



Financing Cities of the Future: Tools to Scale-up Clean Urban Development

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An analysis of programmatic and results-based finance approaches for the deployment at scale of renewable energy and energy efficiency technologies in urban households

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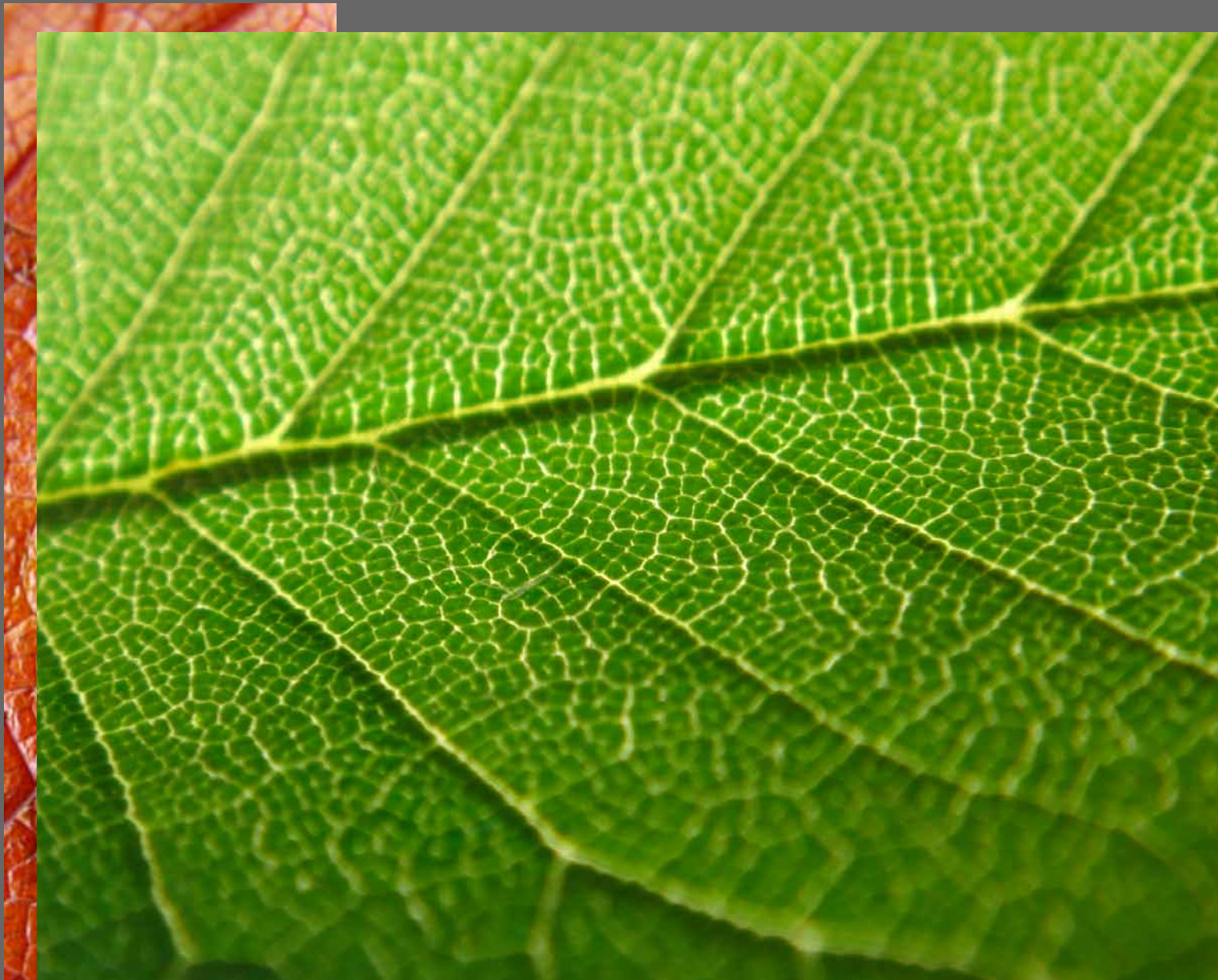
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Executive Summary

Urbanization and climate change are defining issues of the 21st century. Cities account for between 60-80% of current global energy consumption and 75% of the greenhouse gas emissions. Often improvised and uncontrolled, unplanned urban development frequently leads to shocking environmental and quality of life inequalities, with the most deprived and socially excluded communities having the least access to basic services, such as clean drinking water, energy and sanitation. Climate change will only make this issue worse. Further, the development of urban infrastructure is associated with a significant rate of fossil fuel and other unsustainable resource consumption, leading to natural capital depletion, with local and global environmental impacts.

The carbon market has been successful in implementing single project-based interventions in industrial and large-scale project activities and, through the innovations brought to the market by organisations such as The Gold Standard Foundation and its stakeholders, to rural and community-based activities. However, its success in mobilizing carbon finance for city-based activities has been almost exclusively limited to the waste management sector. International climate negotiations envisage the broader deployment of carbon finance for low carbon growth by implementing mechanisms such as NAMAs (Nationally Appropriate Mitigation Actions) or New Market Mechanisms. However, as of now, detailed frameworks for such schemes have not been developed or agreed upon.

It is clear that catalysing the finance required, at the scale required, for true low carbon development in cities globally – and in developing countries in particular - will not be possible without new, cost effective and trusted funding frameworks that address the three over-riding identified barriers to change: 1) the lack of knowledge needed to create integrated, holistic and implementable strategies that deliver not just one or two cleaner technologies (e.g. cookstoves and solar lights), but instead combine a full range of interventions to reduce emissions at scale whilst making significant and lasting improvements to livelihoods; 2) strong governance frameworks combined with consistent, trusted auditing around low carbon project outcomes – both in relation to emission reductions and sustainable development and; 3) long-term, sustainable financing structures that catalyse combinations of public and private investment into sustainable urban infrastructure and development. In order to scale-up and attract new sources of finance in the timescale needed, it is vital that these funding frameworks are replicable in cities around the world. This will give investors confidence that they have a global benchmark to measure progress and outcomes.

With this in mind, The Gold Standard Foundation carried out a ground-level research study to investigate the opportunities for sustainable, low carbon urban development in developing cities—in relation to the distribution of cleaner technologies and other interventions, in combination, and at scale. It then examined the feasibility of using an innovative results-based finance approach versus existing Programme of Activities mechanisms. The research was funded by WWF Netherlands.

Phase one of the research included a detailed assessment of the baseline situation as well as the potential for greenhouse gas (GHG) emission reductions in urban poor and middle-income communities in Delhi, based on available literature and on the ground, household surveys. The objective was to investigate which of the above approaches made most sense, based upon the appropriate interventions.

¹Rode, Philipp and Burdett, Ricky (2011) Cities: investing in energy and resource efficiency. In: United Nations Environment Programme, (corp. ed.) Towards a green economy: pathways to sustainable development and poverty eradication. United Nations Environment Programme, pp. 453-492. ISBN 9789280731439

On the basis of our research and various factors underlined in this report, our conclusion was that, presuming a meaningful price for carbon emission reductions certificates continues to exist (we use current 'Gold Standard VER' and 'Gold Standard-labelled CER' prices as our reference point), an existing Programme of Activities approach is best suited for middle income households, while a results-based finance approach is better suited for the 'urban poor' group of households.

As the logical next step to this study and to further assess the feasibility of this approach, The Gold Standard aims to implement a pilot programme in Delhi and in other suitable destinations globally. Phase 2 of the WWF-funded activity will involve the preparatory work for the Delhi pilot programme.

As an outcome of this study, we have developed a framework for a Gold Standard Sustainable Cities Programme, where mitigation measures are funded based on monitored and verified sustainable development outcomes. The framework and further guidance on the governance, eligibility, consultation and monitoring requirements are outlined in Annex 8.

In parallel, The Gold Standard Foundation has begun working with The World Bank to develop the tools necessary for a city-wide 'green growth' programme in Colombo, Sri Lanka and with the Municipality of Sakarya in Turkey in its UNDP-supported low carbon development programme. We see significant potential for the approaches and tools defined to support the implementation of replicable low carbon urban development and sustainable infrastructure programmes worldwide.



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1.0 Introduction

1.1 Introduction

The rate of global urbanisation is rapid, especially so for cities based in developing countries. By the year 2020, 500+ cities will have more than a million inhabitants and 95 percent of the total population growth is expected to take place in urban areas, with 90 percent of this growth taking place in developing countries. Most of this growth will happen in existing and new informal settlements and slum areas. By 2020, there will be 400 million more people living in slums, increasing the global slum population to 1.4 billion².

Developing countries and Least Developed Countries (LDCs) are the least equipped to deal with the environmental, socio-economic challenges and the consequences of climate change. However, they will be the areas that are most affected and, ultimately, will have to support and address the needs of this drastic increase in urban population growth.

Improvised and uncontrolled urban development leads to shocking environmental and quality of life inequalities. The most deprived and socially excluded communities often have the least access to basic services and experience the poorest environments. The effects of climate change will only further worsen this quality of life in cities, especially for the urban poor, who already have the least access to basic services like clean drinking water, energy and sanitation. Extreme weather events such as prolonged heat waves, storms and flooding will devastate urban areas where housing and infrastructure are makeshift and improvised, putting millions of lives at increased risk and insurmountable pressure on disaster relief agencies.

Furthermore, the development of urban infrastructure is associated with a significant rate of fossil fuel and other unsustainable resource consumption, leading to natural capital depletion, with local and global environmental impacts. For instance, cities are major contributors to greenhouse gas emissions (GHGs). Cities consume around 80 percent of the global energy produced and account for roughly equal share of global GHG emissions³. The International Energy Agency (IEA) estimates that urban areas currently account for over 67 percent of the energy related global greenhouse gases, which is expected to rise to 74 percent by 2030. Moreover, it is expected that the rapid urbanisation in developing countries will contribute to around 89 percent of the increase in CO₂ from energy use⁴. This situation calls for action to promote smarter, more resilient low-carbon urbanisation and the establishment of more sustainable urban areas that include measures for mitigation and adaptation.

It is difficult to imagine that a strategy for significantly curbing CO₂ emissions and ensuring decent access to energy, water and sanitation, waste management and transportation services could be successful without considering changes in the design of the built environment. The high density of activities in urban areas is the cause of numerous negative externalities such as local air quality, unsafe water and noise pollution or extreme traffic congestion. However, this density also creates

² UN Millennium Project, 2005, A Home in the City - Task Force on Improving the Lives of Slum Dwellers. Available at <http://www.unmillenniumproject.org/documents/Slumdweller-chapters1-4.pdf>

³ The World Bank, 2010, Cities and Climate Change: An Urgent Agenda. Available at <http://siteresources.worldbank.org/INTUWM/Resources/340232-1205330656272/CitiesandClimateChange.pdf>

⁴ IEA (International Energy Agency), 2008, World Energy Outlook. Available at <http://www.worldenergyoutlook.org/publications/2008-1994/>

opportunities for significant reductions in energy consumption per-capita, allowing, for example, the use of multiple, integrated measures and clean technologies - notably integrated energy systems associated with a much more rational use of resources.

The project-based approach currently followed in the compliance and voluntary carbon markets has delivered substantial benefits but has also shown its limitations in terms of urban development. The deployment of technologies and measures at the required order of magnitude to meet climate mitigation goals, calls for cost-effective approaches employing multiple, integrate interventions of both technologies and infrastructure at a significantly greater scale. This will need governance and financing tools that can maintain low transaction costs while still ensuring adequate safeguards, effective design and implementation, environmental integrity and assurance of outcomes. The aim of this project is to research, assess and develop such new approaches.

Building on its expertise, demonstrated ability for robust innovation and strong reputation in the international carbon markets, The Gold Standard Foundation provides an ideal platform to identify and field-test innovations. This can be done in the voluntary carbon market, while at the same time advocating and demonstrating suitability for compliance markets. But sustainable urban development is not only about emission reductions – it is about local needs and impacts: livelihoods, economic growth and sustainability, environmental and natural capital management. This underscores the importance of The Gold Standard Foundation's decade of experience in designing and managing mechanisms that ensure a holistic approach that integrates sustainable development, requires meaningful stakeholder engagement and delivers monitoring, reporting and verification of all relevant social and environmental outcomes. Supported by governments and philanthropic organisations, it has also begun work on the creation of new environmental and social assets relevant to those groups and wider corporate CSR interests.

The Gold Standard Foundation thus provides essential services such as the governance framework to manage projects from design, implementation and ongoing management, integrate compliance activities, certify carbon mitigation activities and issue impact credits. We also research and develop cutting edge approaches to carbon mitigation and the monitoring and delivery of sustainable development outcomes. We collaborate closely with a large ecosystem of specialist and expert organisations that: provide policy advice; design and implement low carbon infrastructure, sustainable development and environmental protection projects; provide robust auditing services; act as civil society representatives and environmental stewards and; provide billions of dollars of public and private finance into these activities worldwide. Together with the active support and engagement of government and multilateral agencies, this group has the desire and capability to make the necessary changes at the necessary scale within the necessary time frames.

This project builds upon the above expertise to explore the suitability of a Programmes of Activities (PoAs) approach to support sustainable low carbon urban (re)development. The study will look into whether currently available methodologies can be used or whether new, integrated methodologies more adapted to urban communities will be required. The investigation will also research and consider non carbon-credited concepts such as results-based finance approaches, of which the "Supported NAMA (Nationally Appropriate Mitigation Action)" is an example currently in discussion at the inter-governmental negotiations on climate change mitigation.

Addressing GHG emissions in urban areas in isolation will not lead to a sustainable solution. For example, the GHG emissions from urban transport cannot simply be addressed with the ban of, or penalties for, highly emitting vehicles. Other factors need to be assessed, such as the deployment and access to other low carbon transport alternatives, views of air quality, alternative employment for those who could lose their livelihoods as a result, etc. A core Gold Standard principle is to use a ‘bottom-up’ and integrated approach, relying on sustainability assessment tools, a strong participatory approach and extensive stakeholder consultation. Local communities have a key role to play in defining priorities so as to identify ways in which proposed interventions may positively or negatively impact them. Local acceptance—and more importantly, support and active participation of local communities—will ensure that achievements can be sustained. This includes the role of community organisations and NGOs in influencing governance and decision-making.

The chosen approaches and methodologies are therefore intended to facilitate decision making about urban sustainability issues based on a multi-criteria analysis, so as to allow environmentally, economically and socially sound investment decisions in urban system planning. This will provide a coherent basis for effective negotiations between the various relevant stakeholders on the set of measures to be implemented.

1.2 Cities and Carbon Finance

At an international level, global carbon markets have become an important mode of financing for climate change mitigation activities. The Clean Development Mechanism (CDM) and other voluntary schemes have grown exponentially over the past few years. However, carbon markets, to date, have made a limited contribution to typical emission reduction opportunities in urban settings like residential, energy efficiency, transport, and waste.

Less than one out of ten project activities currently registered under the CDM have been developed or are being developed in urban areas. Moreover, project activities currently under validation do not show any signs of increasing the focus on urban areas (Fig 1.1). The voluntary carbon market represents a similar trend, with an equally low share of activities targeting urban areas.

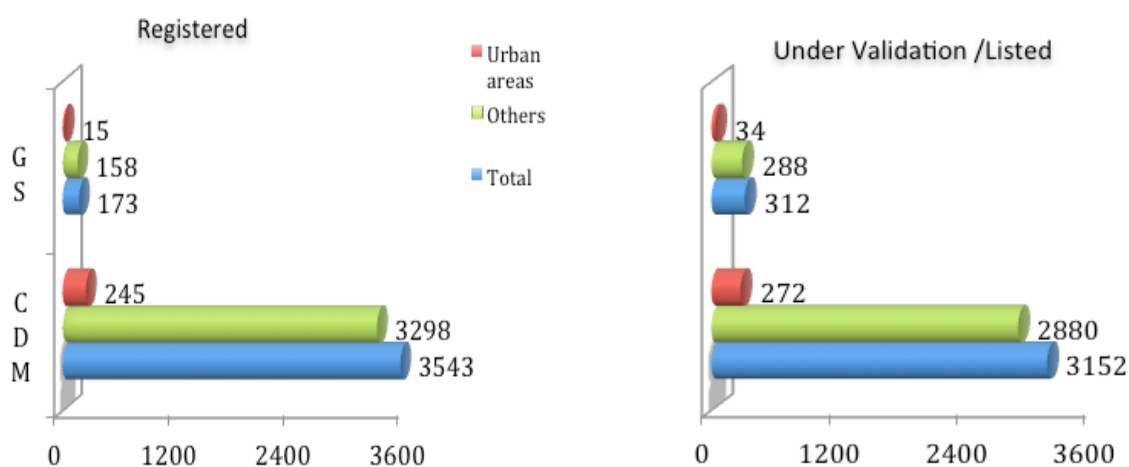


Fig. 1.1:
Clean Development Mechanism (CDM) and Gold Standard (GS) carbon finance based projects in urban areas

(Statistics as of October 2011)

Around 90 percent of the urban-based projects registered with the CDM and The Gold Standard Foundation are from the waste sector (Fig 1.2, statistics as of October 2011). Generally, these projects are executed by private investors or under a public-private partnership model. The remaining 10 percent of projects include activities such as energy efficiency, renewable energy and transportation. These projects involve the implementation of several smaller activities, which are not only difficult to implement but are also hard to monitor and often require the involvement of several local agencies.

A look at the activities currently under validation reveals a greater diversity with respect to sectoral distribution, with only a little more than half of the project activities in the waste management category (Fig 1.2). Energy efficiency activities make up 25 percent, and transportation and renewable energy represent 10 percent each.

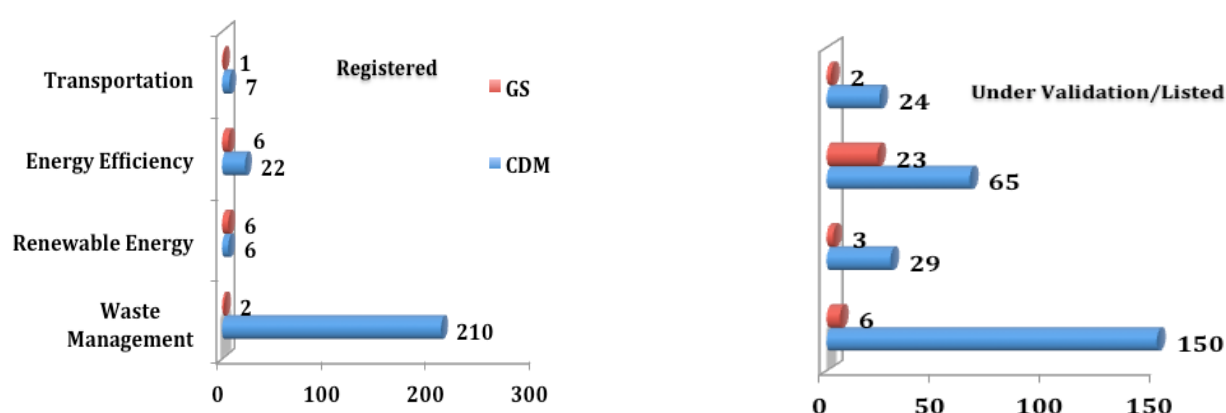


Fig. 1.2: Sector-wise distribution of existing CDM and Gold Standard projects
(Statistics as of October 2011)

This under-representation of carbon activities targeted at urban communities is due to the complexities associated with implementing urban mitigation projects and the difficulties faced by cities when trying to access the carbon market. The rules that regulate the carbon market have not been designed with urban mitigation activities specifically in mind.

The various legal, technical and financial barriers to carbon markets often appear to be insurmountable for urban projects. The factors below outline some of the most cited barriers to developing urban-based carbon mitigation projects:

- **High transaction costs.** The majority of mitigation project activities targeting urban communities are widely dispersed, covering large areas and/or large numbers of small and independent consumers. This makes it difficult and therefore expensive to implement and monitor results. It also makes the co-ordination and management of these projects challenging, as they often involve large and diverse numbers of stakeholders.
- **Limited budgets.** Access to budget and start-up capital is often limited.
- **Limited institutional capacity.** Carbon market mechanisms are complicated. Governmental agencies located in developing countries often lack the resources and technical expertise to successfully implement citywide schemes under this approach. Also, insufficient co-ordination

between the different agencies at a city level can make it difficult for local authorities to grasp the entire process involved, causing issues with co-operation and implementation.

- **Difficulties in the quantification of emission reductions.** Methodologies for typical urban projects such as transportation and energy efficiency in buildings are more complex and often require extensive modelling or monitoring.
- **High monitoring costs.** Urban-based project activities are often widely dispersed throughout a city, increasing the complexity and therefore cost of monitoring. Default factors are being progressively introduced within methodologies (e.g., household lighting). However, these tend to be highly conservative and can reduce the amount of claimable credits.
- **Risk of failure.** The performance of a project depends on multiple stakeholders, increasing the probability of under-delivery.
- **Limited motivation.** Challenges such as climate change or reducing GHGs are often considered to be national issues; therefore, local authorities can sometimes lack the motivation to deal with the problem at a city level.

1.3 Urban Development Initiatives

A large and varied number of organisations are engaged in urban development around the world. These market actors focus on sectors such as water supply and sanitation, urban transport, solid waste management, low carbon economy, or the upgrading of slums. Some of the key initiatives are summarised below:

The Cities Development Initiative for Asia (CDIA)⁵

The CDIA is an International Partnership Programme assisting medium sized Asian cities to bridge the gap between their development plans and the implementation of their infrastructure investments. It is a regional initiative, established in 2007 by the Asian Development Bank and the Government of Germany, with additional core funding support from the governments of Sweden, Austria and Spain and the Shanghai Municipal Government. The CDIA uses a demand-driven approach to support the identification and development of urban infrastructure investment projects in the framework of existing city development plans, which emphasise one or more of the following impact areas:

- Urban environmental improvement
- Urban poverty reduction
- Climate change mitigation or adaptation
- Improved governance

CDIA provides a range of international and domestic expertise and advice to cities to move from strategic master plans to concrete policies and infrastructure projects ready to present to financiers and project developers. Key support areas include urban transport, urban renewal, flood and drainage, wastewater, slum upgrading, water supply and solid waste management.

Cities Alliance⁶

The Cities Alliance is a global partnership for urban poverty reduction and the promotion of the role of cities in sustainable development. The Cities Alliance was created in 1999 when 10 donor governments joined the World Bank, UN-HABITAT and the major international associations of local authorities to form

⁵ <http://www.cdia.asia/>

⁶ <http://www.citiesalliance.org/ca/>

a new partnership aimed at focussing on the growth of slums and the management of cities where slum growth was taking place.

Support provided by the Cities Alliance to cities, local and national governments generally falls within three broad categories:

- Citywide and nationwide slum upgrading programmes
- City development strategies
- National policies on urban development and local government

Energy Efficient Cities Initiative (EECI)⁷

The Energy Sector Management Assistance Program (ESMAP), managed by the World Bank, launched its Energy Efficient Cities Initiative (EECI) in 2008 to help cities meet their energy challenges. The EECI is a flexible and demand-driven programme that identifies innovative ways to improve energy efficiency in the delivery of city services and reduce the costs and environmental impacts of energy use. EECI, in turn, supports the development of the Rapid Assessment Framework (RAF), a practical tool to conduct rapid assessment in cities to identify and prioritise sectors.

The RAF looks at energy efficiency in six sectors: buildings, transport, waste/wastewater, public lighting, solid waste and power/heating. RAF will provide a global framework to facilitate cross-city comparison and sharing of best practices on energy saving initiatives in the six main sectors. In addition to the RAF, ESMAP has a project database of city case studies, which is publicly available.

Ecological Cities as Economic Cities (Eco2 cities)⁸

Eco2 Cities is built on the foundation that ecologically sound cities can be strong cities economically. Eco2 Cities helps cities plan, design, invest, and manage integrated urban systems, moving away from single-purpose, short-term and sector-specific approaches in favour of multi-purpose, long-term and integrated solutions. The Eco2 framework is based on four key principles:

- i. A City Based Approach that enables local governments to take into account their specific circumstances
- ii. An Expanded Platform for Collaborative Design and Decision Making that aligns the actions of key stakeholders
- iii. A System Approach that enables cities to realise the benefits of integration by planning, designing, and managing the whole urban system
- iv. An Investment Framework that values Sustainability and Resiliency by incorporating and accounting for life cycle analysis, the value of all capital assets (manufactured, natural, human, and social), and a broader scope of risk assessments in decision making

A regional programme supporting Eco² in the East Asia and Pacific region, with specific sub-programs in Vietnam, Indonesia, the Philippines, and Laos was launched in 2010.

International Council for Local Environmental Initiatives (ICLEI)⁹

ICLEI is the world's leading association of cities and local governments dedicated to sustainable development. ICLEI is currently working with 12 mega-cities, 100 super-cities and urban regions, 450 large cities as well as 450 medium-sized cities and towns in 84 countries. ICLEI promotes local action for

⁷ <http://www.eeci.cam.ac.uk/>

⁸ www.worldbank.org/eco2

⁹ <http://www.iclei.org/>

global sustainability and supports cities to become sustainable, resilient, resource-efficient, biodiverse, low-carbon; to build a smart infrastructure; and to develop an inclusive, green urban economy with the ultimate aim to achieve healthy and happy communities. ICLEI is primarily engaged in initiatives like capacity building, networking of cities, lobbying activities, and emission reporting from cities.

Carbon Disclosure Project (CDP)¹⁰

The CDP's cities programme provides a voluntary climate change-reporting platform for city governments. The programme is open to any city government, regardless of size or geographic location. CDP primarily focuses on action through disclosure of city-based emissions. CDP provides support, guidance and platform for disclosing the city-based emissions.

C40 Cities¹¹

The C40 is a network of the world's megacities taking action to reduce greenhouse gas emissions. The C40 works with participating cities to address climate risks and impacts locally and globally.

Many of the existing programs are providing much needed and meaningful support to cities in tackling broader issues and working around GHG mitigation. However, there is need to look at the developing cities more holistically in terms of issues faced by inhabitants, and specifically communities most vulnerable to climate change. Through this study, The Gold Standard Foundation envisages new innovations and collaborations to explore and build newer framework for dissemination of cleaner technologies in urban households, at the same time providing these households with basic minimum level of services in terms of energy access, water and sanitation requirements.

¹⁰ <https://www.cdproject.net/en-US/Programmes/Pages/CDP-Cities.aspx>

¹¹ <http://www.c40cities.org/>

2.0: New and Emerging Market Mechanisms

2.1 A look at Programmes of Activities (PoAs)

The concept of a Clean Development Mechanism (CDM) Programme of Activities (PoA), often called Programmatic CDM, is described as follows:

“A Programme of Activities (PoA) is a voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure or stated goal (i.e. incentive schemes and voluntary Programmes), which leads to anthropogenic GHG emission reductions or net anthropogenic greenhouse gas removals by sinks that are additional to any that would occur in the absence of the PoA, via an unlimited number of CDM Programme Activities (CPAs)”¹².

In other words, a PoA is:

- A voluntary action
- Implementing a policy, measure or stated goal
- Coordinated by a public or private entity
- Resulting in emission reductions or removals that are additional

The CDM Executive Board launched the PoA modalities as an effort to reduce transaction costs and expand the access of CDM to smaller, replicable project activities. The replication of single or multiple interventions/measures in a considered project boundary over a specific period of time is expected to allow for the scaling-up of carbon finance whilst keeping transaction costs at a minimum. The GHG emission reductions for an intervention or measure are estimated by following the approved CDM methodologies. The estimated emission reductions are aggregated at the programme (PoA) level.

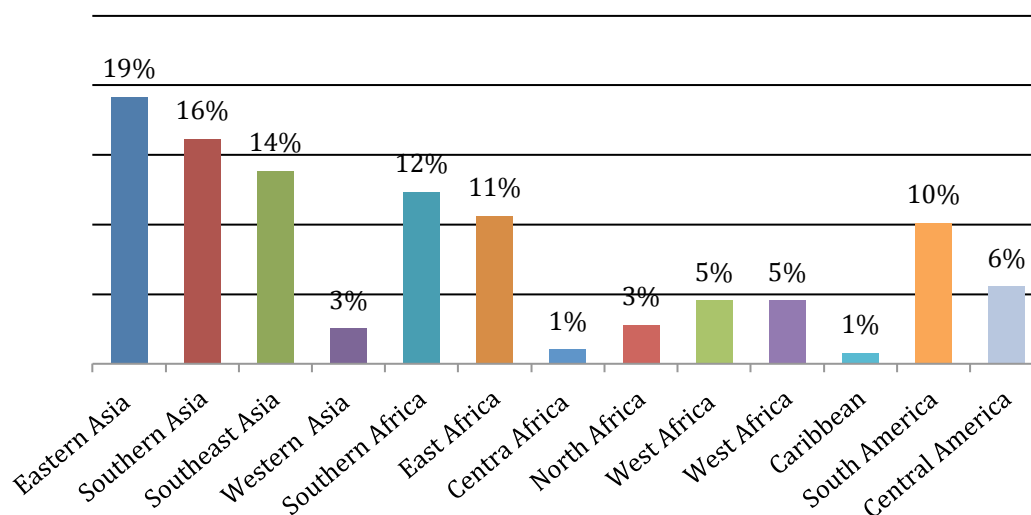
Programmes of Activities are expected to offer advantages over the prevailing project-based carbon financing approach, including:

- Once a PoA is registered, the timeframe for adding additional CPAs into the registered PoA is expected to be drastically shorter (e.g., compliance check and spot-checks versus systematic validation and registration review, sampling verification versus systematic verification, etc).
- Substantially lower transaction costs are expected due to the streamlined registration, monitoring and verification processes for CPAs.
- Increased scalability is expected, as PoAs do not need to specify the exact location and scale of the projects at registration, allowing the PoA to add multiple technologies.
- Opportunities to convert future carbon revenues into upfront carbon finance by reducing the risk of non-registration and shortening the lag time before CDM income is realised.

To date, Asia is dominating the PoA pipeline, with a share of around 52 percent of 400 PoAs submitted to UNFCCC till date (Fig. 2.1). Unlike a traditional CDM scheme, a significantly high number of PoAs

¹² UNFCCC, CDM Executive Board, 2009, Procedure for registration of a Programme of Activities (PoA) as a single CDM project activity and issuance of certified emission reduction for a programme of activities, Paragraph 3, Annex 29, EB – 47, available at http://cdm.unfccc.int/EB/047/eb47_repan29.pdf

activities (31%) have been submitted from Africa as compared to a minuscule share of 3 percent under a traditional CDM scheme. It reflects that the advantages with PoA approach have drastically lowered the entry barriers for regions like Africa.



Asia (52%), Africa (31%), Europe (1%), America (South, Central and Caribbean) (16%) and Oceania (>1%)

Fig. 2.1: Sub-regional and Regional distribution of existing and proposed CDM-PoAs

Due to the flexibility of a PoA approach in terms of scalability, PoAs potentially offer viable opportunities for small and dispersed mitigation activities like household lighting, cookstoves, efficient lighting (CFLs) and household biogas. This can be concluded from the technology mix among the submitted PoAs (Fig. 2.2). The major share is from non-main stream sectors like waste, solar and energy efficiency (demand side), including technologies like household lighting, efficient cookstoves, solar lighting and efficient appliances.

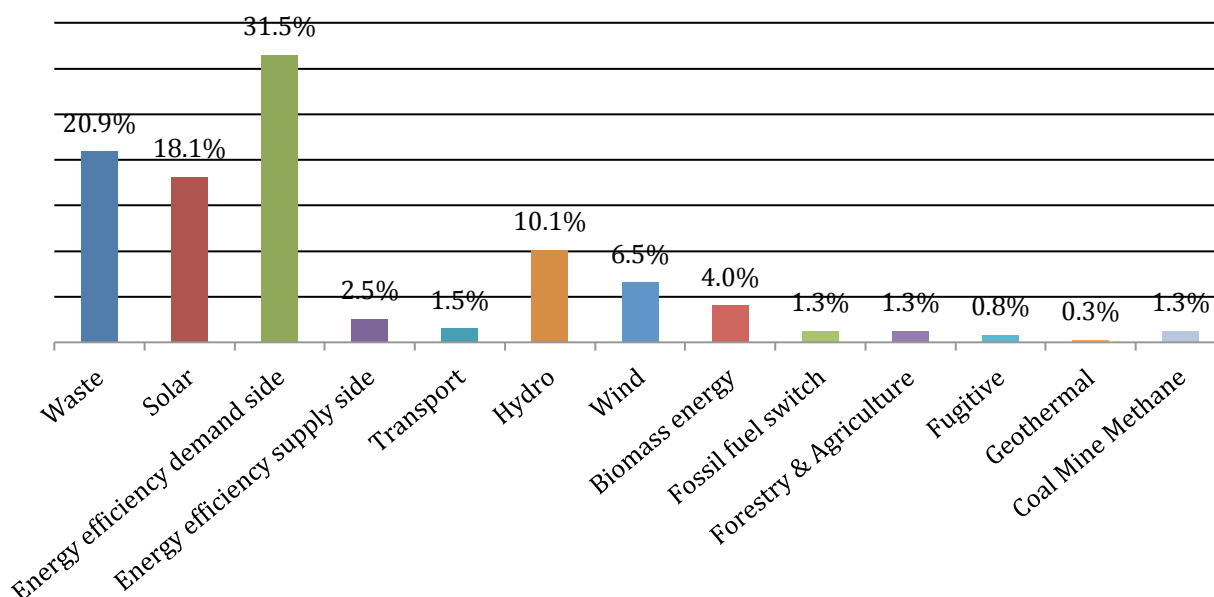


Fig. 2.2: CDM-PoAs sector/ technology

The activities focussing on urban priority areas like residential, energy efficiency, transport and waste have significantly low penetration rates under a project-based scheme. These under-represented sectors have significantly high share (50%) under a PoAs scheme (Fig 2.3). Of this, around 47 percent of PoAs are from energy efficiency at the household level that covers activities like efficient lighting, appliances and cooking, while energy efficiency activities like energy efficiency at residential/commercial buildings, street lighting and water pumping are around 12 percent. The transportation sector is still only marginally represented (<3 percent). A significant increase in the number of activities from an urban context indicates that the PoA concept has the potential to lower the existing barriers.

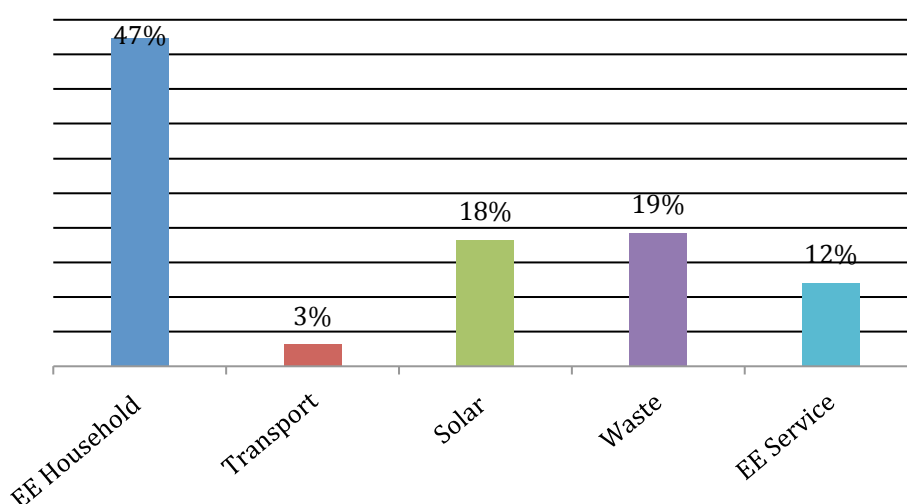


Fig. 2.3: CDM-PoAs in Urban Priority Sectors

The Gold Standard Foundation has introduced rules and procedures for PoAs under the voluntary market. However, in order to address some of the issues that have limited the successful development of PoAs under the CDM, the Gold Standard rules for voluntary PoAs have several significant differences:

- **Verification** – Under the CDM rules, the same designated operational entity (DOE) has to verify all of the activities. This can cause bottlenecks and delays when verifying a PoA. The Gold Standard rules, however, allow for multiple DOEs to verify the different activities applying for issuance under a Gold Standard PoA.
- **Multiple methodologies** – Under The Gold Standard rules, any combination of approved methodologies can be used without prior approval, as long as the methodologies are eligible under The Gold Standard and each methodology is discussed with regards to a pilot activity at the time of registration. Recently, the CDM has made the use of multiple methodologies easier with the application of a new PoA tool, however, prior approval is still required in certain cases, e.g., small-scale (SSC) methodology combination with a large-scale methodology.
- **Retroactive registration** – Under Gold Standard rules, project activities can start being implemented before the PoA has been registered. However, in such cases, the PoAs will need to follow a slightly revised process to ensure environmental integrity.
- **Retroactive crediting** – The Gold Standard rules allows for an activity to claim the emission reductions generated between the operational start date and up to two years (maximum) prior

to the date of registration or its inclusion in a registered programme; this is not allowed in the case of CDM.

In addition, the Gold Standard Foundation has recently launched a new scheme for micro-programmes (mPoA). The mPOA scheme streamlines the procedures, further reducing transaction costs for activities that reduce a maximum of 10,000 tCO₂/annum. This approach may prove useful in an urban context, especially if multiple activities are identified with multiple actors but with limited annual emission reductions (e.g. no cap on the overall programme). The advantages of the Gold Standard mPoA scheme are:

- **Reduced transaction costs** – Submitted mPoAs can proceed using the Gold Standard validation fund and verification fund approach (e.g., submission to Gold Standard for internal validation with a payment of USD 20,000 to initiate validation of the programme, and a fee of USD 2,500 for every VPA submitted for inclusion afterwards).
- **Reduced timeframe** – For registration of micro PoA and inclusion activities as a significant amount of time could be saved due to internal validations and inclusion.
- **Simplified additionality determination** – Under specific conditions (e.g., projects located in LDCs), some projects are automatically deemed as additional.
- **Simplified baseline and monitoring methodologies** – New methodologies can be proposed (and potentially approved) as part of the project documentation submission process instead of going through the usual methodology approval process.

A Gold Standard PoA guidance document has been released as part of the new version of the Gold Standard Rules and Toolkit for GSv2.2¹³.

2.2 A look at Nationally Appropriate Mitigation Actions (NAMAs)

The NAMA concept was first introduced in the Bali Action Plan at the United Nations Climate Change Conference (COP13)¹⁴ in December 2007. The Bali Action Plan¹⁵ states that in order to have “Enhanced national/ international action on mitigation of climate change....”, the developing countries will take “*Nationally appropriate mitigation actions in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner*”.

It is further stated that the developed countries will take “*Measurable, reportable and verifiable nationally appropriate mitigation actions, including quantified emission or actions, including quantified emission limitations and reduction objectives... while ensuring the comparability of efforts among them, taking into account difference in their national circumstances.*”

In brief, it refers to a set of policies and actions that countries undertake as part of a commitment to reduce GHG emissions. The term recognises that different countries may take different nationally appropriate actions based on equity and in accordance with common but differentiated responsibilities

¹³ The Gold Standard Programme of Activities Guidance Document, available at http://www.cdmgoldstandard.org/wp-content/uploads/2012/05/v2.2_ANNEX-V.pdf

¹⁴ UNFCCC, 2007 Report of the Conference of the Parties, COP -13, available at http://unfccc.int/meetings/bali_dec_2007/session/6265/php/view/decisions.php

¹⁵ UNFCCC, 2007 Report of the Conference of the Parties (Bali Action Plan), COP -13, available at <http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3>

and respective capabilities. There is also an emphasis on financial assistance from developed countries to developing countries to reduce emissions.

The NAMA also formed part of the Copenhagen Accord¹⁶ issued following the UNFCCC (COP 15)¹⁷ in December 2009. Since the Copenhagen Accord has been adopted, the policy dialogue surrounding the NAMAs development continues to evolve progressively. At the subsequent COP 16¹⁸ in Cancun, the developing countries were invited to voluntarily provide details on NAMAs for which they are seeking support, along with estimated costs and emission reductions and the anticipated time frame for implementation. In association with this decision and to provide further support to prepare and implement NAMAs, the Cancun Agreement¹⁹ set up a registry to record NAMAs seeking international support, to facilitate the matching of finance, technology and capacity-building support with these actions, and to recognize other NAMAs²⁰. At the recent COP 18 in Doha, parties agreed to establish a work programme to further understand the diversity of NAMAs. This work programme²¹ adopted focussed on further information required to enhance understanding of NAMAs. This includes estimated mitigation impacts of NAMAs, underlying assumptions and methodologies for estimating mitigation impacts, and sectors and gases covered; the need for support for the preparation and implementation of NAMAs; and the role of the Registry in matching NAMAs with international support.

The concept of NAMAs has progressed since the Bali Action Plan was adopted in 2007. The Bali Action Plan states clearly that NAMAs will have to play a dual role alongside the CDM. In response to the Cancun Agreement, several developing countries have already submitted their proposed NAMAs to the (UNFCCC)²². To date, 40 submissions²³ have been made to the UNFCCC Registry outlining activities and detailed plans to implement specific mitigation actions. Also, the Ecofys NAMA database²⁴ tracks the development of specific mitigation actions that are also referred to as NAMAs. The Ecofys database provides additional details based on publicly available information along with the NAMAs officially submitted to the UNFCCC. To date, Latin America is leading the way with respect to the number of proposed NAMAs submitted to the UNFCCC (Fig. 2.2). Latin America remains not only the most advanced region in terms of number of NAMAs developed but also hosts those NAMAs which have moved closest towards implementation, such as the NAMA for Sustainable Housing in Mexico, which is planned to start pilot implementation in 2014²⁵.

¹⁶ UNFCCC, 2009, Report of the Conference of the Parties, (Copenhagen Accord) COP -15, available at <http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf#page=10>

¹⁷ UNFCCC, 2009, Report of the Conference of the Parties, COP -15, available at http://unfccc.int/meetings/copenhagen_dec_2009/session/6262/php/view/decisions.php

¹⁸ UNFCCC, 2012, Nationally appropriate mitigation actions by developing country Parties. AWG-LCA agenda item 3 (b) (ii), available at http://unfccc.int/files/adaptation/application/pdf/itmit_3b2_v1.pdf

¹⁹ UNFCCC, 2010, Report of the Conference of the Parties, COP -16 (The Cancun Agreements) available at http://unfccc.int/meetings/cancun_nov_2010/session/6254/php/view/decisions.php

²⁰ UNFCCC, 2012, Nationally appropriate mitigation actions by developing country Parties. AWG-LCA agenda item 3 (b) (ii), available at http://unfccc.int/files/adaptation/application/pdf/itmit_3b2_v1.pdf

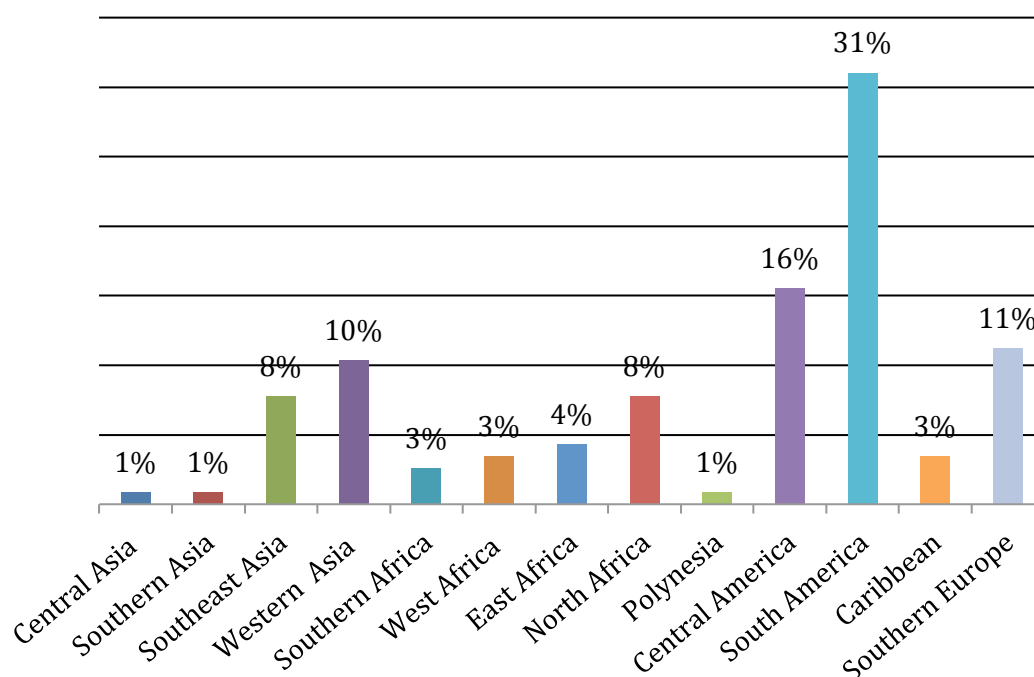
²¹ UNFCCC, 2012, Report of the Conference of the Parties, COP -18, available at <http://unfccc.int/resource/docs/2012/cop18/eng/08a01.pdf#page=3>

²² UNFCCC, 2013, NAMAs and support recorded in the registry, available at http://unfccc.int/cooperation_support/nama/items/6945.php

²³ UNEP Risoe, 2013, NAMA Pipeline Analysis and Database, July 1st 2013 available at <http://namapipeline.org/>

²⁴ Ecofys NAMA database: <http://nama-database.org>

²⁵ GIZ (2013) Mexican Sustainable Housing NAMA (presentation), available at http://www.cepal.org/ccas/noticias/paginas/1/49071/GIZ_ProNAMA-Vivienda-presentacion_estandar.pdf



Asia (20%), Africa (18%), Europe (11%), America (South, Central and Caribbean) (50%) and Oceania (1%)

Fig. 2.2: Regional and Sub-regional distribution of proposed NAMAs

Most NAMAs target multiple sectors, which include technologies/activities related to urban development such as waste management, energy efficiency in buildings, transport or renewable energy (Fig. 2.3). These submissions vary significantly in scope, demonstrating how different countries have interpreted the concept of NAMAs. The submissions range from NAMAs that include very limited details such as providing a summary of mitigation options, sectors and technologies but without stipulating the emission reduction potentials, to very comprehensive NAMAs that include precise lists of mitigation measures with the relevant quantifications. There are also a few NAMAs that simply reinforce a country's position on climate change and the international negotiations, without mentioning any concrete emission reduction potentials. Further, there have been NAMAs proposed by countries such as India and China that stipulate national targets in terms of the reduction of emission intensity of the country's Gross Domestic Product (GDP). This would indicate that NAMAs are being designed to realise the vast mitigation potential at a national level and to help provide a platform to quickly scale-up these mitigation activities.

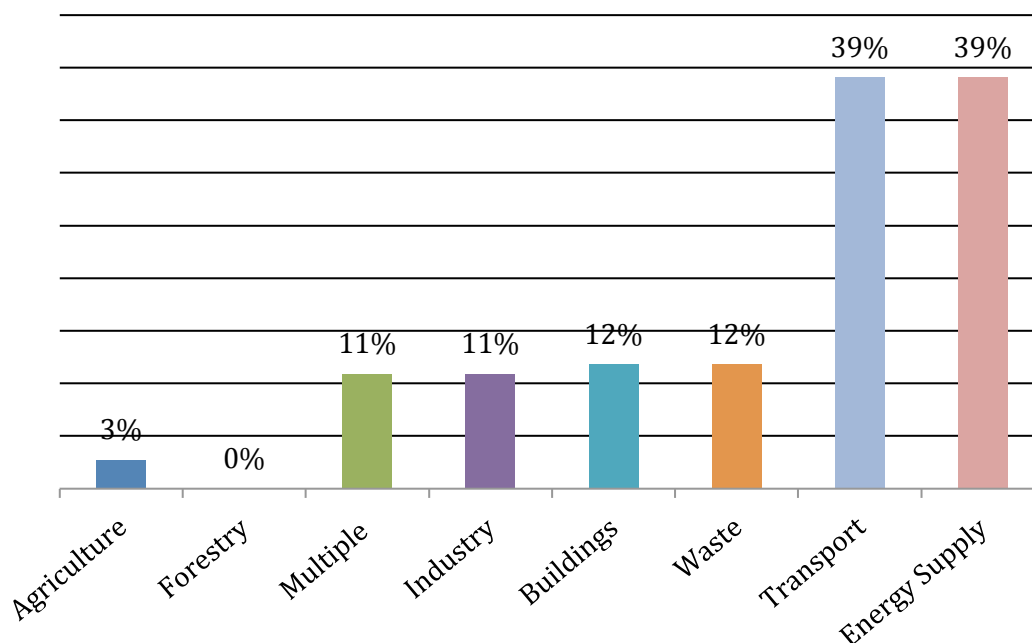


Fig. 2.3: Sector and type of proposed NAMAs

Countries submitted NAMAs to UNFCCC under two generic categories: NAMAs as political pledges by countries, which are generally generic and identify broad goals or areas for emission reductions; and, specific NAMAs, which include clearly identifiable specific mitigation interventions²⁶. The Cancun Agreement recognised two types of NAMAs: Unilateral NAMAs developed with domestic resources, and Supported NAMAs that seek international support in financing, technology transfer or capacity building^{27,28}. There is also a third type, Credited NAMAs, where a developing country earns credit that can be sold in the global market²⁹. It is proposed that Credited NAMAs would reduce emissions beyond an agreed crediting baseline and be granted access to carbon finance through the sale of carbon credits. However, the concept of Credited NAMAs has not been officially established yet.

There will be a number of key considerations in the design of the NAMA, particularly around the concept of Monitoring, Reporting and Verification (MRV). Indicators will have to be defined to show that actions considered important for the success of the NAMA have actually taken place. These indicators will provide information on the amount of emissions saved as well as on the magnitude of the co-benefits and their impact on the sustainable development of the host country. They will also provide evidence that the planned actions have actually been implemented. Such indicators may also provide the necessary milestones or results to assure and appease funders. Thus, NAMAs will require reliable,

²⁶ Sharma, S., and Denis Desgain, 2013, Understanding the Concept of Nationally Appropriate Mitigation Actions, UNEP Risoe Center.

²⁷ UNFCCC, 2010, Report of the Conference of the Parties, COP -16 (The Cancun Agreements) available at http://unfccc.int/meetings/cancun_nov_2010/session/6254/php/view/decisions.php

²⁸ Dave Sawyer et al., 2013, Developing Financeable NAMAs A Practitioner's Guide, The International Institute for Sustainable Development

²⁹ UNFCCC, 2013, Subsidiary Body for Scientific and Technological Advice, <http://unfccc.int/resource/docs/2013/sbsta/eng/misc09a02.pdf>

conservative and transparent methods for evaluating the achieved emission reductions so they can be easily reviewed by the regulator and/or certification body in charge of examining and evaluating the NAMA proposal.

In addition to the potential for reducing GHGs emission, the alignment of national objectives and synergies with other measures and the potential of sustainable development co-benefits will be important in selecting mitigation measures as NAMAs. This will help ensure that these NAMAs attract funding (Supported NAMAs) or sell credits at premium prices (Credited NAMAs).

A Wuppertal Institute study that analysed 16 NAMAs, however, warned that NAMAs might fall short from achieving their dual goal of reducing GHGs emission whilst improving sustainable development. The study finds that although there are good opportunities to link NAMAs to sustainable development, "only one of the NAMA proposals assessed have actually discussed this issue at all"³⁰. The study concludes, "*Sustainable development must be an integral part of NAMAs on every level*" if NAMAs are to avoid the shortfalls seen within the CDM.

The Gold Standard approach to the evaluation of sustainable development combines a bottom-up and integrated approach to project design with top-down defined safeguarding principles based on international conventions. The Gold Standard tools, i.e. the 'Do No Harm assessment', the 'Sustainable Development Matrix', stakeholder consultation guidelines, and monitoring plan requirements have been successfully applied to project-based mechanisms and can be adapted and applied to the evaluation of the sustainable development benefits associated with NAMAs.

At the international policy level many aspects surrounding the development, implementation and support of a NAMA approach are still undefined. There is no official definition of what constitutes a NAMA. Currently, there are no formal channels for presenting information on proposed NAMAs, nor any official support available for finance, technology and capacity building. In addition, the systems and processes for the monitoring the implementation of NAMAs remain unclear.

The majority of activities associated with NAMAs are directed towards readiness and preparation activities including capacity building, setting up processes and institutions and developing NAMA proposals³¹. Several agencies are involved in various capacities for development work around NAMAs (Table 2.1). At COP 18 in Doha, two initiatives were launched to advance actions both on best practice for financing NAMAs, and increasing finance for NAMA implementation³². The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the UK Department of Energy and Climate Change (DECC) jointly set up the "NAMA Facility" to support developing countries for

³⁰ Hanna Wang et al., 2011. Current Developments in Pilot Nationally Appropriate Mitigation Actions of Developing Countries (NAMAs)

³¹ Cameron et al., 2012, Annual Status Report on Nationally Appropriate Mitigation Actions (NAMAs) <http://www.ecofys.com/en/publication/annual-status-report-on-namas-2012/>

³² Tilburg et al., 2013, Status Report on Nationally Appropriate Mitigation Actions (NAMAs) June, available at <http://www.ecofys.com/en/publication/status-report-on-nationally-appropriate-mitigation-actions-namas/>

implementation of NAMAs, covering a total of €70 million³³. The first ‘demonstration’ project supported by the NAMA facility will be a NAMA programme for Sustainable Housing in Mexico³⁴.

Table 2.1 Agencies involved in NAMAs development work through NAMA Partnership³⁵

UN Agencies	<ul style="list-style-type: none"> - UNEP Risoe Centre (URC) - United Nations Development Programme (UNDP) - Food and Agricultural Organisation (FAO) - United Nations Environment Programme - Division of Technology Industry and Economics (UNEP-DTIE) - United Nations Institute for Training and Research (UNITAR)
Development Banks	<ul style="list-style-type: none"> - The World Bank - African Development Bank - Asian Development Bank - The Nordic Environment Finance Corporation (NEFCO) - Inter American Development Bank
Bilateral Organisations	<ul style="list-style-type: none"> - Agence Française du Développement - German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) - United States Agency for International Development (USAID) - International Fund for Agricultural Development (IFAD) - Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) - KfW - Japan International Cooperation Agency
Other Relevant Agencies	<ul style="list-style-type: none"> - World Resource Institute - International Climate Initiative - The Climate Policy Initiative - Climate Markets and Investment Association (CMIA) - Centre for Clean Air Policy - Climate Works Foundation - Climate and Development Knowledge Network (CDKN) - World Business Council for Sustainable Development (WBCSD) - Organisation for Economic Co-operation and Development (OECD)

To speed up the implementation of NAMAs, significant progress needs to be made in terms of developed country commitments to financing such initiatives. However, to attract the financing needed, greater detail needs to be provided in terms of the amount of finance required, how it will be used, what the outcomes will be and how these will be demonstrated and proven. Based on historical experiences with the pace of negotiations, it will likely take a long time before we see systematic fund flows through bilateral schemes or other mechanisms.

³³ Background information: NAMA Facility, 2012, Federal Ministry for Environment, Nature Conversation and Nuclear Safety, Department of Energy & Climate Change, available at http://www.bmu.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/factsheets_nama_en_bf.pdf

³⁴ *ibid*

³⁵ The NAMA Partnership is a group of multilateral organisations, bilateral cooperation agencies and think tanks that have come together to work on Nationally Appropriate Mitigation Actions (NAMAs) with an objective to enhance collaboration and complementarity of the activities of the different organisations to accelerate support to developing countries in preparation and implementation of their NAMAs. Further information is available at <http://www.namapartnership.org/>

2.3 The concept of a Results-Based Finance (RBF) approach

Results-based finance (RBF) is the mechanism of payments on delivery of a pre-defined, verified output. This concept has initially been successfully applied by development aid organisations in the health sector³⁶ and for delivering international aid. In recent past too, it is being considered as one of the effective means to finance GHGs mitigation and adaptation activities as well. For example, the COP has agreed on results-based finance approaches in relation to designing the Green Climate Fund and financing REDD+ activities. At COP 17, the results-based finance approaches were considered as financial instrument for recently launched Green Climate Fund. It has been stated *“The Fund may employ results-based financing approaches, including, in particular for incentivizing mitigation actions, payment for verified results, where appropriate.”*³⁷ At COP 16; Cancun Agreement³⁸, the parties agreed that REDD+ actions could be financed through results-based finance approach. In a recent meeting at COP 18, the parties decided to undertake a work programme on results-based finance to scale-up and improve the effectiveness for REDD+ activities³⁹.

Results-based finance is an umbrella term that covers all other financing approaches that are based on the fundamental principle of providing a *payment or financing or financial incentives on delivery of predetermined measureable and verifiable result(s)*. Financing mechanisms like Payments by Results (PbR), Pay for performance (P4P)^{40,41}, Performance-based Payment⁴², Performance-based Incentives⁴³ are based on same concept. Others, including Advance Market Commitments⁴⁴ (AMCs), Cash on Delivery (CoD)⁴⁵, Conditional Cash Transfer (CCT)^{46,47}, Output Based AiD (OBA)⁴⁸, Output Based Disbursement (OBD)⁴⁹, Result Based Aid (RBA)⁵⁰, Carbon Finance (CF)⁵¹, Payment for Ecosystem Services

³⁶ <http://www.rbfhealth.org/>

³⁷ UNFCCC, 2012, Report of the Conference of the Parties, COP -17 available at <http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf>

³⁸ UNFCCC, 2010, Report of the Conference of the Parties, COP -16 (The Cancun Agreements), Paragraph 73 available at <http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=2>

³⁹ UNFCCC, 2012, Report of the Conference of the Parties, COP -18, paragraph 25-28, available at <http://unfccc.int/resource/docs/2012/cop18/eng/08a01.pdf#page=25>

⁴⁰ Scheer et al., 2010, Pay For Performance (P4P) Programs in Health Services: What is the Evidence?, World Health Report (2010) Background Paper, No 31, World Health Organisation available at <http://www.who.int/healthsystems/topics/financing/healthreport/P4PWHR2010ShefflerFINAL.pdf>

⁴¹ International Energy and Climate Initiative – Energy+, Norwegian government, available at http://www.bellona.org/articles/articles_2011/energy_plus

⁴² UNDP, 2012, Readiness for Climate Finance, available at ent/undp/en/home/librarypage/environment-energy/low_emission_climateresilientdevelopment/

⁴³ World Bank, Forest Carbon Partnership Facility Brochure, available at <http://www.forestcarbonpartnership.org/about-us>

⁴⁴ DFID, 2009, Advance Market Commitments for low-carbon development: an economic assessment. Available at <http://r4d.dfid.gov.uk/Output/184268/>

⁴⁵ Birdsall et al., 2010, Cash on Delivery, Center for Global Development: A New Approach to Foreign Aid, available at <http://www.cgdev.org/publication/9781933286600-cash-delivery-new-approach-foreign-aid>

⁴⁶ Natasha, 2011, The diffusion of Conditional Cash Transfer programs in the Americas, Global Social Policy, 11(2–3) 250–278

⁴⁷ Chaudhury, Nazmul; Friedman, Jed; Onishi, Junko. 2013. Philippines Conditional Cash Transfer Program: Impact Evaluation 2012. World Bank, Washington, DC, available at <https://openknowledge.worldbank.org/handle/10986/13244>

⁴⁸ Global Partnership on Output-Based Aid (GPOBA) Programme is a partnership of donors and international organisation working together to support output-based aid. Please refer to link for further details. <http://www.gpoba.org/>

⁴⁹ World Bank, 2012, Financing Renewable Energy: Options for Developing Financing Instruments Using Public Funds, available at http://www-esd.worldbank.org/refine/index.cfm?Page=knowledge_center

⁵⁰ Klingebiel Stephen, 2012, Results- Based Aid (RBA) and its Application to Promote Good Governance, Centre for Global Development, available at www.cgdev.org/doc/Initiatives/RBA_Publication_2012_04_11.pdf

(PES) are fundamentally similar but with different incentives and/or payment arrangements. Publications from GPOBA (2010)⁵², Musgrove (2011)⁵³ and The World Bank⁵⁴ may be accessed for further details of these approaches.

In the field of development aid, results-based finance is used to ensure every dollar is spent as effectively as possible, helping to address the pressure for greater accountability and value for money in public budgets. In the context of climate change mitigation actions, it provides funders (whether governments or private entities) with the ability and confidence to claim that benefits have genuinely been achieved against specific commitments or targets. It also ensures a return on investment for organisations providing the financing and for the technology providers associated with the financing model.

Lessons learned from previous result-based finance initiatives indicate that soft measures such as capacity building for the development of local micro-enterprises or effectively building the demand for such an initiative are key to enabling an environment for a successful activity. Some of the financing should therefore be allocated to these elements.

This concept has been applied in the field of sustainable energy supply (e.g., World Bank)⁵⁵ although to a relatively limited extent so far, but climate change mitigation actions may provide an ideal opportunity to promote and deploy it at scale.

⁵¹ World Bank, 2013, The Methane Finance Study Group Report: Using Pay-for-Performance Mechanisms to Finance Methane Abatement, available at <http://www.climatefinanceoptions.org/cfo/node/3438>

⁵² GPOBA, 2010, Output-Based Aid in the Results-Based Financing Universe available at <http://www.gpoba.org/OBAinRBFUniverse>

⁵³ Musgrove, P., 2011, Financial and Other Rewards for Good Performance or Results: A Guided Tour of Concepts and Terms and a Short Glossary, available at <http://www.rbhealth.org/system/files/RBF%20glossary%20long%20revised.pdf>

⁵⁴ World Bank, 2012, Financing Renewable Energy: Options for Developing Financing Instruments Using Public Funds, available at http://www-esd.worldbank.org/refine/index.cfm?Page=knowledge_center

⁵⁵ <http://www.esmap.org/node/1328>

3.0 Greenhouse Gases (GHGs) Accounting and Mitigation Measures

The overall objective of this study is to assess the potential to mitigate GHG emissions in urban areas whilst driving wider, positive, sustainable development outcomes, particularly (but not exclusively) in the local area of the activity. The study follows a step-by-step approach to assess the feasibility for scaling-up the mitigation activities in urban areas through either an existing programmatic (PoA) initiative under CDM or Gold Standard or with a new results-based finance mechanisms (RBF). It does this with specific reference to primary research in Delhi, India, though with a much wider perspective based upon a decade of field experience of Gold Standard projects in more than 50 countries. It is the intention of the Foundation to expand the primary activities to other urban areas in countries worldwide.

The objective of this chapter is to identify the major emission sources, the available GHG accounting methodologies and the feasible mitigation measures in the context of urban communities in a developing country. The following sections provide discussion using a preselected example city, i.e., Delhi, the capital city of India. However, the outcomes may be applicable to similar urban communities in other developing countries.

3.1 Sources of GHG emissions: Urban communities

Improving the existing standard of living for individuals, households and communities in urban areas is a critical factor for low carbon urban development. It is necessary to understand the city's current emission pattern and identify the major sources of GHG emissions and the reduction opportunities to address these emissions. Along with other major sources, the household and community consumption levels and their linkages to GHG emission profiles is critical to achieve the desired results.

Urban Communities

The capital city of India was selected for this study. Delhi, with a population of 16.8 million, is the third largest and the most densely populated (11297 person/sq meter) city in India⁵⁶. Around 97 percent (16.4 million) of the population lives in urban areas, which makes it the most urbanised state of the country. It sprawls over an area of 1,486 km², of which the developed urban area covers around 525 km², i.e., about 35 percent of the total area. The urban extensions and urbanised rural areas are spread over the remaining 961 km².

The Municipal Corporation of Delhi (MCD), the New Delhi Municipal Committee (NDMC) and the Delhi Cantonment Board (DCB) are the three statutory towns, which together make up the entire geographical territory of NCT Delhi⁵⁷. The entire territory of Delhi, excluding the DCB, and the NDMC

⁵⁶ Census of India, 2011; Provisional Population Totals Paper 1 of 2011, available at http://www.censusindia.gov.in/2011-prov-results/census2011_PPT_paper1.html

⁵⁷ MCD is among the largest municipal bodies in the world providing civic services to more than an estimated population of 14 million citizens in the capital city. It is next only to Tokyo in terms of area. Within its jurisdiction are some of the most densely populated areas in the world. It has also the unique distinction of providing civic services to rural and urban villages, resettlement colonies, regularized unauthorised colonies, JJ squatter settlements (slum 'basties'), private 'katras' etc.

areas, but including the rural areas, come under the jurisdiction of the MCD for providing basic amenities to this rapidly growing city.

Being the capital of India, Delhi is the centre of power, trade and commercial activity and provides excellent employment opportunities, which account for its booming population and accelerated pace of urbanisation. Rapid population growth is increasing the density and causing a tremendous stress on existing land, housing, infrastructure facilities (water, sewerage, solid waste management, electricity) and services (health, education, public distribution systems). Data reveals a huge gap between the needs of the poor and the services provided to them by the city authorities, and these gaps are increasing at a phenomenal rate.

According to the Census of India, 2011, the population of Delhi was around 16.8 million. Further information on the demographics and the population for various income groups is not available. Therefore the percent share of each income group in total population is assumed as per census 2001 (Table 3.1). The estimated population has been further crosschecked with figures reported in various relevant government reports and literature.

Table 3.1: Population per settlement

Type of settlement	Population (in millions)	
	Year 2000	Year 2011
Slum (Jugghi Jhopri) Clusters	2.07	2.51
Slum Designated Areas	2.66	3.22
Resettlement Colonies	1.78	2.15
Unauthorised Colonies	0.74	0.90
Regularised Unauthorised Colonies	1.78	2.15
Rural Village	0.74	0.90
Urban Village	0.89	1.07
Planned Colonies	3.31	4.00
Total Population	13.96	16.89
Urban Poor Population	7.25	8.77
Middle-Income Population		6.59
Decadal Population Growth Rate 2001-2011	20.96%	

It is difficult to define what constitutes a middle-income household, as there are no clear definitions provided based on income groups. Also, it has been observed that unlike poor income households, middle-income groups are not limited to a specific type of settlement. In literature, various assumptions have been used to define middle-income group, creating further subdivisions in upper and lower middle-income groups. The reported population ranges from 18 – 66 percent⁵⁸ of the total urban population in Delhi. For this study, however, the data for the middle-income group is sourced from the Government of NCT publication, which has been further adjusted with the decadal growth rate. According to these estimates, the middle-income group population is around 6.59 million in Delhi.

NDMC was planned by Sir Edward Lutyens as the new capital city for the British Empire and was inaugurated as such in 1931. It was designed as a garden city with wide avenues, stately office buildings and spacious bungalows in well-laid out residential areas, planned open spaces, and a commercial hub, which is now dominated by the newly built high rise offices and apartment buildings. DCB was planned as the military component of the new capital city. Though a substantial civilian population resides in this part of the city, it is still mostly used for military purposes.

⁵⁸ City Development Plan for Delhi, Department of Urban Development Government of Delhi, IL&FS 2006.

Due to the continuous inflow of migrants and mushrooming of unauthorized colonies and slums (Jhuggi Jhopdi [JJ] clusters), the landscape of Delhi is spotted with different types of urban poor settlements. These include JJ clusters, slum designated areas, unauthorised colonies and JJ resettlement colonies. As per the estimates of Economic Survey of Delhi (2000), around 7.25 million, i.e., more than half of the total population of Delhi, is living in these settlements. This figure is now estimated at 8.77 million and still equates to half of the total Delhi population (Table 3.1). There are five types of settlements in Delhi that potentially house urban poor, which are considered for this study (Table 3.2). It is essential to understand these different types of settlements to evolve specific strategies for their improvement.

Table 3.2: Type of Settlement

Type of Settlement	Description
Jugghi Jhopri (JJ) Clusters / Squatter Settlements	These are normally shanty constructions made by migrant workers in Delhi. These tend to be largely on government agency land or 'encroached' land.
Slum Designated Areas	These are settlements that are notified under Section 3 of the Slum Areas (Improvement and Clearance) Act, 1956, as being too dilapidated or suffering from other disadvantages. Most of the notified slums were listed a long time ago and are located in the walled city.
Resettlement Colonies (RCs)	There were a total of 46 resettlement colonies in Delhi. These have been formed mostly on the outskirts of the city to resettle slum dwellers. Resettlement colonies tend to be better off than JJ relocation colonies in terms of plot size and other amenities.
JJ Relocation Colonies	When the authority that owns the land on which JJ clusters are built wants to use it, clearing takes place. Residents are relocated to other colonies as per the relocation policy. These relocated colonies are known as squatter resettlement sites, but should not be confused with resettlement colonies (which were a pre-1985 phenomena).
Unauthorised Colonies:	Most of these are colonies created by private developers on agricultural land not meant for residential use and therefore have not been approved. There are around 1432 such unauthorized colonies in Delhi.
Regularised Unauthorised Colonies	These were unauthorized colonies, which have now been regularized by the Government. This regularization follows a political decision and often has the effect of amending the 'land use' of the land on which they were created.

A recent study entitled *Undoing Our Future; 2009*⁵⁹ reported that about 52 percent of the total population, i.e., over 6 million people in Delhi, live in urban poor settlements. Some other studies^{60,61,62,63,64, 65,66,67} also indicated that the estimated population is in the range of 2 to 6 million. The

⁵⁹Undoing Our Future, A Report on The Status of The Young Child, 2009 available at <http://www.forces.org.in/publications/Report.pdf>

⁶⁰ Undoing Our Future, A Report on The Status of The Young Child, 2009. available Available at <http://www.forces.org.in/publications/Report.pdf>

⁶¹ Report of the Committee on Slum Statistics/Census, Ministry of Housing and Urban Poverty Alleviation, Government of India. August 2010. Available at mhupa.gov.in/W_new/Slum_Report_NBO.pdf

⁶² Analysis of Slum Area in Delhi & Alternative Strategies of Rehabilitation, October 2011, Centre for Global Development Research Private Limited. Available at (<http://planningcommission.nic.in/reports/sereport/serbody.htm>)

⁶³ Why do Slums exist?; Asha, Aavailable at ccessed on 01/09/2011; <http://www.asha-india.org/delhi-slums/why-do-slums-exist>

⁶⁴ Chapter - 6 : Urban Poor and Slum, City Development Plan; Department of Urban Development Government of Delhi, October 2006

official and unofficial estimates are based on different approaches, different definitions of slums or urban poor, different criteria for inclusion or exclusion of recognised/unrecognised and identified/unidentified slums. It resulted in a gross underestimation of the slum population and current estimates do not reflect the real picture of slum populations. Considering these gaps and to address the concerns of housing, infrastructure, slum development and basic civic amenities with special emphasis to urban poor, the government of India appointed a committee to look into the various aspects of slum statistics/census. The appointed committee estimated the slum population based on data from Census 2001 and statistical techniques for all states⁶⁸. The projected slum population in Delhi for year 2017 is around 3.79 million, which is also lower than the other estimates.

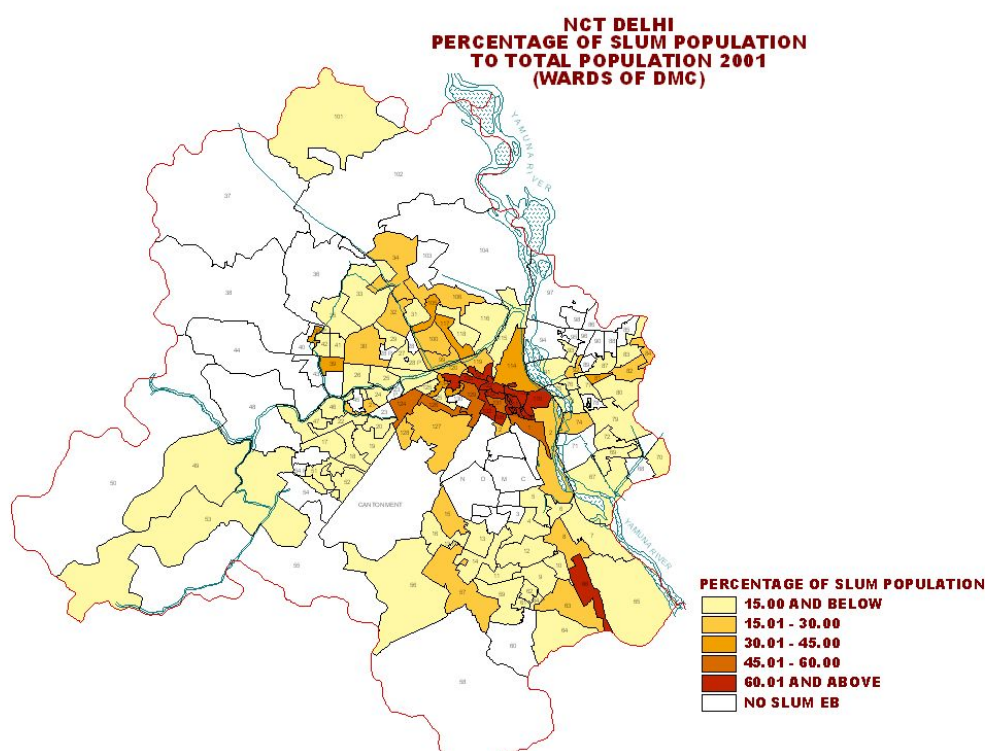


Fig. 3.1: NCT Delhi percentage of slum population to total population

According to the Census of India, there are around 3.4 - 3.7 million households⁶⁹ in urban Delhi including 1.83, 1.26 and 0.64 million in urban poor, middle-income and high-income groups respectively. For the current study, the number of households is estimated based on the household size reported in literature and based on the surveys carried out in the target income groups. The estimated numbers of

⁶⁵ Poverty Mapping Using Clustering, Department of Mathematics, Indian Institute of Technology Delhi, May 2011; available at http://planningcommission.nic.in/reports/sereport/ser/ser_clust1908.pdf

⁶⁶ Urban water crisis in Delhi. Stakeholders responses and potential scenarios of evolution, A. Mari, Iddri - Idées pour le débat N° June, 2008; available at http://www.iddri.org/Publications/Collections/Idées-pour-le-debat/Id_0806_Maria_Urban-Crisis-Water-Delhi.pdf

⁶⁷ Profiling "Informal City" of Delhi; Policies, Norms, Institute & Scope of Intervention; Water Aid India, 2005, available at (http://www.wateraid.org/documents/plugin_documents/profiling_of_delhi_1.pdf)

⁶⁸ Report of the Committee on Slum Statistics/Census, Ministry of Housing and Urban Poverty Alleviation, Government of India. August 2010 Available at mhupa.gov.in/W_new/Slum_Report_NBO.pdf

⁶⁹ The Census 2011 available at http://www.censusindia.gov.in/2011census/population_enumeration.aspx

households are summarised in table 3.3 below. The survey carried out for this study indicates a slight variation, which could be due to the definition of MPCE and the timing of the surveys, e.g., when they were carried out.

Table 3.3: Number of Households (in millions) - Urban Poor Income and Middle Income

Income Group	Household Size	No of Households	Source
Urban Poor (Low Income Group)	5.50	1.72	Literature
	5.43*	1.73	Survey*
Mid-Income Group	4.43	1.49	Literature
	4.38*	1.50	Survey*

* Please refer to the Annex 2a & 2b for further details of survey results.

The estimated population, number of households and the household size are also compared with the most recent study carried out by the Government of Delhi⁷⁰ (2009) for the National Sample Survey Office (NSSO). For comparison, the bottom six classes (Monthly Per Capita Expenditure [MPCE]) are divided into two categories; urban poor and middle-income groups. The assumption is in line with the MPCE class division applied to assess baseline situations.

The number of households located in slum areas is also reported differently in various studies. According to the most recent studies available, the number of slum households is estimated around 0.313 million⁷¹, 0.367million⁷², 0.434 million⁷³ to 0.577 million⁷⁴ including notified and non-notified slums in Delhi. The reported number of households in the National Sample Survey report and estimation by Delhi Government are different due to the different definitions used for slum categorisation. As per the National Sample Survey, a compact settlement of at least 20 households having slum-like physical characteristics was treated as a slum cluster, whereas under the "slum Area (Improvement and Clearance) Act, 1956" the number of households to constitute a slum needs to be 50 or more. Also, there is a variation in the estimated number of notified and non-notified slums⁷⁵ in these two studies. The slum population and number of households are taken as 3.16 million and 0.577 million, respectively, as reported by the Government of Delhi.

This study focuses on households within urban poor and middle-income communities. The high-income group constitutes less than 9 percent of the total population and is highly dispersed throughout Delhi. The effort versus the outcome is limited. Therefore this income group is not included for the present assessment. The emission sources are categorised based on basic services such as energy, water and

⁷⁰ Housing conditions in Delhi, 2010; Government of National Capital Territory of Delhi

⁷¹ NSSO (National Sample Survey Office); Ministry of Statistics and Programme Implementation, Government of India, Some Characteristics of Urban Slums, 2008 -09, 65th Round, May 2010

⁷² The Census 2011 available at http://www.censusindia.gov.in/2011census/population_enumeration.aspx

⁷³ Analysis of Slum Area in Delhi & Alternative Strategies of Rehabilitation, October 2011, Centre for Global Development Research Private Limited (<http://planningcommission.nic.in/reports/sereport/serbody.htm>)

⁷⁴ Urban Slums in Delhi, Based on National Sample Survey 65th Round; Government of National Capital Territory of Delhi, December 2010 (www.indiaenvironmentportal.org.in/files/UrbanSlum_65thRound.pdf)

⁷⁵ According to the Delhi Urban Shelter Improvement Board, Government of Delhi, the notified slums are the areas, which had been notified slum, which are falling mostly in the walled city and its extension under Section .3 of Slums Areas (Improvement and Clearance) Act 1956. All other slums are categorised as Non Notified/listed/identified, located across the city and considered as an illegal encroachment on public land.

sanitation, solid waste management and transportation. The activities included under each service are provided in table 3.4 below.

Table 3.4: GHGs emission sources: Urban Communities

Energy	Water & sanitation	Solid waste management	Transportation
<ul style="list-style-type: none"> •Cooking •Lighting •Heating •Cooling •Appliances 	<ul style="list-style-type: none"> •Drinking •Water supply •Wastewater •Sanitation 	<ul style="list-style-type: none"> •Waste disposal 	<ul style="list-style-type: none"> •Public •Private

3.3 Baseline Situation in Delhi

An assessment has been carried out to investigate the energy consumption for cooking, lighting, street lighting, drinking water, household appliances, sanitation, waste disposal and transportation in urban poor and middle-income communities in Delhi. An initial desk-based assessment was conducted based on literature^{76, 77, 78}. This was further supplemented with community-specific surveys carried out in around 875 households for this study. These households are selected randomly in listed/pre-identified communities in both income groups. To maintain the representativeness, eight communities for urban poor and six communities for middle-income group are selected from different parts of the city (Fig 3.2 & Fig 3.3) as shown below. The survey templates used to collect the baseline information are provided in Annex 1.

⁷⁶ Analysis of Slum Area in Delhi & Alternative Strategies of Rehabilitation, October 2011, Centre for Global Development Research Private Limited (CGDR) (<http://planningcommission.nic.in/reports/sereport/serbody.htm>)

⁷⁷ Urban Slums in Delhi, Based on National Sample Survey 65th Round; Government of National Capital Territory of Delhi, December 2010 (www.indiaenvironmentportal.org.in/files/UrbanSlum_65thRound.pdf)

⁷⁸ Some Characteristics of Urban Slums, 2008 -09, 65th Round, National Sample Survey Office; Ministry of Statistics and Programme Implementation, Government of India, May 2010 (http://mospi.nic.in/Mospi_New/admin/publication.aspx)

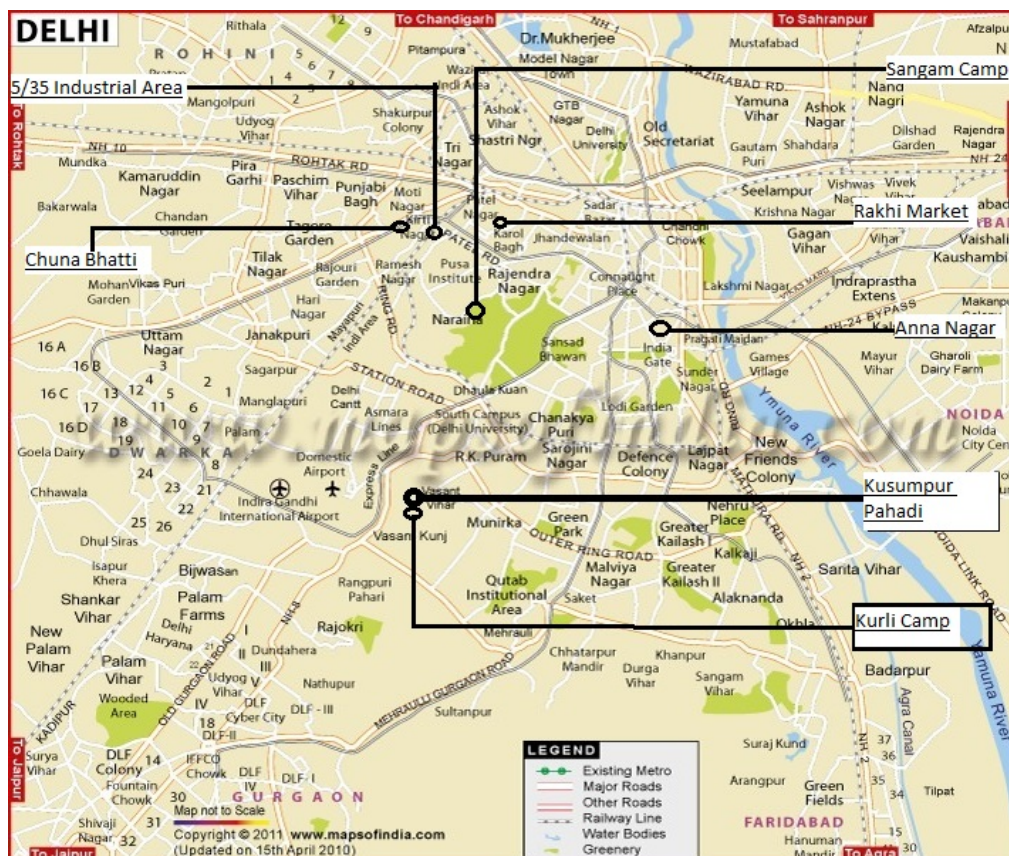


Fig. 3.2 Location of urban poor communities selected for baseline survey

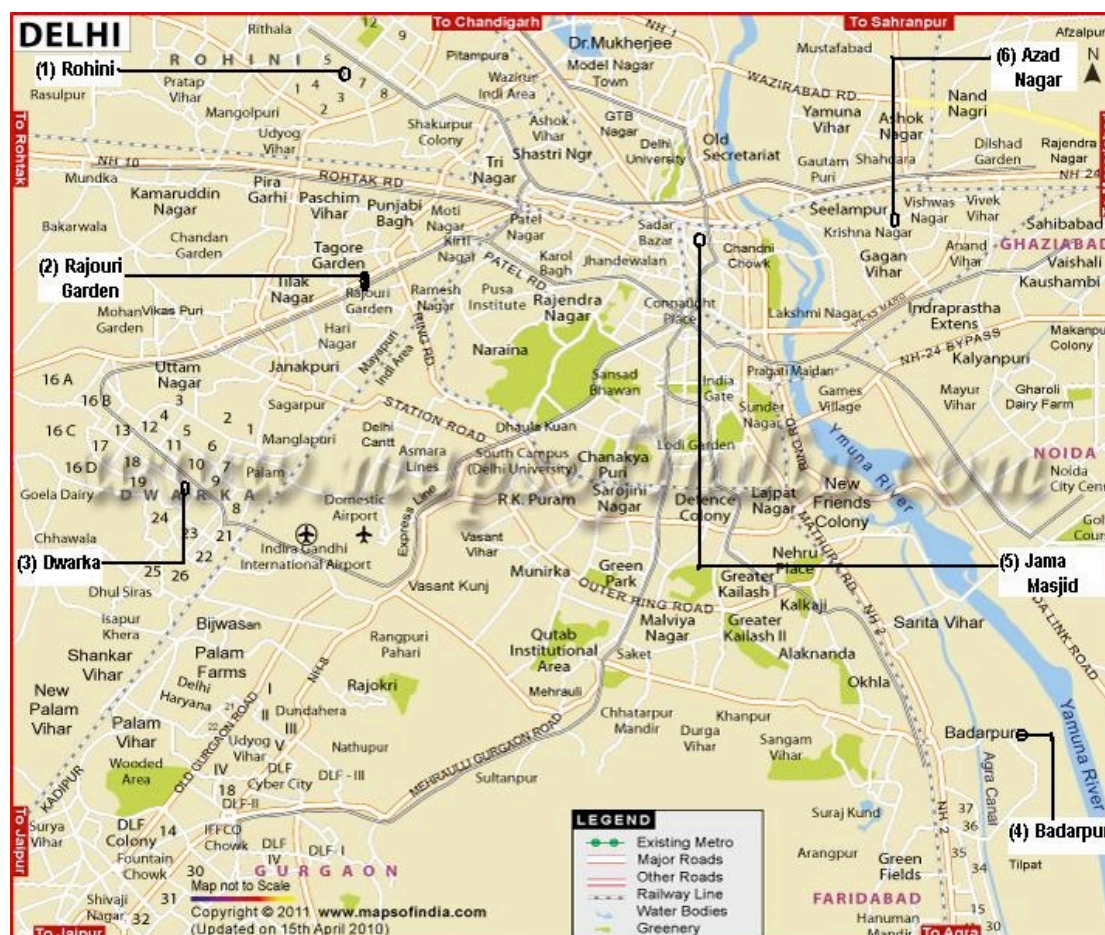


Fig. 3.3 Location of urban poor communities selected for baseline survey

Please refer to Annex 2a and 2b for the survey results for urban poor and mid-income households, respectively. A brief summary of the survey results is provided in Table 3.5 below.

Table 3.5: Baseline situation in Urban Poor and Mid Income Households (Survey)

Activity	(% households)	
	Urban Poor	Middle Income
Types of House		
• Kaccha∞	1.06%	Nil
• Semi –Pakka¥	98.72	Nil
• Pakka\$	Nil	100%
Cooking (Fuel Type)		
• LPG	64.69%	100%
• Firewood	18.82%	Nil
• Kerosene	13.3%	Nil
Cooking (location)		
• Kitchen	8.9%	98%
• Living room	77.2%	2%
Lighting - Household		
• Electricity	99.77%	100%

Activity	(% households)	
	Urban Poor	Middle Income
Drinking water		
• Piped Source	31.37%	83%
Drinking water treatment method		
• Boiling	16.6%	15.1%
• Strain through cloths	6.3%	<1%
• Water filter	4.9%	70.1%
• Other	1.6%	<1%
• No treatment	70.7%	14%
Toilet facility		
• Sewer connected	<1%	99%
• Community toilet	79.52%	1%
• Open defecation	17.6%	Nil
Waste management		
• Community bin	58.07%	92.9%
• Open dumping	41.97%	6.12%
Transportation**		
• Public	83.79%	34.01%
• Private	21.07%	84.3%
• Other		
Lighting – Street		
• Available	39.28%	82%
• No arrangement	60.08%	17%
Heating – Water*		
• Firewood	21.9%	<1%
• Electricity	15.8%	58%
• LPG	18.30%	41%
• Kerosene	10.5%	Nil
• No arrangement	26.4%	Nil
Cooling – Space		
• Fan	86.76%	98%
• Air cooler	48.260	67%
• Air conditioner	<1%	47.4%
• No arrangement	<1%	Nil

[∞]“Kachcha House” is a building made of natural materials such as mud, grass, bamboo, thatch or sticks

[¥]“Semi Pakka house” A combination of the kachcha and pukka style, the semi-pukka, is constructed with durable materials cement, brick etc along with mud, grass, bamboo, thatch or sticks .

^{\$}Fully Concrete structure

*About 66.3% households heat water

** Households own as well as use public transport system.

3.4 Mitigation measures

The purpose of this study is to investigate how cities can successfully adopt low carbon integrated urban development by reducing the GHG emissions from activities related to basic services such as energy, water and sanitation, solid waste management and transportation. In general, the activities categorised

above are in the context of household controlled emission sources. Nevertheless, other local agencies also play a critical role in managing some of these services, for example, solid waste collection and disposal, street lighting and public transportation. The mitigation measures identified can be implemented at a community level or with the active participation of the local communities. A comprehensive list of the possible mitigation measures for each activity is provided in Table 3.6.

A preliminary feasibility assessment has also been carried out to assess the suitability of particular mitigation measures considering the local circumstances and end users perspective. The mitigation measures that are considered for further assessment are listed in Table 3.6.

Table 3.6: Mitigation Measures

Activity	Baseline	Mitigation Measure	Remarks
Selected mitigation measure considered for pre-feasibility for present case study			
1. Energy			
Cooking	Inefficient cookstove / kerosene stove	<i>Improved Cookstoves (ICS)</i> Distribution of improved cookstoves to replace the inefficient stoves, which are currently being used with non-renewable solid fuels (e.g., wood fuel, charcoal).	According to the survey (Annex 2a & 2b) around 19% household in urban poor communities are using inefficient cookstoves. This presents a significant mitigation potential. The survey and literature results show that middle-income communities only use LPG as a primary cooking fuel. Therefore this mitigation measure is proposed only for urban poor communities. Improvements in technology are well proven; however, there is a great variety in the performance of the various improved stoves. Thus, performance and cost must be thoroughly assessed before selecting which type and model of improved cookstove should be installed ⁷⁹ .
		<i>Solar Cookers</i> Distribution of solar cookers to replace the inefficient cookstoves that use non-renewable fuel.	India is blessed with ample solar radiation. The Central and State Government provide much needed subsidies for the successful implementation of solar cookers ⁸⁰ . However, upfront costs and space limitations, due to small households with cramped living conditions ⁸¹ , are significant barriers for the poor and middle-income households in Delhi. Also, the individual household would not be able to meet all of its cooking requirements from a solar cooker. It would be a significant behavioural change to switch to solar cookers for partial cooking needs. Hence, this proposed mitigation measure is not considered suitable for these communities. Despite these barriers, this measure can still be implemented depending on the needs and the willingness of individual households or communities. It is suggested that the feasibility of this measure shall be assessed for the target community prior to implementation.

⁷⁹ National Biomass Cookstoves Programme (NBCP), Ministry of New and Renewable Energy, Government of India, further details available at <http://www.mnre.gov.in/schemes/decentralized-systems/national-biomass-cookstoves-initiative/>

⁸⁰ Jawaharlal Nehru National Solar Mission, Ministry of New and Renewable Energy, Government of India, <http://www.mnre.gov.in/schemes/decentralized-systems/solar-systems/solar-cooking-steam-generating-systems/>

⁸¹ Kumar et.al., 1997 "Solar cooker use in Delhi: pilot survey of urban households"

Activity	Baseline	Mitigation Measure	Remarks
Lighting - Household	Kerosene lamp	Solar lamp Distribution of solar lamps to replace kerosene lamps, candles, LPG lamps or any other temporary arrangements	As per the survey results, almost all urban poor and mid-income households are connected to the regional grid in Delhi. However, power outages of 8-10 hours and 4-6 hours are daily events in urban poor and mid-income communities, respectively. During outages the majority of urban poor communities rely on temporary measures such as candles or LPG powered lamps, while mid-income communities depend on backup systems such as inverters and diesel generators. Solar lanterns are easily available in the market and are highly user friendly, safer and require less maintenance. This measure would replace the temporary lighting arrangements. A mechanism must be put in place for the proper collection and disposal/recycling of batteries.
	Incandescent bulbs	CFL/LED To replace the incandescent lamps currently being used	In Delhi, the majority of households are connected to the regional grid and use variety of lighting devices such as incandescent lamps, CFL, etc. The government of Delhi has already initiated schemes to promote CFL use ⁸² , but still around 30-45% of households use incandescent bulbs to meet lighting requirements. This measure is proposed to replace existing incandescent lamps with CFL or LED in both urban poor and middle-income communities. In addition, a mechanism must be in place for the appropriate collection and disposal/recycling of ILBs and CFL/LEDs.
Lighting- Street	No service available*	Solar lighting Installation of solar street lighting, where street lighting is absent in the baseline	As per the literature and survey results, around 60% of the localities in urban poor areas either do not have streetlight facilities or the streetlights do not work, whereas over 82% of middle income communities have sufficient street lighting. The measure proposed is to first install solar lighting in the areas where there are no streetlights available. However, it may be further extended to replace all streetlights, depending on the success of the initial implementation. It's a proven technology. In addition, CDM revenue may be used to help cash constrained local bodies in both providing and maintaining these street lighting facilities.
	Inefficient sodium lamps	CFL/LED based street lights To replace incandescent lamps	This measure can be applied to the areas where street lighting is already provided but using inefficient sodium lamps. A similar project has been registered (CDM 8415) ⁸³ in various municipalities. This type of project activity and using revenue generated through the CDM are techniques also being considered in several other state governments' plans for the future. This is proposed to replace the existing sodium lamps in both types of communities.

⁸² Government of Delhi, Climate Change Agenda for Delhi 2009 – 2012, available at <http://www.delhi.gov.in/wps/wcm/connect/environment/Environment/Home/Climate+Change/>

⁸³ Bundled Street Lighting Energy Efficiency Projects implemented by AEL in India available at <http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1353985208.36/view>

Activity	Baseline	Mitigation Measure	Remarks
Heating - Water	LPG cookstove, electric geyser and no service available*	Solar water heater To be provided at community or household level to heat water during the four month winter season; currently conventional fuels or electricity are used to heat water	The government of Delhi has made the use of solar water heating systems mandatory in industries and commercial, residential and government buildings ⁸⁴ . The government is providing various incentives for the installation of such systems; however, upfront costs are still high and would be one of the main considerations before implementation. It is proposed that in space constrained urban poor communities, a community-based solar water heating facility could be provided (if space is available for such a facility), while in mid-income communities rooftop solar water heaters would be a more suitable option.
Cooling - Space	Electric fans and no service available*	Solar powered fan To replace electric fans in the baseline; this option also provides cooling to the households not connected to the grid (suppressed demand case)	In urban poor and mid-income households, air-coolers and fans are used for cooling during the summer season. Solar powered battery-based fans are available in the market, but the upfront cost for these fans are higher compared to electric powered fans and air-cooling systems. Carbon finance could help to subsidise upfront costs of purchasing these systems. A mechanism must be put in place for an appropriate collection and disposal/recycling of the batteries. It is proposed that the households in urban poor communities that do not have access to fans or air-coolers will be provided with the solar battery based fans. This proposed mitigation measure is not selected for mid-income communities as there are sufficient backup lighting arrangements in these households (around 80%).
	Cooling appliances	Efficient cooling appliances Fans, air-coolers and AC to replace existing inefficient appliances	In urban poor and mid-income households, air-coolers and fans are used for cooling during the summer season. It is proposed to replace the existing inefficient appliances with efficient cooling appliances. This mitigation measure may be proposed in consultation with the technology suppliers.
Appliances - Household	Inefficient household appliances like TV, radio, refrigerators & kitchen appliances	Efficient household appliances To replace inefficient appliances within grid connected households	In India, the Bureau of Energy Efficiency (BEE) has established a comparative star labelling system for indoor appliances such as refrigerators (frost free and direct cool), LPG, electric geysers and colour TVs etc ⁸⁵ . The usage of high rating appliances would significantly reduce electricity consumption. It is proposed that in urban poor and middle income households the existing inefficient appliances (with low ratings) should be replaced with more efficient appliances over a period of time.
2. Water & Sanitation			

⁸⁴ Government of Delhi, Energy Efficiency & Renewable Energy Management Centre, available at http://delhi.gov.in/wps/wcm/connect/doit_eerem/EEREM/Home/Programmes/

⁸⁵ Bureau of Energy Efficiency, Ministry of Power, Government of India available at <http://beeindia.in/content.php?page=schemes/schemes.php?id=2>

Activity	Baseline	Mitigation Measure	Remarks
Water - Drinking	Water boiling	Zero energy water filter To replace the need to boil water, or to provide access to clean drinking water for households that are currently drinking unsafe water (suppressed demand case)	In Delhi, water availability and the quality of water are of great concern. According to the survey carried out, around 86% of mid-income and only 30% of urban poor households treat water before drinking it. The situation for poor communities is the most alarming; these households treat water by boiling (16%), straining through cloths and sand filters (11%) and other methods, and around 70% households do not treat water at all due to the unavailability or lack of resources. It is proposed to provide zero energy water filters for all households in urban poor communities and for the households where no treatment method is followed in mid-income communities.
	Water boiling	Electricity based water filter RO or UV systems for areas where water quality is very poor	Several other water filter models are available that use electricity; these can be readily implemented in areas where electricity is available. However, this option is not considered for poor communities due to high upfront costs. It could be an option if the resources were available to fund such an initiative.
	Water boiling	Solar water disinfection To replace water boiling, or to provide access to clean drinking water for households that are currently drinking unsafe water (suppressed demand case)	This is a proven and cost effective technology. A pilot project has already been implemented in the slums of Delhi ⁸⁶ . Carbon revenues can allow for initiatives to scale-up, targeting the poorest households and those who cannot afford any upfront payment. However, zero energy water filters are the preferred option, due to the ease of operation and reliability of service compared to solar water disinfection.
Water - Supply	No service available	Solar water pumps Solar water pumps to provide new systems where none exist (suppressed demand case)	Although this is a proven technology and is already in use at several locations in India, the initial cost is a limiting factor for scaling-up the use of solar pumps. However, carbon finance and local subsidies could be combined to help pay for the implementation of such systems. Currently, this proposed mitigation option is not considered for either type of community due to the low GHG emission reductions.
	Inefficient water pumps	Efficient water pumps To replace the existing inefficient water pumps with new efficient pumps	The existing water supply is plagued with inefficient pumps, which leads to high electricity costs for local agencies. These pumps shall be replaced with efficient and modern water pumps.
3. Solid Waste Management			
Solid waste disposal	Open landfilling	Composting Aerobic composting of the waste currently being dumped in landfills	This is a proven technology that can be deployed provided sufficient space is available in the vicinity (thus avoiding transport costs). Also, source segregated waste may also be transported to other locations for treatment. The compost that is produced can be marketed in the vicinity of Delhi, where there is huge agricultural belt (within 100 km radius).

⁸⁶ Development Alternatives, Provision of Safe Drinking Water in 15 slums of Delhi, through point of use (p-o-u) treatment method – SODIS, available at <http://www.devalt.org/sODIS.aspx>

Activity	Baseline	Mitigation Measure	Remarks
	Open landfilling	Anaerobic digestion Anaerobic digestion of the waste currently being dumped in landfills	This is more suitable for areas that have space constraints; however, the initial investment would be higher compared to aerobic composting. Biogas would also be produced in this case, however, it would be very difficult to utilise in existing households due to the limitations with regards to infrastructure (e.g., lack of pipelines to effectively supply the biogas into households). Due to these upfront cost constraints and logistical issues, composting is the preferred option.
4. Transportation			
		Bus Rapid Transport Systems (BRTS)/Mass Rapid Transport Systems (Metro etc.) to replace current individual vehicles or inefficient bus systems	<p>The BRTS are more efficient than the existing bus systems and it is also already under implementation in Delhi. A transfer to BRTS would therefore lead to a significant reduction in emission reductions. Also, as per survey results, around 50% of people do not have access to personal transport. According to the literature (details in Annex 7, 8, 9 & 10), this figure increases to 67%. Thus, if we take suppressed demand into account, this would not lead to reduction in emission, as people would opt for fuel-based two-wheelers when they move up the earning ladder (please refer to chapter 3.7 for more details on suppressed demand).</p> <p>Economical mass transit systems are required for people residing in urban poor and mid-income communities. Several such projects are planned in Delhi. All transport related activities need to be implemented on a large-scale, i.e., at the city level, for them to be effective. Therefore, activities related to transportation are not considered for this study.</p>
Mitigation measures that were not selected for the present case study			
1. Energy			

Activity	Baseline	Mitigation Measure	Remarks
Cooking	Inefficient cookstoves	Renewable biomass briquette	<p>Biomass feedstock(s) like agriculture residues, are available in abundance in the vicinity of Delhi (100 km radius). These residues can be processed to form biomass briquettes that can be used to replace non-renewable biomass (the fuel used in the baseline situation). However, there are several risk factors associated with this mitigation measure including the ensuring a continuous supply of raw feedstock, already established supply chains for biomass briquette production and sale and the willingness to pay for fuel.</p> <p>There would be a need to demonstrate that the biomass feedstock(s) used for the production of briquettes are indeed from a renewable source, as per the rules defined under Gold Standard. Also, the quality of the briquettes and its stability over time are important elements to monitor and verify (burning properties, energy content, atmospheric pollutants etc.).</p> <p>Note that this measure is not compatible with respect to claimed emission reductions, therefore a selection of households benefiting from one or other has to be performed based on relevant criteria to be defined in the next steps.</p>
	Inefficient cookstove / kerosene stove	Biogas stove	Although a biogas digester is a simple, low-cost, low-maintenance technology, it requires a great deal of space, which limits its penetration into urban slums. Also, the required feeding material, i.e., the organic fraction of municipal waste, manure etc, is also considered a limiting factor for the operation of a biogas digester at a household level in slum areas. However, this measure could be considered at a community level.
	Inefficient cookstove / kerosene stove	Plant oil/biodiesel cookstove	In 2003, the government of India started the National Mission on Biodiesel to promote the use of biofuels ⁸⁷ . However, the production level is still low and the availability and production cost (Rs. 21 - 50/liter) limits the application of biodiesel for cooking purposes. Hence, this measure is not considered viable for poor households in Delhi.
Lighting-Street	Sodium lamps	Other renewable sources than solar	Other renewable energy options for lighting are not suitable in Delhi, therefore this measure has not been considered for further assessment.

⁸⁷ Report of the Committee on Development of Bio-Fuel, Planning commission, Government of India, 2003, available at planningcommission.nic.in/reports/genrep/cmtt_bio.pdf

Activity	Baseline	Mitigation Measure	Remarks
Water Heating	LPG cookstove, Electric geyser etc and no service available*	Biogas, Biomass gasifiers, Combined heat & power, Biodiesel	Excluded owing to similar reasons as outlined in the section above for cooking.
Space Cooling	Electric fans and no Service Available*	Energy storage, phase change materials for thermal energy storage	Phase change materials for thermal energy storage faces barriers as manufacturing costs and availability of skilled labour, which limit the commercial scale of implementation for this technology. Also space limitation is another constraint that makes phase change materials an unattractive option.
	Cooling appliances	Solar energy-based absorption cooling	This measure would involve high upfront costs. Also, the housing structures in urban poor communities are not conducive to absorption cooling. Moreover, as per the survey conducted, 98% of households do not have firm concrete houses.
2. Water & Sanitation			
Water Supply	Inefficient water pumps	Efficiency improvement in existing water supply systems	The existing infrastructure faces acute resource problems to meet the minimum service level. Mitigation measures, such as efficient pumps, could be partially funded through carbon revenues and could also provide slum communities with a stable water supply. However, the emission reductions under this scheme are too low to benefit from significant amounts of carbon finance. Moreover, the primary focus is to provide access to those households that do not currently have access to a water supply. Furthermore, this measure does not have any significant sustainable development impacts for the slum households. Hence, this measure has been excluded from further discussions.
Sanitation	No facility available	Community toilets	Slum dwellers do not have access to household toilets, forcing residents to defecate in open/public places. Under this measure an adequate number of community toilets would be provided at the slums.
	No facility available	Low water or recycled water flush	The low water or recycled water flush can reduce the demand for fresh water. However, the energy savings would be too low to make any such measure financial viable through carbon revenue. Hence, this measure cannot be implemented as part of a PoA. It could, however, be considered under a results-based finance approach due to its social and environmental sustainable development benefits.
3. Solid Waste management			

Activity	Baseline	Mitigation Measure	Remarks
Waste collection	Waste recycling	Recycling	This practice is already in use in Delhi, where useful materials from the waste are segregated and sent for recycling. Therefore it is not considered for implementation.
4. Transportation			
Public/ private transportation	Existing transportation mode	Biodiesel	The production level of biodiesel is still very low and the availability and production costs (Rs. 21 - 50/litre) are prohibitive. Also, biodiesel would increase atmospheric pollution compared to other options available. Hence, this measure is not considered for Delhi.
	No arrangement	Providing cycles to households where there is currently no transportation arrangement	As per the survey results in the slum households, around 50% of people do not have access to personal transportation, and as per the literature this figure is 67%. Under this measure we proposed to provide bicycles to the urban poor households since people have to travel long distances for work. However, as per the survey conducted in these communities, people would not adopt bicycles as a transport arrangement and would prefer to use motorised personal transport or public transport. Hence, this measure has not been considered further.

*No Service Available represents the suppressed demand situation as discussed in subsequent sections.

3.5 Sustainable development impact assessment of identified mitigation measures

According to Gold Standard principles, the selected activity must have real and positive impacts on sustainable development. Therefore, an assessment of the sustainable benefits for each identified mitigation measure is carried out following The Gold Standard Sustainable Development Assessment. The outcome of the preliminary assessment is summarised in Table 3.7 below. However, further details including the selection of sustainability indicators and monitoring parameters and the approach for monitoring the real time performance evaluation are provided in the Monitoring, Reporting and Verification section in chapter 6 and also in Annex 7.

Table 3.7: Sustainable Development Assessment

Activity	Mitigation Measure	Sustainable Development Dimensions	Score	Criteria and impact (change as compare to baseline)
1. Energy				
Cooking	Improved cookstoves (ICS)	Environment	+ive	Air quality Improvement in indoor air quality
		Social	+ive	Livelihood of poor Fuel cost saving Time saving in fuel collection
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	+ive	Awareness programme Number of awareness campaigns to promote the positive health impacts of ICS
	Solar cookers	Environment	+ive	Air quality Air pollutants, i.e., Particulate matter, CO concentration, Total Suspended Particulate Matter (TSPM)
		Social	+ive	Livelihood of poor Fuel cost saving
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people Skill development Know-how training for local people
		Governance and capacity building	+ive	Capacity building activities
Lighting - Household	Solar lighting	Environment	+ive	Air quality Air pollutants, i.e., particulate matter, CO concentration, TSPM
		Social	+ive	Livelihood of poor Fuel cost saving Access to affordable and clean energy Renewable energy sources Access to basic services Access to lighting
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people

Activity	Mitigation Measure	Sustainable Development Dimensions	Score	Criteria and impact (change as compare to baseline)
	CFL/LED			Skill development Know-how training for local people
		Governance and capacity building	+ive	Capacity building activities
		Environment	+ive	Air quality National/regional air quality improvement due to avoidance of fossil fuel based electricity generation
		Social	+ive	Livelihood of the poor Fuel cost saving
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	+ive	Capacity building activities
Lighting - Street	Solar lighting	Environment	+ive	Air quality National/regional air quality improvement due to avoidance of fossil fuel based electricity generation
		Social	+ive	Access to basic service Access to basic lighting for streets
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	+ive	Capacity building activities
	CFL/LED	Environment	+ive	Air quality National/regional air quality improvement due to avoidance of fossil fuel based electricity generation
		Social	+ive	Access to basic service Access to basic lighting for streets
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	+ive	Capacity building activities
Heating - Water	Solar water heater	Environment	+ive	Air quality (Indoor and or national/ regional) Air pollutants, i.e., Particulate matter, CO concentration, TSPM
		Social	+ive	Livelihood of poor Fuel cost saving Access to clean energy Access to basic service

Activity	Mitigation Measure	Sustainable Development Dimensions	Score	Criteria and impact (change as compare to baseline)
Cooling - Space		Economic and technology development	<i>+ive</i>	Employment generation Skilled/unskilled employment provided to local people Skill Development Know-how training for local people
		Governance and capacity building	<i>+ive</i>	Capacity building activities
	Solar powered fan	Environment	<i>+ive</i>	Air quality National/regional air quality improvement due to fossil fuel based electricity generation
		Social	<i>+ive</i>	Livelihood of poor Fuel cost saving
		Economic and technology development	<i>+ive</i>	Employment generation Skilled/unskilled employment provided to local people Skill development Know-how training for local people
		Governance and capacity building	<i>+ive</i>	Capacity building activities
	Efficient cooling appliances	Environment	<i>+ive</i>	Air quality National/regional air quality improvement due to fossil fuel based electricity generation
		Social	<i>+ive</i>	Livelihood of poor Fuel cost saving
		Economic and technology development	<i>+ive</i>	Employment generation Skilled/unskilled employment provided to local people Skill development Know-how training for local people Technology transfer and technology self reliance Penetration of advanced and efficient technology
		Governance and capacity building	<i>+ive</i>	Capacity building activities
Appliances Household	Efficient household appliances	Environment	<i>+ive</i>	Air quality National/regional air quality improvement due to fossil fuel based electricity generation
		Social	<i>+ive</i>	Livelihood of poor Fuel cost saving
		Economic and technology development	<i>+ive</i>	Employment generation

Activity	Mitigation Measure	Sustainable Development Dimensions	Score	Criteria and impact (change as compare to baseline)
				Skilled/unskilled employment provided to local people Skill development Know-how training for local people Technology transfer and technology self reliance Penetration of advanced and efficient technology
		Governance and capacity building	+ive	Capacity building activities
2. Water & Sanitation				
Water- Drinking	Zero energy water filter	Environment	+ive	Air quality Indoor air quality improvement Water quality Access to clean water drinking water
		Social	+ive	Access to basic service Access to drinking water
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	+ive	Capacity building activities
	Electricity based water filter	Environment	+ive	Water quality Access to clean water drinking water
		Social	+ive	Access to basic service Access to drinking water
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	+ive	Capacity building activities
	Solar water disinfection	Environment	+ive	Air quality Indoor air quality improvement Water quality Access to clean water drinking water
		Social	+ive	Access to basic service Access to drinking water
		Economic and technology development	+ive	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	+ive	Capacity building activities
Water	Solar water pumps	Environment	+ive	Air quality

Activity	Mitigation Measure	Sustainable Development Dimensions	Score	Criteria and impact (change as compare to baseline)
				National/regional air quality improvement due to fossil fuel based electricity generation
		Social	<i>+ive</i>	Access to basic services Increases access to water availability
		Economic and technology development	<i>+ive</i>	Skill development Know-how training for local people Technology transfer and technology self reliance Penetration of advanced and efficient technology
		Governance and capacity building	Neutral	
	<i>Efficient water pumps</i>	Environment	<i>+ive</i>	Air quality National/regional air quality improvement due to fossil fuel based electricity generation
		Social	<i>+ive</i>	Access to basic services Increases access to water
		Economic and technology development	<i>+ive</i>	Skill development Know-how training for local people Technology transfer and technology self reliance Penetration of advanced and efficient technology
		Governance and capacity building	Neutral	<i>N/A</i>
3. Solid Waste Management				
Solid waste disposal	<i>Composting</i>	Environment	<i>+ive</i>	Solid waste management Improved solid waste management practice
		Social	Neutral	<i>N/A</i>
		Economic and technology development	<i>+ive</i>	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	<i>+ive</i>	Capacity building workshops
	<i>Anaerobic digestion</i>	Environment	<i>+ive</i>	Solid waste management Improved solid waste management practice
		Social	Neutral	<i>N/A</i>
		Economic and technology development	<i>+ive</i>	Employment generation Skilled/unskilled employment provided to local people
		Governance and capacity building	<i>+ive</i>	Capacity building workshops

Activity	Mitigation Measure	Sustainable Development Dimensions	Score	Criteria and impact (change as compare to baseline)
4. Transportation				
Transportation	<i>Bus Rapid Transport Systems/Mass Rapid Transport</i>	Environment	<i>+ive</i>	<i>Air quality</i> Local air quality
		Social	<i>+ive</i>	<i>Access to basic services</i> Access to transportation facility
		Economic and technology development	<i>Neutral</i>	N/A
		Governance and capacity building	<i>+ive</i>	<i>Capacity building workshops</i>

3.6 GHG accounting methodologies

An assessment of the GHG accounting methodologies has been carried out to identify the suitable methodologies for the identified mitigation measures. A step-by-step approach has been followed to ensure the appropriate methodologies are selected. Initially all possible methodologies (e.g., large and small scale from CDM and Gold Standard) are listed for each mitigation measure as summarised in Table 3.8. The next step is to identify the suitable methodologies in the context of the pre-selected mitigation measures listed in Table 3.9. The applicability criteria, baseline scenario, monitoring requirements of the selected methodologies are also discussed in Table 3.9. One methodology for each mitigation measure is discussed in detail in Table 3.9; however, details of other potential methodologies are provided and summarised in Annex 3.

Table 3.8: List of potential methodologies

Activity	Baseline technology	Mitigation measure	Applicable methodology*		
			CDM – SSC	CDM- large scale/ consolidated	Gold Standard
1. Energy					
Cooking	Inefficient cookstove	Improved cookstoves	AMS I.C, AMS II.C, AMS II.G	AM 0094	GS 1, GS 2, GS 7
		Solar cookers	AMS I.C, AMS I.K		GS 2
		Renewable biomass briquette	AMS i.C, AMS I.E		GS 2, GS 3
		Biogas stove	AMS I.E, AMS I.I, AMS III.D, AMS. III.R, AM III.AO	AM 0069, AM 0075	GS 2
		Biomass gasifiers	AMS I.I, AMS I.C		GS 2
		Plant oil, biodiesel cookstove	AMS I.G, AMS I.H		GS 1
Lighting Household	- Kerosene Lamp/ Incandescent lamp	Solar lanterns	AMS III.AR		GS 4
		CFL, LED	AMS II.J		GS 4
		Other renewable source (e.g., wind battery chargers)	AMS III. AR		GS 4
Lighting - Street	Incandescent/ Sodium lamps	Solar lighting (PV battery chargers)	AMS I.A		
		CFL, LED lighting	AMS II.L		GS 4
Heating - Water	LPG cookstove, Electric Geyser etc and No Service Available*	Solar water heaters	AMS I.J, AMS I.C, AMS II.E, AMS III.E		GS 2
		Biogas	AMS I.C,	AM 0075, AM 0094	GS 2
		Biomass gasifiers	AMS I.C, AMS III.E	AM 0094	GS 2, GS 3
		Efficient heating, saving	AMS II.B, AMS II.E	AM 0036, AM 0058, AM 0091	GS 2, GS 4
		Heat pumps	AMS III.AR		GS 2
		Other measures (e.g., community based CHP, biogas space heating system, insulation)	AMS I.I		GS 2, GS 6

Activity	Baseline technology	Mitigation measure	Applicable methodology*		
			CDM – SSC	CDM- large scale/ consolidated	Gold Standard
Cooling household	- Electric fans and No Service Available*	Water saving	AMS II.M		GS 4
		Plant oil, biodiesel	AMS I.G, AMS I.H		GS 5
		Solar battery	AMS I.A		-
		Other renewable sources	AMS III.E		-
		Efficient cooling appliances	AMS II.C, AMS II.E	AM 0060, AM 0091	-
Appliances	Inefficient household appliances like TV, radio, refrigerators & kitchen appliances	Solar (PV battery chargers)	AMS I.A		
		Efficient equipment	AMS II.C, AMS III.X, AMS-II.O	AM 0070	
		Other renewable sources (wind mills)	AMS II.E, AMS I.B, AMS-II.O		
Water - Drinking	Water boiling	Zero energy water filters (HHs/community based)	AMS III.AV, AMS II.C	AM0086	GS 2
		Water filters	AMS III.AV, AMS II.C		GS 2
		Solar water disinfection	AMS I.E		GS 2
		Water boiling (renewable biomass)	AMS I.E		GS 2
Water - Supply	Inefficient water pumps	Solar water pumps	AMS I.B		
		Efficient water pumping	AMS I.A, AMS II.C	AM 0020	
Waste management	Open landfilling	Aerobic composting	AMS III.F	ACM 0022, AM 0080	
		Anaerobic digestion	AMS III.F, AMS III.H, AMS III.I, AMS III.Y, AMS III.AO	ACM 0022, ACM 0014	
		Thermal treatment	AMS III.E, AMS III.L		
Transportation	Existing transportation	Recycling	AMS III.I		
		Biodiesel	AMS III.T, AMS III.AQ		
		BRTS, MRTS	AMS III.U	AM 0031, AM 0090, ACM 0016	
		Electric/Hybrid Vehicles	AMS III.C		
		Non-motorized transport (Cycle rickshaws and hand carts)	N/A**	N/A	
		Cycling	N/A**	N/A	

Activity	Baseline technology	Mitigation measure	Applicable methodology*		
			CDM – SSC	CDM- large scale/ consolidated	Gold Standard
		Low GHG emitting Vehicles	AMS III.S		
		Retrofitting	AMS III.AA, AMS III.A		

- Please refer to Annex 6 for further details of the methodologies including title, scope, applicability criteria, baseline estimation approach, monitoring requirement and others.

** N/A stands for Not Available

Table 3.9: List of recommended methodologies for selected mitigation measure for present case study

Activity	Mitigation Measure	Recommended Methodology and Key Aspects
Cooking	Improved cookstove (ICS)	<p>GS2: Technologies and practices to displace decentralized thermal energy consumption (TPDDTEC)⁸⁸</p> <p>Applicability:</p> <ul style="list-style-type: none"> Programs or activities that involve the introduction of technologies and/or practices that reduce or displace greenhouse gas (GHG) emissions from the thermal energy consumption of households and non-domestic premises. Examples of these technologies include improved biomass or fossil fuel cookstoves, ovens, dryers, space and water heaters (solar and otherwise), heat retention cookers, solar cookers, bio-digesters, safe water supply and treatment technologies that displace water boiling, thermal insulation in cold climates. It is a comprehensive methodology that addresses all thermal applications, including the boiling of water and biogas generation and utilisation in a household boundary. In addition, it is applicable to both small and large-scale activities, thus providing more flexibility with respect to scaling-up the activity(ies) within the PoA boundary. The methodology also contains provisions for the consideration of suppressed demand. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> The key monitoring requirements of the methodology includes, field performance tests, usage surveys, a baseline and project survey of a representative sample target group. The methodology provides flexibility in carrying out the required performance test after the implementation of the activity/programme but prior to the first verification. This approach on the one hand, allows the project to develop whilst on the other hand, it allows the target population to get familiar with the project technology, resulting in more representative results.
	Solar cookers	As discussed for “Improved Cookstove”
Lighting - Household	Solar lamp	<p>AMS III.AR: Substituting fossil fuel based lighting with LED lighting systems⁸⁹</p> <p>Applicability:</p> <ul style="list-style-type: none"> Project activities that involve the replacement of portable fossil fuel based lamps (e.g., wick-based kerosene

⁸⁸ Gold Standard Foundation, Technologies and practices to displace decentralized thermal energy consumption available at <http://www.cdmgoldstandard.org/project-certification/gs-methodologies>

⁸⁹ Clean Development Mechanism, UNFCCC, AMS III. AR. Substituting fossil fuel based lighting with LED/CFL lighting systems, available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

Activity	Mitigation Measure	Recommended Methodology and Key Aspects
		<p>lanterns) with battery charged LED or CFL based lighting systems. Project activities can be applied in both residential and non-residential circumstances (e.g., ambient lights, task lights, portable lights).</p> <ul style="list-style-type: none"> At a minimum, project lamps shall be certified by their manufacturer to have a rated average life of at least 5,000 hours when claiming up to two years as its lifetime or 10,000 hours when claiming up to 7 years as its lifetime. Project lamps shall have a minimum of one-year warranty. The project activity shall restrict the number of project lamps distributed throughout the project activity to no more than five per household. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> Ex-post monitoring surveys to determine percentage of project lamps distributed to end users that are operating and in service. The replaced baseline lamps are those that directly consume fossil fuels.
	CFL/LED	<p>GS4: Indicative Program, Baseline and Monitoring Methodology for Large-Scale Supply and Distribution of Efficient Light Bulb, Showerheads and Water Saving Products to Households⁹⁰</p> <p><i>(There are four methodologies that can be applied for this mitigation measure. It is recommended to use The Gold Standard methodology, as this would also allow the inclusion of other potential measures, such as water saving devices etc. It also requires additional Gold Standard criteria that would have to be complied with.)</i></p> <p>Applicability:</p> <ul style="list-style-type: none"> Programme activities that involve the supply of CFLs only, or the supply and installation of CFLs and/or Low Flow Showerheads (LFS), Flow Regulators (FR) or other Water Saving Products (WSP) or a combination of these devices to households located within the individual project boundaries to reduce GHG emissions. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> The CFL products used in the programme shall be certified in accordance with the national or international standard for lifetime, on/off cycles, start time, color reading etc. Establish the collection and appropriate disposal or recycling of CFLs at the end of its lifetime. The operational period
Street Lighting - Solar	Solar lamps	AMS I.A Electricity generation by the user⁹¹

⁹⁰ Gold Standard Foundation, Indicative Program, Baseline and Monitoring Methodology for Large-Scale Supply and Distribution of Efficient Light Bulb, Showerheads and Water Saving Products to Households available at <http://www.cdmgoldstandard.org/project-certification/gs-methodologies>

⁹¹ Clean Development Mechanism, UNFCCC, AMS I.A Electricity generation by the user available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

Activity	Mitigation Measure	Recommended Methodology and Key Aspects
		<p>Applicability</p> <ul style="list-style-type: none"> Project activities that involve the installation and operation of renewable electricity generation units that supply electricity to individual households/users or groups of households/users, which are included in the project boundary. The renewable energy generation units include technologies such as solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which are used on-site/locally by the user, e.g., solar home systems and wind battery chargers. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> An annual check of all systems or a sample check to ensure that they are still operating Number and "power" of a representative sample of the replaced devices Monitoring either the "power" and "operating hours" or the "energy use" of the devices (constant current) or metering energy use of the devices (variable current) of a sample group installed using an appropriate method
	CFL/LED	<p>AMS II.L: Demand-side activities for efficient outdoor and street lighting technologies⁹²</p> <p>Applicability:</p> <ul style="list-style-type: none"> Project activities that lead to the efficient use of electricity through the adoption of energy efficient lamps and/or fixture combinations. Replacing less efficient lamps and/or fixture combinations in public- or utility-owned street lighting systems. One-for-one replacements of baseline luminaires with project luminaires or for replacing multiple baseline luminaires with multiple project luminaires. Only applicable if failed project equipment is continuously replaced during the crediting period, using local maintenance practices and by equipment of an equivalent or better lighting and energy performance specification. This methodology applies to street lighting projects that provide lighting performance quality either: (a) equivalent to or better than the baseline lighting performance or (b) equivalent to or better than the applicable street lighting standard. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> Annual failure rate

⁹² Clean Development Mechanism, UNFCCC, AMS II.L, Demand-side activities for efficient outdoor and street lighting technologies available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

Activity	Mitigation Measure	Recommended Methodology and Key Aspects
		<ul style="list-style-type: none"> • Average annual operating hours • Average project equipment power • Number of project luminaires placed in service and operating under the project activity • Electricity consumption in the baseline scenario (calculated based on baseline lamps data)
	Solar water heater	<p>AMS I.J Solar water heating systems (SWH)⁹³</p> <p>Applicability:</p> <ul style="list-style-type: none"> • The installation of residential solar water heating (SWH) systems and commercial SWH systems for hot water production. The SWH systems displace electricity or fossil fuel that would otherwise have been used to produce hot water. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> • Within three months of installation each SWH system shall be inspected and shall undergo acceptance testing (commissioning) for proper operation in compliance with the manufacturer specifications. • The units are operational and in compliance with manufacturer-required maintenance procedures.
	Solar powered fan/coolers	<p>AMS I.A : Electricity Generation by the User</p> <p>Applicability</p> <ul style="list-style-type: none"> • Project activities that involve the installation and operation of renewable electricity generation units that supply electricity to individual households/users or groups of households/users, which are included in the project boundary. The renewable energy generation units include technologies such as solar, hydro, wind, biomass gasification and other technologies that produce electricity all of which are used on-site/locally by the user, e.g., solar home systems and wind battery chargers. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> • Number and "power" of a representative sample of the replaced devices • Monitoring either the "power" and "operating hours" or the "energy use" of the devices (constant current) or metering energy use of the devices (variable current) of a sample group installed using an appropriate method • Annual checks of a sample of non-metered systems to ensure that they are still operating

⁹³ Clean Development Mechanism, UNFCCC, AMS I.J Solar water heating systems (SWH) available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

Activity	Mitigation Measure	Recommended Methodology and Key Aspects
	Efficient appliances	<p>AMS II.C : Demand-side energy efficiency activities for specific technologies⁹⁴ <i>(The other available methodology is AM0070; however, this methodology is only applicable to refrigerators and the monitoring requirements are cumbersome and complex to follow. Therefore, AMS.II.C is the only methodology that is applicable for a wide range of appliances, and when looking at the mitigation potential this small-scale methodology would be more suitable for this measure.)</i></p> <p>Applicability:</p> <ul style="list-style-type: none"> Activities that involve the installation of new, energy-efficient equipment (e.g., lamps, ballasts, refrigerators, motors, fans, air conditioners, pumping systems, and chillers) at one or more project sites. The service level (e.g., rated capacity or output) of the installed, project energy-efficient equipment is between 90% and 150% of the service level of the baseline equipment. <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> Number and "power" of a representative sample of the replaced devices Monitoring either the "power" and "operating hours" or the "energy use" of the devices (constant current) or metering energy use of the devices (variable current) of a sample group installed using an appropriate method Annual checks of a sample of non-metered systems to ensure that they are still operating The grid emission factor Project activities that involve a large amount of small devices (lamps, ballasts, refrigerators, motors, fans, air conditioners, water pumping units) shall provide a clear description of the transfer of credit ownership along the entire investment chain. Evidence shall be provided that end-users are aware of and are willing to give up their rights to the emission reductions.
	Solar water pumps	<p>AMS I.B: Mechanical energy for the user with or without electrical energy⁹⁵ Applicability</p> <ul style="list-style-type: none"> The units include technologies such as hydropower, wind power, and other technologies that provide mechanical energy, all of which are used on-site by the individual household(s) or user(s), such as wind-powered pumps, solar water pumps, water mills and wind mills etc.

⁹⁴ Clean Development Mechanism, UNFCCC, AMS II.C : Demand-side energy efficiency activities for specific technologies available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

⁹⁵ Clean Development Mechanism, UNFCCC, AMS I.B: Mechanical energy for the user with or without electrical energy available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

Activity	Mitigation Measure	Recommended Methodology and Key Aspects
		<p>Key monitoring requirements:</p> <ul style="list-style-type: none"> Recording annually the number of systems operating (evidence of continuing operation, such as on-going rental/lease payments could be a substitute) Estimations for the annual hours of operation for the equipment
Water - Drinking water	Zero energy water filters	As discussed for “Improved Cookstove”
	Electricity based RO/UV filters	<p>AMS III.AV: Low greenhouse gas emitting safe drinking water production systems⁹⁶</p> <p>Applicability</p> <ul style="list-style-type: none"> Prior to the implementation of the project activity, a public distribution network supplying safe drinking water to the project boundary does not exist. The application of the project technology/equipment achieves compliance with either: (i) at a minimum the performance target as per the document “Evaluating household water treatment options: Health based targets and microbiological performance specifications” (WHO, 2011); or (ii) an applicable national standard or guideline <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> The units are in operation or are replaced by an equivalent in service appliance Safe drinking water quality Quantity of purified water
	Solar water disinfection	As discussed for “Electricity based RO/UV filters”

⁹⁶ Clean Development Mechanism, UNFCCC, AMS III.AV: Low greenhouse gas emitting safe drinking water production systems available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

Activity	Mitigation Measure	Recommended Methodology and Key Aspects
Waste Management	Aerobic composting	<p>AMS III.F: Avoidance of methane emissions through composting⁹⁷</p> <p>Applicability:</p> <ul style="list-style-type: none"> Project activities that involve the composting of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> Quantity of municipal solid waste treated Quantity of compost produced Soil application of the compost in agriculture or related activities
	Anaerobic digestion	<p>AMS III.AO: Methane recovery through controlled anaerobic digestion⁹⁸</p> <p>Applicability:</p> <ul style="list-style-type: none"> Project activities that involve anaerobic digestion of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure <p>Key monitoring requirements:</p> <ul style="list-style-type: none"> Quantity of solid waste (excluding manure), residual waste Methane content in biogas

⁹⁷ Clean Development Mechanism, UNFCCC, AMS III.F: Avoidance of methane emissions through composting available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

⁹⁸ Clean Development Mechanism, UNFCCC, AMS III.AO: Methane recovery through controlled anaerobic digestion available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>

3.7 Suppressed Demand Assessment for GHG accounting

It is a fundamental requirement that a project activity that aims to reduce GHG emissions, must also meet the sustainable development objectives of the host party. Further, the emission reductions achieved must be “real, measurable and long term”, and that emission reductions are additional to those that would have occurred anyway.

To calculate emission reductions, it is essential to define an accurate baseline considering historic and/or existing data. With these considerations, existing small-scale methodologies use a variety of approaches to define the baseline levels of an activity; in some cases assuming the same level of activity (e.g., product quality or hours of residential lighting) or varying levels of activity (e.g., changes in industrial production output). However, in some specific situations, where the existing level of services are “suppressed”, due to poverty, lack of resources or lack of access to modern energy infrastructure, over reliance on historical data may result in very low emission baseline scenarios. For example, in least developed and developing countries, poverty and/or lack of resources and infrastructure leads to poor levels of basic services such as access to clean cooking fuel, clean water, sanitation and/or effective waste disposal. The existing low baseline for service levels results in insignificant levels of GHG emissions, but it is unrealistic to assume that the level of services, as these countries/regions develop, will remain low/poor throughout the 7 or 10 years of a standard crediting period. Further, such low baseline levels may result in such an insignificant level of emission reduction estimates from renewable energy and energy efficiency projects, that carbon credit revenue has a marginal or negligible impact on a project's financial viability. For these specific situations, it can be argued that the historical and or existing service level is not an accurate and reliable proxy for future energy/service demand.

The Gold Standard Foundation is advocating this issue and has already developed methodologies⁹⁹ to account such “specific situations” which refers to the “suppressed demand”¹⁰⁰ in the baseline selection. In its 62nd meeting the CDM Executive Board has also adopted and released the “Guideline on the Consideration of Suppressed Demand”¹⁰¹ in CDM methodologies. This guidance recognises and defines suppressed demand within the CDM framework and sets out a methodological framework for assessment and inclusion in baseline and monitoring methodologies. According to these guidelines “the baseline may include a scenario where future anthropogenic emissions by sources are projected to rise above current levels, due to the specific circumstances of the host Party”. As discussed above, these “specific circumstances of the host Party” may be due to infrastructure constraints (infrastructure underdevelopment), resource availability constraint and income constraints (poverty) of the households and communities targeted for the implementation of GHG mitigation measures/interventions. Considering these constraints, the following situations are identified where future anthropogenic emission by sources may rise:

- A. Where services to meet basic human needs (e.g., basic housing, lighting, cooking, transport, or waste treatment) were previously unavailable;
- B. Where a service was previously available to an inadequate level (demand remains suppressed, e.g., as in the situation where due to low income, inefficient kerosene lamps in inadequate

⁹⁹ Gold Standard Methodologies <http://www.cdmgoldstandard.org/project-certification/gs-methodologies>

¹⁰⁰ “Suppressed demand” is the situation where energy services provided are insufficient – due to poverty or lack of access to modern energy infrastructure – to meet the needs of stakeholders given their human development needs.

¹⁰¹ Guidelines on the consideration of suppressed demand in CDM methodologies
<https://cdm.unfccc.int/Reference/Guidclarif/index.html>

numbers are used for a curtailed duration of time in households to only partially meet the lighting demands); or a service is currently provided with a resource that is assumed to result in no emissions. For example, the burning of dung cake (which is considered to be a renewable biomass) in cookstoves to meet cooking energy needs of the households is considered to be in the lowest rung in the energy ladder indicating the highest levels of poverty and lowest levels of cleanliness, efficiency and convenience for household cooking energy supply. Whereas, almost any other fuel in this energy ladder would result in emissions, such as kerosene, and other issues (e.g., health impacts). To address these situations, the minimum service level is a reference benchmark, which indicates the minimum required level¹⁰²/quality of the desired service¹⁰³. In this section, the baseline situations pertaining to various services including cooking, drinking water, lighting, cooling & household heating, sanitation, waste disposal and treatment and transportation, possible suppressed demand situations are discussed in detail. These scenarios are considered in the context of the present case study and discussed with respect to the baseline situation in the case of Delhi. In addition to these indicative scenarios, new scenarios based on local circumstances, which are representative of a suppressed demand situation may be developed and included with the appropriate justification.

The suppressed demand situation is addressed and accounted for GHGs emission estimation for current case study as per the country specific and/or internationally approved indicative benchmarks, which may further be adjusted as per the location specific circumstances. Please refer to the Table 3.10 and Annex 4 on "SD assessment" for further details.

¹⁰² The minimum service level is a service level that is able to meet basic human needs (e.g. basic housing, basic energy services including lighting, cooking, drinking, water supply, waste treatment/disposal).

¹⁰³ "Satisfied Demand" the level of energy services that would be reached with access to better quality and more affordable services, and that would be adequate and reasonable for, in this case, rural households to meet their basic needs. i.e. satisfied demand is when the income effect and energy cost effect are overcome. Therefore, Satisfied Demand = level of service suppressed by income effect + level of service suppressed by energy cost effect.

Table 3.10: Suppressed demand assessment

Activity	Possible Service Indicator	Suppressed Demand Situation Type	Possible Scenario(s)
		Type A: Service is not available Type B: Minimum service level is not met	
Cooking	Quantity of fuel (Kg or m3) per household per day or energy (J or kWh) per person per day or per household per day	A	The households do not have cooking arrangements.
		B	The households only partially meet their cooking needs because they cannot afford to buy more modern fuel (kerosene in Delhi). The households are using dirty or low-grade fuel, which are zero or low GHG emitting fuels, to meet the cooking requirements, as modern fuels such as kerosene, LPG are unaffordable due to high unit costs.
Lighting	Lumens (for quality) and availability in hrs per day	A	The households do not have any electricity connection.
		B	The households have an electricity connection, but due to the intermittent supply the minimum hrs of lighting level is not reached. Therefore, kerosene lamps or candles are used to meet the basic lighting demand of the household; these provide lower quality light and can be hazardous.
Street Lighting	Lumens (for quality) and availability in hrs per day	A	The community areas do not have any street light facilities.
		B	The community areas have street lighting but due to poor electricity supply or maintenance the minimum service levels are not met.
Space & Water Heating	Litres of hot water per day °C hrs per day	A	The households are not equipped with adequate facilities (i.e. insulation) to maintain the minimum bioclimatic comfort in households.
		B	The households cannot afford the sufficient amount of fuel to maintain the minimum required comfort due to the high per unit cost of energy.
Space Cooling	°C indoor temperature hrs per day	A	The households do not have sufficient resources to use the appliances to maintain the minimum cooling service level.
		B	The households have the appliances in place, but are unable to use them sufficiently because of intermittent electricity supplies or insufficient means to afford more.

Activity	Possible Service Indicator	Suppressed Demand Situation Type	Possible Scenario(s)
Other Appliances	Hrs per day	A	The household does not have access to electricity to operate a TV and or other appliances to maintain the minimum level of service.
Water supply & Sanitation	Litres of water per person per day or per household	A	Households and or communities do not access to the necessary infrastructure for water supply and sanitation.
	Litres of water per person per day or per household	B	Households and or communities have access to the infrastructure, however the water supply is maintained only for limited hours during the day.
Drinking water	Litres of water (l) of suitable quality per person per day	B	The water quality is not fit for drinking therefore the end user boils the water for drinking purpose or is forced to drink the poor quality water.
Municipal Waste management	Collection frequency trip/day or week	A	The local agencies do not provide the collection services to the residents.
	Appropriate treatment method capacity tons/day/month	B	The local municipal agencies are unable to provide full services for collection, transportation and or treatment of municipal solid waste due to resource and/or infrastructure constraints.
Public Transportation	Trip per day	A	No transportation facilities are provided for a specific area.
	Trip per day	B	The minimum number of trips is not maintained due to unavailability of transport services at a specific location.

4.0 Case Study – New Delhi

4.1. Institutional framework in Delhi

An analysis has been carried out to assess the existing administrative, institutional and financial framework of Delhi, to propose an appropriate approach for the successful implementation of the proposed Programme of Activities or results-based finance schemes. This section provides an overview of the existing framework and an assessment of the city's strengths, weaknesses, opportunities and threats (SWOT). The SWOT analysis has been carried out for both, implementing the proposed programmes in an urban poor and mid-income group household context.

A multiplicity of authorities are engaged in administering the city—the municipal corporation, water board, electricity board, urban development authority, road transport corporation, slum development board and the central and state government¹⁰⁴ who wield the ultimate powers of control and direction. Therefore, the institutional and administrative setup in Delhi consists of multiple agencies, at both central and state level, responsible for various aspects of planning, urban infrastructure and its management is depicted below in Table 4.1, Fig. 4.1 and Fig 4.2.

In parallel, the city has three local municipal corporations namely, Municipal Corporation of Delhi (MCD), New Delhi Municipal Council (NDMC) and Delhi Cantonment Board.

The Municipal Corporation of Delhi, under the Government of Delhi is the premier body for provision and maintenance of urban services, sanitation, etc. It however lacks power with regards to planning and development. Independent from the Delhi Government and from the Municipal Corporation of Delhi, the New Delhi Municipal Council performs municipal functions and supplies electricity and water to the core area of New Delhi. The New Delhi Municipal Council functions more as an administrative set up under the Ministry of Home Affairs, Government of India through the Lt. Governor, Delhi. The Delhi Government has hardly any role in its functioning. In principal, parastatal organisations for transportation and water supply report to the Delhi Government, whilst solid waste management, sewerage, street lighting remain the responsibility of the Municipal Corporation of Delhi. The Delhi Cantonment Board carries out similar duties as the Municipal Corporation of Delhi and the New Delhi Municipal Council for the areas under its jurisdiction.

The Delhi Development Authority (DDA) along with the National Capital Region Planning Board (NCRBP), under the Government of India is the major actor in the field of urban planning, land management and housing.

Infrastructure development projects, which cover basic infrastructure development, sewerage, drainage and solid waste management, water supply, power, transport, hospitals and others, are financed by the NCR Planning Board and the Constituent States and National Capital Territory of Delhi and their development authorities and urban local bodies (Fig.7).

¹⁰⁴ Government of Delhi <http://www.delhi.gov.in/wps/wcm/connect/DoIT/delhi+govt/delhi+home>

These infrastructure projects are financed through money borrowed from the NCRBP and from revenue generated by taxes. The income through tax revenue also contributes to the management of existing services.

Table 4.1 Institutional framework of Delhi

Institutional Framework in Delhi		
Subsector	Government of India	Government of Delhi
1. Urban Planning and Development		
<ul style="list-style-type: none"> Housing Transport Infrastructure development Land Use 	<ul style="list-style-type: none"> Ministry of Urban Development (MoUD) Delhi Development Authority (DDA) National Capital Region Planning Board (NCRBP) Central Public Works Department (PWD) Ministry of Housing and Urban Poverty Alleviation (MoHUPA) 	<ul style="list-style-type: none"> Municipal Corporation of Delhi (MCD) New Delhi Municipal Corporation (NDMC) State Public Works Department (PWD)
2. Water & Sewerage		
<ul style="list-style-type: none"> Water supply 	<ul style="list-style-type: none"> Autonomous body under 	<ul style="list-style-type: none"> Delhi Jal Board (DJB)
3. Municipal Solid Waste Management		
Waste Management		<ul style="list-style-type: none"> Municipal Corporation of Delhi New Delhi Municipal Corporation Cantonment Board
4. Transport		
Public Transport	<ul style="list-style-type: none"> Delhi Metro Rail Corporation (DMRC) 	<ul style="list-style-type: none"> Delhi Transport Corporation (DTC)
5. Electricity		
Electricity Supply		<ul style="list-style-type: none"> Delhi Electricity Board (DEB)
6. Slum Development		
<ul style="list-style-type: none"> Rehabilitation of JJ colonies (slums) Basic services in slums 		<ul style="list-style-type: none"> Delhi Slum Improvement Board (DSIB) Municipal Corporation of Delhi
7. Health		
Health Services		<ul style="list-style-type: none"> Municipal Corporation of Delhi New Delhi Municipal Corporation

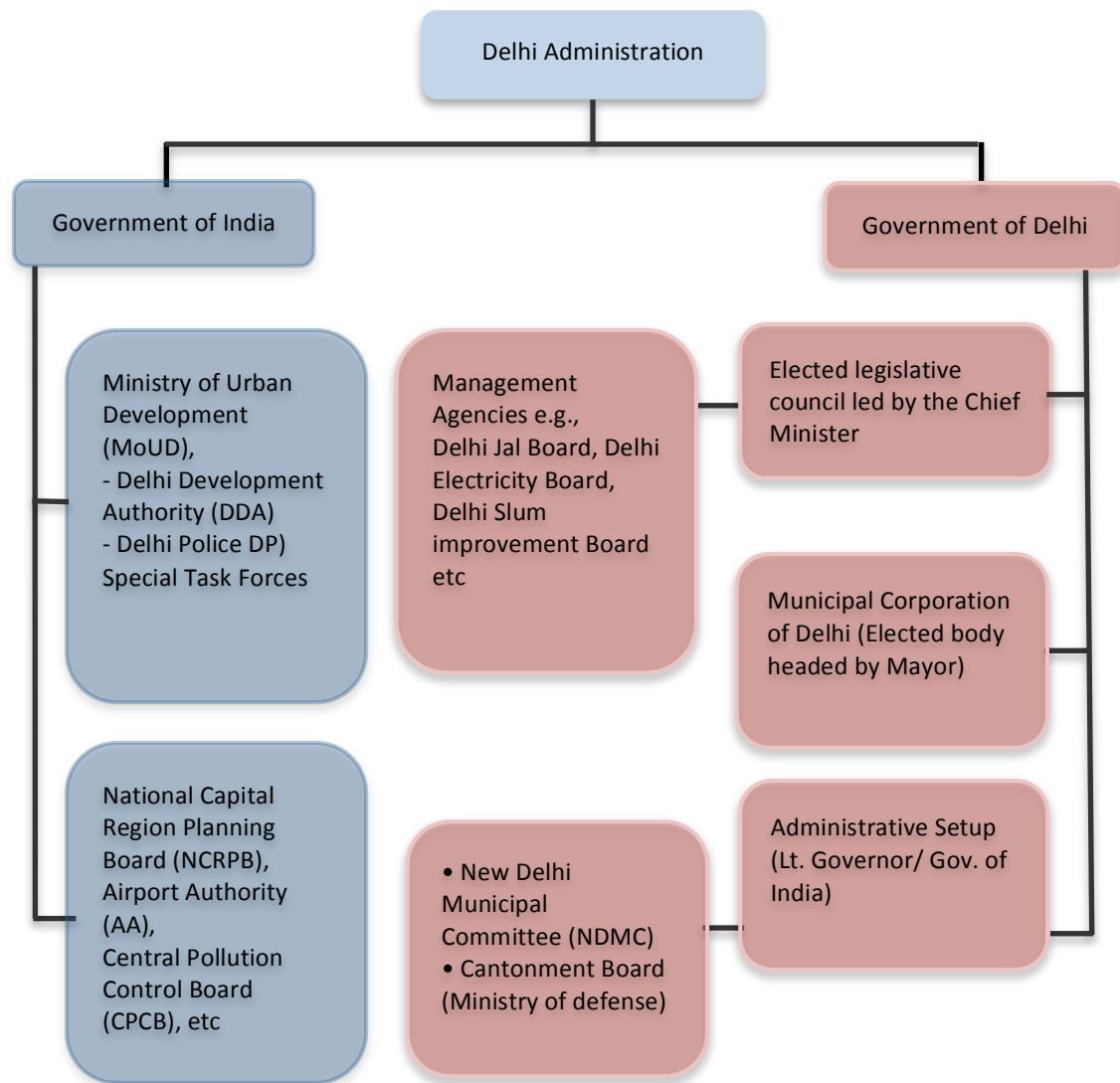


Fig. 4.1 Administrative Setup of Delhi

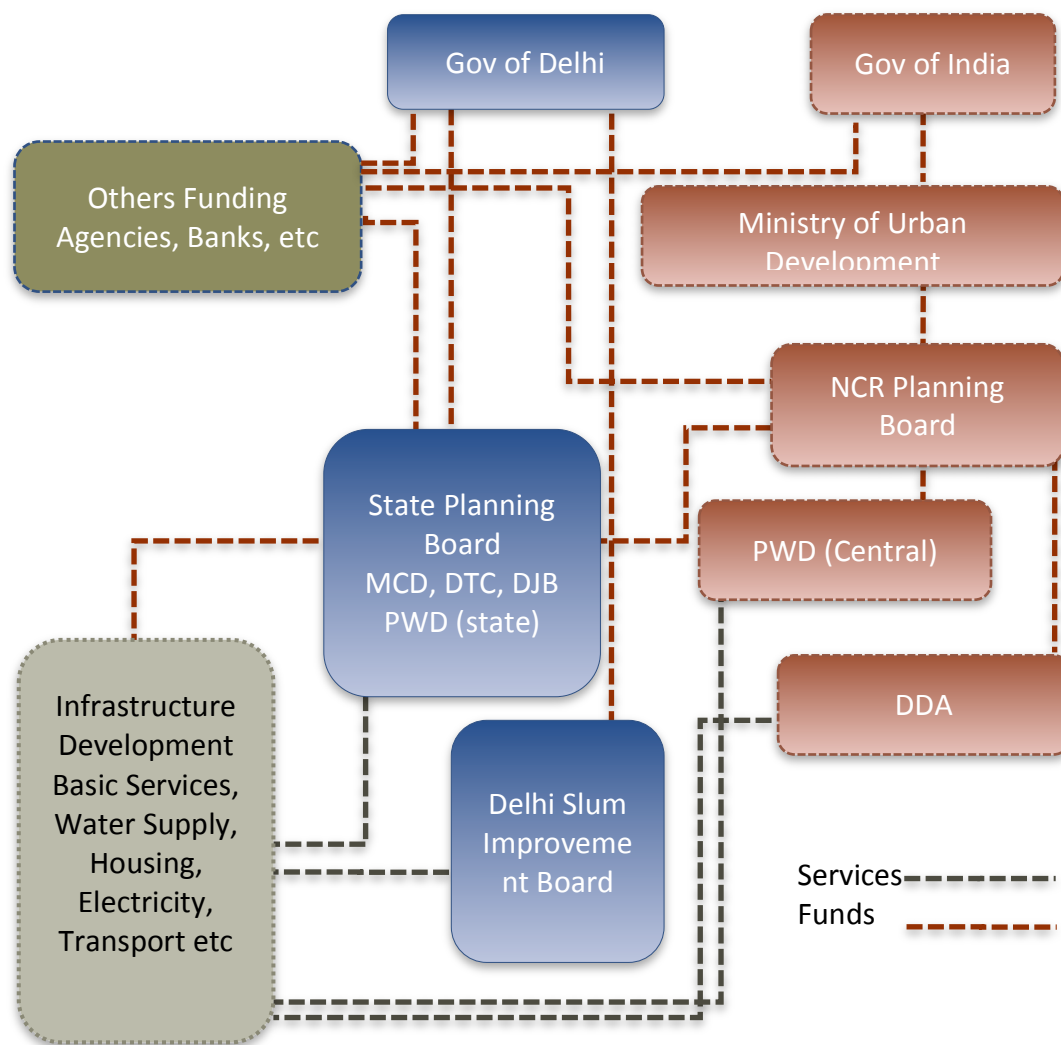


Fig. 4.2 Institutional Framework of Delhi

The Government of India has recognised the importance of the urban sector for the Indian economy and has taken a major initiative in the form of the Jawaharlal Nehru National Urban Renewal Mission (JNNURM)¹⁰⁵.

This initiative aims to improve and augment the economic and social infrastructure of cities as well as providing affordable housing and basic services to the urban poor. It consists of two schemes:

1. Scheme for Urban Infrastructure and Governance (UIG)¹⁰⁶ and
2. Scheme for Basic Services to the Urban Poor (BSUP)¹⁰⁷.

The other two schemes, i.e., the Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) and the Integrated Housing and Slum Development Programme (IHSDP), cover non-mission cities and towns with the aim of integrated provision of basic entitlements and services to all

¹⁰⁵ Jawaharlal Nehru National Urban Renewal Mission, Ministry of Urban Development, Government of India available at <http://jnnurm.nic.in/>

¹⁰⁶ Ministry of Urban Development, Government of India, <http://urbanindia.nic.in/programme/ud/uidssmtbody.htm>

¹⁰⁷ Basic Services to the Urban Poor (BSUP), Ministry of Urban Development, Government of India. <http://mhupa.gov.in/programs/index2.htm>

including the urban poor. The city of Delhi is one of the identified cities under the mission. The first stage of the initiative has been completed, however, the full extent of the outcomes are still to be realised.

To help prepare an implementation strategy for the proposed programme in urban poor and mid income communities, an assessment of the strengths, weakness, opportunities and threats of the existing institutional and financial framework of the city has been carried out and is summarised in the Table 4.2.

Table 4.2: SWOT analysis of the institutional and financial framework of Delhi

Strength	Weakness
<ul style="list-style-type: none"> Capital City of India Trade and commerce hub of Northern India Proactive government Pro-poor focused programmes, schemes, policies, e.g., Jawaharlal Nehru National Urban Renewal Mission and Basic Services to Urban Poor (BSUP) Programme to upgrade the slum settlements Promotion of collaborative Public-Private-Partnership approach Established community participation mechanism, i.e., Bhagidari Presence of a number of active Residential Welfare Associations (RWAs) and NGOs 	<ul style="list-style-type: none"> Lack of coordination among central, state government and various agencies like Municipal Corporation of Delhi, Delhi Jal Board, Delhi Development Authority Overlapping jurisdictions of various agencies Poor infrastructure facilities in both JJ clusters and resettlement colonies that do not meet basic service levels Lack of adequate and reliable data, resource and financially weak agencies The gap between planning and implementation Haphazard growth of the city due to uncontrolled migration, poor housing and poor infrastructure Lack of efficient and effective legal, regulatory and institutional frameworks Inadequate financial support to promote widespread use of Renewable and Energy Efficiency measures that protect consumer interests Inability of many urban poor to pay market rates for energy services
Opportunities	Threats
<ul style="list-style-type: none"> Improvement of basic services in JJ clusters and urban slums is one of the main focus area for the state and central government On-going institutional reforms for efficient resource utilisation Increasing population in these areas could provide significant market opportunities. On-going infrastructure development and pro-poor initiatives High economic growth 	<ul style="list-style-type: none"> Lack of adequate infrastructure to capitalize on opportunities Inadequate capacity building initiatives for local agencies, which might lead to the proposed measures not being implemented Inadequate incentives for private sector engagement or support Absence of security of tenure for slums and JJs Overlapping responsibilities might lead to inadequate initiatives from various agencies

4.2 Quantification of GHG emissions

At a city level, activities that contribute to GHG emissions can broadly fall under two categories:

- i. Controlled by the national/local agencies
- ii. Controlled by the household owner

The objective of this study is to estimate the GHG contribution at a household level and or community level. Therefore, for the activities that are not directly controlled by the household owners, for example, municipal solid waste management, transportation, water supply etc., the total GHG emissions are allocated to each household of the selected community on a pro-rata basis. The total emissions from street lighting are equally allocated to each household in the selected community. The following generic frameworks have been used to estimate the overall GHG emissions at a household level.

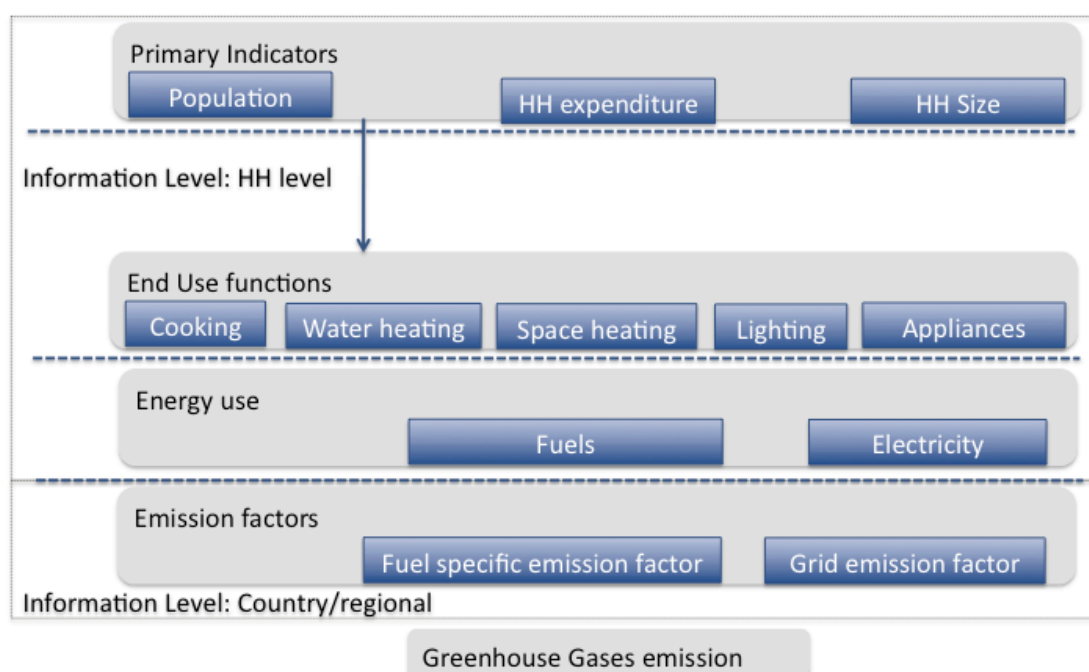


Fig. 4.3: Quantification framework for GHG emissions - household activities

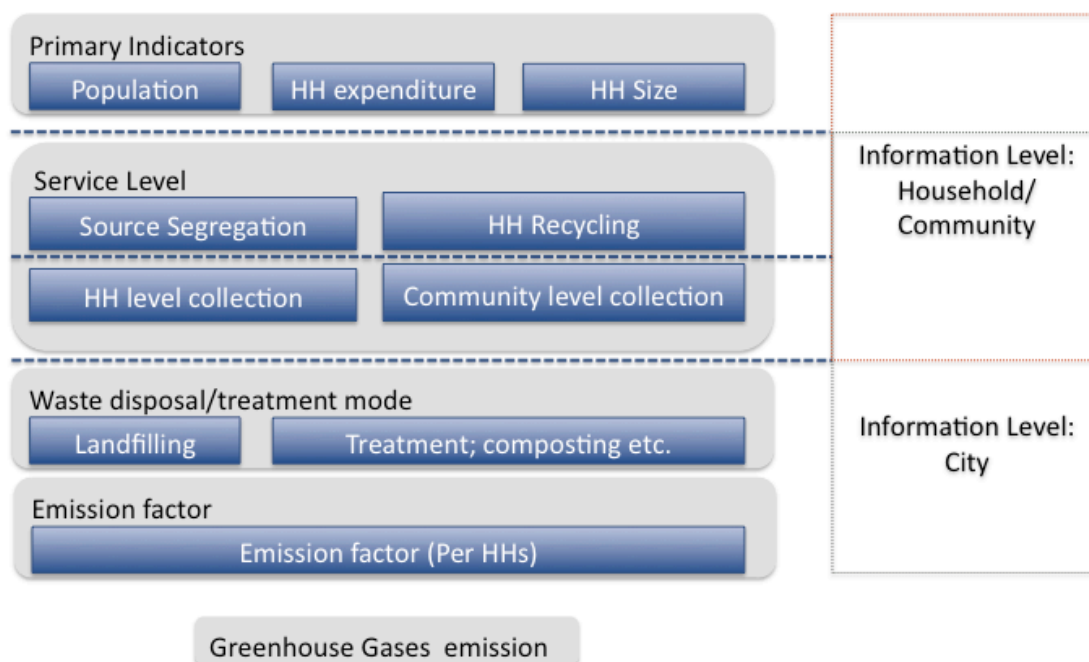


Fig. 4.4: Quantification framework for GHG emissions - municipal solid waste management

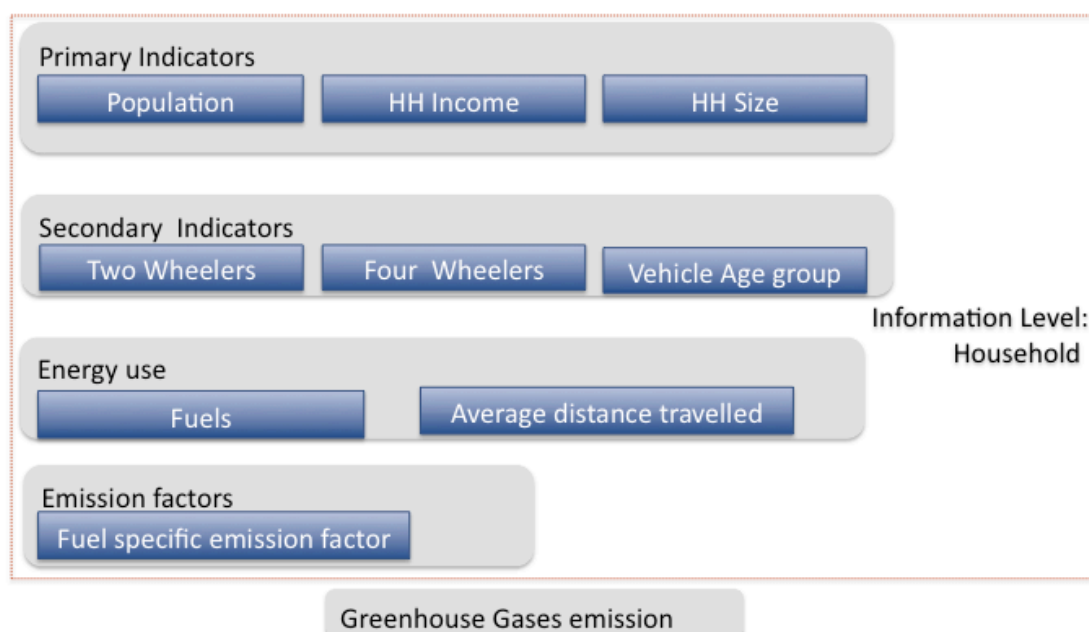


Fig.4.5: Quantification framework for GHG emissions from transportation

In order to effectively estimate the GHG emissions from urban poor and mid-income households, input data has been collected through both a desk-based literature review and community specific surveys. Assessment sheets have been prepared to outline the baseline GHG emissions and mitigation potential. These are located for urban poor communities in Annex 5a & 5b and for mid-income communities in Annex 6a & 6b.

4.3 Emission reduction potential:

In this section, the key results are discussed briefly for each community and further details are provided Annex 5a & 5b and 6a & 6b.

The GHG emissions released at a household level and the types of activities that contribute to these emissions are summarised in Table 4.3. Research suggests that each urban poor household contributes around 2.41 tCO₂ per year to the total GHG emissions in Delhi. The survey and the literature based assessment carried out for this study provides similar results for emission reduction potential of around 1.5 - 1.7 million tCO₂/hh for urban poor households. The suppressed demand situation takes into account the service level and hence provides a more realistic picture of the current and future emissions levels. The results reflect that if the suppressed demand situation is taken into account, the emission reduction potential rises around 20 – 30 percent for each household as compared to the actual baseline situation. It indicates that the level of basic services is below as compared to peer households.

The middle-income households contribute between 5.8 - 8.07 million tCO₂ per year to the total GHG emissions in Delhi. This group provides an opportunity to curtail around 1.50 million tCO₂ per year. The suppressed demand situation does not apply to mid-income households. The emission level and emission reduction potential for individual households as per the different assessments is provided in Table 4.3.

Table 4.3 GHG emissions at a household level

Community	Type of assessment	Emission level tCO ₂ / household/ year	
		Baseline	Emission reduction potential
Urban Poor	Literature	2.41	1.00
	Literature - suppressed demand	3.84	2.20
	Survey	2.44	1.09
	Survey - suppressed demand	4.19	2.44
Middle Income Household	Literature	3.90	1.01
	Survey	5.38	2.07

* SD stands for suppressed demand

In terms of the types of activities that contribute to these emissions, for urban poor households the highest emitting activity is from cooking, with 1.31 million tCO₂/year being released from cooking activities. This is due to a dependence on more GHG intensive fuels such as wood and kerosene or on low quality fuel like dung cake and straw. According to the survey around 32 percent of households still depend on firewood and kerosene. Another major contribution is from household appliances (1.1 million tCO₂/year), followed by household cooling activities (0.55 - 0.67 million tCO₂/year). However, if suppressed demand situation is accounted, drinking water treatment becomes the second largest contributor to GHG emissions. This is because 70 – 82 percent of the urban poor population does not have access to drinking water of adequate quality. A summary of the GHG emissions and emission

reduction potential for each activity is provided in Table 4.4. Please note that the results based on survey results are included here. Please refer to Annex 5a & 5b for more detailed results.

Table 4.4: Urban Poor – type of GHG emission activity (survey based assessment)

Activity	Actual Scenario		Suppressed Demand Scenario	
	Baseline emission (Million)	Emission reduction (Million)	Baseline emission (Million)	Emission reduction (Million)
Cooking	1.31	0.37	1.31	0.39
Lighting - Household	0.54	0.23	0.54	0.23
Lighting - Street	0.01	0.01	0.09	0.05
Heating - Water	0.26	0.26	0.40	0.40
Cooling - Space	0.67	0.13	0.67	0.13
Household Appliances	1.13	0.23	1.19	0.24
Drinking Water	0.19	0.19	2.56	2.56
Water Supply	0.02	0.01	0.06	0.03
Sanitation and Wastewater	0.03	0.00	0.03	0.01
MSW Disposal	0.03	0.03	0.14	0.11
Transportation	0.02	0.00	0.25	0.00
Total	4.20	1.93	6.99	2.44

For mid-income households, household appliances contribute the most emissions (2.54 million tCO₂/year), followed by household cooling activities (1.64 tCO₂/year). These two activities support the perception of a high living standard for mid-income households and the energy intensive lifestyle it thus incurs. Unlike urban poor households, the contribution from cooking activities is low due to the fact that all households use less GHG intensive, LPG fuelled stoves. The third major contribution is from the transport sector, e.g., use of car for domestic purposes. However, the transport sector was excluded from this report due to a lack of any realistic mitigation measures. A summary of the GHG emissions and emission reduction potential for each activity is provided in Table 4.5.

Table 4.5: Middle income activity - type of GHG emission activity (survey based assessment)

Activity	GHGs Emission Level	
	Baseline emission (Million)	Emission reduction (Million)
Cooking	0.79	0.00
Lighting – Household	0.73	0.16
Lighting – Street	0.02	0.00
Heating - Water	0.50	0.25
Cooling - Space	1.64	0.37
Household Appliances	2.54	0.51
Drinking Water	0.09	0.09
Water Supply	0.04	0.02
Sanitation and Wastewater	0.02	0.00
MSW Disposal	0.16	0.14
Transportation	1.54	0.00
Total	8.07	1.55

5.0 Feasibility assessment of PoA and results-based finance approach

Carbon market based mechanisms are developed around the idea of reducing GHG emissions. The CO₂ emission or carbon credit carries a monetary value, and can be traded in the carbon market to drive carbon finance into initiatives that support low carbon development. The Gold Standard insists on ensuring that local sustainable development is a core part of any Gold Standard certified carbon mitigation project or initiative. However, outside of our organisation and more generally, contributions towards sustainable development are not stringently monitored and verified.

During the initial development of the market, the activities with a significant potential for reducing emissions were the key focus and were developed across various sectors, e.g., wind, hydro, industrial gases etc. In recent years, thanks to much needed CDM reforms and the introduction of more flexible approaches such as PoAs, this has changed and activities that have greater co-benefits but result in lower GHG emission reductions (due for example, to the dispersed nature of the project) are getting the attention required.

As discussed previously in Chapters 3 & 4, the activities that involve technologies based on small household interventions such as improved cookstoves and household lighting have significantly increased in a short period of time. However, urban areas—which are a major source for GHG emissions—are still lagging behind due to various reasons including lack of funds, the complex nature of local structures and lack of capabilities and awareness. Carbon finance could be an alternative source of funding and help to successfully alleviate these barriers. The rapid pace of urbanisation is resulting in a variety of challenges for its residents. On the one hand the improvement in the standard of living for mid-income communities is leading to a more energy intensive lifestyle; on the other hand, the already resource constrained poor communities are unable to even meet or gain access to basic services. Due to a lack of resources and infrastructure, these conditions are worsening day by day.

This chapter assesses the feasibility of designing and implementing a carbon finance backed scheme such as a PoA and/or a results-based finance mechanism to achieve successful and sustainable low carbon urban development. The assessment covers household and community related services such as energy, water and sanitation, solid waste management and transportation. The objective of this chapter is to find the most suitable mechanism for reducing GHG emissions and supporting sustainable development in the target communities, i.e., poor and mid-income groups in urban areas.

The following section includes a SWOT analysis of a PoA and a results-based finance approach for the urban poor and mid-income communities. It also justifies how the chosen approach for each of these communities was selected.

5.1 SWOT Analysis

5.1.1. Programme of Activities (PoA)

The various advantages of a programmatic approach compared to a conventional standalone project are discussed in detail in Chapter 2. This section uses a case study to outline how a programmatic approach can be applied to poor and mid-income urban communities in Delhi. The objective is to develop a programme that will focus on the integrated development of the selected community.

The programme would deploy identified mitigation measure for services, i.e., energy, water and sanitation, solid waste management and transportation. It will involve the installation of large volumes of several different types of technologies. These individual technologies have great social impacts but are associated with very small amounts of emission reductions. A primary consideration for projects using carbon finance as a funding stream is that the initiative needs to generate significant carbon credits in order to make the project financially viable. However, under a PoA scheme, the individual technologies are combined, allowing them to benefit from economies of scale, making the project more financially attractive and therefore feasible.

A core principle of a PoA is to create an umbrella structure that supports the inclusion of single or multiple technologies with the opportunity to bundle together multiples of similar types of activities over its lifetime. To include additional activities, validators will simply conduct a simplified 'compliance check'. These can be included even when the PoA has already passed the registration stage, thus it reduces the time involved and the overall transaction cost of the programme development.

In addition, it provides the opportunity for replication of similar types of activities in other cities when funding is available. The programme envisaged the implementation of a set of mitigation measures for various services to take place over several years in numerous households. However, in the context of the present case study, it is not yet possible to envisage the scale or extent of the project implementation, as the success of the programme will depend on a number of factors, including the scale of available funding and the availability of resources including local institutional capacities. Thus the flexibility allowed under the PoA approach would suit the proposed programme for Delhi and for further replication in similar communities in other cities in India.

The PoA approach has its own limitations; for example, the selected mitigation measures will need to reduce enough emissions to make it financially viable. The proposed programme involves mitigation measures that are critical for providing access to basic services, but would not result in significant emission reductions. This could make the programme financially less attractive, especially to private investors, who might prefer to invest in selective measures that would help them in achieving the desired returns for their investment. To overcome this barrier, the community (for example, mid-income) may share the upfront cost. This would improve the financial attractiveness for investors and could lead to the successful implementation of the programme. However, this solution may not be feasible for the urban poor community, which already suffers from resource constraints and would not be able to bear the extra burden. Such limitations may lead to the implementation of attractive mitigation measures in a select few communities only. This approach would not meet the desired results of landscape-level holistic development.

The success of the PoA requires meeting the minimum requirements of the GHGs accounting methodologies to ensure that the emission reductions are real, measurable and verifiable. It involves

establishing a detailed monitoring and reporting procedure to achieve the results, which makes the managing of the projects comparatively difficult and costly due to lack of quality information, institutional capabilities and the complex nature of local infrastructure. Also, the dispersed nature of the measures, end use requirements and varying end-user knowledge levels add to the complexity of the issue. It leads to risk with issuance of emission reduction units, and thus to the overall success of the programme.

In addition, the PoA approach does not provide finance specifically for capacity building activities, limiting the availability of funds for such initiatives. The investment in such initiatives certainly ensures the benefits in the long run, but it will lead to an additional cost for the programme developer. Certainly the PoA approach provides a platform for developing such programmes, but it has its own limitations. A SWOT analysis of the PoA approach with respect to the proposed programme in the urban communities is carried out in Table 5.1.

Table 5.1: SWOT Analysis: PoA approach

Strengths	Weaknesses
<ul style="list-style-type: none"> • Types of activities; Ideal for small, dispersed project types for example Renewable Energy (RE) and Energy Efficiency (EE) at household level like improved cookstoves, solar lighting, efficient appliances. • Replication and scaling-up of similar activities; The PoA provides flexibility such as; inclusion of similar activities, expanding the programme boundary, inclusion of new measures. • GHG accounting; Several GHG accounting methodologies can be combined to facilitate multi-technologies in a single PoA. • Proven track record; The existing PoA approach has successfully demonstrated its ability to deliver results, e.g., energy efficient CFL lighting programme extended to several areas in India. • Establish and Experience Market; PoA market is already established and rules and procedures are clearly defined. • Private sector involvement; The private sector has played a critical role in driving this market based mechanism by providing the necessary carbon finance. 	<ul style="list-style-type: none"> • Types of activities; PoA approach is not suitable for measures resulting in low or no emission reductions such as public toilets. • Data and information; A successful PoA requires reliable information and data that is generally lacking in developing country urban areas, especially for poor income communities. • Low domestic financing options; The upfront financing is limited due to the poor financial state of the relevant implementing local/national agencies and local communities in developing countries. • High transaction costs; The PoA registration cycle is not only complicated but also involves high transaction costs. • Lack of institutional capacities; The local agencies have limited experience with market based mechanism, especially PoAs. • Lack of institutional coordination;
Opportunities	Threats
<ul style="list-style-type: none"> • Evolving PoAs; PoA schemes are evolving, providing more flexibility for the implementation of such programmes in future. • Opportunity for replication and scaling-up the programme; Market-based business models that subsidise the cost of technologies or other similar service based models may help in successfully scaling-up activities in target communities such as mid-income households. 	<ul style="list-style-type: none"> • Lack of know how; Lack of adequate local institutional/administrative infrastructure or "know how" for PoA implementation. This could affect how successfully the programme is implemented. • Lack of provision of capacity building initiatives; The PoA doesn't involve the monetisation of capacity building initiatives for local agencies and end users. Without adequate funding for capacity building, the programme could risk not being implemented.

- | | |
|---|--|
| <ul style="list-style-type: none"> • Institutional reforms; New market based mechanisms such as PoAs may lead to institutional reforms in cities that help facilitate improvements such as more efficient resource utilisation. It might also help with advocacy and policy implementation. • Urbanisation; The high pace of urbanisation due to the ever-increasing population could provide significant market opportunities as well as presenting opportunities, via PoA mechanisms, for scaling-up activities. • Infrastructure development; A PoA approach could help to ensure the long-term success of pro-poor initiative(s), especially with regards to infrastructure development. • Readiness; The rules and procedures for a PoA approach are already well defined, allowing for the immediate implementation of identified measures in target communities. | <ul style="list-style-type: none"> • Lack of motivation; A lack of motivation among local implementing agencies may result in ineffective programme monitoring, which will affect the delivery of emission reductions and subsequently the carbon financing. • Carbon market; Recent fluctuations in CER/VER prices make investments more vulnerable and risky. • Lack of standardised approaches; Urban PoAs are very complex. Not only with regards to implementation but also with establishing baseline, monitoring and verification protocols. These risks could be mitigated by providing sectoral baselines and simplified monitoring procedures, for example, city-wide and/or community-wide standardised baselines. • Stringent monitoring, reporting and verification (MRV) requirements; For PoAs, MRV requirements are not flexible and one has to strictly follow the CDM/Gold Standard GHG accounting methodologies as already required for single CDM/voluntary projects, hence it limits the applicability for community-focused measures. • Additionality; Additionality requirements are complex and need to be demonstrated at PoA/CPA (activity) level. • Absence of security of tenure; This is especially prevalent for poor income households and slum areas. If a household is displaced, it may cripple the supply of VER/CER in the latter stages of the crediting period. However, mid-income households, where the houses are permanent in nature, do not suffer from the same issue. |
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5.1.2 Results-based Finance

Governments in developing countries and members of the development aid community are aware of the need to find more effective ways to improve basic living conditions for the poor. Traditional approaches to deliver public support have not always led to the intended results. Under results-based finance (RBF), a principal entity provides a financial or in-kind reward, which is conditional on the recipient of that reward undertaking a set of predetermined actions or achieving a predetermined performance goal. The ultimate aim is to increase the effectiveness of scarce public resources for the provision of basic services.

RBF or OBA (Output-based Aid) ties the disbursement of aid or public funding (in the form of subsidies or free equipment) to the achievement of clearly specified results that directly support improved access to basic services. OBA is gradually emerging as an important way to finance access to basic services as well as infrastructure provision in a range of sectors, including roads, energy, telecommunications, health and education. The need for subsidy is assessed on the basis of the level of demand for the service, costs, and social benefits generated. Subsidies are provided to encourage the provision of basic services to poor households in a targeted manner. A fundamental purpose is to encourage service providers to deliver services in areas that are not necessarily commercially attractive or where they would not naturally get involved without the subsidy.

So far, funding for OBA schemes has come from the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), Global Partnership on Output Based Aid (GPOBA), other donors such as the German development bank KfW, and governments themselves using, for example, tax revenues and cross-subsidies collected from users. IDA and IBRD are the biggest donors with over US\$3.3 billion committed to fund subsidies in 80 projects. Many of the first projects were in the Latin American region and were used to improve the roads and Information & Communication Technology sectors.

There are several fundamental preconditions for introducing an RBF approach. It needs to be possible to monitor and verify the results against which payments might be made, and these results need to be closely linked to the overall desired outcomes. A RBF instrument will be impractical in the absence of a measure against which to disburse it.

If payments are only made by a funding agency after the delivery of the results, the implementing agency will need to have access to sufficient finance to cover any upfront costs prior to the delivery of results. This largely relates to access to capital markets, although it is possible that certain agents could finance any upfront costs from within its own resources.

Sufficient access to upfront finance may be a more acute challenge for capital intensive and large projects and/or in countries where financial sectors are less mature. A further critical determinant of access to finance will be the credibility of the RBF scheme. It will be easier to raise finance against an RBF scheme when the principal responsible for paying against delivered results is financially robust (and, more critically, has financial resources that extend beyond the horizon of the RBF scheme) and when determination of whether the results have been delivered resides with a trustworthy institution.

Both funding and implementing agencies need to have sufficient institutional capacity to set up and respond to an RBF incentive. This relates to the ability of constructing and monitoring the instrument and ensuring quick disbursement of resources upon delivery of agreed results. Also required is technical

capacity related to the planning tools and managerial ability that allow them to map out the expected cash flows from an RBF instrument, and to react to the new incentive structure.

It is important to note that RBF and conventional support are at opposite ends of a spectrum, where either all or none of the support is linked to the achievement of the given results. It is perfectly possible and, in many cases may be desirable, to adopt an intermediate or hybrid approach that combines some upfront support with additional support provided on a results basis. For instance, in cases where the implementing agency faces capital constraints, the benefit of the stronger incentives from RBF can be achieved without making the entirety of the principal's support contingent on the delivery of results.

Verification of the achievement of the set of results is a crucial and challenging exercise. Independent verification is a key mechanism to enhance the performance of service providers. For the funding entity, it mitigates the risk of misuse of funds, providing assurance and evidence that funds have been used for the intended purpose. In RBF projects, verification should be conducted by an independent verification agency. Its function is to ensure that only verified outputs are reimbursed, through a) certifying that the contractual outputs, as reported by the implementing agency, have been physically delivered and that pre-agreed standards of service have been achieved, and b) validating the implementing agency's reimbursement request (performing cost reconciliation by multiplying the quantity of outputs achieved by their unit cost), and recommending to the funding entity that they should honour payment.

Table 5.2: SWOT analysis result-based finance approach

Strengths	Weaknesses
<ul style="list-style-type: none"> • Type of activities; There is no limitation on project type and scale. However, the experience with renewable energy and energy efficiency is limited. • Proven track record; A results-based finance approach has been successfully applied for some time by development aid organisations in other sectors such as healthcare. Donor financing could be limited to the communities that do not have access to basic services. • Upfront financing; There is the flexibility to tailor upfront financing depending on the type of arrangement agreed upon between donor and implementing agency. • Scale of financing; The scale of financing available is known and is guaranteed in advance. This may also help to provide the required confidence for private investors and local/international lending agencies to invest in such initiatives. • Tailor-made implementation and monitoring approach; It provides flexibility when designing how the programme will be implemented and monitored, allowing the scheme to actively address local circumstances. This may also help in scaling-up the activities within a short time span. • Results oriented; The results-based finance approach ensures every dollar is spent effectively to ensure the concerns for greater accountability and value for money are addressed. • MRV; The monitoring, reporting and verification requirement can be designed in a cost effective way. The direct or indirect indicators may be selected, which are measurable and verifiable quantitatively or 	<ul style="list-style-type: none"> • Lack of experience with Renewable Energy and Energy Efficiency project types; There are very few existing projects in the climate change domain; especially with regards to implementing Energy Efficiency and Renewable Energy measures. • No such precedence exists in this sector for implementation of Energy Efficiency and Renewable Energy measures through results-based finance that is subjected to international level MRV. • Lack of market; Absence of crediting/market mechanism may result in a lack of interest from prospective funders/financing agencies. • Lack of institutional capacities with city government to plan and implement such measures;

<p>qualitatively, at a cost that is reasonable so that transactions costs associated with monitoring do not represent a significant share of the value of the benefits expected from the implemented measures.</p>	
Opportunities	Threats
<ul style="list-style-type: none"> • Type of activities; The results-based finance approach offers opportunities to broaden the rationale for investing in climate change related activities and to include initiatives that will have greater local impacts and lead to genuine sustainable development. • Measures with low GHG reductions but high co-benefits; Measures that are commercially less attractive under a PoA due to the lesser number of credits generated but have excellent co-benefits can be implemented through a results-based finance mechanism. • Eligibility criteria; It provides an opportunity to design inbuilt criteria for assessing programme eligibility, for example, simplified additionality check. • Opportunity for scaling; Similar programmes may be replicated in other cities. • MRV; Monitoring requirements are easier and can be tailored to both the prevailing situation in a city/community and the requirements of a funding agency. • Inclusion of policy measures and other initiatives; This type of mechanism provides the flexibility to include broad policy measures and other initiatives such as capacity building measures. 	<ul style="list-style-type: none"> • Risk of low uptake; In the absence of any commodity that would be traded for a return, crucial market actors such as lawyers/brokers/intermediaries would be absent. • Low upfront financing; Attracting sufficient donor funding could be challenging. • Low confidence of private investors; A cultural barrier for private sector involvement in such an approach may affect the financing options. • Absence of security of tenure; The displacement of poor income households, especially in slums, may cripple the implementation of such a programme, subsequently negatively affecting the outcome.

5.2 Selection of Approach

This section explores which is the most promising approach for each target community. The programmatic approach (PoA) makes use of a set of CDM and/or Gold Standard carbon accounting and monitoring methodologies and Gold Standard sustainable development criteria to generate and trade carbon credits. The results-based finance approach uses a methodology that gradually allocates funding for activities based on preliminary assessments and the monitoring, reporting and verification of their respective impacts on carbon reduction and sustainable development.

The two SWOT analyses carried out in Section 5.1 outline the pros and cons of each approach. The PoA and the results-based finance approach are compared against different key criteria. Table 5.3 assesses the feasibility of both schemes for an urban poor community. Table 5.4 assesses the schemes for mid-income communities. The score of "0" or "+1" are assigned on a comparative scale between the two approaches. Please note, this does not necessarily indicate the ability of a particular approach to work independently.

Table 5.3 Feasibility for Approach Selection: Urban Poor

Criteria	Details	PoA	RBF	Explanation of the Scoring
Project preparation/planning	Opportunity and ease/speed of scaling-up; could be due to a combination of factors like upfront financing, baseline data, MRV requirements, etc.	0	+1	Extent of possible scaling-up through a particular mechanism is one of the primary considerations, especially for projects at a city level, due to the huge population that is to be catered to via measures planned under the low-income group case study. Although a PoA itself could serve as a good scaling-up tool, on a comparative basis, the results-based finance approach ranks higher in being able to scale-up activities due to factors like availability of upfront financing, lesser requirements on baseline data and tailor made monitoring requirements. Hence, the results-based finance approach is scored as positive for this criterion.
Inclusion of non/low GHG measures	Support for implementation of non/low-GHG measures; several measures are specifically chosen due to their co-benefits, and such measures do not result in significant GHGs emission reductions.	0	+1	PoAs provide financial support based on carbon credit trading potential; therefore they are limited to measures that result in real, measurable and verifiable emission reductions. Thus, it does not support measures that result in low or no emission reductions but that do have great co-benefits. The RBF approach can help in overcoming this problem, as financing would be dependent on the pre-agreed outcome rather than solely on the emission reduction units.
Financing	Dependence on market prices of the commodity; Fluctuating prices of CER/VER can adversely affect the interests of implementing agencies, specifically in the case when CER/VERs are the major or only source of revenue.	0	+1	A PoA results in the creation of emission reduction certificates, which are tradable for market driven prices. Large fluctuations (e.g., a reduction) in prices can make a community project unviable for an investor or implementation agency. RBF tries to address this problem by defining the finance available on the basis of the investment required for a particular measure, thus reducing the dependency on market forces and increasing the assurance for returns/funding for the implementation agency.
Involvement of private sector	Private sector involvement is possible.	+1	0	Private sector finance is available for a PoA due to the presence of a defined market and existing commodity (emission reduction certificates). However, it is absent in the case of RBF and hence can be a negative factor.
Implementation / experience	Use of the approach in current practice; successful implementation experience from past projects increases the	+1	0	The PoA approach has been in use for the past five years and it has well defined rules/procedures etc. including an already established governance framework. This can be a disadvantage for RBF projects.

Criteria	Details	PoA	RBF	Explanation of the Scoring
	availability of streamlined rules and procedures and the likelihood of success for a typical framework.			
Monitoring and evaluation	Monitoring requirements; requirement of quantitative and qualitative monitoring, number of key performance indicators, flexibility in monitoring, expenses on data collection and monitoring.	0	+1	Monitoring requirements are one of the big deterrents for the implementation of PoAs related to urban areas, as the monitoring is often complex and requires considerable time and resources for full adherence to the PoA methodologies. This monitoring complexity and cost problem could be well addressed by a results-based finance approach, as it offers the flexibility to define and choose the indicators and the extent of the monitoring required.
Grand Total		+2	+4	
Conclusion: Both the PoA and results-based finance approach have their own merits and demerits. However, on a relative scale for implementing identified measures for urban poor communities, results-based finance scores higher. Hence, we would examine the results-based finance approach in greater detail and proceed with building the MRV and related protocols for facilitating the implementation of GHG mitigation and sustainable development measures in Delhi slums.				

Table 5.4 - Feasibility for Approach Selection: Mid-Income Group

Criteria	Details	PoA	RBF	Explanation of the Scoring
Project preparation/planning	Opportunity and ease/speed of scaling-up; could be due to a combination of factors like upfront financing, baseline data, MRV requirements etc.	+1	0	The extent of upfront financing that could be garnered through donor funding under a results-based finance approach could be doubtful due to a low interest in developing such programmes for mid-income communities (as compared to poor communities who would benefit on more fronts). Also the availability of data or ease in the collection of information and the potential of scaling-up the programme is more favourable for a PoA approach.

Criteria	Details	PoA	RBF	Explanation of the Scoring
Inclusion of non/low GHGs measures	Support for implementation of non/low-GHG measures; several measures are specifically chosen due to their sustainable development impacts, and such measures do not result in significant GHG emission reductions.	0	+1	PoAs provide financial support based on carbon credit trading potential, but they are limited to measures that result in measurable and verifiable emission reductions. Thus, POAs do not support measures that do not result in emission reductions or measures that result in a very small amount of emission reductions compared to the efforts and resources required to generate them. RBF can help in overcoming this problem, as financing would be dependent on the results defined in the MRV rather than on a number of emission reductions.
Financing	Ability of mid-income group households to pay for the EE and RE technologies proposed to be installed in these households would reduce the amount of financing required, and the reduced financing can probably be availed through existing carbon markets.	+1	0	Mid-income households are capable of bearing the costs of equipment (with or without additional support through mechanism like carbon revenue) to be installed under the various proposed measures. However, there is a need for capacity building, training and convincing households of the benefits of such measures. Thus, this can be addressed via financing available through the creation of emission reduction certificates, which are tradable for market driven prices.
Involvement of private sector	Availability of private sector finance; commodities that would be traded for returns. Existence of defined market for flows of financing.	+1	0	Private sector finance is available for PoAs due to the presence of a defined market and existing commodity (emission reduction certificates); however, it is absent in the case of RBF and hence can be a negative factor.
Implementation / experience	Use of the approach in current practice; successful implementation experience from past projects increases the availability of streamlined rules and procedures and the likelihood of success for a typical framework.	+1	0	The PoA approach has been in use for the past five years and it has well defined rules/procedures, etc. including an already established governance framework. This can be a disadvantage for RBF projects.

Criteria	Details	PoA	RBF	Explanation of the Scoring
Monitoring and evaluation	Monitoring requirements; requirement of quantitative and qualitative monitoring, number of key performance indicators, flexibility in monitoring, expenses on data collection and monitoring.	0	+1	As monitoring is often complex, PoAs related to urban areas require considerable time and resources for full adherence to the PoA methodologies. This monitoring complexity and cost problem could be well addressed by a results-based finance approach, as it offers the flexibility to define and chose the indicators and the extent of the monitoring required.
Grand Total		+4	+2	
Conclusion: From the above analysis it can be concluded that while a results-based finance approach was preferred for urban poor households, for mid-income household the study scores the PoA approach as the more suitable mechanism. Hence, we would examine the PoA approach in greater detail with respect to mid-income communities. However, the MRV requirements will need to be in line with the applied CDM/Gold Standard methodologies. A summary of these requirements is included in Chapter 3 of this report.				

5.3 Development of PoA for Middle Income Communities

The programme focuses on the deployment of low carbon technologies in poor and mid-income urban communities in the city of Delhi. The prevailing baseline situation and an estimation of the baseline emissions in the urban poor and mid-income communities has been assessed based on a desk study of existing sources of information, followed by a field survey of 800 households. A list of the identified mitigation measures, which focus on both reducing GHG emissions and contributing towards the sustainable development of selected communities, are briefly summarised in Table 22. There is more than one mitigation measure with different emissions reduction potential for each activity. Technical feasibility and the sustainable development benefits are the primary criteria to select any mitigation measure. Out of the various possible mitigation measures listed in the Annexes 7, 8, 9 & 10, some have been excluded for the PoA approach for reasons provided in Annex 4.

5.3.1 Identified mitigation measures

The PoA boundary broadly includes household energy consumption (electricity, fuel), waste management, drinking water, sanitation and transportation.

Several targeted areas have been identified after studying the baseline situation in the poor and mid-income communities in Delhi. Table 5.5 provides further details about the targeted basic services for the implementation of the various measures and which are included in the PoA boundary. It includes a discussion on the shortlisted measures that are considered to be potentially feasible based on a preliminary analysis. All these measures would be implemented under a unique PoA instead of adopting multiple PoAs. The reasons for choosing a unique PoA are discussed previously in this report.

5.3.2 Emission reduction potential for a PoA approach

The emission reduction potential of the identified mitigation measures for the mid-income communities are summarised in Table 5.5. Note that mid-income communities do not qualify for a suppressed demand scenario; therefore, the emission reduction potential provided in the table is for an actual scenario only.

Table 5.5: List of mitigation measure and emission reduction potential – Mid-Income Group

Activity	Mitigation Measure(s)	Target HHs (Million)	Emission reduction potential (million tCO ₂ /yr)
Lighting – HH	Compact fluorescent lamp (CFL)	0.67	0.16
Lighting – Street	Compact fluorescent lamp (CFL)/LED	0.3*	0.06
Heating – Water	Solar water heater (SWH)	0.25	0.50
Cooling – Space	Efficient appliances	N/A**	1.51
Household appliances	Efficient appliances	N/A**	1.91
MSW management	Aerobic composting	1.47	0.14

*Emission reductions are based on number of lamps.

**Emission reductions are based on number of appliances.

Multiple PoAs versus Single PoA

Looking at the variety of measures under consideration as well as the difference in the baseline situation among the various households, one could think about classifying the measures into different subsets, implementing an individual PoA for each of the subsets.

Although there are about 20 different measures planned under the PoA, at an individual Voluntary Project Activity (VPA) level, the number of measures might reduce to 8 to 10 on average. In the case when it becomes complex and difficult to manage the large number of measures in a single PoA, VPAs may be designed to include a smaller number of measures or even one type of measure only.

Also, normally in a PoA, the number of usable methodologies is lower than the number of measures to be implemented. For example, the methodologies such as The Gold Standard VER methodologies on the displacement of decentralised thermal energy are applicable to a variety of measures, which makes the PoA easier to document and manage, since you have to deal with only one methodology for multiple measures.

Opting for a single PoA would also help in reducing the upfront costs and efforts involved. This is therefore the option retained and proposed in the context of the slum case study, unless other criteria such as the organisations involved and the need for a Coordinating and Managing Entity (CME) at a later stage make such an approach unworkable. The next section discusses the various relevant stakeholders in the context of this case study.

Stakeholders in the planned PoA

The success of a PoA largely depends on the stakeholders involved. A multidimensional PoA, which would include several measures, would require extensive management capacities from the CME and any other organisations involved. The main difference with standalone project activities resides in the way the CME, which plays the role of overall project manager, co-ordinates between the different entities involved. The names and roles of the PoA stakeholders are defined as follows:

- CME (Coordinating and Managing Entity) is responsible for the overall management, operation, monitoring and potentially the carbon credit distribution in the PoA, if VPA implementers decide to issue the credits into the CME registry account.
- DOE (Designated Operational Entity) is responsible for PoA validation, VPA inclusion and PoA verification.
- Project participant is an authorised entity participating in a particular VPA.
- Project implementer is an entity/individual responsible for the VPA. The implementer can, in some cases, also be a project participant.
- Entity(ies) financing the PoA/individual VPA (in the case when they are different from the Project Implementer/CME).
- Various local authorities that are willing to extend cooperation, or from whom different formal approvals would be required (e.g., for street lighting, for usage of common areas in slums, for external measures like water supply efficiency improvements).
- The Gold Standard Foundation is required for registration of the PoA, approval of activities and revisions in methodologies and the issuance of carbon credits.
- Local stakeholders such as slum dwellers, local service providers, retailers, technology suppliers and local NGOs.
- The Gold Standard NGO supporters, who can provide feedback at appropriate stages of the PoA development.

Role of the CME

The CME is entrusted with the overall management of the programme. It could be just a governing body but it could also be involved in the implementation of the various measures proposed under the PoA.

For a diverse PoA like the one planned for slums, a single organisation may not be able to manage and implement the entire programme. Hence, the CME could also be a function of several organisations, which can come together to collaborate and form a consortium for implementing such an initiative.

Following are the broad responsibilities of a CME:

- Bring together the various financial, legal and carbon aspects in a coherent structure.
- Create a clear business plan for the programme.
- Work according to a roadmap, set deadlines and avoid delays.
- Be the focal point for all matters related to the PoA.
- Assign all tasks, varying from sourcing financing to securing carbon standard compliance and promoting the programme.
- Train relevant staff on carbon methodologies and procedures.
- Make sure that qualified staff is available for all tasks required.
- Secure political support and organize meetings to provide updates on the status of the programme.

5.4 Results-based finance based programme for urban poor communities

The detailed development of a results-based finance initiative targeting urban communities must be grounded in a practical assessment of the local situation and capabilities so as to not lose community support or become unfeasible given the local circumstances.

Whether the theoretical concept can be turned into a practical scheme that would operate in the voluntary market and would be able to attract private funding remains to be seen and will be a major challenge in this work. The case studies considered in this effort allow for an investigation of how the results-based concept could be applied to the deployment of low-carbon technologies in practice. Pilot activities also help illustrate how to effectively overcome institutional and policy barriers.

The case for upgrading the slums is one of great interest given the numerous benefits that would be associated with activities implemented within such communities. Governments and development aid organisations have thus already invested significantly in upgrading programmes for slum areas. However, these programmes can hardly cope with the pace at which slums have been growing across the world.

The scaling-up of successful initiatives rarely occurs due to systemic constraints in access to capital at scale and in the institutional framework for urban management (administrative procedures, overlapping mandates, corruption, etc.). The public sector cannot address the situation alone and alternative approaches such as results-based finance have the potential to mobilise the deeply needed private sector funding.

The informal economy produces an estimated average of about 20 percent of GNP in India and accounts for most of the purchasing power of the poor communities. This represents a significant un-captured market for the formal private sector and thus an opportunity, as long as measures are taken to create an environment suitable for investment. Poor communities are at a disadvantage and paradoxically have to pay a premium on the price of energy consumption for a lower quality service because they cannot afford the upfront cost for efficient energy technology or the connection to the electricity grid, cooking gas or water network. The fact that they do pay such a premium can be seen as a sign of willingness to pay for more modern and sustainable services and could encourage the formal private sector to invest. Results-based finance can be seen as an appropriate tool for a market that private investors would

typically be reluctant to explore otherwise as they tend to pursue low volume, high profit margins, which are more acceptable to consumers at higher income levels.

A major challenge for the deployment of low carbon technologies within poor communities is obviously the inability to pay upfront for advanced distributed devices or electricity, gas or water connection. Since most urban poor, especially slum dwellers, do not hold title to their land, they are not eligible for loans with formal sector lenders, as they cannot comply with the collateral requirement. Also, technology providers cannot access these households, as the installation of the advanced technology requires an authorisation, which in turn requires proof of land entitlement by the beneficiaries. However, slums tend to be accepted more and more as marginal poor neighbourhoods rather than illegal squatter settlements that need to be cleared. This provides these populations with some degree of security of informal or sometimes semi-formal (temporary legal rights) tenure.

Another issue with private investors' involvement is the fact that many of the basic services needed by the poor communities are either seen as public goods by nature (e.g., public lighting) which once supplied cannot be denied to anyone, or can be to some degree sold privately but then denying these basic services to those in the same area who cannot afford them, which is socially and politically unacceptable and can lead to social unrest. In the cases when it can be socially accepted, another difficulty is then the cost involved in restricting the access to only those who contribute and/or the risk of not being able to collect payments (free riding). Ideally these public services and universal access to these should be addressed by the state, but the motivation for private sector involvement is precisely the lack of public resources, which deprives these populations of access to basic services.

Examples of innovative payment services have been known to address such issues and help mobilise private capital. Services have been developed, such as prepayment systems by which slum dwellers can purchase family passes on a monthly basis or pay-per-use services for access to the bathroom, washhouse facilities or water at shared points. Collective responsibility for payment at the community level is also a way to relieve private sector providers of the burden of revenue collection and further induce them to enter these markets.

The establishment of a price for the delivery of these basic services can also be problematic. One way for the private sector to provide slum dwellers with access to basic services while still being able to recover the cost is to adopt a tariff structure by which wealthier households cross-subsidise poor ones. Tariffs can thus be set by zones or consumption levels to benefit poor slums. The private investors can in this way achieve greater coverage without losing the revenue generated from charging higher prices to those who are willing to pay more. But the private sector is not necessarily always comfortable with such an approach, as basic unit pricing is much simpler to deal with. There is also the risk of seeing government regulation fix the price of the services delivered in response to social pressure or unilaterally change the terms of an agreement, for example within public-private partnerships. This can potentially create difficulties in recovering the investment. The generation of assets such as carbon credits from these activities can contribute to limiting this risk, since they deliver revenues, which are independent from cash payments by the beneficiaries. Combining such crediting with results-based finance can in such cases be beneficial, but crediting approaches typically require more sophisticated quantification methods and monitoring when the original purpose of the results-based finance approach is to reduce transaction costs in order to scale-up.

Finally, there is also a cultural barrier to private sector involvement in upgrading slums due to mutual misunderstanding and/or mistrust between slum dwellers and the formal private sector actors. Various

architectures can be thought of so as to fund the implementation of low carbon technologies within urban communities, and more specifically poor communities.

Public-private partnerships have typically been used in the context of large programmes for the connection of poor households to the electricity grid or water distribution network. In these cases municipal authorities partner with large private utilities with the financial means to invest into grid and/or network expansion and the capacity to take a risk with respect to cost recovery and the generation of returns on investments.

Another approach that has been experimented with, and notably in India, is using municipal bonds to mobilise domestic capital, sometimes combined with credit guarantees from foreign development aid agencies. To attract private finance through municipal bonds, municipal governments must be able to receive a sufficiently high credit rating to ensure an interest rate in line with what the ability to pay is believed to be, based on 'willingness-to-pay' studies. For smaller cities, only by pooling revenues of several municipal initiatives in a fund (pooled finance) is it possible to get an investment-grade credit rating in order to borrow from commercial markets.

An example of this is the Greater Bangalore Water and Sanitation Project set up to connect people living on the outskirts of Bangalore to piped water and sanitation by laying new distribution pipelines in the periphery. The project aimed to be commercially viable based on state loans, grants and debt raised through municipal bonds. But besides these, more than 35 percent of the project's total capital expenditure had to be sourced from future customers through upfront payments. After stalling for some time, the programme was resurrected when it benefited from a USAID credit guarantee. In June 2005, municipal bonds were floated through a pooled fund backed by a 50 percent guarantee on the principal amount from the US government to protect investors from defaults and to reduce the cost of borrowing. This scheme however led to some criticism claiming that the highly centralised decision making process resulted in low political buy-in and low public acceptance, and that upfront payments from citizens have not guaranteed timely and satisfactory service. Modifications to the original financial model have been said to be crucial in sustaining credibility and getting the project off the ground. The Greater Bangalore Facility raised about USD 20 million from municipal bonds out of a total initial planned budget of about USD 60 million (2007).

Another financing model can be used to distribute renewable energy or energy efficiency technology to households by multiple, smaller dealers. Under this, a government-backed organisation can be used in the role of a programme managing entity, which would be selecting and contracting the various retailers on a competitive basis (set of predefined criteria) and providing them with loans so as to finance the upfront cost of implementation. The managing entity accessed both development aid finance (grants) through a results-based finance and debt finance from development banks. Households are required to make down payments equivalent to a small share (e.g., 10 percent) of the actual cost of the systems installed and are being delivered the system through loans contracted at market rates through the dealers. The dealers enter themselves into sale or lease agreements with technology suppliers (e.g., 3 months credit) that need to be approved by the managing entity so as to guarantee the technology distributed meets expected quality standards. The subsidised cost of the systems is refinanced by the managing entity upon application by the dealers and confirmation through monitoring that the systems have indeed been installed appropriately and reporting of the results to foreign aid organisations so as to release the results-based finance. Dealers pay back the credit received from the suppliers once funding is released by the managing entity.

The Global Partnership on Output-Based Aid in Bangladesh is applying this model with success for the deployment of solar home systems, with more than 1 million systems installed by the end of 2011. A similar sort of financing model could be well suited to the concept envisioned in this work in view of the various measures identified.

Table 5.6: List of mitigation measures and emission reduction potential - urban poor

			Actual		Suppressed demand
Activity	Mitigation Measure(s)	Target HHs (Million)	Emission potential reduction (Million tCO ₂ /yr)	Target HHs (Million)	Emission potential reduction (Million tCO ₂ /yr)
Cooking	Improved cookstove (ICS)	0.37	0.37	0.39	0.39
Lighting – HH	CFL & solar lamps	1.7	0.23	1.7	0.23
Lighting – Street*	CFL		0.03		0.0
	CFL & solar lamps		0.04		0.05
Heating – Water	Improved cookstove (ICS)	0.28	0.05	0.28	0.05
	Solar water heater (SWH)	1.16	0.40	1.16	0.40
Cooling – Space	Efficient appliances	1.75	0.13	1.75	0.13
	Solar powered appliances	1.51	0.28	1.54	0.31
Household appliances	Efficient appliances	1.24	0.36	1.75	0.24
Drinking – Water	Improved cookstove (ICS)	0.05	0.15	0.24	0.81
	Zero energy water filters	0.28	0.19	0.45	2.56
Water supply and sanitation	Efficient water pumps & solar water pumps	0.82	0.01	1.75	0.03
MSW management	Aerobic composting	0.40	0.03	1.75	0.11

*Emission reduction are based on number of lamps.

5.5 Identification of the various relevant organisations

Table 5.7 provides a summary of the analysis performed for the identification of the various relevant organisations in the context of the planned PoA and RBF for low carbon technology deployment in urban poor and mid-income households in Delhi.

Table 5.7 Key stakeholders to be engaged for each measure

Mitigation measure	Stakeholder	Role of stakeholder
Improved cook stoves	<ul style="list-style-type: none"> Ministry of New and Renewable Energy (MNRE) & Department of Environment, Delhi The Ministry of New and Renewable Sources (MNRE), Government of India, has launched a "National Biomass Cookstoves Initiative" with the primary aim of enhancing the availability of clean and efficient energy for energy deficient and poorer sections of the society. MNRE is already implementing a CDM-PoA, specifically in rural areas in India; they are also main body for approval of various designs of cookstoves. 	- MNRE would be consulted for the stove design approvals as well as to avail any subsidies available on the cookstoves as part of its program.
Solar cookers	<ul style="list-style-type: none"> Ministry of New & Renewable Energy has launched Jawaharlal Nehru National Solar Mission¹⁰⁸, which covers solar cooking and steam generating systems. MNRE is already providing a subsidy for adopting solar cookers and also approving designs of solar cookers eligible for the subsidy. Indian Renewable Energy Development Agency (IREDA) is primarily involved in the funding of renewable energy projects and initiatives in India. 	- MNRE would be consulted for the solar cooker design approvals as well as to avail any subsidies available on the solar cookers as part of its program.
Solar lamps	<ul style="list-style-type: none"> Ministry of New & Renewable Energy has launched the Green City Initiative, which covers decentralized solar lighting systems. North Delhi Power Limited (NDPL) & BSES are private power supply utilities in Delhi that have launched initiatives on efficient lighting and appliances in the past. 	- NDPL and BSES would be consulted for distribution of the efficient lighting units and other appliances.
CFL/LED in households	<ul style="list-style-type: none"> North Delhi Power Limited & BSES (Private power supply utilities in Delhi) are private power supply utilities in Delhi that have launched initiatives on efficient lighting and appliances in the past. Bureau of Energy Efficiency (BEE) has launched an India-wide PoA on CFL lighting scheme. Some parts of Delhi are also being covered under this initiative. 	- BEE would be consulted for their experience with distributing the CFL in the cities and NDPL and BSES would be consulted for distribution network.
Solar Street Lighting	<ul style="list-style-type: none"> Ministry of New & Renewable Energy has launched the Jawaharlal Nehru National Solar Mission, which covers decentralized solar lighting systems. 	- MNRE would be consulted for any subsidies available on the solar street lighting as part of its program.

¹⁰⁸ The Ministry of New and Renewable Energy (MNRE), Government of India. <http://www.mnre.gov.in/schemes/decentralized-systems/solar-systems/scheme-7/>

Mitigation measure	Stakeholder	Role of stakeholder
	<ul style="list-style-type: none"> North Delhi Power Limited & BSES are private power supply utilities in Delhi that have launched initiatives on efficient lighting and appliances in the past. Municipal Corporations (MCD, NDMC) are responsible for providing street lighting in different parts of the city. 	
CFL/LED for street lighting	<ul style="list-style-type: none"> North Delhi Power Limited & BSES are private power supply utilities in Delhi that have launched initiatives on efficient lighting and appliances in the past. Municipal Corporations (MCD, NDMC) are responsible for providing street lighting in different parts of the city. 	<p>- NDPL and BSES would be consulted for implementation of this initiative and for supply side data requirements.</p> <p>- MCD would also be consulted for implementation of the programme and also to check availability of any funding with them.</p>
Solar water heaters	<ul style="list-style-type: none"> Ministry of New & Renewable Energy approves the solar water heater designs and provides subsidy for installation of such systems in households. Solar water heating systems are also covered under the Jawaharlal Nehru National Solar Mission^{109, 110}. North Delhi Power Limited & BSES are private power supply utilities in Delhi that had schemes on providing subsidy in electricity bills on usage of solar water heaters. 	<p>- MNRE would be consulted for approval of design of solar water heaters and also to avail any subsidy available under the Jawaharlal Nehru Solar Mission.</p> <p>- NDPL and BSES can be consulted for implementation of the programme as well as to avail subsidies in the electricity bills.</p>
Solar powered fan/coolers	<ul style="list-style-type: none"> Ministry of New & Renewable Energy is the prime agency and can be approached for granting subsidy to such systems. North Delhi Power Limited & BSES are private power supply utilities in Delhi that have launched initiatives on efficient lighting and appliances in the past. 	<p>- MNRE would be consulted for approval of design of solar fans and also to avail any subsidy available under the Jawaharlal Nehru Solar Mission.</p> <p>- NDPL and BSES can be consulted for implementation of the programme as well as to avail subsidies in the electricity bills.</p>
Efficient appliances	<ul style="list-style-type: none"> North Delhi Power Limited & BSES are private power supply utilities in Delhi that NDPL was running a scheme on replacement of inefficient appliances. 	<p>- NDPL and BSES can be consulted for implementation of the programme as well as to avail subsidies in the</p>

¹⁰⁹ The Ministry of New and Renewable Energy (MNRE), Government of India, <http://www.mnre.gov.in/schemes/decentralized-systems/solar-systems/solar-cooking-steam-generating-systems/>

¹¹⁰ The Ministry of New and Renewable Energy (MNRE), Government of India, <http://mnre.gov.in/Solar-water-heaters/booklet-swhs-delhi-govt.pdf>

Mitigation measure	Stakeholder	Role of stakeholder
	<ul style="list-style-type: none"> Bureau of Energy Efficiency (BEE) is the prime agency for energy efficiency improvements in India and comes up with the appliance energy star rating system from time to time. 	<p>electricity bills.</p> <ul style="list-style-type: none"> BEE can be consulted for technical guidance on various available appliances and the data related to the star rating systems and baseline efficiency, which has been compiled by them for the star-rating program.
Efficient water pumping	<ul style="list-style-type: none"> Ministry of Urban Development, Government of India has launched Jawaharlal Nehru National Urban Renewal Mission (JNNURM), which involves up-grading of cities under which water supply improvements are also a focus. Delhi Jal Board (DJB) is the nodal agency for all drinking water, water supply and water treatment related matters. The water supply across Delhi is being controlled by DJB. 	<ul style="list-style-type: none"> MoUD would be consulted for funding availability under the JNNURM and to know their planned measures in the urban slums. DJB has to be involved as they own all the existing water supply system and their approval and involvement would be required for any modifications or new installations in the city.
Low water or recycled water flush	<ul style="list-style-type: none"> Delhi Jal Board (DJB) is the nodal agency for all drinking water, water supply and water treatment related matters. The water supply across Delhi is being controlled by DJB. MCD & NDMC are municipal agencies in charge of developing the maintaining public sanitation services. MCD is already operating several community toilets in the slums. 	<ul style="list-style-type: none"> DJB supplies water to the community toilets in the slum areas and otherwise. They can be involved for implementation of this project as costs savings would accrue to them as well. MCD and NDMC operate the community toilets and this measure can be implemented with their help.
Zero energy water filters	<ul style="list-style-type: none"> Delhi Jal Board (DJB) is the nodal agency for all drinking water, water supply and water treatment related matters. The water supply across Delhi is being controlled by DJB. 	<ul style="list-style-type: none"> In some of the slum areas water supply is not available and for others DJB maintains the supply. DJB is to be involved for providing the supply of water to slums and also for obtaining the baseline data about water quality.
Electricity based RO & UV filters	<ul style="list-style-type: none"> Delhi Jal Board (DJB) is the nodal agency for all drinking water, water supply and water treatment related matters. The water supply across Delhi is being controlled by DJB. 	<ul style="list-style-type: none"> DJB is to be involved for providing the supply of water to slums and also for obtaining the baseline data about water quality.
Solar water disinfection	<ul style="list-style-type: none"> Delhi Jal Board (DJB) is the nodal agency for all drinking water, water supply and water treatment related matters. The water supply across Delhi is being controlled by DJB. 	<ul style="list-style-type: none"> In some of the slum areas water supply is not available and for others DJB maintains the supply. DJB is to be involved for providing the supply of water to

Mitigation measure	Stakeholder	Role of stakeholder
		slums and also for obtaining the baseline data about water quality.
Water boiling using renewable biomass	<ul style="list-style-type: none"> Delhi Jal Board (DJB) is the nodal agency for all drinking water, water supply and water treatment related matters. The water supply across Delhi is being controlled by DJB. Ministry of New and Renewable Energy 	<p>- In some of the slum areas water supply is not available and for others DJB maintains the supply. DJB is to be involved for providing the supply of water to slums and also for obtaining the baseline data about water quality.</p> <p>- Funding can be sought from MNRE for establishing the renewable biomass briquetting systems.</p>
Aerobic composting	<ul style="list-style-type: none"> Municipal Corporation of Delhi (MCD) New Delhi Municipal Corporation (NDMC) State Public Works Department (PWD) <p>These are three local municipal corporations under which governs municipal functions under various areas of Delhi. Waste management comes under the purview of these agencies and hence we would have to involve these agencies.</p>	<p>- MCD and NDMC have to be involved in any measure related to waste management and treatment. All the existing such projects are in partnership with these agencies. Their help can be sought in design, collection and treatment of waste.</p>
Anaerobic digestion	<ul style="list-style-type: none"> Municipal Corporation of Delhi (MCD) New Delhi Municipal Corporation (NDMC) State Public Works Department (PWD) 	<p>MCD and NDMC have to be involved in any measure related to waste management and treatment. All the existing such projects are in partnership with these agencies. Their help can be sought in design, collection and treatment of waste.</p>
BRTS/MRTS	<ul style="list-style-type: none"> Urban Development Ministry, Government of Delhi Delhi Metro Rail Corporation (DMRC) 	<p>- Urban Development Ministry is involved in planning and approval of any new transport related projects in Delhi.</p> <p>- DMRC is already involved in development of MRTS system in Delhi and their help can be sought in implementation of any such new project.</p> <p>- DTC owns the largest fleet of green buses in the world and their help would be required in case of</p>

Mitigation measure	Stakeholder	Role of stakeholder
	- Delhi Transport Corporation (DTC)	implementation of BRT system.

6.0 Gold Standard Sustainable Cities Programme Framework & generic guidance for future programme development

As a significant outcome of this exercise, The Gold Standard Foundation has developed a proposed certification scheme for city-based projects entitled 'The Gold Standard Sustainable Cities Programme'. A detailed framework has been developed which will provide guidance on the application of the standard and the certification of programmes and results under this programme. It is the Gold Standard Foundation's intention, subject to identifying the necessary funding, to seek stakeholder and expert input into the proposed approach, revise as appropriate and make it available for use.

This section discusses the elements of The Gold Standard Sustainable Cities Programme Framework. For the complete framework please refer to Annex 8 of this report. The detailed set of rules and comprehensive set of guidelines, templates and methodologies (if required) will be developed in due course.

This framework has been developed with an understanding that cities need not only contain GHG emissions, but they also need to adapt to the impacts of climate change. Cities account for 60 - 80 percent of current global energy consumption and 75 percent of GHG emissions. Cities also have a critical role to play in dramatically reducing the pollution that causes this environmental problem. The challenge for climate change mitigation and adaption is enormous and expensive, given the social, political, technical and institutional complexities within cities. It is estimated that by 2050, more than a trillion U.S. dollars in investment will be needed for the required mitigation and adaptation work and 90 percent of the money required will have to come from private investment. Hence, the framework has been developed to channel more and more private as well as public funding into urban development with a focus on overall sustainable development of the city. It is expected that The Gold Standard Cities Programme Framework will help to scale up and drive the currently missing investment needed for low carbon cities and address sustainability issues in urban communities.

The Gold Standard Sustainable Cities Programme is designed to be a scalable framework that can support the financing and implementation of sustainable urban development programmes, which can include specific project activities. The target programme may focus on small units such as individual households or may involve large-scale projects such as the upgrading of urban infrastructure in a city. The standard is applicable to the entire programme and/or individual projects/activities within such programmes that are seeking finance through innovative results-based finance schemes. However, for consistency, they are hereafter referred to only as programmes.

For clarity, The Gold Standard's project-based certification programme for crediting of voluntary emission reductions (VERs) against GHGs emission reductions achieved will continue to operate separately. This programme is as of now applicable only for a results-based finance scheme. However, sustainability crediting and other modes of financing would be explored in due course.

The Gold Standard Sustainable Cities Programme has been developed to catalyse finance for sustainable development projects at a city-wide level, providing strong governance and verified outcomes to the donors/investors and funding agencies. Recognising the need for a wider range of outcomes than simply mitigation (including, but not limited to, adaptation and resilience issues, access to services, employment, health and livelihood improvements), there is flexibility based on cities' needs as to the types of activities eligible to be certified. Furthermore, new areas may be proposed, approved and added, based on future developments.

The Gold Standard Sustainable Cities Programme is modelled upon a results-based finance approach in which payments are made after a set of pre-defined results have been achieved and verified. Some up-front funding may be required and deployed based upon a commitment to follow the framework. However, the objective of results-based finance is to link funding/payments more closely to outcomes, incentivising the provision of goods or services, creating or expanding markets or stimulating innovation. Possible target outputs might include the provision of solar street lighting in a defined area, implementation of a retrofitting programme to achieve certain levels of efficiency and resilience, delivery of sustainable transport infrastructure that achieves certain targets or deployment of energy access technologies such as solar lighting, advanced cookstoves or water purification devices that are sold.

Therefore, a programme wishing to define itself as a Gold Standard City Programme and through this to attract greater levels of interest, engagement and finance, should clearly outline its objectives, identify the impacts expected to materialise within a designated geographic area and define key indicators associated with the proposed measure under the programme, including milestones. These will be instrumental for ex-post measuring, reporting and verification of the performance of a programme. Additionally, defining specific objectives, corresponding indicators and associated parameters and setting targets for these different parameters will assist in the monitoring of the real-time impact of the programme. The performance of the programme will be verified based on the recurrent collection of data and reporting for selected indicators. Ideally, the selected measure(s) should not only provide short-term, but also long-term benefits to livelihoods by addressing institutional barriers in the host countries. Monitoring, reporting and verification must take place to ensure the achievement of the pre-defined objectives. Evaluation should also be performed to assess the impact of the action from a broader perspective, such as the long-term benefits in addressing a problem in the environment where the actions take place.

6.1 Activities/projects applicable under Gold Standard Sustainable Cities Program

The programme(s) that are eligible under the Gold Standard Sustainable Cities Programme include projects/activities in the following areas:

1. Renewable energy
2. Energy efficiency
3. Waste management (solid waste & domestic waste water)
4. Urban forestry
5. Transport
6. Other activities that involve improvements to basic services like water supply, sanitation & healthcare facilities in the target city

Additional activities and sectors may be approved and made eligible by the submission of a written request to The Gold Standard Secretariat.

6.2 Governance Structure for GS SCP

The key bodies involved in the governance of The Gold Standard Sustainable Cities Programme are depicted below. The governance structure would evolve in future and each programme would also establish a governance structure that should ideally involve agencies at city level.



Fig. 6.1: Governance Structure of a Gold Standard Sustainable Cities Programme

The roles and responsibilities of the different bodies are discussed below:

1. **The Gold Standard Technical Advisory Committee (TAC)** is an independent body comprised of market specialists that provide expertise, guidance and decisions on programme rules and approvals. The role of the TAC is outlined below along with Gold Standard Secretariat responsibilities.
2. **The Gold Standard Secretariat** manages the day-to-day running of the Sustainable Cities standard/framework and tools, including strategic and technical development, operational

performance, programme/outcome certification support and governance, registry management, capacity building, marketing and fundraising.

- a. The Secretariat shall be closely involved with the progress of a programme and, dependent on the scale of the programme and associated funding a dedicated Gold Standard staff member shall be positioned locally. This shall minimise the need to hire external experts for technical input, approvals and initial validation and verification of the programme. The decision to require a dedicated, local Gold Standard resource is made by the Gold Standard Secretariat.
 - b. The Gold Standard Secretariat shall review the programme documentation and shall certify, that it conforms to The Gold Standard Sustainable Cities Programme rules and requirements in consultation with the TAC. The TAC would also be consulted in case of any specific issues and escalation points.
 - c. Gold Standard local staff shall provide input on the addition of new sectors under the programme and The Gold Standard Secretariat shall review the addition of new sectors into the programme, which would be augmented into after positive review outcome.
 - d. The Gold Standard Secretariat shall review verification reports submitted by third party auditors and shall certify the outcomes obtained from the implementation of different measures under the programme. TAC would be consulted in case of any specific issues and escalation points.
3. **NGO Supporters** will play an active role in the programme development process, offering input in their areas of expertise. Each and every Gold Standard programme shall be open to feedback and input from The Gold Standard NGO community during the design, implementation, validation and verification phases, lending further credibility to local sustainable development initiatives. Every NGO that supports The Gold Standard strengthens the robustness of the standard and the programmes operating with it.
- a. The feedback from Gold Standard NGO supporters shall be sought during stakeholder consultation as well as during the approval of the Programme(s) under The Gold Standard Sustainable Cities Programme.
 - b. In cases where there is no existing NGO regional supporter, ideally, a local NGO will be recruited to join as a Gold Standard NGO partner.
4. **Auditors/verifiers** shall be required to validate programmes and verify results
- a. Independent external auditors shall verify the physical implementation progress (i.e., on the ground) as well as the social and environmental outcomes from the different activities implemented under a project.
 - b. The team of auditors involved in verification of the outcomes under the programme must have ISO14000, as well as SA8000, certification and training.
5. **Stakeholders;** NGOs, inhabitants, city authorities and funding agencies shall be involved during various stakeholder consultation rounds.

The Gold Standard Foundation Board shall provide overall oversight to The Gold Standard Secretariat and TAC.

6.3 Programme Cycle

Programme Coordination

The programme co-ordinator or implementing team shall manage Gold Standard Sustainable Cities Programme activities within the selected city in a clear and transparent manner. This shall be done by:

- Taking overall programme responsibility
- Providing the requisite capacity to support the documentation and implementation of related activities
- Co-ordinating independent third party validation/verification
- Maintaining appropriate records, as outlined in this document

The programme shall follow the stepwise approach of The Gold Standard Sustainable Cities Programme Cycle as depicted below. The Gold Standard requires reporting using pre-defined formats for the approval of any programme and The Gold Standard Secretariat reserves the right to ask for additional information at anytime during or after the approval process. The Programme Cycle is outlined in detail in the below section.

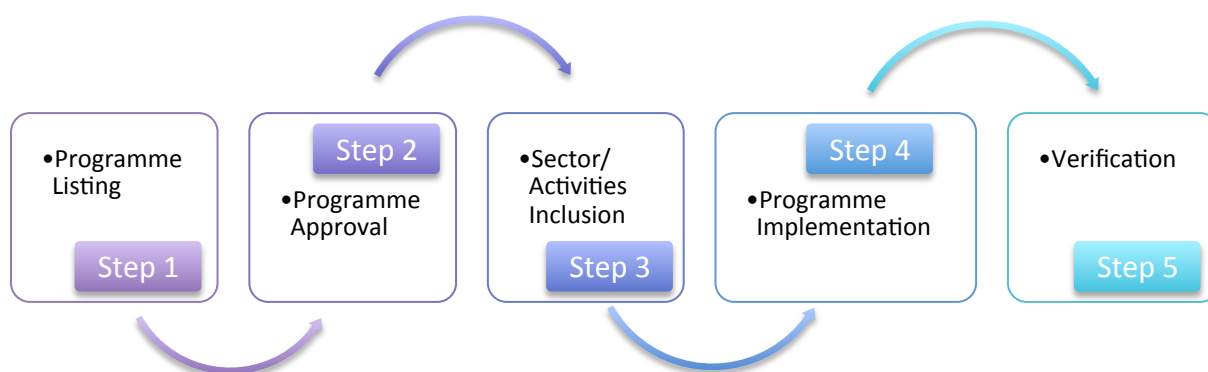


Fig. 6.2: The Gold Standard Sustainable Cities Programme Cycle

Step 1. Programme Listing

This is the initial step in the programme cycle, at which stage the programme concept is to be communicated to The Gold Standard Secretariat and key stakeholders. The programme co-ordinator prepares a programme concept note and a first level stakeholder consultation is carried out. These documents are then reviewed by The Gold Standard Secretariat and, if found to be satisfactory, the programme will be listed on The Gold Standard Cities Registry. If necessary, The Gold Standard Secretariat may ask for additional information before the listing of the programme. The outcome of this step is the listing of programme on The Gold Standard Cities Registry. City-based programmes can be complex in nature, and may require more consultations before programme concept stage. The Gold Standard would be open to offer any pre-concept discussion or case-by-case changes in the process depending upon discussion and feedback from prospective developers.

Step 2. Programme Approval

During this second step the sectors (e.g., household energy, public buildings, water, waste management, transport, infrastructure, etc.) are identified for augmentation into the programme. The sectors and the overall programme shall have a positive impact on at least three of the four Sustainable Development

dimensions (environmental, social, economic & technological development and governance), explained in detail in the Sustainable Development section. These details, additional to the programme concept note, are included in a sector and programme report to be submitted in a pre-defined format. This is reviewed by The Gold Standard for consistency, completeness and adherence to Gold Standard rules and principles. The Gold Standard Secretariat then approves the programme in consultation with TAC. The TAC and/or Secretariat may ask for further information/clarification at any point during this approval process.

As an outcome of this step the programme and sectors are registered with The Gold Standard and are made available publicly on The Gold Standard Cities Registry. Further augmentation of any new sectors would follow an identical process.

Step 3. Sector/Activity Inclusion

Different activities are identified that would be implemented within the approved sectors. Details of the activities shall be provided in a predefined format and a second level stakeholder consultation shall then be carried out with local stakeholders before the submission of these measures to The Gold Standard Secretariat. The programme coordinator's technical committee and Gold Standard local staff then approve these activities. In case of the non-availability of a local technical committee or staff, the Gold Standard Secretariat shall approve the activities. The outcome of this step shall be the approval and listing of the specific activities under the different sectors of the overall program.

Step 4. Programme Implementation and Monitoring

The implementation of the programme commences once the specific activities and sectors have had their finance approved. Prior to implementation the programme co-ordinator shall agree with the funder various monitoring indicators that need to be part of the monitoring plan for the certification of outcomes. The monitoring plan, including the financing agency's approval, shall also be submitted to The Gold Standard Secretariat before commencing implementation and shall form part of the programme documentation.

Step 5. Verification

A key element in the evaluation of a programme is the verification of outcomes and verification of physical progress of implementation of measures. The main objective of verification, in the context of results-based finance, is to ensure that the objectives of a particular measure have been met and also to protect the funding entity against the potential manipulation of results. For Gold Standard Sustainable Cities Programmes, the verification agency shall be an independent third party body and shall not be related to the implementing agency.

The programme co-ordinator shall appoint an external verification agency that will be required to verify the outcomes of a particular sector and activity as defined in the monitoring plan. The chosen verification agency shall be an external independent auditor who has certification to carry out ISO14000 as well as SA8000 auditors. The verification team shall comprise of at least one auditor accredited with each of these standards.

The monitoring report from the programme co-ordinator and verification report from the verification agency shall be submitted to The Gold Standard Secretariat for further scrutiny and compliance checks. The Gold Standard Secretariat may request additional information based on the completeness and

transparency of the reports. The outcomes are then approved by the Gold Standard Secretariat and can be found on the Gold Standard Cities Registry.

Table 6.1 The Gold Standard Sustainable Cities Programme Cycle

Step	Activities	Deliverable/ Outcome
1. Programme Listing	Prepare Programme Conceptualisation	Programme Concept Note
	Organise Stakeholder Consultation (1st)	Stakeholder Consultation Report
	Submit Programme concept note and 1st consultation report to The Gold Standard Secretariat	
	Review by The Gold Standard Secretariat	Programme Listing
2. Programme Approval	Identify the sector(s)	
	Prepare the sector report including the Sustainable Development Assessment	Sector Report
	Submit the Sector Report to The Gold Standard Secretariat	
	Review and approval by The Gold Standard Secretariat and TAC	
	Programme & Sector registered with Gold Standard Secretariat	Sector Approval Report made available on Gold Standard Cities Registry
3. Sector/Activity Inclusion	Identify the activity/measure under pre-approved sector	
	Prepare activity inclusion report including sustainable development assessment, implementation and monitoring plan	Activity Inclusion report
	Organise stakeholder consultation (2nd)	Stakeholder Consultant report
	Update the activity inclusion report in line with the stakeholder comments/concerns (if any)	
	Upload activity inclusion report & stakeholder consultation report on Gold Standard Cities Registry for NGOs supporters and other stakeholder to review	
	Review and approval by Gold Standard Secretariat	Activity Inclusion Report made available on Gold Standard Cities Registry
4. Programme/ activity Implementation	Implement the programme	
	Monitor the performance in line with the registered monitoring plan	
	Prepare the programme and/or activity performance report	Programme and or activity performance report
	Contract the verification agency	

5. Verification	Verification by accredited agency (ISO 14000 & SA 8000 Auditors)	Verification report by the auditors
	Upload monitoring report and verification report on Gold Standard Cities Registry	
	Review of Monitoring & verification report by Gold Standard Secretariat	
	Programme performance approval by Gold Standard Secretariat and TAC	Programme Performance Approval Report

6.4 Stakeholder Consultation

The Gold Standard requires that the programme developer discuss the programme/activity design and its potential environmental and social impacts with relevant (local) stakeholders and actively seeks their comments/suggestions. The objective of this consultation process is to involve stakeholders in a proposed programme, its design and implementation plan and to provide an opportunity for understanding the social and environmental impacts of a proposed programme. The overall goal is to improve the programme design based on stakeholder suggestions and to increase the local ownership and involvement. In principle, The Gold Standard stakeholder consultation process shall include two consultations: an initial citywide programme consultation at broader level followed by the consultation(s) with the local stakeholders who are going to be affected directly. In addition, the consultation with the local stakeholders shall be followed with a follow up feedback round to discuss the changes made by the programme coordinator to account for the suggestions/comments of local consultations.

The first consultation includes a discussion of the programme design and consequent impacts with the group of stakeholders, such as city authorities, local leaders, private sector and civil society organisations who may have direct influence in decision-making and who are familiar with local issues of concern. The objective of an initial city level consultation is to discuss the programme design and secure the commitment, and participation, of stakeholders who are useful for decision-making and opinion framing at city level.

The second consultation includes a discussion of the programme design/proposed initiatives and overall framework and its impact on the environment and local communities. It shall primarily involve local stakeholders that are going to be affected, for example, target populations, the municipality, local NGOs etc. The detailed guidelines, rules and templates for stakeholder consultation would be developed in future and would be made available to programme developers.

6.5 Sustainable Development Assessment

The proposed citywide programme shall contribute positively towards the overall sustainable development of the target city. To assess the risk/impact of the programme, the proposed programme shall be evaluated as per The Gold Standard “Do No Harm” and “Sustainable Development” assessments. The objectives of these two exercises are to assess the risk/impact that a programme may have on the environment, society, economy or governance of a target city. In addition, it will input into the robust monitoring plan that measures the performance of the programme against the pre-defined targets.

The safeguarding principles of the United Nations Development Programme, derived from the Millennium Development Goals (MDG) set by 189 UN member states, lead to the “Do No Harm” assessment. In total eleven safeguarding principles are broadly arranged under four categories: Human Rights, Labour Standards, Environmental Protection and Anti-corruption. The objective of this self-assessment is to determine if there is any potential negative to a programme or project and to detail how it shall be avoided or mitigated.

Table. 6.2 Safeguarding Principles for “Do No Harm Assessment”

Safeguarding Principles	
Human Rights	
1	The programme respects internationally proclaimed human rights including dignity, cultural property and the uniqueness of indigenous people. The project is not complicit in Human Rights abuses.
2	The programme does not involve, and is not complicit in, involuntary resettlement.
3	The programme does not involve, and is not complicit in, the alteration, damage or removal of any critical cultural heritage.
Labour Standards	
4	The programme respects employees’ freedom of association and their right to collective bargaining and is not complicit in restrictions of these freedoms and rights.
5	The programme does not involve and is not complicit in any form of forced or compulsory labour.
6	The programme does not employ and is not complicit in any form of child labour.
7	The programme does not involve and is not complicit in any form of discrimination based on gender, race, religion, sexual orientation or any other basis.
8	The programme provides workers with a safe and healthy work environment and is not complicit in exposing workers to unsafe or unhealthy work environments
Environmental Protection	
9	The programme takes a precautionary approach in regard to environmental challenges and is not complicit in practices contrary to the precautionary principle. This principle can be defined as: “When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”
10	The programme does not involve and is not complicit in significant conversion or degradation of critical natural habitats, including those that are (a) legally protected, (b) officially proposed for protection, (c) identified by authoritative sources for their high conservation value or (d) recognised as protected by traditional local communities.
Anti Corruption	
11	The programme does not involve and is not complicit in corruption.

Table. 6.3 Dimensions and corresponding criteria for Sustainable Development assessment

Dimensions for Sustainable Development Assessment			
Environment	Social	Economic and Technology Development	Governance and Capacity Building
<ul style="list-style-type: none"> • Air quality • Water quality • Solid waste management • Sanitation and drainage • Noise • Soil condition • Biodiversity 	<ul style="list-style-type: none"> • Quality employment • Livelihood of poor • Access to clean energy • Access to basic services (drinking, lighting, sanitation, health etc) • Human and institutional capacity • Access to education 	<ul style="list-style-type: none"> • Quantitative employment and income generation • Access to investment • Technology transfer and technology self reliance 	<ul style="list-style-type: none"> • Participatory planning • Capacity building and awareness programme by local government

The programme shall also be evaluated for its positive contribution to the sustainable development of the target city against four dimensions: Environment, Social, Economic and Governance. The detailed impact assessment for each dimension shall be carried out with the help of a pre-defined set of sustainability indicators for each criterion. The programme needs to score various indicators under each dimension as positive, negative or neutral. The programme coordinator may select, or develop, a set of sustainability indicators keeping in mind the principle characteristics, i.e., relevance/impact, availability of data, universality and low potential for manipulation. The objective is to assess the existing baseline situation quantitatively by selecting indicators for each criterion, which will later be instrumental for an ex-post monitoring of sustainability performance. The targets for selected indicators shall be compared with the possible baseline to assess “positive”, “negative” or neutral impacts of the programme. If there is any “negative” impact, it must be mitigated, and corresponding mitigation measures shall be monitored along with the non-neutral indicators.

To qualify for Gold Standard certification, each programme must, at minimum, contribute positively at programme level for at three minimum three indicators and none of the indicator should be negative. At measure level, two or more sustainability dimensions should attain a positive score out of the four dimensions. The net score of all the indicators put together must be positive for a dimension to be counted as positive. A robust sustainability-monitoring plan shall be devised for all non-neutral indicators to ensure that the programme has indeed contributed to sustainable development and/or mitigated the severe negative impacts on various dimensions. The overall objective is to better understand the programme impacts, and in particular the interaction among various dimensions of sustainable development, as well as following up the progress in relation to pre-defined targets.

The scoring approach, as defined above, may result in same outcomes from same measures being rated differently across different programmes. We intend to enhance the consistency across programmes in terms of rating of sustainability outcomes. However, this will be implemented progressively based on the experience and feedback from few initial programmes. Various options like Sustainability Crediting would be explored in future to ensure consistency and comparability across the programmes and measures.

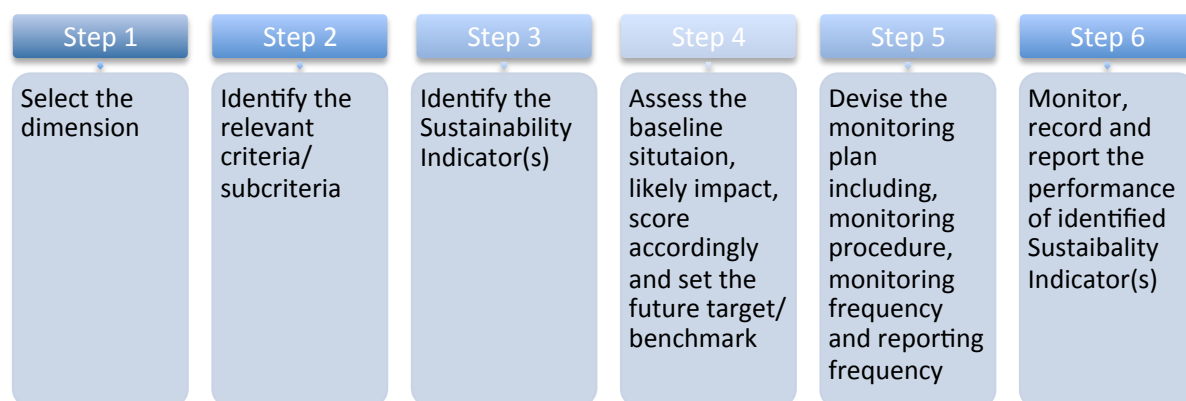


Fig. 6.3: Sustainable Development Assessment Approach

6.6 Monitoring, Reporting and Verification

Proposed programmes applying this framework shall put in place a Monitoring Plan based on the outcome of the Stakeholder Consultation, Do No Harm assessment, and detailed Sustainable Development impact assessment to ensure that the programme, indeed, contributes to sustainable development and does no harm. The parameters in the Monitoring Plan shall be regularly monitored, clearly reported and independently verified.

The programmes should lead to the establishment of a Capacity Building Plan ahead of the implementation of the programme and a part of the financing should go to capacity building or to increasing resources within key institutions. This shall be made part of the monitoring plan of the programme. In case capacity building is not deemed necessary under the programme, the programme coordinator shall justify why not.

The monitoring plan shall be discussed with the funding agencies and additional indicators shall be included based upon their feedback. The plan shall ensure monitoring of the long-term impacts of the programme and shall also install a milestone-based payment system to distribute the payments from funding agencies for at least five years after completion of implementation of the programme. In case the lifetime of the measures are shorter than five years, the monitoring and verification shall be carried out till the end of life of measures.

For each one of the indicators, the following elements shall be assessed and defined prior to the implementation of the activity:

- Baseline status, from a primary source of data (baseline study) or from secondary sources of data (e.g., collected in the recent past for other purposes, but confirmed by several independent credible sources)
- Targets in absolute terms or relative improvements versus the baseline
- Parameter(s) to monitor the progress of implementation

- Monitoring methods, including the approach to statistical sampling, sample size, and representativeness when needed, measurement frequency and quality control and assurance procedures
- Actors involved and respective roles

GHG Accounting

Gold Standard Sustainable Cities programmes can choose to establish an emission inventory of various sectors, which are under the focus of the programme. This can be decided after consultations with stakeholders and funding agencies. Alternatively, the programme may choose to apply existing approaches methodologies as per the following:

- Existing approved methodologies by the UNFCCC, The Gold Standard Foundation, city inventory standards such as standards by ICLEI, the CDP or any other international agency
- Sectoral guidance provided by the IPCC

The inventory for a particular sector shall be subject to verification at the time of the first verification of the outcomes. The emission reductions shall also be verified at the time of verification if they are part of the agreed outcomes and monitoring plan.

6.7 Monitoring, Reporting and Verification for Delhi Case Study

The case study is carried out in line with the proposed framework for the Gold Standard Sustainable Cities Programme. It is envisaged that the pilot case study will be implemented based on the principles and approach set in the framework discussed above.

MRV is about monitoring whether climate actions are being taken, how successful they are, the emission reductions they create, and whether the support promised is really being provided. It is expected that some form of monitoring for the results-based finance project and the international/domestic support pledged for the project will be required. In the language of the climate negotiations, this is referred to as measurement, reporting and verification (MRV), which applies to both the action and the support in terms of finance, technology and capacity building (if applicable).

Measuring the results will help determine if an initiative has been a success or failure. It will provide the basis to reward success (or not reward failure) and to address adequately and in due time the identified failures. It will ensure support through the demonstration of the results in the field. The data collection process must be continuous (although different measurement frequencies must be defined for the various impacts monitored) and analysis be performed on a sufficiently regular basis so as to allow for a real-time feedback loop and further action if, when and where necessary.

Indicators must be defined to show that actions considered important for the success of the scheme have actually taken place. They will confirm or inform the relevance, effectiveness, impact magnitude, and sustainability of the various measures implemented. In the context of climate mitigation action, these indicators will provide information on the amount of emissions saved, the magnitude of the co-benefits and their impact on sustainable development of the host country and the concrete implementation of the actions planned. Such indicators may be used by funders as milestones linked to

the provision funding. The potential sustainable development co-benefits are important measures to attract funding.

An evaluation must then be performed so as to analyse, if and when necessary, the reasons for a gap between the achieved performances and the targets. It will also potentially investigate unintended results and consequences of the measures implemented, and thus can lead to revising and/or expanding the monitoring plan. In the end, the evaluation must highlight the accomplishments and possible failures, and suggest further actions based on the lessons learned. The evaluation/verification of a results-based finance approach would be carried out by an external agency. External verification would increase the costs as compared to internal verification; however, it would assure funding agencies and provide confidence on the authenticity of the results obtained from the evaluation process.

6.7.1 MRV Indicators for project

Indicators make it possible to more precisely measure the attainment of goals. They may measure quantitative or qualitative results of a project. Individual project implementation activities should have separate indicators. These indicators can reflect what a donor wants to track:

- Indicators should reflect what the project seeks to achieve, for example:
 - Direct emissions reductions
 - Indirect emissions reductions, i.e., those difficult to attribute to the project
 - Capacity development for monitoring
 - Sustainable development co-benefits
- For monitoring implementation, it needs to be defined:
 - Who monitors the indicators
 - Timing and frequency of monitoring of indicators
 - Procedures for reporting and verification

6.7.2 Co-benefits

The project seeks to monitor and report non-GHG reduction outcomes, such as the project's contribution to development goals and/or the improvement of living conditions in the slums. Co-benefits may include a wide range of national development goals, such as:

- Access to clean energy
- Access to clean drinking water
- Improved air quality
- Improved livelihoods

In the absence of effective means to measure emission reductions from the proposed measures, it may be sufficient to have an MRV that ensures

- A certain magnitude of GHG emission reductions is achieved
- The project uses the financing for the stated purpose
- The proposed actions are actually undertaken
- The implementation is done effectively

Below are the sample details on indicators to be monitored for each of the measures planned to be implemented under the project. For more details please refer to Annex 7.

Table 2.4 List of Indicator direct/indirect for GHG monitoring

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter	Unit	Parameter		Unit	
1. Energy							
Cooking	Improved Cookstove (ICS)	Fuel saving per cookstove	Kitchen performance test, or water boiling test or literature survey*	Tonnes per cookstove or per household (HHs) per day or per year	Number of improved cookstoves distributed (type) and/or number of improved cookstove end users	Project database and sales records and/or households survey	% of improved cookstove users
		Adoption rate	Households survey	% of usage or adoption rate	Adoption rate	Households survey	% of usage or adoption rate
	Solar Cookers	Fuel saving per cookstove	Kitchen performance test, or water boiling test or literature survey*	Tonnes per cookstove or per household (HHs) per day or per year	Number of improved cookstoves distributed (type) and/or number of improved cookstove end users	Project database and sales records and/or households survey	% of improved cookstove users
		Adoption rate	Households survey	% of usage or adoption rate	Adoption rate	Households survey	% of usage or adoption rate
	Solar Lamps	Fossil fuels avoided per lamp	Number of solar lamps distributed to end users	Amount of lighter fuel avoided per solar lamp per year	Number of solar lamps distributed to end users	Project sales records	% of solar lamp users (against total population) or households
		Adoption rate	Project lamps distributed to end users that are operating and in service	% of project lamps operating and in service	Adoption rate	Households survey	% of usage or adoption rate
Lighting - Household							

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter		Unit	Parameter		Unit
	CFL/LED	Electricity saving	Total number of project lamps supplied or distributed in project	kWh/lamp per year (saving)	Total number of project lamps supplied or distributed in project	Project sales records	% of solar lamp users (against total population) or households
					Adoption rate	Households survey	% of usage or adoption rate
Street Lighting- Solar	Solar lamps						
	CFL/LED	Electricity saving	Total number and type of lamps replaced by the project lamps	kWh/lamp/ year	Total number and type of lamps installed/replaced	Project maintenance record/database	Streetlight per sq km
		Annual failure rate	The fraction of installed lamps that fail annually	Fraction	Number of lamps in operation per sq km	Project or local municipal agencies maintenance records	Fraction of installed/replaced lamps in operation
		Annual operational hrs	Average annual number of operational hrs based on 90 days continuous monitoring	hrs per year	Annual operational hrs	Project or local municipal agencies maintenance records or estimated based on expert judgement	hrs per year
Heating -Water	Solar Water Heater	Energy saving per	Various approaches	Energy or electricity saving	Number of solar water heaters	Project sales records or	% of households using solar water heaters

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter		Unit	Parameter		Unit
		solar water heater	including default, continues monitoring & model based assessment	per unit year	installed or number of households equipped with solar water heaters	database	
		Number of solar water heater units	Total number of Installed solar water heater units	Number of installed solar water heater units	Adoption rate	Households survey or project maintenance records	% of usage or adoption rate in operational service
		Adoption rate	Percentage of systems operating and in compliance with manufacturer Performance test in line with manufacturer specification	% of usage or adoption rate			
Cooling - Household	Solar powered fan	Electricity saving per unit	Number and "power" of a representative sample of the replaced devices	kWh/year/unit	Number of solar powered fans distributed or number of households equipped with a solar powered fan	Project sales records or database	% of households using solar powered fan
		Operational units	Number of units that are in	% of units in operation	Operational units	Households survey or project	% of units in operation

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter		Unit	Parameter		Unit
			operation			maintenance records	
	Efficient cooling appliances	Annual energy consumption	Number and "power" of a representative sample of the replaced devices or specific energy consumption	kWh/unit/year	Number of units installed or replaced	Project sales records/database	Units (number) installed /replaced per year
		Operational units	Number of units that are in operation	Number of units installed per year	Number of units in operation	Households survey	% of units in operation
		Operating hrs	Average annual number of operational hrs based on 90 days continuous monitoring	hrs per year			
Appliances - Household	Efficient household appliances	Annual energy consumption	Number and "power" of a representative sample of the replaced devices or specific energy consumption	kWh/unit/year	Number of units installed or replaced	Project sales records/database	Units (number) installed /replaced per year
		Operational units	Number of units that are in operation	Number of units installed per year	Number of units in operation	Households survey	% of units in operation

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter		Unit	Parameter		Unit
		Operating hrs	Average annual number of operational hrs based on 90 days continuous monitoring	hrs per year			
2. Water and Sanitation							
Water -drinking	Zero energy water filters	Fuel saving or avoided	Kitchen performance test, water consumption test and water boiling test or literature survey	tonnes per person per day	Number of zero energy water filters distributed (type) and/or number of end users using the water filters	Project database and sales records and/or households survey	% of water filter users
		Adoption rate	Households survey	% of usage or adoption rate	Adoption rate	Households survey	% of usage or adoption rate
		Water quality check	Quality test		Water quality check	Quality test	
	Zero energy water filters	Fuel saving or avoided	Kitchen performance test, water consumption test and water boiling test or literature survey	Tonnes per person per day	Number of zero energy water filters distributed (type) and/or number of end users using the water filters	Project database and sales record and/or households survey	% of water filter users
		Adoption rate	Households survey	% of usage or adoption rate	Adoption rate	Households survey	% of usage or adoption rate

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter		Unit	Parameter		Unit
		Water quality check	Quality test		Water quality check	Quality test	
	Electricity based RO/UV filters	Fuel saving or avoided	Kitchen performance test, water consumption test and water boiling test or literature survey	Tonnes per person per day	Number of zero energy water filters distributed (type) and/or number of end users using the water filters	Project database and sales records and/or households survey	% of water filter users
		Adoption rate	Households survey	% of usage or adoption rate	Adoption rate	Households survey	% of usage or adoption rate
		Water quality check	Quality test		Water quality check	Quality test	
	Solar water disinfection	Fuel saving or avoided	Kitchen performance test, water consumption test and water boiling test or literature survey	Tonnes per person per day	Number of zero energy water filters distributed (type) and/or number of end users using the water filters	Project database and sales records and/or households survey	% of water filter users
		Adoption rate	Households survey	% of usage or adoption rate	Adoption rate	Households survey	% of usage or adoption rate
		Water quality check	Quality test		Water quality check	Quality test	

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter		Unit	Parameter		Unit
Water Supply	Solar water pumps	Annual energy consumption	Number and "power" of a representative sample of the replaced devices or specific energy consumption	kWh/unit/ year	Number of solar water pumps installed	Project sales records and/or maintenance records	Number of solar water pump units installed
		Operational units	Number of units that are in operation	Number of units in operation	Operational units	Project maintenance records	Units in operation
		Operating hrs	Average annual number of operational hrs based on 90 days continuous monitoring	hrs/year			
	Efficient water pumping	Annual energy consumption	Number and "power" of a representative sample of the replaced devices or specific energy consumption	kWh/unit/ year	Number of efficient water pumps installed	Project sales records/ maintenance records	Number of units installed or replaced
		Operational units	Number of units that are in operation	Number of units in operation	Operational units	Project maintenance records	Units in operation

Activity	Mitigation Measure	GHGs Monitoring					
		Direct Monitoring Parameter(s)			Possible Indirect Monitoring Parameter(s)		
		Key Parameter		Unit	Parameter		Unit
		Operating hrs	Average annual number of operational hrs	hrs/year			
Waste Management	Composting	Waste quantity treated	Total quantity of waste treated per year	Tonnes/year	Waste treated at composting site	Project records	Tonnes/year
					Number of Household provided access to the waste collection services	Households survey	% of households that have daily/weekly collection facility

*[Simplified GS Cookstove Methodology](#) allows the fuel saving estimation and corresponding emission reduction based on Water Boling Test (WBT) and/or Literature Survey. Only activities that reduce less than 10,000 emission reductions per year are eligible under this methodology.

Table 2.5: Sustainable development co-benefits and monitoring

Activity	Mitigation Measure	Sustainable Development Co-benefits			
		Sustainable Development Assessment		Monitoring Parameter	
		Dimension	Indicator	Parameter(s)	Monitoring parameter and unit
1. Energy					
Cooking	Improved cookstove (ICS)	Environment	Air quality	Indoor air quality	• % or number of end users that have positive opinion
				Health impact	• % decrease in reported cases of respiratory/eye problem/ pneumonia (infant) etc.
		Social	Livelihood of the poor	Poverty alleviation (fuel cost saving)	• Expenditure/month or year for cooking fuel • (%) of total household expenditure spent on cooking fuel
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building	Awareness programme		• Number of awareness campaigns implemented to promote the positive impacts of improved cookstoves
	Solar cookers	Environment	Air quality	Indoor air quality	• % or number of end users that have positive opinion
				Health impact	• % decrease in reported cases of respiratory/eye problem/ pneumonia (infant) etc.
		Social	Livelihood of the poor	Poverty alleviation (fuel cost saving)	• Expenditure/month or year for cooking fuel • (%) of total household expenditure spent on cooking fuel
		Economic &	Quantitative	Employment generation	• Number of jobs provided to local people

Activity	Mitigation Measure	Sustainable Development Co-benefits			
		Sustainable Development Assessment		Monitoring Parameter	
		Dimension	Indicator	Parameter(s)	Monitoring parameter and unit
Household Lighting	Solar lighting	technology development	employment and income generation		• Local employment for skilled/un-skilled and permanent jobs
			Technology transfer and technology self reliance	Skill development	• Number of 'know-how' training sessions
		Governance and capacity building	Awareness programme		• Number of capacity building workshops
		Environment	Air quality	Indoor air quality	• % or number of end users that have positive opinion
				Health impact	• % decrease in reported cases of respiratory/eye problem/ pneumonia (infant)
		Social	Livelihood of the poor Access to clean energy Access to basic services	Poverty alleviation (fuel cost saving)	• Expenditure/month or year for lighting fuel • (%) of total household expenditure spent on fuel for this measure • Number or % of household using solar lights
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
			Technology transfer and technology self reliance	Skill development	• Number of 'know-how' training sessions
	CFL/LED	Governance and capacity building	Awareness programme		• Number of capacity building workshops
		Environment	Air quality	National/regional air quality	• Number of CFL/LED units in use
		Social	Access to basic services	Access to lighting	• Number of CFL/LED units in use
		Economic &	Quantitative	Employment generation	• Local employment for skilled/un-skilled

Activity	Mitigation Measure	Sustainable Development Co-benefits			
		Sustainable Development Assessment		Monitoring Parameter	
		Dimension	Indicator	Parameter(s)	Monitoring parameter and unit
		technology development	employment and Income generation		and permanent jobs
		Governance and capacity building	Awareness programme		• Number of capacity building workshops
Street Lighting	Solar lighting	Environment	Air quality	National/regional air quality	• Number of units installed
		Social	Access to basic services	Access to lighting	• Streetlight per sq km
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building	Awareness programme		• Number of capacity building workshops
	CFL/LED	Environment	Air quality	National/regional air quality	• Number of units installed
		Social	Access to basic services	Access to lighting	• Streetlight per sq km
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building	Awareness programme		• Number of capacity building workshops
Heating -water	Solar water heater	Environment	Air quality	Indoor and or national/regional air quality improvement	• % or number of end users that have positive opinion • Number of units installed
				Health impact	• % decrease in reported cases of respiratory/eye problem/ pneumonia (infant)
		Social	Livelihood of poor Access to clean energy Access to basic services	Fuel cost saving	• expenditure/month or year for fuel • (%) of total household expenditure spent on fuel for this measure

Activity	Mitigation Measure	Sustainable Development Co-benefits			
		Sustainable Development Assessment		Monitoring Parameter	
		Dimension	Indicator	Parameter(s)	Monitoring parameter and unit
					<ul style="list-style-type: none"> • Number or % of household using solar water heaters
		Economic & technology development	Quantitative employment and income generation	Employment generation	<ul style="list-style-type: none"> • Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
			Technology transfer and technology self reliance	Skill development	<ul style="list-style-type: none"> • Number of 'know-how' training sessions
		Governance and capacity building	Awareness programme		<ul style="list-style-type: none"> • Number of capacity building workshops
Cooling - space	Solar powered fan	Environment	Air quality	National/regional air quality improvement	<ul style="list-style-type: none"> • Number of units installed
		Social	Livelihood of poor	Fuel cost saving	<ul style="list-style-type: none"> • Expenditure/month or year on electricity • (%) of total household expenditure spent on electricity for this measure • Number or % of household using solar water heaters
			Access to clean energy		
			Access to basic services		
		Economic & technology development	Quantitative employment and Income generation	Employment generation	<ul style="list-style-type: none"> • Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
			Technology transfer and technology self reliance	Skill development	<ul style="list-style-type: none"> • Number of 'know-how' training sessions
		Governance and capacity building	Awareness programme		<ul style="list-style-type: none"> • Number of capacity building workshops
	Efficient cooling appliances	Environment	Air quality	National/regional air quality improvement	<ul style="list-style-type: none"> • Number of units installed/replaced
		Social	Livelihood of poor	Fuel cost saving	<ul style="list-style-type: none"> • Expenditure/month or year on electricity • (%) of total household expenditure spent

Activity	Mitigation Measure	Sustainable Development Co-benefits			
		Sustainable Development Assessment		Monitoring Parameter	
		Dimension	Indicator	Parameter(s)	Monitoring parameter and unit
					on electricity for this measure • Number of units installed/replaced
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
			Technology transfer and technology self reliance	Skill development	• Number of 'know-how' training sessions • Number of advanced appliances installed/replaced
		Governance and capacity building	Awareness programme		• Number of capacity building workshops
Water- Drinking	Zero energy water filters	Environment	Air quality	Improvement in indoor air quality	• Number of units installed
			Water quality	Improvement in water quality	• % of sample test meeting quality standards
		Social	Access to basic service	Access to clean drinking water	• Number of units installed
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building			• Number of capacity building workshop
	Electricity based water filters	Environment	Water quality	Improvement in water quality	• % of sample test that meets the quality standards
		Social	Access to basic service	Access to clean drinking water	• Number of units installed
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building			• Number of capacity building workshop

Activity	Mitigation Measure	Sustainable Development Co-benefits			
		Sustainable Development Assessment		Monitoring Parameter	
		Dimension	Indicator	Parameter(s)	Monitoring parameter and unit
	Solar water disinfection	Environment	Air quality	Improvement in indoor air quality	• Number of units installed
			Water quality	Improvement in water quality	• % of sample test that meets the quality standards
		Social	Access to basic service	Access to clean drinking water	• Number of units installed
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building	Awareness programme		• Number of capacity building workshops
Water Supply	Solar water pumps	Environment	Air quality	Improvement in indoor air quality	• Number of units installed
		Social	Access to basic services	Improvement in access to water	• Access to water per day (hrs/day)
		Economic & technology development	Quantitative employment and income generation	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
			Technology transfer and technology self reliance	Skill development	• Number of 'know-how' training sessions • Number of advanced appliances installed/replaced
		Governance and capacity building	N/A	N/A	• N/A
	Efficient water pumps	Environment	Air quality	Improvement in indoor air quality	• Number of units installed
		Social	Access to basic services	Improvement in access to water	• Access to water per day (hrs/day)
		Economic & technology	Quantitative employment and	Employment generation	• Number of jobs provided to local people • Local employment for skilled/un-skilled

Activity	Mitigation Measure	Sustainable Development Co-benefits			
		Sustainable Development Assessment		Monitoring Parameter	
		Dimension	Indicator	Parameter(s)	Monitoring parameter and unit
		development	income generation		and permanent jobs
			Technology transfer and technology self reliance	Skill development	<ul style="list-style-type: none"> • Number of 'know-how' training sessions • Number of advanced appliances installed/replaced
		Governance and capacity building	N/A	N/A	• N/A
Waste Management	Composting	Environment	Solid waste management	Improved waste management practice	• % of total waste treated
		Social	N/A	N/A	• N/A
		Economic & technology development	Quantitative employment and Income generation	Employment generation	<ul style="list-style-type: none"> • Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building	Awareness programme		• Number of capacity building workshops
	Anaerobic Digestion	Environment	Solid waste management	Improved waste management practice	• % of total waste treated
		Social	NA	NA	• NA
		Economic & technology development	Quantitative employment and income generation	Employment generation	<ul style="list-style-type: none"> • Number of jobs provided to local people • Local employment for skilled/un-skilled and permanent jobs
		Governance and capacity building	Awareness programme		• Number of capacity building workshops

7.0 Conclusion and future developments

As a major outcome of this study, a framework and associated guidance for the development of projects and programmes under The Gold Standard Sustainable Cities Programme has been developed. The framework will undergo public consultations and will be tested with pilot programmes in Delhi as well as other suitable developing cities.

Performance of this theoretical concept in the real world would definitely provide the desired impetus for the programme and would help in establishing a full-scale programme including the development of further detailed guidance, rules and templates. The Gold Standard is working to establish both a Cities Programme Secretariat and Registry in the coming year.

Activities under Phase-II of this project:

The following activities have been planned as part of an extension to this study. The next phase is to implement a full-scale pilot programme on the basis of the results-based finance approach developed under this project:

- Consultation process to identify suitable candidates for a pilot project
- Identify most promising measures for identified project (in line with the measures shortlisted in this report)
- Preparation of a business plan for selected project and measures
- Identification of possible project partners and funders
- Contribution to ToRs for Call for Tenders
- Contribution to project development
- Development of case study
- Dissemination of activities and active engagement with stakeholders

Identifying potential partners and funders for the pilot activity will be one of the most crucial aspects for the successful extension of this concept. At least two consultation events are planned during this phase to invite inputs, comments and feedback on the proposed approach as well as to engage with potential funding and implementing agencies.



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