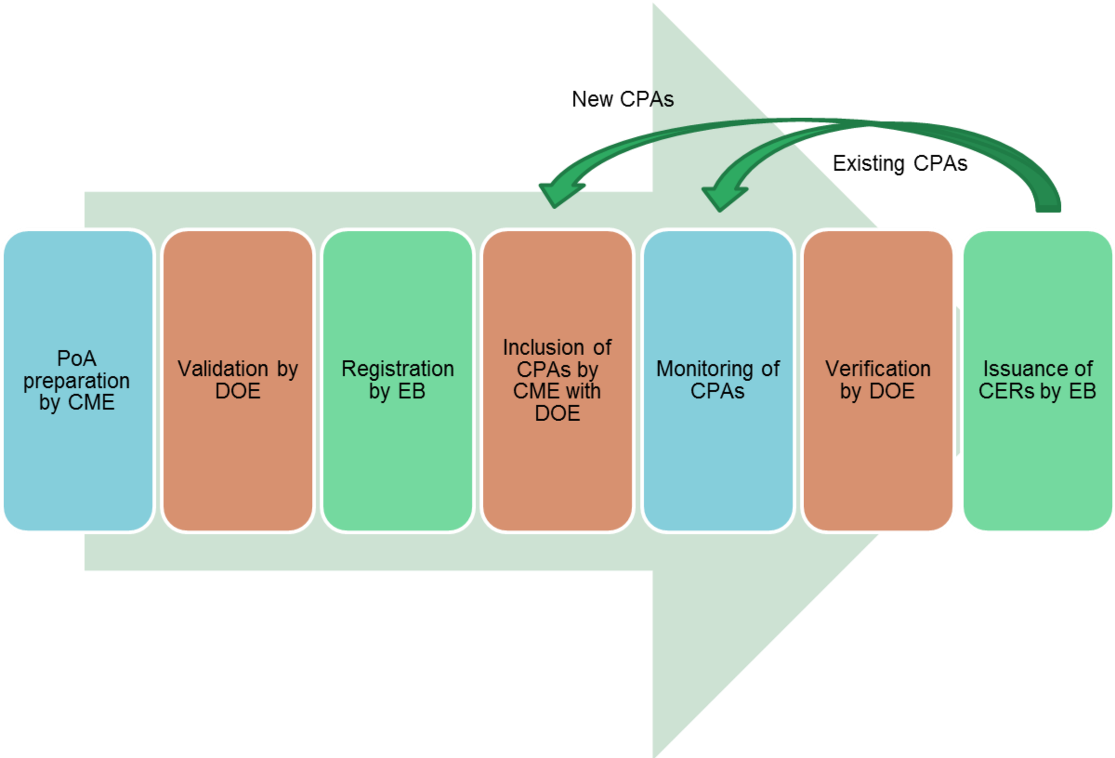
"listed" by the country-specific SCF administrative body based on the information in a simplified listing template that would clearly define the technology requirements for eligibility. An example of the simplified listing template is presented in Annex A. A full third-party audit would happen during verification (Figure 7). Note that the simplified listing template would include a section where the proponent should confirm their compliance with the applicable environmental impact assessment (EIA) regulations, and that they had undertaken a stakeholder consultation. Once registered, the program would initiate a monitoring program to collect data annually to determine emission reductions, which would in turn be verified by a third-party auditor before credits were issued. The crediting period would start at the time of listing.

Figure 5. Current project cycle of CDM project activities



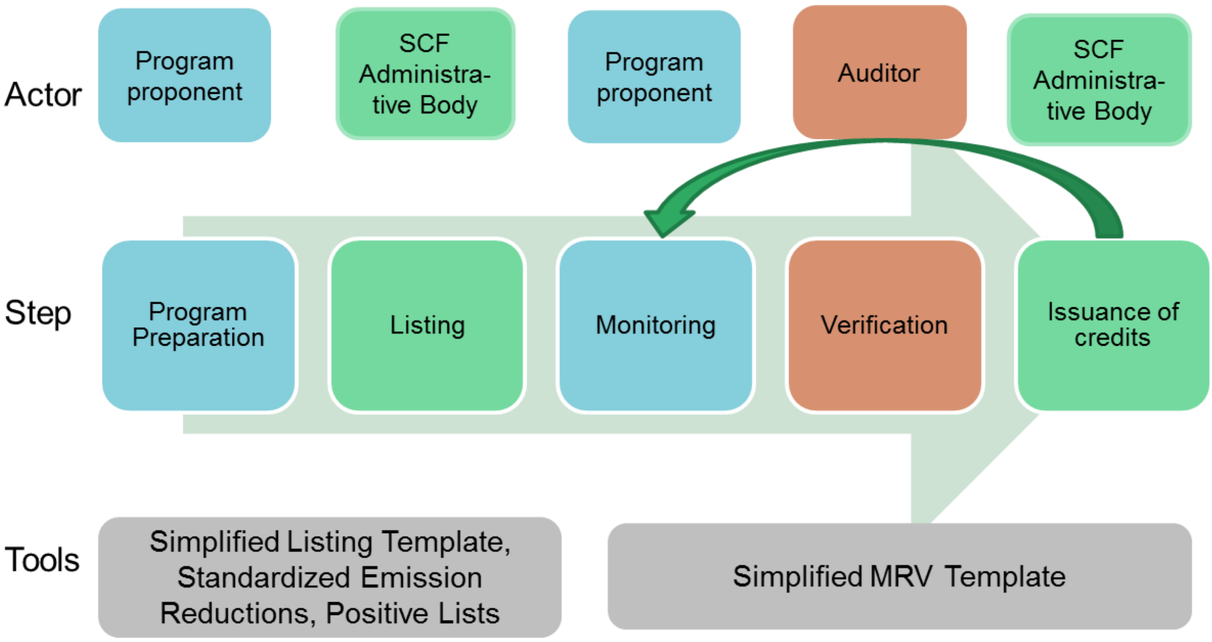
Note: PP = project proponents; DOE = Designated Operational Entity; EB = Executive Board

Figure 6. Current project cycle for a CDM Programme of Activities (PoA)



Note: PP = project proponents; DOE = Designated Operational Entity; EB = Executive Board; CPA = component project activity; CERs = Certified Emission Reductions; CME = Coordinating/Managing Entity (of a PoA)

Figure 7. Project cycle, actors and tools under the SCF



4.5 Streamlined MRV approaches

The SCF, in this report, is designed to be a departure from the CDM mechanism, providing a simplified approach for energy access entrepreneurs to access carbon markets. This section includes additional simplifications that could be made compared to the current CDM rules, based on the structure and procedures of the proposed SCF. The CDM terminology is used here to describe aspects which will be streamlined, even though it is possible that new terminology would be eventually used for country-specific SCF applications.

The suggestions below tie in with ongoing efforts by the CDM Executive Board to develop more cost-effective and context-appropriate approaches for MRV in particular for project activities involving households and communities. In response to the mandate given by CMP.11 in December 2015 (Decision 6/CMP.11), the CDM Executive Board has already approved or is considering the following simplifications:

- Carrying out on-site inspections at validation and verification is up to the discretion of the validating or verifying DOE and only mandatory under certain conditions (e.g. when the estimated annual average emission reductions exceed 100,000 tCO_2eq at validation or for the first verification) (EB 90)
- If local calibration standards are not available, project proponents can also use regional or national standards of other (comparable) countries and do not have to revert to high international calibration standards (EB90 and concept note on cost-effective and context-appropriate approaches for MRV)
- Development of a procedure for data handling protocols to deal with data gaps (EB90 and concept note on cost-effective and context-appropriate approaches for MRV)

4.5.1 Data-specific simplifications

Under the SCF, the monitoring will be streamlined and the number of monitored parameters reduced to a strict minimum as described in previous sections. Against this background, accuracy requirements and calibration will be less of an issue than under current CDM methodologies, but still need to be addressed for specific cases (e.g. electricity meters on large mini-grids or for some consumers receiving new grid connections). Simplifying the approach to accuracy requirements under the SCF could entail the adoption of a tiered approach based, for instance, on the type of technology used or the program's location. Concerning calibration, applying international standards often requires international experts and equipment with significant cost implications. Instead, under the SCF, local/national standards or approved default values could be adopted based on program's specifications provided through listing and MRV templates. If data gaps occur, specific guidance documents or a decision tree would provide program developers with a detailed solution on how to address the issue.[28]

[28] For the sake of comparison with the CDM, the EB examined options to increase flexibility related to ex-post adjustment of monitoring during EB84 but no decisions were taken until now.

4.5.2 Procedural simplifications

Compared to CDM PoA/CPA, the SCF would apply simpler procedures. The need for site visits for instance would be lower, because of the streamlined monitoring standards (e.g. fewer monitored parameters, extensive use of sectoral default values, etc.) and the increased use of digital communication, which allows greater reliance on off-site evidence.[29] The SCF would allow qualified local experts to provide auditing services, as is the case already with other crediting frameworks such as the Gold Standard. Allowing local experts for verification purposes would not only lower transactions costs and simplify the procedure but more importantly could support building local/regional capacity. The local experts should obviously not be affiliated with any government body, to ensure verification integrity and prevent a conflict of interest, since the government is the program proponent. Training could provide interested local companies with the required level of competence. In addition, and due to the scope of the SCF (i.e. equivalent to CDM small-scale methodologies related to energy-access), the same entity would automatically be allowed to act as a third-party for both validation and verification processes.[30]

While listing and MRV templates, as well as simplifications of the data requirements, would contribute to faster processes, strict timelines for information checking at the country-specific SCF administrative body would prevent unnecessary delays and increase investor confidence in the delivery of timely results.[31]

Finally, the SCF could greatly benefit from the adoption of innovative approaches for dealing with program documentation. This involves digitization of forms for instance, which is already in place in other schemes such as the EU ETS or the JCM,[32] and slowly being rolled-out in the CDM.[33] As opposed to the CDM, where project documents can be cumbersome and tedious to complete, the use of listing and MRV templates as part of the SCF would allow straightforward adoption of digitized forms. Furthermore, country-specific SCF authorities could capitalize on advances in low-cost wireless communication technologies to implement innovative monitoring techniques (i.e. data collection and management tools) at national scale.

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[29] The topic of site visit exemptions or flexibility is also currently being discussed extensively by the CDM EB, for example at EB88 (Annex 4 – Available at: http://bit.ly/1LWukqc) and ias part of the agenda for EB89 (Annex 2 – Available at: http://bit.ly/1ruwLrd)

[30] This rule was recently revised at EB88 (Annex 4 – Available at: http://bit.ly/1UPBAXK)

[31] Reducing UNFCCC timelines for complexness checks and information & reporting checks is a recurrent complaint from CDM project developers – the issue was raised several times (in particular by the Project Developers Forum) and subsequently acknowledged at EB88 but no tangible solutions were provided to date.

[32] Under the JCM, the monitoring report is actually skipped altogether and the Excel template is used instead for reporting

[33] Under the CDM, digitization was first considered during EB81 and then through EB85 and EB87, where concept notes were issued on the process. A dedicated working group developed Word and Excel-based digital forms/documents prototypes focusing on methodologies AMS-II.J, AMS-III.AR and AMS-I.L. As of January 2016 and following a procedure of road testing and approval, digitized methodological tools for AMS-II.J and AMS-III.AR are available to use to project developers on a voluntary basis (EB87 – Annex 9, Para. 26. Available at: http://bit.ly/1XccC2B)

4.6 Business model neutrality

As highlighted in section 3.5, scaling-up energy access is not possible without access to the full range of sources of capital, particularly since results-based payment tools (e.g. related to emission reductions or other targets) will not provide upfront capital. One of the major sources of capital for energy access is ODA, which in 2013 amounted to 45% of total capital investment in energy access projects[34]. Any restrictions on the use of ODA may undermine the optimum mix of sources of capital that is required for successful realization of the energy access agenda, given the current challenges faced by CDM project developers in utilizing public funding.

Adopting the CDM approach (i.e. identifying all public funding sources and requiring all of them to provide letters verifying that no official development assistance been diverted) could create perceived or real challenges with blending public finance with carbon finance, and so could reduce the effectiveness and reach of the SCF concept and discourage innovative financial models for scaling up. The SCF does not, therefore, have specific requirements on identifying financing sources. Donor countries would, of course, still have to abide by any OECD Development Assistance Committee (DAC) reporting rules related to carbon financing, if the rules for CDM project financing were to apply to new market mechanisms as well (OECD, 2004).

[34] http://www.worldenergyoutlook.org/resources/energydevelopment/energyforallfinancingaccessforthepoor/

5. Case study of application of standardized crediting framework

The purpose of developing a case study based on one of the Ci-Dev programs is both to illustrate the new approaches presented in this report as well as understand how simplified versions of some of the current rules under the CDM could be used for a country-specific SCF application. In this chapter we apply each of the major proposals as part of the SCF concept introduced in the previous chapter to the Senegal Rural Electrification program. Note that, in this example, there would only be one “SCF program” within the “country-specific SCF application”, because the entire national rural electrification program is overseen by one body. An alternative, which could also be explored, would be for the government to oversee the country-specific SCF application, and then have all the concessionaires or other actors (see below) in Senegal apply to lead SCF programs. Given the experience of the national agency with carbon markets, however, in this case we present the case where government itself leads the program.

We present the case study as though the Senegal program were being designed from scratch as a country-specific SCF application (albeit with a single SCF program), rather than already being part of the way through the CDM project cycle. Note that, while a national government agency (e.g. ASER) plays the role of program proponent in the Senegal case, its main role is as an aggregator of multiple electrification businesses and interventions. This role could also be played by a private entity in other countries, or there could be multiple private entities undertaking electrification initiatives (with government approvals where necessary). The implications of multiple private entities listing programs under a country-specific SCF application are also noted below, where they might be different than the case of a national authority playing the lead role.

5.1 Overview of rural electrification initiative

The government of Senegal has set a goal to increase rural electrification rates in Senegal from 24% in 2012 to 60% in 2017 and universal access in 2025. The GHG emission reductions from achieving this goal would be in the order of hundreds of thousands of tons of carbon dioxide per year. The Senegalese Rural Electrification Agency (ASER)[35] has the responsibility to define the strategy for rural electrification. From 2000 to 2010, ASER’s electrification efforts include using grid extensions, solar home systems, and isolated diesel mini-grids, but this only resulted in approximately 1000 villages gaining access over that decade. Achieving universal access, however, requires reaching more than 11,000 additional villages and close to half a million households. The rural electrification initiative under development by ASER could contribute to this effort, but does not necessarily include full scope rural electrification because of the diversity of initiatives and business models that will be used to reach the access goals.

Much of the electrification activities are implemented through an innovative concession program to extend access to affordable energy services. For the main electrification effort, the country is divided into 10 concession areas, for which concessionaires have been selected through an international bidding process. The concessionaires will be responsible

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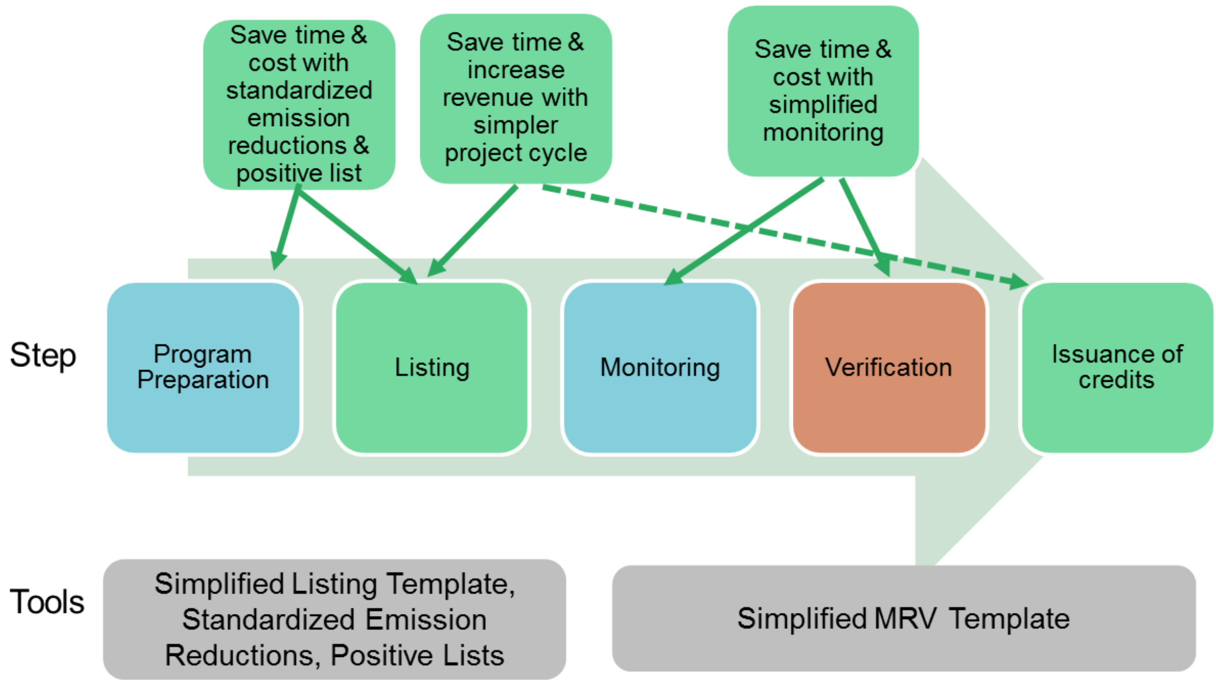
[35] Agence Senegalaise d’Electrification Rurale

for most of the implementation and the entire ongoing operation of the rural electricity system within their geographic area. However, there are many other actors that are also engaged with specific investments and activities, including the national utility, SENELEC, private mini-grid developers, local and provincial authorities bringing energy to schools and health centers, etc. This case study for the SCF therefore explores how ASER, as the lead institution and aggregator of many different interventions, could cover all of the activities in the sector with a single crediting program.

Figure 8. Benefits of SCF for case study initiative



5.2 Additionality and positive lists

The rural electrification program includes solar home systems, mini-grid and grid extension. A private program implementer might not include all three technologies, but the additionality evaluation would be the same as for a national-scale program. The solar home system and hybrid mini-grid components of the electrification would all fall under the current positive lists of automatic additionality accepted in the CDM rules (see section 4.2). The Senegal program also includes grid electrification, which is one of the technologies that is not automatically additional under the CDM. In terms of the options for the SCF proposed in section 4.2, the application to Senegal would be as following:

- Penetration rate: Senegal's rural electrification rate is already above 20%, so this criterion would not be sufficient to demonstrate additionality
- Geography: Senegal is an LDC, so under this criterion could demonstrate additionality
- Recent trends: in terms of trends in Senegal, the rural electrification rate increased from 24% in 2009 to 29% in 2013

5.3 Standardized emission reductions

- **Households receiving access**

Senegal has a national Energy Information System (abbreviated SIE in French)[36], maintained by the Ministry of Energy and Renewable Energy Development (MEDER), which is used by various actors in the sector to capture, among other things, data on energy access. SENELEC and the rural electrification concessionaires, for example, all submit reports to the Ministry and to ASER on their progress in line extension, connection of households to the grid, distribution of solar home systems, and construction of mini-grids. This data is used as the basis for calculating the rural electrification rate by Department (i.e. province) each year in the SIE report. During 2016 the Ministry is revising the structure and operation of the SIE to more easily aggregate across different implementing institutions, while tracking the different technologies used to provide electricity. The SIE could therefore be used to collect the required data on number of households from individual implementing agencies, so that this could be aggregated to precise numbers of households reached so far by the program. In the case where multiple private entities were developing programs under the SCF, they would use the same data supplied to the SIE as their monitoring data on number of households. Data on number of new connections could be compiled and presented as shown in Table 9.

Table 9. Illustration of monitoring data on number of (cumulative) households receiving access through the program

	Year 1	Year 2
Hybrid/RE mini-grid	10,000	15,000
Grid	20,000	45,000
Solar home system	3,000	7,000

Note: yellow values are reported by program proponent.

- **Consumption**

For grid and mini-grid electricity consumption, only households with higher consumption levels in Senegal have electricity meters. Households with consumption or load limited connections pay a month tariff and do not generally have meters. In Senegal's case, consumers are separated into four service levels, with the Service Level 4 having unlimited usage (and electricity meters) and the other three service levels having consumption limits. The national default factors for average consumption should therefore be different for each service level. These average consumption levels could be determined through sample surveys carried out by ASER and/or concessionaires and other implementing entities. Once established, they could be fixed for the program. In the case where multiple private entities were developing programs under the SCF, they might choose to do their own surveys of average consumption, but using the national default values (if available) would save considerable time and effort.

For solar home systems, consumption is based on the deemed solar output per unit of installed capacity. This national default factor can be calculated from the geographic location of the country and some basic technical requirements for solar PV systems, using a tool such as RETScreen (the tool used in the relevant approved CDM methodology). Alternatively, a more conservative international default factor could also be used (e.g. 12% solar availability, as in AMS I.L and AMS III.BL). Example values and sources of data are shown in Table 10.

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[36] Systeme d'Information Energetique du Sénégal

Table 10. Illustration of average household electricity consumption

Consumer type	kWh/yr	Source
Hybrid/RE mini-grid	250	National default factor, based on sample surveys by ASER
Grid	500	National default factor, based on sample surveys conducted by concessionaires and SENELEC
Solar home system	66	International default factor: deemed consumption based on average system size

- **Baseline emission factor components**

To determine the baseline emission factor, the **mix of baseline technologies** (e.g. whether households had no access at all, access to a mini-grid, etc.) could be fixed at the national level, based on a survey of households without access at the start of the program. In the case where multiple private entities were developing programs under the SCF, they might choose to do their own surveys of average consumption among only the households served by their networks. For the illustrations below, we assume that the program proponents use the international default factors for emissions factors. In other words, the **emission factors for baseline technologies** would be fixed at an international level, similar to the default factors provided in CDM baseline methodologies.

Table 11. Illustration of calculation of baseline emission factor for electrification program

		Mix of baseline technologies	Emission factor (tCO2/ MWh)
Target households	**No connection**	**90%**	
	no electricity	76%	1.7
	car batteries	10%	1.2
	diesel generator	5%	1.4
	Fossil fuel mini-grid	**10%**	1
Weighted Average			1.6

Note: data on share of households is for illustrative purposes only. Yellow values are reported by national government or program implementer, while grey values are international default factors.

- **Program emission factors: grid and mini-grid emission factors**

The grid emission factor could also be fixed using standard tools and with approval of the national authorities that oversee carbon markets (i.e. Direction de l'Environnement et des Etablissements Classés). In the case of Senegal, the simplest approach to the grid emission factor is to use the emission factor of the most GHG-intensive fuel source on the grid. This is oil-fired power for Senegal, with a default emission factor used in the CDM of 0.9 tCO_2/MWh. For hybrid mini-grids, the emission factor depends on the amount of diesel generation in a hybrid system. Senegal does not yet have standards for this, although the experience of ASER suggests that 40-50% is typical. For monitoring, ASER would either have to do a survey of mini-grids to establish this value, or work with the Ministry to enact regulations capping the share of diesel, in which case this maximum value could be a conservative default value (e.g. 50% diesel, with emission factor of 1.3 tCO_2/MWh, which implies a hybrid mini-grid emission factor of 0.65 tCO_2/MWh). In the case where multiple private entities were developing programs under the SCF, they might choose to monitor the renewable versus diesel output of their own specific mini-grids. Mini-grids including only fossil fuel generation would simply use an international default factor of 1.3 tCO_2/MWh.

- **Emission reductions**

Using the data in this and the previous sections, emission reductions in the first year of program implementation can be calculated as shown in Table 12.

Table 12. Illustrative calculation of emission reductions for electrification in a given year

		Mini-Grid	Grid	SHS
Number of households receiving access		10,000	20,000	3,000
Average consumption	MWh/yr	0.250	0.500	0.066
Baseline emission factor	tCO2/MWh	1.6	1.6	1.6
Project emission factor	tCO2/MWh	0.7	0.9	0
Emission reductions	tCO2	2,304	6,714	310
Total	tCO2	9,328		

5.4 Simple project cycle

Combining validation with verification and using a simplified listing template for an individual SCF program for electrification in Senegal could save significant costs and time, compared to the current average of 500 days for CDM PoAs to be registered (Fenhann, 2016) . Not having CPAs also would significantly reduce the future work required by the program proponent, since there would be no need to draft new CPA documents and hire an auditor as part of the inclusion process. All that would be required would be the annual monitoring process described in section 4.3 above.

More importantly, because listing would essentially occur at the same time that the start of validation could have occurred with the CDM PoA, the crediting period would essentially start almost two years earlier. All of the program performance would still be subject to third-party auditing during verification, ensuring that only eligible programs receive credits. From the perspective of a program proponent, by following the guidelines in the simplified listing template and by providing the data required by the simplified MRV template, they would have high confidence in receiving credits even without a validation phase. The early start to crediting would significantly increase carbon revenue. Estimates of emission reduction from the ASER CDM PoA suggest that at least 80,000 CERs per year could be generated. This means that bringing forward the start of the crediting period could add more than 150,000 CERs of carbon revenue to the program, at the early stages when investment and incentives are most needed.

5.5 Streamlined MRV approaches

Section 4.5 presents a number of streamlined MRV approaches for energy access programs, and the principal ones that could impact the Senegal program are presented here.

Tiered accuracy requirements: Mini-grid technologies in Senegal will be a combination of solar PV and wind together with diesel. Accuracy requirement issues tend to be less of a concern for electricity meters than they would be, for instance, for flow meters or temperature sensors. The benefits of tiered accuracy requirements would hence not apply to this particular program.

Alternatives to calibration: Calibration is not an issue in the Senegal program, as the electricity consumption by households is not measured, but estimated as most households do not have electricity meters.

Providing site visit exemptions: A significant portion of the cost of verification is likely to be for site visits, since the Senegal program is national-wide and includes remote rural areas. Eliminating the need for site visits, or making them biannual instead of annual, would result in significant cost savings during verification.

Conducting verification using a local expert: None of the DOEs serving the CDM has an office in Senegal with qualified staff for CDM validation and verification. This means that validation and verification both include travel costs and also potentially much higher daily rates for international experts. Utilizing local experts with similar training (e.g. ISO14000 auditors) under the SCF could therefore reduce transaction costs and also provide more flexibility in the validation and verification process. While the cost reduction is relatively small on its own, it could be part of a larger package of MRV approaches that significantly reduce upfront costs when compared to the CDM.

Enforcing shorter timelines for the SCF administrative body: Keeping wait times for various functions at the SCF administrative body to a minimum would speed up listing, but because the SCF would allow for generation of CERs from the start of validation, this would not affect potential carbon revenue for the Senegal case.

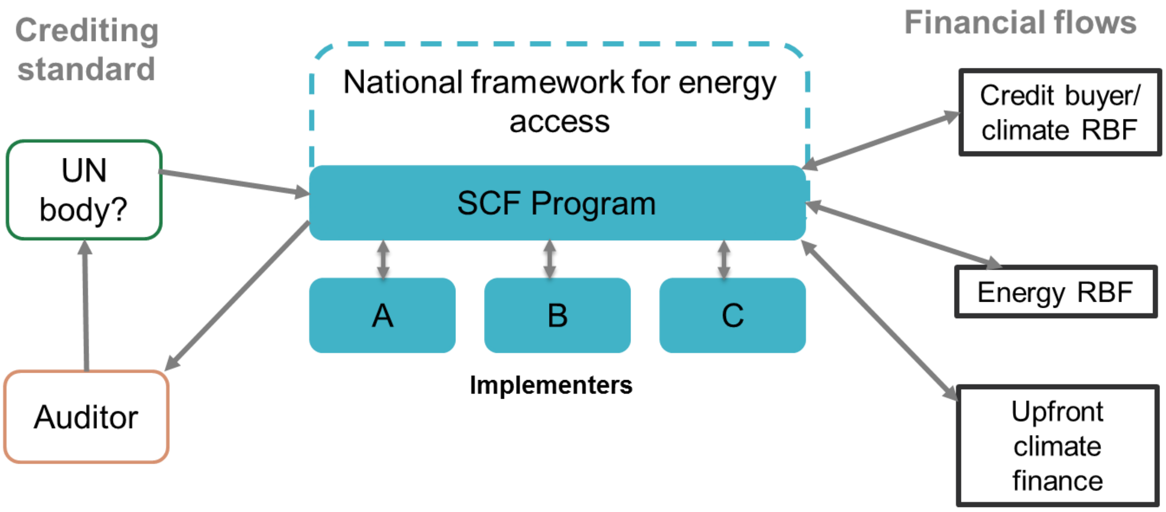
Standardization and digitization of forms: This measure could significantly reduce the transaction costs for a Senegal program. Just to reach the start of validation under the CDM has already required several person-months of time from consultants, Ci-Dev staff, and ASER staff. Some of this time is because of lack of clarity on what is required in the CDM forms, and generating fairly standard tables and procedures from scratch (e.g. sampling plans, management plans). An example of the standardization could be allowing the developers to choose, in each sub-section of the documentation, from a library of standard approaches, text, and procedures.

6. Future innovations in MRV – aggregated approaches

The purpose of the SCF presented in this report is to combine all of the crediting reform ideas proposed over the last few years, and to go as far as possible in simplifying the crediting system, say for example for energy access, *while still using a private-sector driven model that allows multiple entities to develop programs in the sector*. An alternative to this approach would be to take a more aggregated approach to energy access crediting, that would focus on national programs and use national/sectoral-level data. There still might be many actors at the sub-national level involved in different energy access investments and activities, but the focal point for MRV of mitigation and the recipient of the credits would be the government. This chapter briefly discuss how such a system might work for energy access, and the disadvantages and advantages. While the differences in the aggregated approach compared to the approach in Chapter 4 may appear to be modest and primarily technical, this would represent a fundamental change in the crediting system and the role of the public sector.

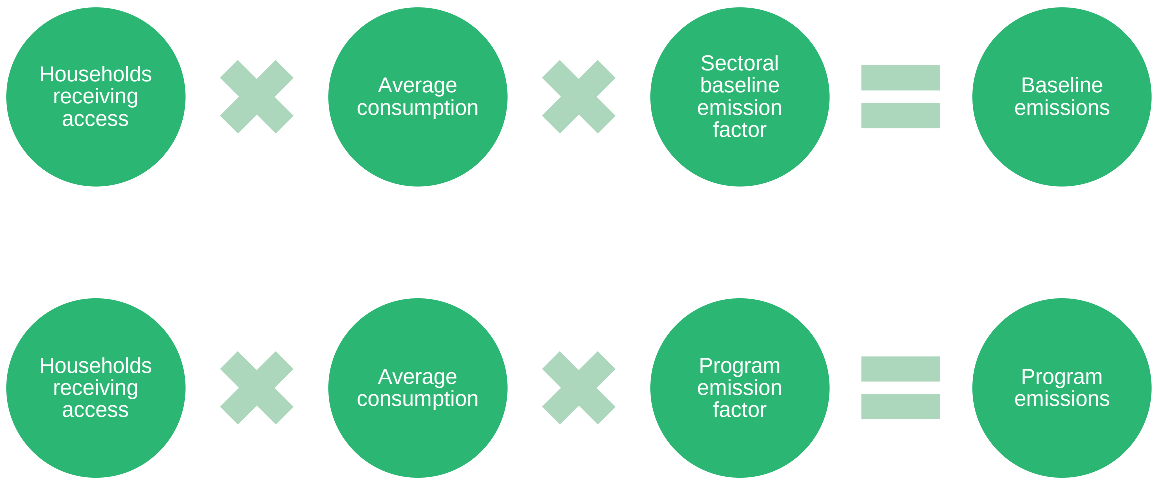
Under an aggregated approach to MRV and crediting, all of the data gathering for both the baseline and monitoring activities are under the direction of a national program with government responsibility. There is essentially only one "SCF program" per country, unlike the concept presented earlier where there are multiple SCF programs with different proponents that are under a given country-specific application of the SCF concept. Under the aggregated approach, the credits generated could provide results-based payments, which the government could, in turn, use (in part) to incentivize a wide variety of energy access activities undertaken by implementing organizations such as project developers, NGOs and suppliers of devices and hardware (see Figure 9).

Figure 9. Structure of an aggregated approach for the SCF concept



To support national programs (e.g. all rural households in the case of rural electrification) the baseline and monitoring approach would then encompass changes in access across the *entire* population, not simply groups of households that are engaged with specific energy access businesses (e.g. electrification concessionaires, distributors or installers of solar devices, etc.). In other words, an aggregated approach would not be the sum of multiple CDM PoAs and project activities, but would be a comprehensive program that covers the entire relevant population. The aggregated approach could use a simple but robust approach to measuring the change in emissions across the entire sector, based on changes in energy access levels from year to year (e.g. number of households throughout the country with electricity access or access to modern cooking services) and consumption of energy services[37]. This requires setting a *fixed sectoral baseline emission factor*, utilizing *sectoral energy access performance data*, and *estimating household energy consumption* as the basis for the MRV of emission reductions (Figure 4). This approach is illustrated in Figure 10 and discussed in more detail in Annex D. Note that, because this aggregated MRV approach uses national-level data, if it were used in parallel with existing project- or program-level crediting activities in the sector, then any credits issued to these ongoing activities would have to be subtracted from the estimated mitigation impact of the aggregated program to prevent double counting of emission reductions (see Annex D for further explanation).

Figure 10. Scheme of calculating baseline and program emissions using an aggregated approach



There are several potential advantages of the aggregated approach to MRV. First, using national or sectoral data on energy access, particularly data that is already collected for national or international reporting purposes, would significantly reduce the total costs of monitoring. In addition, this monitoring would be closely aligned with the requirements for international reporting under the UNFCCC, such as for national GHG inventories and progress towards achieving the pledges set out in NDCs, and national reporting on climate change strategies and action plans. Because national government already has obligations for GHG reporting, while individual energy access businesses and entrepreneurs do not, this would more closely align the responsibility of the actors in the system with their capabilities

[37] Note that to prevent double issuance of emission reductions, and energy access program should use *either* consumption/demand or supply to measure emission reductions, but not both. For example, a renewable energy plant added to the grid or a mini-grid will reduce sector emissions, but this will be captured when calculating project emissions for a consumption-oriented approach and so the plant should not also receive credit for reducing emission on the supply side.

and interests. Governments could, in turn, create domestic incentive schemes that reward entrepreneurs for achieving energy access goals, which is the core business of those organizations. Finally, by covering progress in the entire sector, this approach to MRV could take into consideration the impact of national policies more fully.

An aggregated approach to MRV would, however, be a fundamental shift in responsibilities and the conceptual rationale for monitoring, and would bring certain challenges. Most importantly, such an approach relies on public institutions having sufficient capacity to carry out the monitoring required and to engage with the relevant international authorities proactively. Some project developers in the current carbon markets have expressed concern about relying on governments to play this role, given the wide range of capacities and effectiveness of the CDM DNAs. For this reason, shifting to an aggregated approach could discourage the participation of the private sector, and innovative business models, unless the government created an effective domestic incentive scheme (or regulatory intervention) that was supported by the international revenue received. At a technical level, because of the expected uncertainties of the monitored values at a national level, the aggregated approach would be most suited to national interventions that have major impacts on energy access. The impact of small interventions (e.g. affecting 1% of the population) might be within the normal error margin of measurement, and so would not be captured. In addition, issuing credits to the government based on the total change in access implicitly assumes that all of those changes are driven by government intervention. This opens up the risk of "free-riders", and awarding credits for actions that might have occurred without government incentives. In other words, even with technologies that may be considered automatically additional in a project-based system such as the CDM, those concepts of additionality may not be as robust at the aggregated level. For example, a donor-driven program in the energy sector – unrelated to carbon and climate finance – might increase access but have no relationship to any incentives related to GHG emission reductions.

One final implication of an aggregated approach to MRV is how different sources of financing to the sector might be taken into consideration. If the SCF concept does not have any specific requirements on funding sources, then no further challenges are expected if an aggregated approach is adopted. If, however, the current CDM rules for disclosing information on public funding were applied, further challenges specific to the application of those rules to an aggregated approach could be expected. Identifying all of the sources of finance, and providing letters from funders that no ODA has been diverted, may be workable at a project or fairly narrow program level. This could present a significant challenge for an aggregated crediting program, however, and in particular an energy access program, where a country may often receive multiple sources of funding and may not be able to differentiate all of the details of these sources and the extent to which they constitute public financing[38], as well as how the mix of financing sources and donors changes over time.

[38] Multi-later development banks, for example, source their resources from both public and private financing, so identifying the specific public components, particularly those related to ODA, can be difficult.

7. Implementation of the SCF

This chapter provides a roadmap for the implementation of the SCF, taking into consideration the current regulatory situation of carbon markets at the UN level. With the adoption of the Paris Agreement, the CDM is gradually losing relevance given that it will only continue to serve the second commitment of the Kyoto Protocol and is not recognized as a mechanism under the Paris Agreement. While the SCF builds on the CDM and many of its innovations, the SCF should however not be directly linked to the CDM or face the same regulatory phase out. Rather the SCF should provide a vehicle to enable the transition of the Ci-Dev portfolio from the CDM to a successor market mechanism under Article 6 of the Paris Agreement, and to build the relevant operational reforms into the new mechanisms.

The mechanism for mitigation and sustainable development established in Article 6.4, in terms of its governance and some of the basic principles as an international mechanism, is a close successor to the CDM. Article 6.4 may therefore be a natural place for anchoring the SCF in the architecture of the Paris Agreement. However, the SCF could potentially also become recognized as a cooperative approach under Article 6.2. It is too early to provide definite answers on the ideal location of the SCF, because Article 6 is still in the operationalization phase and many questions remain unanswered. Integrating the SCF into the evolving regulatory framework is instead a question of process. A key component of this process is the actual piloting a country-specific SCF application in order to test the ideas and establish lessons learned. By demonstrating real benefits and garnering support among stakeholders, the SCF would have more chance of being accepted as part of the Article 6 negotiations.

7.1 Conceptualizing a pilot

To road test the SCF, one or preferably several pilot applications could be undertaken that apply the concept in a specific country and to a set of eligible technologies, sponsored by climate finance donors. To maximize the learning, the SCF should be piloted for both electrification markets and device markets and should be applied in at least two countries. While drawing upon the experience of the CDM, the pilot programs would however take place outside the UNFCCC framework. Most importantly, implementation of the country-specific SCF application as a pilot would not require authorization by the UNFCCC institutions, such as the CDM Executive Board or the UNFCCC Secretariat, but be the prerogative of the participants. The flows of financing and evidence of emission reductions achieved would be subject to bilateral or multilateral agreement among the providers of results-based climate finance, program implementers and relevant host country institutions.

A decision-making body would be required under the pilot to define the rules and select eligible technologies. This body could, for example, consist of representatives from the implementing country government(s) and climate finance donors. An equal representation would be ideal to generate ownership on both sides. This group could remain on an ad-hoc basis or constitute a more formal institution, following the example of the Joint Steering Committees established for the Japanese Joint Crediting Mechanism. In the process of defining the rules, potential program developers should also be consulted.

Furthermore, the pilot would need an administrator that would oversee the operational procedures and engage relevant stakeholders. This role could, for example, be filled by a (group of) climate finance donor(s) or a designated organization such as Ci-Dev or a local sectoral institution.

In testing the concept, the pilot could draw upon existing elements of the CDM, in particular approved methodologies (or parts of those methodologies), accredited DOEs, the validation and verification standard and the host country DNA. Given that the pilot would operate outside the UNFCCC, it would not, however, result in the registration of individual SCF programs with the UNFCCC or issuance of CERs. The pilot would pioneer the simplifications discussed above: a simplified project cycle, standardized emission reduction calculations, streamlined MRV and an extended positive lists for the demonstration of additionality.

Importantly, the development and implementation of the pilot for the SCF concept should address the relationship between the program and the host country's NDC. For any units issued under a country-specific SCF application to be compliance-grade (i.e. usable by the acquiring Party to meet its NDC pledge), recognition of the SCF concept and application under the UNFCCC would have to be sought.

7.2 Introducing the SCF into the UNFCCC process

As discussed above, the SCF could eventually become part of the UNFCCC rulebook by being introduced either under Article 6.2 or 6.4, which contain the provisions for market mechanisms under the Paris Agreement. Both pathways seem feasible in principle. While the details of the operationalization of both articles are not yet known, a characteristic difference is the governance system. Where the cooperative approaches under Article 6.2 are developed bottom-up and administered by non-UN entities based on globally defined standards, the mechanism of Article 6.4 is, like the CDM, centrally governed.

The key for recognition under Article 6.2 is that the SCF concept and its applications in specific countries would fulfil the yet-to-be defined guidance on cooperative approaches. In broad terms the text of 6.2 suggests that any approach would need to ensure robust accounting for the avoidance of double counting, ensure environmental integrity and promote sustainable development and transparency of governance. The SCF as described here would likely fulfill these criteria, at least at a high level. If the SCF were to be introduced into Article 6.4, the supervisory body of the new mechanism would have to endorse the modalities and procedures of the SCF and integrate them into its own rulebook. This could be more challenging to achieve in the negotiations but would come with the benefit of global recognition. The SCF would then be usable by all Parties and administered and supervised by the UN.

8. The value of a standardized crediting framework for Ci-Dev

Creating a new framework such as the SCF, and applying it to specific countries and sectors, will require time, effort and possibly expenses by the World Bank and Ci-Dev supporters. For this reason, this chapter briefly considers what value the SCF could potentially deliver as a return on this investment. This includes benefits to the existing Ci-Dev pipeline, as well as to energy access programs more broadly.

8.1 Value for the current portfolio

Assessing the value of the SCF for the current Ci-Dev portfolio is challenging in part because this framework might not be part of the CDM, but instead part of a future crediting scheme under the Paris Agreement mechanisms. If the SCF were simply implemented through the CDM, then the simplification and streamlining of CDM rules for energy access could be compared to the current system in terms of potential transaction costs and time requirements. Piloting the SCF concept in specific countries and possible inclusion of this type of framework under a new mechanism, however, makes the comparison somewhat more difficult without elaborating an entirely new standard (e.g. the full content of program standards, validation/verification standard, etc.)

Upfront transaction costs: The twelve PoAs that are currently under consideration in the Ci-Dev pipeline are at various stages of development. Changes that reduce *upfront* transaction costs may not benefit those programs that are already registered under the CDM, and, given the time required to implement a country-specific SCF application, this could be true for many programs at validation as well. However, given that the life of the CDM may be limited to 2020 or shortly thereafter, registered programs might need to go through some additional eligibility screening to qualify for inclusion future mechanisms. For this, the SCF could be of significant value, since it provides an example of the type of rules or framework that could be used in the future, and so might facilitate the inclusion of the pilot-phase programs in future mechanisms. In addition, for programs at a very early stage of development, developing these under a pilot country-specific SCF application instead of under the CDM could significantly reduce transaction costs. Consultation with project developers suggests that internal staff and time and consulting costs for developing a CDM PoA could easily exceed $100,000. Typical DOE fees for validation of individual project activities are close to $30,000 (Gatti and Bryan, 2013), while fees for PoAs could be substantially higher. These would be reduced by the MRV proposals discussed in Chapter 4 (e.g. local verifiers, exemption from site visits), as well as streamlining the project cycle. Applying a standardized emission reduction approach (Chapter 4.3) would have the greatest impact on upfront costs, and the standardization and digitization of forms could also make important contributions.

MRV costs: The goal of the standardized emission reduction approaches to monitoring and the other improvements discussed in Chapter 4 is to reduce the costs of MRV. All of the previously identified MRV reforms would, according to a survey for project developers, already reduce MRV costs significantly. Moving to more national and international default factors would create important economies of scale, particularly when compared to the multiple device programs being implemented in some countries. In other words, collecting the data across a country is less expensive than the sum of many individual entities collecting the same data in sub-national areas. In the best case, if the national government already collects some relevant data (e.g. energy consumption data as part of the census process or energy sector reporting) there might be no incremental costs for those type of parameters. Even where new data collection efforts are needed, conducting this research across the country or region will be more cost effective than multiple parallel measurement campaigns. The auditing cost would also fall because site visits would not be necessary for many technologies and programs, particularly when compared to the current situation where multiple PoAs and project activities all require separate site visits. For the current Ci-Dev portfolio, these benefits would only accrue once the SCF rules were in place and assuming the CDM PoAs could be converted to programs under a country-specific SCF application. Given the long life of crediting programs, even if this took 3-5 years, the reduced future MRV costs for another 10 years or more would be valuable.

Time delays and carbon revenue: One the most important positive impacts of the SCF would be to bring forward carbon revenue potential by up to two years for energy access programs. By combined validation with verification, and starting the crediting period immediately upon listing, as well as eliminating the concept of individual CPAs, activities could begin to earn carbon revenue immediately upon implementation rather than being delayed by the bureaucratic process. To illustrate the magnitude of this change, the seven registered PoAs in the Ci-Dev portfolio generate an estimated 4.8 million CERs per year. Bringing forward the start of the crediting period for the remaining programs, particularly those at the earlier stages of development, could have a major impact on the carbon revenue and financing structure of similar initiatives in the portfolio that are not yet registered.

8.2 Value for future initiatives

In terms of reduced costs and the opportunity to bring forward carbon revenue, all of the benefits to the current Ci-Dev pipeline would be magnified for future programs where the entire SCF can be applied from the start, whether under a pilot phase or in the framework of some future mechanism. For example, the total annual CERs from the currently registered energy access PoAs is more than 12.6 million per year, and these programs have barely scratched the surface of the energy access needs of most countries. This points to the **potential for scaling up** - by creating a simpler, more accessible system to help energy access programs access both carbon finance and climate finance. The SCF could open up the possibility of dramatic increases in energy sector carbon market programs. The potential for scaling up will also be related to the funding available from the existing (and potential new) donors for Ci-Dev beyond 2020, based on their demand for post-2020 emission reductions. As discussed in Chapter 1, the carbon market has barely touched the needs for energy access. For example, Africa has 32 countries with rural electrification rates below 20%, but only one African country (Uganda) has a registered rural electrification CDM PoA. Cookstove programs are more widely spread, but also have yet to reach critical scale. Scaling up will only be possible, however, if energy access businesses have access to capital for growth from a variety of sources, which will have to be tackled through investment and credit mobilization efforts alongside crediting reform.

Supporting new market mechanisms: as discussed in Chapter 6, during this period of negotiations on the details of new market mechanisms under the Paris Agreement, as well negotiations on the future of the CDM pipeline after 2020, the SCF concept and piloting country-specific SCF applications could provide a real-world case study of innovation that could inform the evolution of carbon markets. By piloting immediately alongside of the discussions on future mechanisms, the SCF concept and experience in the applications could both inform the international process and possibly even be recognized under one of the Article 6 mechanisms in the future. Rapid progress and demonstration of the value of the simplification, streamlining and standardized approaches recommended as part of the SCF can positively support the negotiations on new market mechanisms.

9. Conclusions

The Standardized Crediting Framework presented in this report could provide a more efficient and cost-effective channel for multiple energy access programs to access carbon market incentives. The SCF concept departs from the CDM project activity and PoA rules by using more international and national default factors to create standardized emission reductions for energy access technologies. In addition, the SCF incorporates a positive list approach for grid electrification under certain conditions, and incorporates many of the MRV reforms suggested in previous work on streamlining the CDM. Furthermore, the SCF provides a simpler project cycle and earlier access to crediting revenue, making it more attractive to private sector participants.

As discussed in Chapter 6, it is recommended that the SCF concept be initially piloted by a group of funders and implementing countries, to gain the practical experience to motivate for the inclusion of this type of framework within the new market mechanisms under the Paris Agreement. Given that the life of the CDM may be limited to 2020 or shortly thereafter, registered Ci-Dev programs might need to go through some additional eligibility screening to qualify for inclusion future mechanisms. For this, the SCF could be of significant value, since it provides an example of the type of rules or framework that could be used in the future, and so might facilitate the inclusion of the pilot-phase programs in future mechanisms. In addition, the potential for replication of Ci-Dev programs in additional countries is considerable, given the reduced program development costs and time required because of applying standardized and streamlined approaches to baselines, additionality and MRV. The case study of electrification in this report demonstrates the potential of the SCF concept for that group of technologies. Additional case study analysis in device markets (e.g. the SCF concept applied to cooking) would be useful to understand how the needs of these energy access markets may be somewhat different.

Several broader market conditions would be important for the SCF to succeed. First, based on the assumption that a significant component of the funding of an individual SCF program would come from monetization of carbon credits, there must be demand for those credits, and at higher prices than carbon markets have provided in recent years. For the existing Ci-Dev pipeline, this means that demand from the existing group of donors for emission reductions beyond 2020 could support these programs sustainably over a longer time frame. To expand this pipeline, either additional commitments from these countries would be needed for post-2020 emission reductions or demand from other countries would be needed. Because of the small emission reductions per household in energy access activities, higher carbon prices are needed to have a material impact on the viability of these investments. Second, energy access programs will need improved access to *upfront* financing, including concessionary financing. The importance of this cannot be overemphasized, because purely results-based payments will not remove the fundamental financing barriers for energy access programs. Finally, given the importance of government in developing national default factors for standardized crediting, the institutional requirements for a successful SCF should be explored in more detail, and a plan of action for capacity building put in place alongside the proposal for a new crediting approach for energy access.

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10. References

Arens, C., Burian, M., Sterk, W., Schnurr, J., Beuermann, C., Blank, D., Kapor, Z., Kreibich, N., Mersmann, F., Burtscher, A., Schwan, S., 2011. The CDM Project Potential in Sub-Saharan Africa with Focus on Selected Least Developed Countries. A study commissioned by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Wuppertal Institute for Climate, Environment and Energy & GFA Invest, Wuppertal & Hamburg.

Banerjee, S., Wodon, Q., Diallo, A., Pushak, T., Uddin, H., Tsimpo, C., Foster, V., 2008. Access, Affordability, and Alternatives: Modern Infrastructure Services in Africa (No. Africa Infrastructure Country Diagnostic Background Paper 2). World Bank, Washington, D. C.

ESMAP, 2013. Results-based financing in the energy sector: an analytical guide. Technical Report 004/13. Energy Sector Management Assistance Programme, World Bank, Washington, D. C.

Fenhann, J., 2016. UNEP DTU Partnership PoA Pipeline overview, 1 February 2016 [WWW Document]. URL www.cdmpipeline.org (accessed 2.5.16).

Fenhann, J., 2015. UNEP DTU Partnership CDM/JI Pipeline Analysis and Database, 1 June 2015 [WWW Document]. URL www.cdmpipeline.org (accessed 6.10.15).

Gadde, H., Platanova-Oquab, A., Biaou, A.L., Godin, J., Opperman, K., 2011. Promoting energy access projects under the clean development mechanism: standardized baselines and suppressed demand. World Bank, Washington, D. C.

Gatti, E., Bryan, S., 2013. Performance of Designated Operational Entities in Household Energy Projects. Benchmarking Survey. Nexus Carbon for Development, Singapore.

Greiner, S., Kolmetz, S., Betzenbicher, W., Houshyani, B., Galt, H., 2015. Ci-Dev CDM MRV Study: Facilitating credit issuance by improving the monitoring, reporting and verification procedures and issuance rules of the CDM. World Bank, Washington, D. C.

IEA, 2015. World Energy Outlook 2015. International Energy Agency, Paris.

IFC, 2012. From Gap to Opportunity: Business Models for Scaling Up Energy Access. International Finance Corporation, Washington, D. C.

OECD, 2004. ODA eligibility issues for expenditures under the Clean Development Mechanism (CDM). DAC/CHAIR(2004)4/FINAL. Organisation for Economic Co-operation and Development, Paris.

Platanova-Oquab, A., Spors, F., Gadde, H., Godin, J., Opperman, K., Bosi, M., 2012. CDM Reform: Improving the efficiency and outreach of the Clean Development Mechanism through standardization. World Bank, Washington D. C.

Spalding-Fecher, R., 2013. National policies and the CDM rules: options for the future. Commissioned by the Swedish Energy Agency. Carbon Limits, Oslo.

Spalding-Fecher, R., Achanta, A.N., Erickson, P., Haites, E., Lazarus, M., Pahuja, N., Pandey, N., Seres, S., Tewari, R., 2012. Assessing the impact of the Clean Development Mechanism. Report commissioned by the High Level Panel on the CDM Policy Dialogue. United Nations Framework Convention on Climate Change, Bonn.

Spalding-Fecher, R., Sammut, F., Ogunleye, J., 2015. Promoting energy access through Results-Based Finance within the framework of the CDM: Assessing business models. World Bank, Washington, D. C.

Warnecke, C., Day, T., Klein, N., 2015. Analysing the status quo of CDM project: Status and prospects. New Climate Institute & Ecofys, Cologne, Germany.

Winkler, H., Simões, A.F., Rovere, E.L. la, Alam, M., Rahman, A., Mwakasonda, S., 2011. Access and Affordability of Electricity in Developing Countries. World Development 39, 1037–1050. doi:10.1016/j.worlddev.2010.02.021

Yamin, F., Depledge, J., 2004. The international climate change regime: a guide to rules, institutions and procedures. Cambridge University Press, Cambridge.

Annex A. Simplified Listing Template for electrification

I. GENERAL PROGRAM INFORMATION

1. Program country: [insert]
2. Program title: [insert]
3. Lead Institution [insert]
4. Date of start of program implementation [insert]
5. Program commissioning date: ____________ ❑ Expected ❑ Actual
6. Crediting period of program: [insert]

II. APPLICABILITY CONDITIONS

7. Which of the following technologies to increase access will be tracked under the program:
   a. Connection to individual renewable energy systems (e.g. solar home systems or facility-scale wind) ❑ Yes ❑ No
   b. Connections to hybrid or renewable mini-grids ❑ Yes ❑ No
   c. Extension of a grid to supply new customers (at least one must be "yes")
      - is the rural electrification rate less than 20%? ❑ Yes ❑ No
      - is the implementing country an LDC or SIDS? ❑ Yes ❑ No
      - has the rural electrification rate increased by less than X% in the past Y years? ❑ Yes ❑ No
8. The program complies with national laws and regulation ❑ Yes ❑ No
9. The program equipment meets applicable national and/or international standards ❑ Yes ❑ No

III. METHOD USED TO CALCULATE EMISSIONS

10. Year of data used to calculate baseline emissions factor: [insert year]
11. Target group: number of rural households by type of electricity services

Table 1. Ex-ante data required for setting baseline emission factor

	Household energy service		Emission factor (tCO_2/MWh)
Target households	**No connection**		
	no electricity		2.8
	car batteries		1.3
	diesel generator		1.3
	Fossil fuel mini-grid		**1**
Program access	**Hybrid/RE mini-grid**		
	Grid		

Solar home system	
Total	

12. Weighted average emission factor for target households (calculated from table above): [insert]
13. Emission reductions target: [insert]

IV. MONITORING

[may only be included in MRV template]

V. STAKEHOLDER CONSULTATION

14. Confirm that stakeholder consultation is required to implement the program

    ❑ Yes ❑ No *(Please justify why the stakeholder is not required)*

    ____

15. Confirm that stakeholder consultation was conducted in compliance with the national requirements and based on international good practice as applicable, before program implementation date: [insert date] ❑ Yes
16. Confirm that comments provided by local stakeholders are taken into account in compliance with the national requirements and based on international good practice as applicable ❑ Yes ❑ No
17. Confirm that the relevant governmental entities have been fully informed about the outcome of the stakeholder consultation ❑ Yes

VI. ENVIRONMENTAL IMPACT ASSESSMENT

18. Confirm whether an EIA is required to implement the program ❑ Yes ❑ No
19. Confirm that, if required, an EIA and required procedures were properly conducted before program implementation date: [insert date] ❑ Yes
20. Confirm that, if required, an EIA was approved by the relevant national authority ❑ Yes

VIII. INFORMATION ON PROGRAM LEAD INSTITUTION

Annex B. Simplified MRV template: electrification

I. GENERAL PROGRAM INFORMATION

21. Program country: [insert]
22. Program title: [insert]
23. Lead Institution: [insert]
24. Date of start of program implementation [insert]
25. Crediting period of program: [insert]
26. Monitoring period number for program: [insert]
27. Dates of monitoring period: XX/XX/XXXX to XX/XX/XXXX

II. IMPLEMENTATION DATA

Table 13. Cumulative number of households receiving different types of access as a result of the program, at end of monitoring period [insert additional sub-groups as necessary]

Type of access	Number	Source				
		National energy database or	National utility	Program-level survey	Other	Comment/ explanation
Hybrid/RE mini-grid		☐	☐	☒	☐	
Grid		☐	☐	☐	☐	
- Tariff A		☒	☐	☐	☐	
- Tariff B		☒	☐	☐	☐	
Solar home systems		☐	☐	☒	☐	
Fossil mini-grids		☐	☒	☐	☐	New connections only – not total

Note: All data must be from same time frame as current monitoring period

Please attach documentation for data presented above, as appropriate based on the source.

III. ADDITIONAL MONITORING DATA

Table 14. Average household electricity consumption [insert additional sub-groups as necessary]

Type of access	kWh / yr	Source

		Electricity meters	Total distributed/ customer number	Household survey	Deemed consumption	Default value	Other	Comment/ explanation
Mini-grids		☐	☒	☐	☐	☐	☐	
Grid		☐	☐	☐	☐	☐	☐	
- Tariff A		☒	☐	☐	☐	☐	☐	
- Tariff B		☐	☒	☐	☐	☐	☐	
Solar home systems		☐	☐	☐	☒	☐	☐	

Note: All data must be from same time frame as current monitoring period, unless default values are used

Please attach documentation for data presented above, as appropriate based on the source.

Table 15. Data used to calculate program emissions [insert sub-categories as necessary]

Supply source	Unit	Value	Source				
			Most GHG intensive fuel	Combined margin	Default share of diesel	Other	Comment/ explanation
National Grid Emission Factor	tCO2/ MWh		☒	☐	☐	☐	
Hybrid Mini-Grid Emission Factor	tCO2/ MWh		☐	☐	☒	☐	
Fossil Mini-Grid Emission Factor	tCO2/ MWh		☐	☐	☐	☒	Default value of fossil mini-grids
Transmission & distribution losses in the grid	%		☐	☐	☐	☒	Default value in provided in SCF
Transmission & distribution losses in mini-grids (average)	%		☐	☐	☐	☒	Default value in provided in SCF

Please attach documentation for data presented above, as appropriate based on the source.

V. CALCULATION OF EMISSION REDUCTIONS

[*a spreadsheet annex, similar to what has been done for AMS II.J and AMS I.L under the CDM, could be attached*]

Baseline and project emissions are calculated considering the consumer sub-groups shown in the previous tables.

Equation (1)

$$BE_y = \sum_i \left(\left(N_{HMG,i,y} + N_{FMG,i,y} \right) \times EC_{MG,i,y} \times EF_{SBL} \right) + \sum_j \left(N_{G,j,y} \times EC_{G,j,y} \times EF_{SBL} \right) + \sum_k \left(N_{OG,k,y} \times EC_{OG,k,y} \times EF_{SBL} \right)$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$N_{HMG,i,y}$	=	Number of new hybrid/RE mini-grid connections since the start of the program of sub-group i in year y
$NF_{FMG,i,y}$	=	Number of new fossil mini-grid connections since the start of the program of sub-group i in year y
$EC_{MG,i,y}$	=	Average household electricity consumption in mini-grid (hybrid or fossil) consumer sub-group i in year y (MWh)
EF_{SBL}	=	Standardized baseline emission factor (tCO_2/MWh)
$N_{G,j,y}$	=	Number of new grid connections since the start of the program of sub-group j in year y
$EC_{G,j,y}$	=	Average household electricity consumption in grid consumer sub-group i in year y (MWh)
$N_{OG,k,y}$	=	Number of new off-grid connections since the start of the program of sub-group j in year y
$EC_{OG,k,y}$	=	Average household electricity consumption in off-grid consumer sub-group i in year y (MWh)

Project emissions

Equation (1)

$$PE_y = \frac{\sum_i \left(N_{HMG,i,y} \times EC_{MG,i,y} \right)}{(1 - TL_{MG})} \times EF_{HMG} + \frac{\sum_i \left(N_{FMG,i,y} \times EC_{MG,i,y} \right)}{(1 - TL_{MG})} \times EF_{FMG} + \frac{\sum_j \left(N_{G,j,y} \times EC_{G,j,y} \right)}{(1 - TL_{G})} \times EF_G$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
$N_{HMG,i,y}$	=	Number of new hyrid/RE mini-grid connections since the start of the program of sub-group i in year y
$EC_{MG,i,y}$	=	Average household electricity consumption in mini-grid consumer sub-group i in year y (MWh)
EF_{HMG}	=	Hybrid/RE Mini-grid emission factor (tCO_2/MWh)
TL_{MG}		Transmission and distribution losses in mini-grids (fraction)

$NF_{FMG,i,y}$	=	Number of new fossil mini-grid connections since the start of the program of sub-group i in year y
EF_{FMG}	=	Fossil mini-grid emission factor (tCO_2/MWh)
$N_{G,j,y}$	=	Number of new grid connections since the start of the program of sub-group j in year y
$EC_{G,j,y}$	=	Average household electricity consumption in grid consumer sub-group i in year y (MWh)
EF_G	=	National grid emission factor (tCO_2/MWh)
TL_G		Transmission and distribution losses in national grid (fraction)

VI SUMMARY OF EMISSION REDUCTIONS

[from spreadsheet annex]

	tCO_2e
Baseline emissions	
Project emissions	
Emissions reductions	

Annex C. Examples of standardized emission reductions factors

Figure 11.Concept for calculating emission reductions for electricity under the SCF

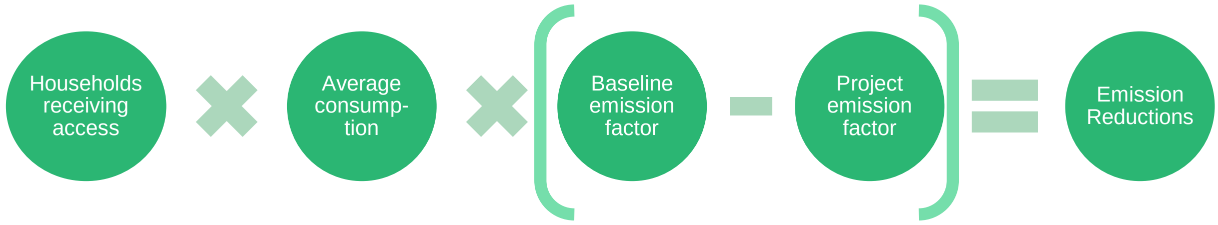


Table 16. Standardizing emission factors: mini-grid electricity example

	Households receiving access	Consumption	Baseline emission factor components		Project emission factor
			Mix of baseline technologies	Emissions per baseline technology	Mini-Grid emission factor
		kWh/household by category	% of households	tCO2/MWh	tCO2/MWh
International default factor	X	X	X	R	X
National default factor	X	O	O	X	X
Program-specific factor	R	O	O	X	R

Key: R = required, O = optional; X = not allowed

Table 17. Standardizing emission factors: solar home system example

<table>
<tr><th></th><th>Households receiving access</th><th>Consumption</th><th colspan="2">Baseline emission factor components</th><th>Project emission factor</th></tr>
<tr><td></td><td></td><td></td><td>Mix of baseline technologies</td><td>Emissions per baseline technology</td><td></td></tr>
<tr><td></td><td></td><td>kWh/household by category</td><td>% of households</td><td>tCO2/MWh</td><td>tCO2/MWh</td></tr>
<tr><td>International default factors</td><td>X</td><td>X</td><td>X</td><td>R</td><td rowspan="2">N/A (zero)</td></tr>
<tr><td>National default factor</td><td>X</td><td>R</td><td>R*</td><td>X</td></tr>
</table>

Program-specific factor	R	X	X	X

* solar home systems are only provided to consumers that do not have any electricity source at all
Key: R = required, O = optional; X = not allowed

Figure 12.Concept for calculating emission reductions for improved cookstoves under the SCF

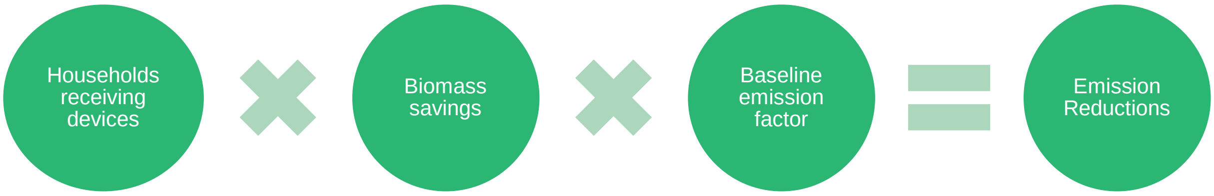


Table 18. Standardizing emission factors: improved cookstoves example

	No. of devices	Biomass savings components			Baseline emission factor components		
		Baseline household consumption	Efficiency of baseline technology	Efficiency of project technology	NCV of biomass	Fraction non-renewable biomass	Fossil fuel emission factor
		kg/household by category	%	%	GJ/kg	%	tCO2/GJ
International default factor	X	X	O	O	O	X	R
National default factor	X	O	O	O	O	R	X
Program-specific factor	R	O	X	O	X	X	X

Key: R = required, O = optional; X = not allowed

The emission reductions will be calculated using the following equation:

$$ER_y = N \times cons_{BL} \times \left(1 - \frac{\eta_{BL}}{\eta_{PJ}}\right) \times NCV_{biomass} \times fNRB \times EF_{FF}$$

Figure 13.Concept for calculating emission reductions for replacing non-renewable biomass with renewable fuels under the SCF

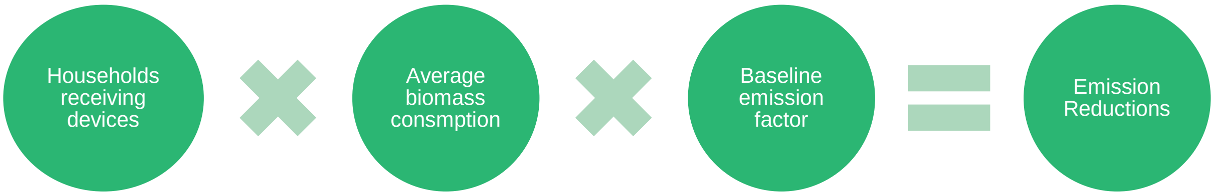


Table 19. Standardizing emission factors: renewable fuels for cooking example

	Households receiving devices	Baseline consumption	Baseline emission factor components		
			NCV of biomass	Fraction non-renewable biomass	Fossil fuel emission factor
		kg/household by category	GJ/kg	%	tCO2/GJ
International default factor	X	X	O	X	O
National default factor	X	R	O	R	O
Program-specific factor	R	X	X	X	X

Key: R = required, O = optional; X = not allowed

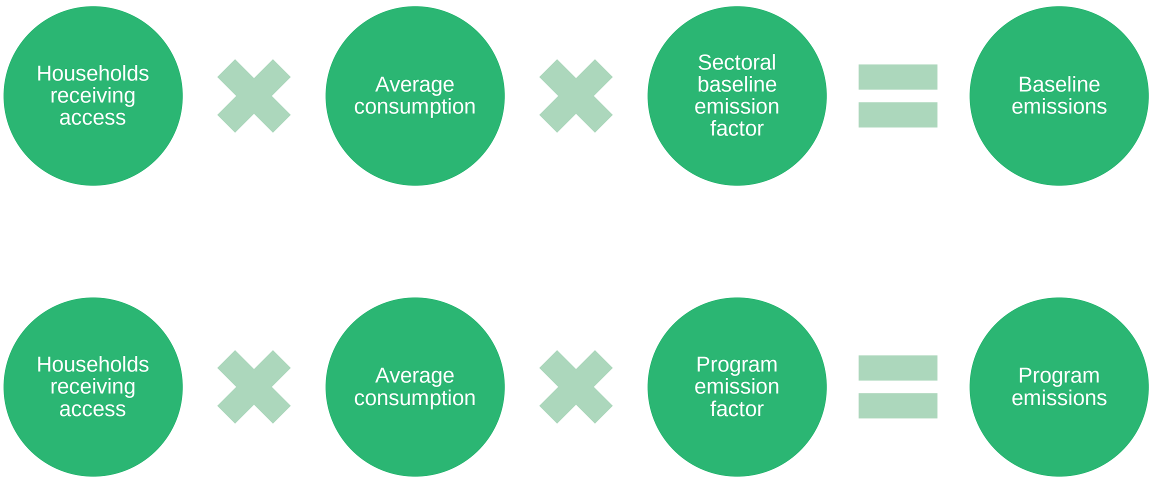
The emission reductions will be calculated using the following equation:

$$ER_y = N \times cons_{BL} \times NCV_{biomass} \times fNRB \times EF_{FF}$$

Annex D. Aggregated MRV concept

As explained in Chapter 6 of this report, further innovations in MRV could include using aggregated or national level energy access as the foundation for monitoring. This annex explains this concept in more detail, and provides an example of how it might be applied to national energy access programs. An aggregated approach would measure emission reductions across the entire sector, based on changes in energy access levels from year to year (e.g. number of households with electricity access or access to modern cooking services) and consumption of energy services[39]. The process would include setting a *fixed sectoral baseline emission factor*, utilizing *sectoral energy access performance data*, and *estimating household energy consumption* as the basis for the MRV of emission reductions (Figure 14), which are described in the sections below.

Figure 14. Example of calculating change in emissions at an aggregated level



Fixed sectoral baseline emission factor

The key methodologies used for energy access under the CDM provide baseline emission factors for specific alternative technologies. For example, households received an electricity connection for the first time would have one baseline emission factor if they previously had no access at all and a different one if they were previously using a stand-along diesel generator. Similarly, a household receiving a biogas digester and gas stove, would have one baseline emissions factor if there were using non-renewable biomass and a different one if they were

[39] Note that to prevent double issuance of emission reductions, and energy access program should use *either* consumption/demand or supply to measure emission reductions, but not both. For example, a renewable energy plant added to the grid or a mini-grid will reduce sector emissions, but this will be captured when calculating project emissions for a consumption-oriented approach and so the plant should not also receive credit for reducing emission on the supply side.

using kerosene or charcoal. An example of the technology-specific emission factors that could be used for a rural electrification program is shown in Table 20.

Table 20. Example emission factors for current (baseline) technologies for electrification programs

Current situation	Emission factor (tCO2/MWh)	Rationale
No access at all	1.7	based on tiered emission factors from AMS III.BL with average household consumption of just under 500 kWh/yr
Rechargeable car batteries	1.2	based on mini-grid charging with 15-20% efficiency loss in batteries
Stand-alone diesel generator	1.4	based on < 15 kW and 50% load factor
Connection to isolated fossil-fuel based mini-grid	1.0	based on 35 – 135 kW capacity diesel at 50% load factor or higher

As an alternative to identifying the current/historical energy source for each new connection during implementation, a aggregated approach could establish a fixed sectoral baseline emission factor for all units based on the weighted average energy and technology mix across the entire population at the start of the program. This would be similar to the role of national government in the process of developing Standardized Baselines (SBs), since the resulting emission factor would be country-specific. As an example, for electrification, this would mean determining the energy use patterns of the target rural population prior to the start of the program (e.g. no electricity at all, stand-alone diesel generator, connection to fossil fuel mini-grid, or, for households with access, whether this is by grid, hybrid/renewable mini-grid or stand-alone off-grid systems). For cooking, on the other hand, establishing a sectoral baseline emission factor would involve determining the mix of cooking fuels used, the share of non-renewable biomass (where biomass is used), and the efficiency of the baseline cooking technologies[40]. The typical quantity of fuel used for cooking could be determined ex-post, based on the efficiency of the program technologies versus the (fixed) efficiency of the baseline technologies, or this quantity could be fixed ex-ante based on a national survey or other similar official data. In summary, by combining the technology-specific emissions factors already provided in approved CDM methodologies with national data on the mix of technologies and energy sources currently used, the aggregated approach could provide a fixed sectoral baseline emission factor so that baseline emissions could be easily calculated from the future energy access performance of the sector.

Sectoral energy access performance data

To cover the entire target population (e.g. all rural households), performance would be based on the change in energy access across the entire country, not simply those areas or

[40] Water purification could be captured similarly, by establishing the mix of energy sources (or non-energy alternatives) used, and either the relative efficiency of those technologies or the quantity of fuel used for water purification.

households that had been enrolled in a discrete crediting program like a CDM PoA. In other words, all of the changes in energy access would be attributable to the interventions included in the national energy access programs (except independent CDM PoAs – see discussion below).[41] The basis for assessing the energy access performance, therefore, must be data that covers the entire sector.

For electrification, this means the total number of households with access to electricity in each year, and how those households are served (e.g. grid, mini-grid, off-grid renewables). For cooking, this means the total number of households with access to modern cooking services (e.g. improved cookstoves, biogas digesters and stoves, alternative fuel stoves, high efficiency gas stoves). Providing this data would be the responsibility of the lead government authority for the program, who might, in turn, rely on inputs from many actors in the sector (e.g. national electricity utility, concessionaires, distributors of energy devices), as well as national household surveys (existing or new) on energy use patterns.

Household energy consumption

In addition to overall progress on energy access, estimating emission reductions requires an understanding of typical consumption levels (e.g. kWh, kg of wood) in households that receive access to improved energy services, as well as, in some cases, the efficiency of the technologies used by those households. For electrification, the emissions impact will be based on number of new households receiving access, how much electricity they consume, and the difference in the project and baseline emissions factors. The baseline emission factor would be fixed on a aggregated basis, as explained in the previous section, while project emissions will be addressed below.

For estimating household consumption, either for the entire population or for relevant sub-groups (e.g. provinces, income levels, or other stratifications used in national data collection systems), several options could be included:

- Calculation of average consumption from total electricity distributed in a given area divided by the number of households and other consumers in that area, based on agreed rules for allocation of the energy use across user groups
- A dedicated household survey, stratified as appropriate to capture important differences in consumption patterns.
- Other official survey data or reputable research data, as long as the data collection is for the same year, the populations covered are not significantly different, and the sampling is appropriately stratified
- Deemed consumption based on electricity technology – for example, solar PV systems could be assigned a 12% availability factor to calculate consumption directly from installed capacity, as in the approved CDM methodologies for electrification.

[41] The limitations of this approach are discussed in Chapter 6 and so are not repeated here.

- Conservative default values (for grid and mini-grid only)– for example, electricity consumption of 250 kWh/household, which is the minimum service level for rural households.[42]

Similarly, for cooking, household energy consumption under the program and/or the efficiency of the new appliances and energy sources could come from several sources:

- A dedicated household survey, stratified as appropriate to capture important differences in consumption patterns.
- Other official survey data or reputable research data, as long as the data collection is for the same year, the populations covered are not significantly different, and the sampling is appropriately stratified
- Conservative default values – for example, 500 kg of wood per capita per year
- Calculated from the efficiency of the new and old technologies, as determined by a national testing center[43] or manufacturer's specifications, and the historical consumption used to create the sectoral baseline emission factor.

Program emission factors

The emission factor for the energy supplied to newly connected households under a aggregated program would depend on the technology used to provide them with new energy services. For electrification, the emission factors of the national grid, different types of mini-grids and off-grid systems would need to be considered separately, which is why the energy access performance data must distinguish between these service delivery mechanisms. For cooking, improved cookstoves that use non-renewable biomass more efficiently would still have emissions related to the lower amount of fuel wood used, while biogas digesters using household waste would not have project emissions.[44]

Correction for other crediting activities

Moving aggregated data for monitoring means that, in the short term, the scope off the MRV would encompass the existing registered CDM PoAs in the sector. This would be most common in a program addressing devices, because, as discussed earlier, some countries already have multiple private sector driven PoAs and project activities distributing solar lighting and improved cookstoves. Because the impact of these existing programs would show up in the sectoral energy access performance data, there could be the risk of double

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[42] The most prominent source for a minimum service level related to household electricity is the work of the International Energy Agency (IEA), UNPD and UNIDO on the amount of energy required to eliminate energy poverty worldwide by 2030 (IEA 2010). The analysis of electricity requirements states, "to assess the extent of the additional generating capacity required to achieve universal access, we have made assumptions about minimum levels of consumption at both the rural and urban level: rural households are assumed to consume at least 250 kWh per year and urban households 500 kWh per year." This is also used as a minimum service level in the justification for approved CDM methodologies AMS I.L and AMS III.BB.

[43] For example, a government agency might coordinate a dedicated team of experts conducting field tests such as kitchen performance test (KPT) and water boiling test (WBT) for new program technologies

[44] This assumes that physical leakage of methane from the digester can be kept very low. Otherwise, this must be accounted for based on manufacturer's specifications or actual field tests.

issuing emission reductions for these activities (i.e. once under the CDM PoA and again under an aggregated program). One solution to this would be to transfer the ownership and management of existing PoAs and project activities to the aggregated program and not to allow any new CDM activities in the sector once the aggregated program commenced. Not only would this approach face legal challenges from existing PoA and project activity owners, but it could also discourage innovation by limiting the potential actors in energy access activities seeking carbon finance. A better alternative would be to address the double issuance risk by subtracting any CERs issued to energy access-related CDM PoAs or project activities from the total emission reductions that could be credited to the aggregated program.[45] For example, if the calculations at the aggregated level yielded 200,000 tCO_2e of emission reductions for a given year, and for the same year the existing PoAs were issued 40,000 CERs, then this aggregated program would only be credited with 160,000 tCO_2e of emission reductions.

[45] This could be more difficult for existing CDM PoAs or project activities for grid-connected electricity supply. Because only a small portion of demand of grid electricity is from newly connected household the overlap would be limited, although this might need to be evaluated.