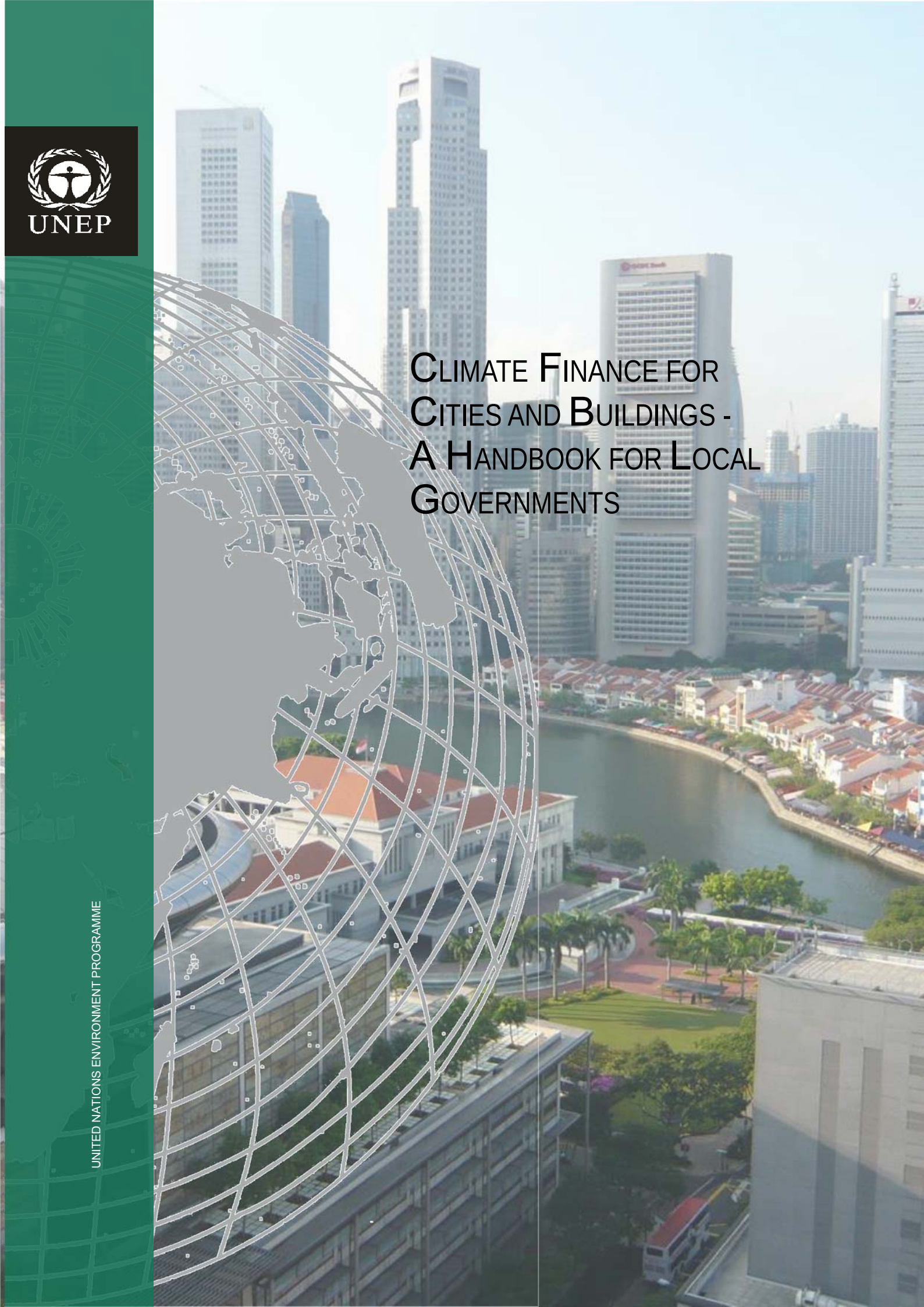
UNEP
CLIMATE FINANCE FOR CITIES AND BUILDINGS - A HANDBOOK FOR LOCAL GOVERNMENTS
UNITED NATIONS ENVIRONMENT PROGRAMME

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Climate Finance for Cities and Buildings:

A Handbook for Local Governments

UNEP

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Myanmar. Photo: ENERGIES 2050

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Rabat tramway, Morocco. Photo: ENERGIES 2050

Acronyms and abbreviations

CDM	Clean Development Mechanism
CER	Certified Emission Reduction (also known as ‘carbon credits’)
COP	Conference of the Parties (to the UNFCCC)
CPA	Component Project Activity
DNA	Designated National Authority
DOE	Designated Operational Entity
GHG	Greenhouse gas
GI-REC	Global Initiative for Resource Efficient Cities (UNEP GI-REC)
MRV	Measurement, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Actions
NMM	New Market-based Mechanism
PDD	Project Design Document
PoA	Programme of Activities
SBCI	Sustainable Buildings and Climate Initiative (UNEP - SBCI)
tCO_2e	Tonne of carbon dioxide equivalent
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

The importance of cities in climate policy refers to the simple reality that they house the majority of the world's population and associated human activities, and that they account for approximately two-thirds of global energy use and **over 75% of energy-related greenhouse gas (GHG) emissions**. This is also true for the buildings sector, which generates up to 30% of all energy-related GHGs. At the same time, cities as well as buildings have a unique and significant emission reduction potential but, in both cases, they often lack the knowledge and financial resources necessary to act.

In the international arena, **climate finance** has become an important means to support GHG emissions mitigation projects and programmes. This being said, existing mechanisms do not specifically target local authorities, cities or building stakeholders and as a result there is a great disparity between the low proportion of climate finance projects and programmes focused on cities and buildings, compared to their GHG mitigation potential.

There is a need to adapt existing and developing mechanisms **to suit the complex built environment** and urban context, whilst building capacity to facilitate the inclusion of climate finance as a means to supporting cities' climate change strategies.

To support this, guidance is needed to help local policy makers and city managers navigate through the key climate finance mechanisms and to understand their relevance to cities and buildings, as part of wider GHG mitigation strategies and a means to access finance to support these.

In response, this Handbook has been prepared to provide local governments and other interested parties with an overview of climate finance mechanisms, both existing and in development, and their relevance to the built environment and the urban context.

The objectives of this Handbook are to help **raise awareness among local stakeholders regarding climate finance and its potential in the built environment**, given the important role that this sector has to play in climate change mitigation. It also aims to help local governments to use climate finance mechanisms as an opportunity to increase the energy performance of their district whilst creating additional revenue, improve resource efficiency and support their wider climate strategies.

Solar water heater project in South Africa implemented by SouthSouthNorth. Photo: Nic Bothma

The **characteristics of carbon and climate finance** are discussed, which, defined very broadly concern the transfer of (usually international) finance and/or other resources from developed to developing countries for climate-related actions. For simplicity, the term 'climate finance' is used throughout this Handbook, to encompass both carbon finance projects and broader climate finance programmes.

It is important to recognise that climate finance is not just about GHG emissions. It should be considered as just part of wider climate change mitigation and adaptation strategies, and as a means to fund both GHG emissions reductions and **important benefits for quality of life and sustainable development**. So cities should be interested in climate finance not just from a climate change perspective but also as an enabling factor for delivering key benefits for their population.

The **International context** to this Handbook includes recent negotiations under the United Nations Framework Convention on Climate Change (UNFCCC), with ambitions to reach a new, legally binding agreement by 2015 for meaningful GHG emission reductions, but against a backdrop of slow progress to date. The role that cities have to play is increasingly being recognised at the international level, and some cities are already showing leadership above and beyond that of national commitments.

The characteristics of cities and buildings from a climate change perspective give rise to both challenges and opportunities. Whilst every city is unique and has a difference GHG emissions profile, the main contributing sectors are generally buildings, transport, waste, industry and electricity production. **Opportunities** for reducing GHG emissions from these sectors often align with broader sustainable development goals, whether through improved living conditions, access to clean energy, a better transport service or more efficient waste management.

Key **challenges** for mitigation range from physical ones – the sheer complexity and diversity of the buildings sector for example – to institutional barriers, such as a lack of integration between national targets and local policy, funding or technical expertise. Accurately measuring GHG emissions (and other indicators) can also pose significant challenges, particularly where limited data is available and a lack of consistency in approaches hinders comparisons. Considerable efforts are however underway to provide the **tools and methodologies** to set robust baselines, track progress and provide the information necessary to engage in climate finance mechanisms.

Indeed, '**Measurement, Reporting and Verification'** (MRV) of GHG mitigation activities is a crucial aspect of climate finance, to ensure the transparency of funding received, of the claimed emissions reductions and to demonstrate that they are additional to what would have been achieved otherwise.

Key principles of MRV are set out in this Handbook along with particular considerations for the urban context (such as conducting a citywide GHG inventory), whilst signposting readers onto more detailed guidance linked to specific climate finance mechanisms.

The key **carbon and climate finance mechanisms** are described, and their relevance to the urban context considered - beginning with an overview of the **Clean Development Mechanism** (CDM) in its various forms. The order in which the various mechanisms are addressed reflects a transition that is underway to move from the established individual, large scale CDM projects, towards small scale projects encouraging more widespread participation and which can now be brought together under one umbrella **Programme of Activities** (PoA) – and potentially on a multi-sector citywide scale.

The involvement of developing countries is being encouraged more strongly through **Nationally Appropriate Mitigation Actions** (NAMAs), in which carbon finance may be integrated with climate change policy and targets and broader sustainable development goals. Discussions are also underway for a **New Market-based Mechanism** (NMM) – to be determined in the coming year, to encourage GHG mitigation across broad sectors of the economy in a bid to increase its cost-effectiveness and uptake in both developed and developing countries.

Relevant case studies are show-cased throughout this document, in order to demonstrate and share experience from implementing GHG mitigation projects using climate finance and developing associated tools from around the world.

This Handbook can be accessed online at: www.unep.org/publications

Kuala Lumpur, Malaysia. Photo: ENERGIES 2050

1 Introduction – what, for whom and why?

1.1 What is this Handbook?

This **Handbook** provides stakeholders from local government and other interested parties with an overview of climate and carbon finance mechanisms (both existing and in development), and their relevance to the urban context. It has been prepared in response to a recognised need for a user-friendly guide to such mechanisms, given their potential to help reduce greenhouse gas (GHG) emissions from cities and buildings, particularly in developing countries, whilst generating income and other sustainable development benefits.

…and what is it not?

The authors of this Handbook do not wish to reinvent the wheel or provide in-depth technical guidance on climate and carbon finance mechanisms, but rather to gather together and give a practical overview of understanding on these subjects, within the context of cities and buildings, and the associated challenges and opportunities. As such, the Handbook gives an introduction to the topic while signposting readers to relevant resources and initiatives, and highlighting good practice examples through a range of case studies.

Objectives

This Handbook aims to help **raise awareness among local stakeholders regarding climate finance and its potential in the built environment**, given the important role that this sector has to play in climate change mitigation. It also aims to help local governments to use climate finance mechanisms as an opportunity to increase the energy performance of their district whilst creating additional revenue, improving resource efficiency and supporting their wider climate strategies. This is one of the first Handbooks on the topic exclusively dedicated to context of cities and buildings.

Structure

Chapter 2 introduces the international context to climate change mitigation, key challenges and opportunities for cities and buildings, and some relevant tools to support climate finance in this context.

Chapter 3 explains the principles of 'Measuring, Reporting and Verification' (MRV) and why this is an important consideration for GHG mitigation activities.

Building on these context-based sections, **Chapter 4** goes onto describe climate and carbon finance and the key mechanisms for these – with a focus on their application in cities and buildings. Relevant **case studies** are included throughout to demonstrate and share experience of developing or supporting GHG mitigation projects using climate and carbon finance.

1.2 Who is it for?

This Handbook has been produced for, among others: **policy makers from local and other sub-national government particularly in developing countries**; city managers and community leaders; managers of large building portfolios; private sector investors interested in urban climate finance; and organisations and industry interested in supporting or coordinating urban climate finance projects.

It is widely recognised that the greatest investment in climate change mitigation efforts occurs, directly or indirectly, at the sub-national level, highlighting the importance of engaging local and regional governments in achieving national GHG emission reduction targets and in translating national climate strategies into local policy and action on the ground (1).

1.3 Why cities and buildings?

> ***"Cities are where the Climate Change battle will be won or lost over the next decades"***
>
> *Marco Scuriatti, Senior Operations Officer at the World Bank, 2011*[1]

Cities have a crucial role to play in the fight against climate change, both because they generate around 75% of global GHG emissions and because of their great potential to reduce these emissions through local policy and action. Local governments have a greater understanding of – and influence on – local realities and constraints. Even if by nature each local government can only act locally, the accumulated impact can be significant when they act collectively on the same issue – contributing to global efforts to address climate change and complementing the efforts of national governments. (2)

Decisions made in cities now can have long-standing impacts on future GHG emissions trends; for example new infrastructure and buildings, depending on their design, could either "lock in" unsustainable energy consumption over their lifetime, or deliver net climate benefits (3).

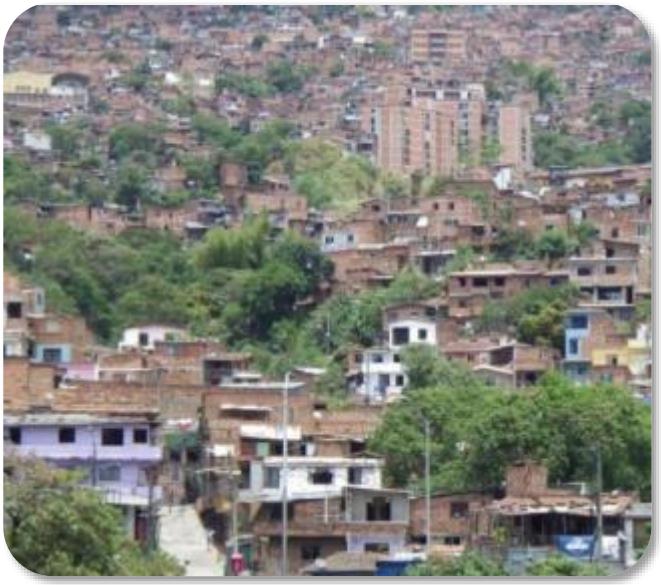
Buildings – in cities and elsewhere – represent a key area for focusing climate change mitigation. They account for approximately 40% of global energy consumption, which in turn generates around 30% of all energy-related GHG emissions. Current trends in population growth and urbanisation will lead to a significant need for new buildings in a very short period, with an additional two billion urban inhabitants expected by 2030. Such growth will bring with it a rise in energy consumption and associated GHG emissions – and not just from residential buildings but also the commercial and industrial developments that accompany them.

Considerable opportunities exist to realize significant gains in energy efficiency and implement low carbon strategies in our cities. The building sector in particular has some of the greatest untapped potential for reducing GHG emissions and at least cost. In order to make the most of these opportunities, governments and industry must be mobilized to put meaningful and effective projects and policies in place.

1.4 What are climate and carbon finance?

Climate finance concerns any financing that is tied specifically to projects and programmes for climate change mitigation (reduction of GHG emissions) or adaptation (actions to minimise the effects caused by climate change). The term is used very broadly and lacks a precise definition, but in the international context it infers the transfer of finance (and/or other resources) from developed to developing countries for climate-related actions.

Carbon finance more specifically concerns resources provided to projects generating GHG emission reductions, often in the form of 'offsetting' mechanisms. This generally involves the sale of 'carbon credits' to actors in developed countries to help reach their emissions reduction obligations by supporting mitigation projects in developing countries.[2] Action supported by such finance must account for measurable, reportable, verifiable GHG emission reduction in the host country.



Medellin, Colombia. Photo: ENERGIES 2050

[1] From World Bank Institute: *WBI Global Dialogues on Climate Change: Scaling up Mitigation Actions in Cities*. Article online: http://wbi.worldbank.org/wbi/stories/wbi-global-dialogues-climate-change-scaling-mitigation-actions-cities [accessed 22.10.13]
[2] World Bank Carbon Finance Unit: https://wbcarbonfinance.org/Router.cfm?Page=Glossary&ItemID=24686

Crucially, the GHG emission reductions supported by climate or carbon finance must be demonstrated as **additional** to what would have otherwise been achieved under a business-as-usual scenario.

For the host country, these mechanisms are a way of providing access to finance to support GHG mitigation activities and deliver other sustainable development benefits. Some examples of the kind of activities that may be supported by climate or carbon in the urban environment include the following:

- Improving energy efficiency in buildings (e.g. insulation, low-energy lighting)
- Switching to renewable energy (e.g. installing solar water heating to replace fossil fuel alternatives)
- Improving the efficiency of domestic fuel use (e.g. for cooking, by replacing traditional stoves/fires with more fuel efficient cook stoves)
- Moving public transportation (e.g. buses) to low emissions vehicles
- Reducing GHG emissions from landfill sites (e.g. by composting organic waste; capturing methane for generating power).

It should be emphasised here that ***climate and carbon finance are not just about carbon***. They should be considered as just part of wider climate change mitigation and adaptation strategies, and as a means to fund both GHG emissions reductions and **important benefits for quality of life and sustainable development** (e.g. air quality and health, poverty reduction, access to energy, education, transport services, economic growth). Indeed, such factors are likely to be more pressing at the local scale.

So cities should be interested in climate and carbon finance not just from a climate change perspective but also as an enabling factor for simultaneously implementing other priority plans and policies, to deliver key benefits for their population and sustainable development goals.

Throughout this Handbook, the term 'climate finance' is used for simplicity, to encompass both carbon finance projects and broader climate finance programmes.

Alexandria, Egypt. Photo: ENERGIES 2050

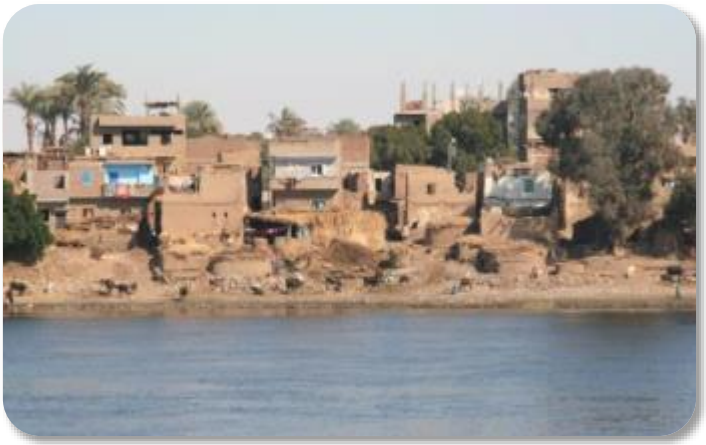
1.5 Case studies in this Handbook

The following **case studies** are included in this Handbook, to share learning from existing projects that are implementing carbon and climate finance mechanisms and/or developing methodologies to support them.

Table 1-1 ***Overview of case studies presented in this Handbook***

Case study	Chapter	Summary
- Gwangju City Carbon Banking System – incentivising energy conservation in households	2 – Cities, buildings and climate change	Carbon finance scheme in Gwangju City which grants 'carbon points' with a cash value to households for reducing electricity, gas and drinking water consumption.
- UNEP-SBCI's Common Carbon Metric – establishing GHG emissions baselines for buildings	2 – Cities, buildings and climate change	Tool and protocol developed as a consistent methodology for measuring and reporting buildings' climate impact and to help meet MRV requirements.
- The Francophonie's Initiative for Sustainable Cities - developing a systematic approach for implementing sustainable urban strategies	2 – Cities, buildings and climate change	Developing a systematic, adaptable approach for sustainable urban strategies across cities to drive consistency and replicate good practice.
– Developing climate finance in the building sector that meets MRV requirements	3 - MRV	Project supporting the development of NAMA opportunities in the building sector in four Asian countries along with a suitable MRV methodology that could be replicated elsewhere.
- Developing a toolkit of urban CDM methodologies	4 – Overview of the CDM	Highlights the CDM methodologies with the highest "applicability" in the urban context and proposes improvements to facilitate their implementation
- Large scale CDM in the transport sector - TransMilenio bus rapid transit system, Bogotá, Colombia	4.1 – Large Scale CDM	State-of-the-art traffic management system providing sustainable, efficient mass urban transport - registered with the CDM since 2006 and provided the model for the Bus Rapid Transit CDM methodology.
- Large scale CDM in the waste sector - Bandeirantes Landfill Gas to Energy Project, São Paulo	4.1 - Large Scale CDM	Largest landfill gas recuperation plant in the world, generating power from the methane released by municipal solid waste. Had generated more than US$ 35.5 million in CER credits through the CDM by 2008
- Combining several scale CDM methodologies – the Kuyasa low-cost urban housing energy upgrade project, South Africa	4.2 – Small Scale CDM	Project improving the thermal performance of low income homes near Cape Town, through the application of three small scale CDM methodologies in combination.
- PoA in the waste sector: Uganda Municipal Waste Compost Programme	4.2 – PoA	PoA for reducing methane emissions from landfills by composting the organic waste component. Coordinated at the national level and implemented by several local governments.

Case study	Chapter	Summary
- PoAs for solar water heating – experience from Tunisia and South Africa	4.3 - PoA	PoAs focussing on the widespread installation of solar water heaters in households – one is driven by the public sector (the Tunisian National Agency for Energy Conservation) while the other has a private company as project owner (the Solar Academy of Sub-Saharan Africa is project owner).
- Mexico's Sustainable Housing Project - Combining CDM methodologies in a nationwide PoA	4.4 - Citywide PoA	Nationwide PoA providing subsidies and other financial assistance for the purchase of energy efficient new homes in many cities. Now evolving into part of a NAMA.
– The Gwangju Low Carbon Green City Approach	4.4 – Citywide PoA	Testing a citywide carbon reduction strategy which would integrate climate finance with wider urban planning through a network of CDM projects across city sectors using different technologies.
- Tunisia's NAMA for energy efficiency measures in the building sector	4.5 - NAMA	NAMA align with the national energy strategy aiming to reduce fossil fuel based energy consumption in buildings by offering a 'menu' of energy conservation options to homeowners.
- Engaging sub-national government in NAMA design, in Indonesia and South Africa	4.5 - NAMA	Two pilots under the v-NAMA programme to develop a practical approach for integrating multiple levels of government in NAMA design and implementation – one focussing on energy efficiency in public buildings in South Africa, the other on the solid waste management sector in Indonesia.
- A city scale cap-and trade emissions programme to drive energy efficiency in buildings, Tokyo	4.6 - NMM	A sectoral market-based approach to driving energy efficiency in large buildings and to encourage low-carbon construction for new ones, through a city scale emissions cap-and-trade system.



Buildings on the banks of the River Nile, Egypt. Photo: ENERGIES 2050

2 Cities and buildings in the climate change context

Cities and buildings have a unique and significant potential to reduce energy consumption and GHG emissions, but they often lack the financial resources and methodologies to implement this. As such, climate finance has become an important means and approach for supporting GHG mitigation activities and has potential to help realise projects in the urban context.

In this chapter, a brief look is taken at the international context which is driving climate finance mechanisms. Some of the generic challenges and opportunities are considered for cities and buildings when it comes to GHG mitigation. Finally, some tools and methodologies are presented which are being developed to support climate finance in the built environment through the measurement of GHG emissions and mitigation.

2.1 The international context

The latest assessment report of the Intergovernmental Panel on Climate Change (IPCC) highlighted the **unprecedented warming of our climate and the urgent need for action** to mitigate climate change and its effects. Despite efforts so far, there remains a considerable gap between the ambition of international commitments to reduce emissions, and that needed to limit global warming to 2°C, the widely accepted threshold to avoid dangerous climate change.[3]

Photo: ENERGIES 2050

Given this context, it is useful to consider the recent **international climate change negotiations** of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). This not only indicates the current status of the international climate agenda, but also provides the background to developments in the climate finance mechanisms described in this Handbook.

The UNFCCC is an international treaty produced at the 1992 'Earth Summit' in Rio de Janeiro (the United Nations Conference on Environment and Development), with the aim of cooperating to limit global warming and its effects. The convention was strengthened by the Kyoto Protocol, adopted in 1997, which gives developed countries legally binding targets for GHG emissions reduction, and which has driven the development of climate finance mechanisms.[4] At negotiations in Durban 2011, with the first commitment period of the Kyoto Protocol due to end in 2012 with poor results, an agreement was reached to continue the second commitment period to 2020 and to launch a new platform of negotiations for a post-2020 agreement.

Photo: ENERGIES 2050

UNFCCC negotiations have since been held at Doha in 2012 (COP18) and Warsaw in 2013 (COP19). Some key outcomes include the reconfirmation of the official objective to **limit global warming to 2°C** and that another agreement of legal force on an international target for GHG emissions reduction must be reached by 2015, for implementation by 2020 by all Parties. Elements of this agreement were further explored at the Bonn Climate Change Conference in June 2014. However, the negotiations have overall been subject to many delays in reaching a consensus on meaningful actions, and **a breakthrough in securing a global climate deal is yet to be reached**. Given this context, there is a clear role to play from "bottom up" approaches, and many local governments are taking the lead. For example, the world's megacities are implementing measurable actions on climate change through the C40 Cities Climate Leadership Group network, founded in 2005 and now with 67 affiliated cities.[5]

[3] IPCC Fifth Assessment Report: https://www.ipcc.ch/report/ar5/index.shtml
[4] For further background see UNFCCC web site: http://unfccc.int/essential_background/items/6031.php
[5] C40 Climate Leadership Group, including case studies of actions underway: www.c40.org

While the UNFCCC negotiations are held between State-level representatives, the role of cities and local governments is increasingly being recognised, both in the text of decisions on the implementation of climate change mitigation and through participation at side events at the negotiations. At the 2013 COP in Warsaw, the first **Cities Day** was held as an official side event, directing the spotlight to local and sub-national governments and demonstrating the growing recognition of cities as key actors in the global climate agenda.

The run up to the 2015 COP (at which the new climate agreement is to be reached) is an important time for local governments and other actors in cities and the buildings sector to engage, and to push for the new agreement to recognise their important role in climate change mitigation and to include provisions for climate finance mechanisms that are suited to the urban context.

2.2 Challenges

Cities may account for less than 4% of the Earth's surface but they house 51% of the world's population and this figure is expected to reach 75% of the population by 2050. Every week, the urban population increases by about one million inhabitants and more than half of these "newcomers" live in urban slums. As such, the growing cities of developing countries are expected to contribute to the majority of the predicted increase in urban GHG emissions over the coming years (4).

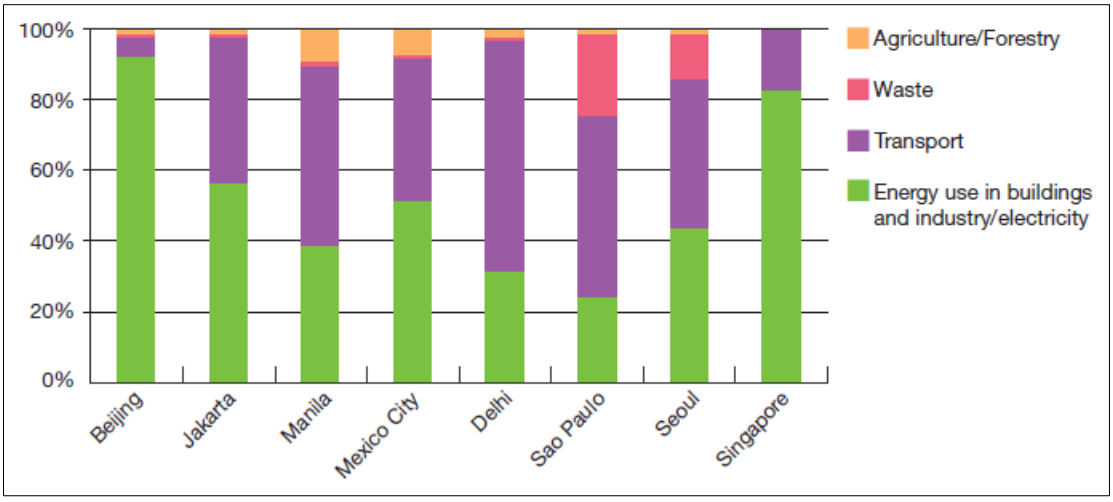
However, despite this important role that cities play in climate change, they are so far underrepresented among climate finance projects. This is partly due to a lack of capacity among key actors such as local governments but also because climate finance mechanisms have not, until recently, attempted to cater for the complexities of the urban environment.

Cities – each unique but facing the same challenges

Just as characteristics such as appearance, economy and population vary greatly from one city to another, so does the GHG emissions profile – that is, the relative contribution from different sources and sectors to the city's total GHG emissions. This is influenced by factors such as size, density, location, layout, urban planning (historical and current), economic activity and the type of electricity production (which may be within or outside of city boundaries). Figure 2.1 shows how the GHG emissions profile varies for a selection of cities, showing the contribution from each of the key sectors.

Given the complex and varied nature of cities, with their multiple, interrelated sectors and many different actors involved in their use and management, the approach taken to GHG mitigation must be adapted on a case by case basis. Very importantly, it should also be integrated with other key elements of urban planning such as public transport, waste management, public works or housing provision.

Figure 2.1 ***GHG emissions source profiles for selected cities by key sectors***



Source: UNEP & Gwangju City (3)

Barriers for sub-national governments

It is crucial to engage sub-national governments (city, municipality, provincial) in the local-level delivery of national plans and targets for GHG mitigation. However, there are common barriers to this, including a lack of financial or political support or incentives; poor integration, communication and coordination between government levels; and a lack of capacity (in terms of resources, skills, information). Among these challenges, institutional issues can present particular barriers to implementing climate finance for local authorities (4), (5), for example:

- GHG emissions mitigation may be considered a responsibility for national government;
- There is often a misalignment between localised, relatively short term priorities / politics of local government and the global, longer term challenge of GHG mitigation;
- Capacity may be limited in areas needed for climate finance;
- Efforts to build and use capacity are often constrained by time and budget;
- Overlaps in responsibilities exist among authorities in certain sectors (e.g. waste management; transport), making climate finance projects more complicated;
- Over-emphasis on delivering co-benefits may not necessarily favour projects with the highest GHG mitigation potential.

Despite such barriers, local authorities are theoretically well-placed to oversee citywide multi-source GHG emission mitigation activities, given their existing infrastructure and local understanding. But faced with permanent budget constraints, a major challenge remains access to funding, since such projects clearly require substantial financial resources to implement. Climate finance could provide a means to access at least part of the necessary funds, particularly where projects deliver revenues through the sale of carbon credits.

Buildings – a complex sector

The building sector is characterized by a variety of building types (public, residential, commercial, industrial etc.) with a large number of technologies for heating, cooling, lighting and a wide range of building materials and techniques. Moreover, this sector involves many different stakeholders and decision-makers, with varying levels of awareness, knowledge and skills.

While the buildings sector usually accounts for a large proportion of a city's GHG emissions, the individual emissions sources (buildings) are multiple, dispersed and often small - or at least there are only a few large emitters (e.g. factories, hospitals) and then many small ones (e.g. houses, small businesses). On the one hand, this offers opportunities for replicating GHG mitigation actions across many sites (e.g. installing solar water heaters on houses). On the other hand, it presents challenges for climate finance, such as project coordination, monitoring GHG emissions, conformance with approved methodologies, and potentially high set-up costs relative to potential earnings from the sale of carbon credits.

City rooftops in Cuba. Photo: ENERGIES 2050

Another issue specific to the buildings sector is that of the 'landlord-tenant dilemma' in which there is a lack of financial incentive for investing in energy efficiency measures in buildings where landlords are not also the occupant and are therefore unlikely to benefit from savings as a result of the improvements.

Buildings are also very much a local phenomena. Buildings reflect local needs, culture, and policy and are defined by their local communities. Many of the issues related to governance of buildings are dealt with at the local or national level. How is a building defined or named? How is it measured? Operated? What are the appropriate rules and regulations for a building's design, use and construction? These are all questions that must be taken into consideration when designing a climate finance project in the building sector.

Despite these challenges, it should be remembered that buildings can be one of the most cost effective and expedient opportunities for GHG mitigation, since proven and often inexpensive technology can deliver significant gains in energy efficiency, with considerable co-benefits (such as improved living conditions).

Data availability

Climate change mitigation activities are often supported by, and of interest to, the broader international community. Therefore, there is a growing need for consistency in data collection and reporting, for transparency in how data is measured and for results to be made available for broader comparison. By encouraging transparency and data sharing, cities and municipalities can support broader efforts and are able to share experience and make comparisons with other cities, building owners and programmes. Furthermore, a transparent approach to data collection allows for the broader engagement of key stakeholders and society as a whole.

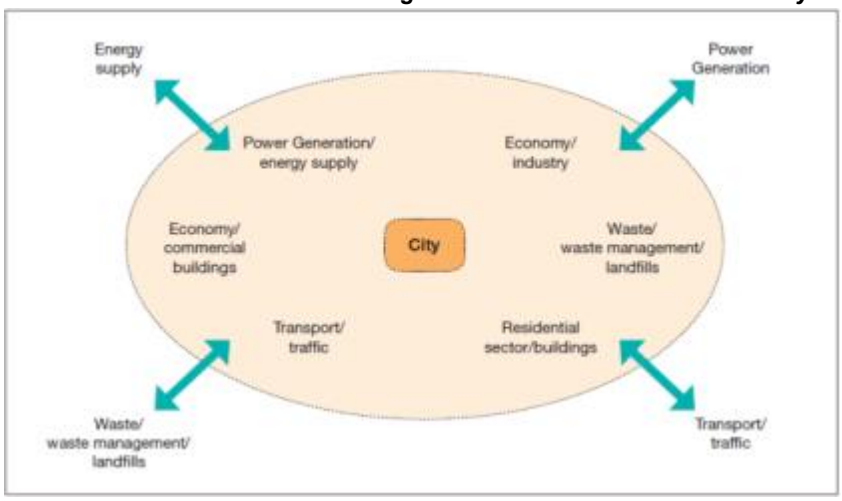
However, a common obstacle to measuring GHG emissions and mitigation is the availability of consistent, robust data. Such data is particularly crucial for climate finance projects as a GHG emission baseline needs to be established and progress against that monitored, in order to determine the GHG emission reductions achieved and the number of carbon credits that can be sold. Reasons for problems with data availability in cities and buildings include the huge number of actors involved, such as landowners, tenants, energy providers and municipal authorities, some of which may consider the energy consumption of their buildings to be sensitive information. Another reason is the lack of a framework for data collection and aggregation on a scale greater than the individual building, although several initiatives are underway to address this challenge – see section 2.4 *Tools and methodologies*.

2.3 Opportunities

Despite the challenges outlined above, it is clear that cities and buildings have an important role to play in climate change mitigation and that they hold great potential to achieve significant GHG emission reduction.

While every city is different, the main GHG emissions sources are usually: **buildings**, **transport**, **waste**, **industry** and **electricity production** (figure 2.2) and so these sectors present the main opportunities for mitigation activities and provide a focus for citywide climate change strategies.

Figure 2.2 ***Typical emissions sources in cities including those that flow in and out of a city's boundaries***



Source: UNEP & Gwangju City (3)

The rapid growth of cities, particularly in the developing world, presents a clear driver for implementing sustainable, low-emissions development within the key sectors highlighted above. Since buildings are already a major contributor to city GHG emissions it is particularly urgent to ensure that the buildings in which urban newcomers will live and work are as energy efficient as possible. In addition, transportation is an important focus area since, without substantial policy changes, it is expected that GHG emissions from this sector will be around 80% higher than current levels by 2030. (4) This presents a motivation not only for climate change mitigation but also to address air quality and its associated health effects.

Transport is the largest GHG source in some cities such as New Delhi, India. Photo: ENERGIES 2050

Examples of opportunities for GHG mitigation within key urban emitting sectors include [adapted from (4)]:

- **Buildings**
  - Energy efficiency measures and renewable energy generation for new and existing buildings
  - Establishing building energy efficiency codes and incentive programmes
  - Mitigating emissions from city-owned estate
  - Building-user behavioural change campaigns
- **Energy (supply and demand)**
  - Energy efficiency and renewable energy generation
  - Street lighting and related services (e.g. installing LEDs and PV)
  - District heating and cooling systems – installation and improvement
  - Policy e.g. planning policy for new development
  - Training of facility managers, with emphasis on monitoring and calibration of building systems to meet (energy, water, etc.) performance targets and end-user needs
- **Transport**
  - Transport planning to increase efficiency of system and reduce distances travelled
  - Replacing GHG-intensive modes of transport with more efficient, lower GHG alternatives (e.g. electric trams, LNG buses, Mass Transit Systems)
  - Regulations such as congestion charges, incentives for car-pooling and other alternatives to individual motorised transport
- **Waste and wastewater**
  - Landfill gas capture for energy generation (methane emissions are the largest source of GHG emissions from solid waste)
  - Mitigation as per the waste hierarchy – reduce (influence production and consumption, set landfill fees), reuse, recycle (provision of necessary facilities, including compost)
  - Wastewater - significant mitigation potential through capture of biogas from treatment plants
- **Water**
  - Reduced energy consumption e.g. for pumping, through improved distribution systems
  - Other water conservation actions e.g. rainwater harvesting, water efficiency in buildings
  - Incorporation of green infrastructure, e.g. green roofs in buildings, landscaping (benefits for both storm water management and energy consumption for cooling)
- **Urban greening/agriculture** (although note long-term horizon of such projects).
  - Urban ecology - can create carbon sinks and provide considerable co-benefits
  - Urban agriculture can reduce transport distances of food and provide food security

The majority of these examples are, or have potential to be, addressed through approved methodologies for climate finance mechanisms. Some of these are highlighted in the case studies presented in this Handbook.

Opportunities for showing leadership

When considering city-scale climate finance, the ability and willingness of local governments to drive the changes that are necessary to facilitate this become crucial; four key approaches that they can take are as follows (4):

- **Self-governing** - reduce their own energy consumption and ecological footprint (e.g. through energy efficiency in municipal buildings, strict sustainability criteria in procurement);
- **Governing by provision** - reduce the carbon footprint of services they provide (e.g. energy services, sewerage and waste management, public transport, street lighting);
- **Governing by authority** - implementing targets and/or standards (e.g. energy efficiency in buildings through planning policy, influencing urban traffic through transport policy and perhaps direct incentives such as congestion charges);
- **Acting as facilitators/enablers** - supporting other stakeholders in GHG mitigation activities (e.g. information provision, subsidising energy audits, supporting private and civil society organisations).

The choice of approach for any given local authority would be influenced not only by GHG mitigation potential/priorities for that city, but by technical capacities and the options available within the context of the country's national climate change strategy. In reality, a combination of the above options is likely and in all cases there are opportunities to show leadership, encourage replication elsewhere and seek the involvement of climate finance. See Case Study 1 for an innovative example from Gwangju City, South Korea.

There is also an important role for **communities**. In the UK for example, building on a growing trend for community action on energy, the Government has recently released a Community Energy Strategy[6], encouraging for example community-led renovation of homes for energy efficiency, community co-operatives and social enterprises for generating sustainable electricity and heat, and awareness raising through energy saving 'drop-ins'. This is to be supported by funding (£10m Urban Community Energy Fund and £80m Green Deal Communities scheme), information and advice, efforts to remove bureaucratic barriers and a commitment from industry to substantially increase shared ownership of renewable energy installations.

Case Study 1 - Gwangju City Carbon Banking System – incentivising energy conservation in households

The ***Carbon Banking System*** (CBS)[7] of Gwangju City, South Korea, is a voluntary carbon finance scheme which grants 'carbon points' with a cash value to households for reducing their consumption of electricity, gas and drinking water. The points can be used for green goods and discounts. It is a collaborative effort between the city government, utility companies, banks and households. The scheme uses the 'Green Card' - a credit card like system for household carbon 'bank accounts'. By 2012, over half of all households in the city were taking part, generating US$ 250,000 in carbon points and 84,000 tCO_2 emission savings (the equivalent of planting 30 million pine trees). By 2020 the aim is for 100% participation and almost 100,000 tCO_2 in emission reductions.

The CBS 'Green card' (UEA/Gwangju City)

Focus on buildings

For policy-makers and city governments the built environment remains a promising area for action. UNEP's Sustainable Buildings and Climate Initiative (UNEP-SBCI) and others have found that, by employing proven and commercially available technologies, energy consumption in both new and existing buildings could be cut by an estimated 30% to 50%, with a potential net profit during the life span of buildings. As the place of work, leisure and domestic life, any policy that aims to improve the energy efficiency of buildings can deliver both cost-savings at the household or building-owner level and improve the quality of life for occupants (6) while yielding benefits such as economic competitiveness, climate resilience and green jobs for the wider community (7).

[6] UK Community Energy Strategy 2014: www.gov.uk/government/publications/community-energy-strategy
[7] CBS further info: http://www.gjsummit.com/sub/sub.php?subKey=06020100&PHPSESSID=c57646198608611d25c74b87f1710eed

2.4 Tools and methodologies

To support the implementation of climate finance projects in cities and buildings, there is an urgent need to spread awareness and build technical capacity among national and local governments and other relevant actors. It is also important to harmonize the metrics and methods used for measuring and reporting GHG emissions from the buildings sector and from cities as a whole in order to set accurate baselines and track performance. As such, several initiatives are underway to address these needs, here a few examples are referred to that may be of direct interest to readers – others are also referred to elsewhere in this Handbook.

Common Carbon Metric (CCM)

The CCM was developed by UNEP-SBCI and partners to help establish GHG emissions baselines for buildings, in response to the need for a standardised approach and harmonized metrics. For context, UNEP-SBCI focuses on global building sustainability and climate change in partnership with multinational corporations, local and national governments, NGOs, and building sector representatives from across the globe. It aims to assist government with accessing finance for sustainable cities and buildings through the development of practical tools and methodologies, such as the CCM presented here in Case Study 2.

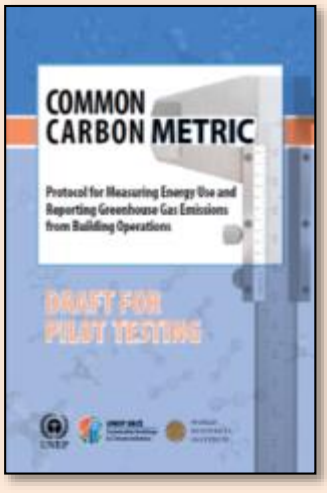
Case Study 2 - UNEP-SBCI's Common Carbon Metric – establishing GHG emissions baselines for buildings

The Common Carbon Metric (CCM) comprises a tool and protocol which have been developed by UNEP's Sustainable Building and Climate Initiative (UNEP-SBCI). It provides a globally consistent methodology for measuring and reporting energy use and GHG emissions from building operations, to help set baselines and track performance. It has been designed specifically to meet requirements for 'measurable, reportable and verifiable' data and thus to be compatible with climate finance. The CCM includes two approaches to measuring energy consumption and GHG emissions:

- "**Top-down**" - high-level data entered for a building stock, city, region etc. (total area, occupants and energy use for each fuel, with an approximate breakdown of each for each broad building type);
- "**Bottom-up**" - more detailed, measured data at the level of an individual building or a representative sample of buildings to validate the results from the top-down approach.

Most of the data is entered on an annual basis. For both approaches, information on the data source and quality must be provided, to ensure transparency.

The CCM measures both energy intensity and carbon intensity, *relative* to building size and/or the number of occupants. Even where the simplified, top-down approach is applied, the CCM soon highlights key areas for focusing GHG emissions reduction activities.



Two pilot phases have been conducted in order to validate and refine the CCM with buildings in several countries. Refinements included developing consensus on key definitions to allow valid comparisons - such as building area, occupancy and building types (a challenging task since such definitions vary widely). Also to account for the impacts of climatic zone on building energy performance, which allows the meaningful comparison of buildings located in different places.

The CCM is being used as the basis for a new ISO standard on measuring the environmental performance of buildings and is already helping to develop NAMAs in the building sector (see case study 4).

Further information: www.unep.org/sbci/activities/ccm_Pilot.asp

International standard for measuring GHG emissions from buildings

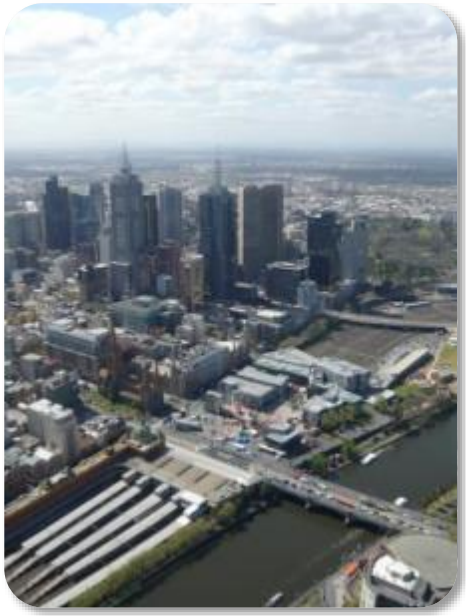
Building on the success of the CCM tool, an International Standard is under development by the International Organization for Standardisation (ISO), in order to provide a fully recognised universal method of measuring GHG emissions from buildings during the operational stage. The standard is using UNEP-SBCI's CCM tool and protocol as a basis and reference and the final version is expected later this year.

Global Protocol for Community Scale GHG Emissions (GPC)

The GPC initiative[8] aims to develop a global framework for accounting and reporting city- and community-scale GHG emissions. This follows the wide success of the Greenhouse Gas Protocol and family of related standards produced by the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD). The GPC is being prepared by WRI in partnership with the C40 Cities climate leadership group and ICLEI. It is hoped that the GPC will help address the need for a single minimum global standardized step-by-step approach to help cities (or project owners in the case of buildings) to quantify their GHG emissions, in order to manage and reduce them. At the time of writing, the GPC pilot version, which covers scope 1, scope 2 and some scope 3 emissions[9], had been tested through a pilot phase in over 30 cities worldwide.[10] The final version is expected by the end of the year, with more detailed guidance on accounting for scope 3 (indirect and upstream) GHG emissions to follow.

Carbonn Cities Climate Registry (cCCR)

The cCCR[11] has been developed by local governments, for local governments. It is a global mechanism that encourages local governments to report regularly and publicly, on their GHG emission reduction commitments, climate change mitigation actions and GHG emission inventories (based on the International Local Government GHG Emissions Analysis Protocol, IEAP). A key objective of the cCCR is to ensure that local climate action is Measurable, Reportable and Verifiable (MRV - see next chapter). Another goal is for data to be consistent with global climate regime standards in order to guarantee the credibility of local climate action on a global level through transparency, accountability and comparability. Participation in the cCCR since its launch in 2010 has increased rapidly, with 414 cities and local governments reporting by October 2013, representing 45 countries and a population of 438 million. By the same date, 770 GHG inventories covering municipal operations and community activities had been conducted and reported. Through the cCCR, these governments have also reported their climate change mitigation commitments, actions and performance, and the majority of commitments are more ambitious than national targets set under the Kyoto Protocol (63% have a GHG reduction ambition of more than 1%/yr).[12]



Melbourne, Australia is engaging with the cCCR, with actions including a programme for energy efficiency for buildings and a 'Carbon Neutral Council'.
Photo: ENERGIES 2050

In the long run, the cCCR intends to act as a *global* mechanism for reporting *local* climate action, by developing synergies with similar systems that exist at the national and regional level. The cCCR also aims to improve local government access to global climate funds thanks to the emphasis on MRV requirements, in particular for the preparation of *Nationally Appropriate Mitigation Action*s (NAMAs) – see section 4.5.

The Francophonie's Initiative for Sustainable Cities

This initiative, presented in Case Study 3, is developing a consistent yet adaptable methodology for implementing sustainable urban strategies, with GHG mitigation and MRV as key elements. This is in response to the huge variability among the different approaches to climate change mitigation in cities so far.

[8] GPC: www.ghgprotocol.org/city-accounting
[9] Refers to the grouping of GHG emission sources: scope 1 - all direct GHG emissions; scope 2 - indirect GHG emissions from purchased electricity, heat or steam; scope 3 - other indirect emissions, such as the extraction and production of purchased materials and fuels, vehicles not owned or controlled by the reporting entity, outsourced activities, waste disposal.
[10] ICLEI update on the GPC 22nd June 2014 : http://www.iclei.org/details/article/global-protocol-for-community-scale-ghg-emissions-gpc-to-enter-public-reviewing-phase.html
[11] cCCR: www.citiesclimateregistry.org
[12] Carbon*n* Cities Climate Registry figures: http://citiesclimateregistry.org/fileadmin/user_upload/cCCR/cCCR_2013/Carbonn-News-November_2013.pdf

Case Study 3 - The Francophonie's Initiative for Sustainable Cities - developing a systematic approach for implementing sustainable urban strategies

The Francophonie's Sustainable Cities Initiative was founded by the Institute of la Francophonie for Sustainable Development (IFDD - Institut de la Francophonie pour le développement durable), subsidiary organ of the International Organisation of la Francophonie (OIF - Organisation Internationale de la Francophonie) and by ENERGIES 2050.

The purpose of this initiative is to develop a systematic approach to implementing sustainable urban strategies by building on existing initiatives and by developing a common language to enable sharing and replicating of good methods and best practices. Indeed, even though cities have different sizes and evolve in various contexts, each of them faces similar barriers when working towards sustainable development.

The Initiative is like building a puzzle (the strategy) in which each piece (component topics and actions) is independent and essential but only useful when connected to the others as part of a planned, optimized and coherent organization. The goal is to provide city actors with concrete solutions and tools for each piece of the puzzle, while including these actions in an overall holistic approach with a long-term vision.

In order to overcome sustainable development challenges with a consistent and comparable but adaptable approach, the Initiative is based on methodologies that are **measurable, reportable and verifiable** – and therefore transparent.

Key activities include:

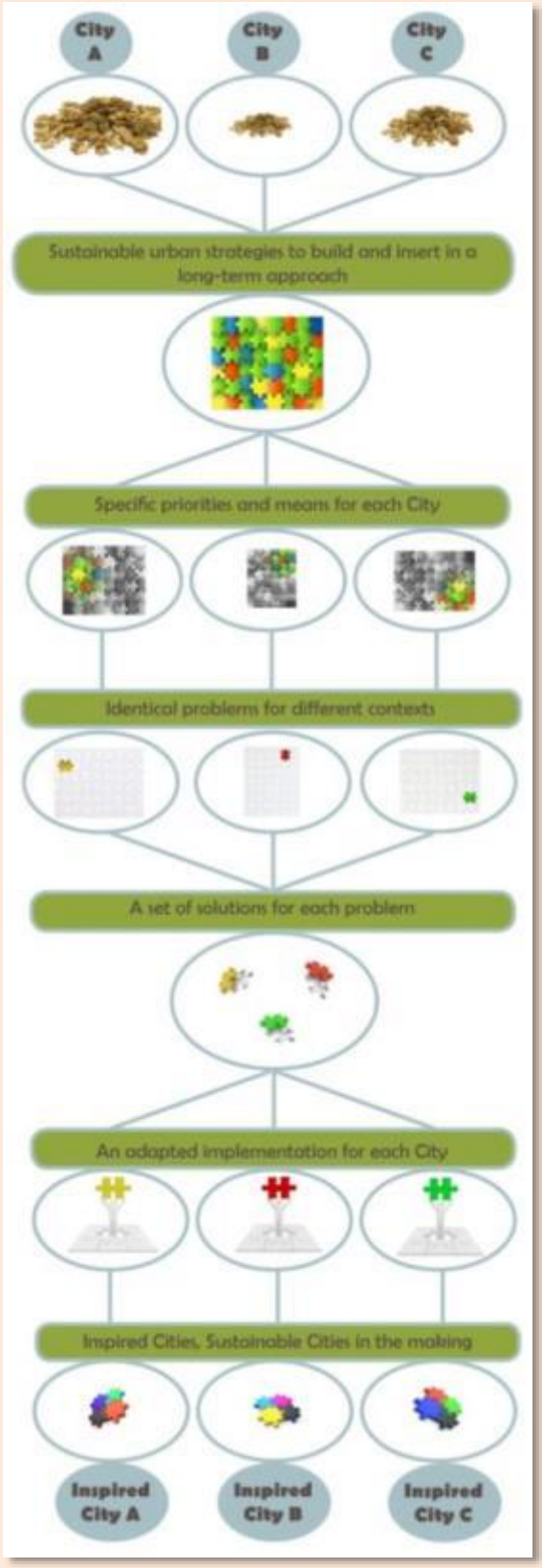
- Building links between cities
- Exchange of best practice among these cities
- Developing an adaptable, consistent approach to sustainable urban strategy
- Implementation of innovative and sustainable concrete solutions that can be replicated elsewhere

The Sustainable Cities Initiative hopes to address the problem that, among the numerous existing approaches for sustainable cities, very few are based on binding agreements or transparent methodologies (e.g. for their GHG inventory), and on which many stakeholders are working but not necessarily together - resulting in inconsistent approaches and competition among actors to access the available funds, which are already insufficient.

As part of the initiative, a training module on energy efficiency has been developed for professionals in the construction and building sector along with urban planners. This is being delivered in 14 Africa Sub Saharan countries, in partnership with the African School of Architecture and Urban professions (EAMAU).

The Initiative is wide-reaching, through both ENERGIES 2050 members and the OIF network which gathers 77 states and governments (54 member states, 3 associated states and 20 observers), which together represent over one-third of the United Nations' member states.

Further information:
www.energies2050.org/nos-projets/initiative-villes-francophones-durables/?lang=en#.U3CMB_mSxJA



Source: ENERGIES 2050 / OIF IFDD (5)

3 MRV – *what is it and why is it important?*

This chapter provides an introduction to the topic of MRV, explaining its importance to climate finance (and other aspects of GHG mitigation) and drawing out issues of particular relevance for cities and buildings. Attention is also given to the subject of conducting GHG emissions inventories for cities, an important first step for implementing and monitoring climate change mitigation at the city scale.

3.1 What is MRV?

MRV stands for **measuring** (or monitoring), **reporting** and **verification**. In the context of climate change this means the series of processes required to calculate a robust GHG emissions baseline (i.e. the amount of GHGs being emitted from a given source) and measure how that changes over time. The three components of MRV can be summarised as follows (8):

- **Measuring (monitoring)** of GHGs emitted, mitigation actions implemented, and the support provided for this mitigation (finance, capacity building and technology) – all within a defined boundary (project, programme, geographical area e.g. a city)
- **Reporting** the results to stakeholders and the international community through transparent disclosure of information on climate activities (e.g. via national communications, project reports)
- **Verification** through independent review of the above information and the methodologies applied to ensure reported information is correct and complete, and as an opportunity to make recommendations for improving the approach taken.

MRV is crucial for all GHG mitigation activities and particularly for climate finance mechanisms, since these require robust *measuring, reporting and verification* of GHG emissions, to demonstrate reductions achieved.

While the approach taken to MRV will vary by country and activity, the key dimensions common to all MRV systems should be as follows (9):

- **Transparency** - key for reporting on progress (both domestic and externally), meeting UNFCCC requirements and building trust among stakeholders
- **Robustness** - how comprehensive an MRV system is will depend on its purpose, the scope of the project and in-country capacity – the most relevant indicators must be monitored and the system progressively improved
- **Feasibility** and **Cost-effectiveness** - a pragmatic balance must be sought between these two factors and the two above (transparency and robustness) since there will often be trade-offs between them and this will also be affected by technical capacity and stakeholder expectations.

However, be aware that an MRV system is not fixed, but can (and should) be changed and improved over time, for example as funding becomes available and technical capacity is improved through training etc.

MRV systems will also vary according to the chosen indicators for a given project, which will be linked to the project's goals and targets. These indicators can be quantitative or qualitative, as appropriate, although the principle indicator in the case of climate finance mechanisms will of course be GHG emissions reduction.

As for all goal-setting activities, it is recommended to apply the SMART principles, which are closely related to those of MRV; they also help to determine the indicators to be measured. The SMART principles are: **S**pecific, **M**easurable, **A**chievable, **R**elevant and **T**imely.

It should be emphasised that MRV is more than just data collection – it encompasses the whole system from measurement of the given indicators (i.e. data collection, monitoring and management), the disclosure of this information (how, when, to whom?) and the checking process to ensure the data and methods used are robust and transparent (e.g. data sources are clear).

3.2 Why is MRV important for climate finance?

MRV of GHG emissions data to an acceptable standard is a key pillar of the international climate regime overseen by the UNFCCC and Kyoto Protocol. It is essential for tracking progress of countries towards the binding carbon reduction commitments they have made, and to monitor worldwide progress towards limiting global warming to 2°C.

Indeed, MRV has a role to play from the international and national scale right the way down to citywide programmes, individual projects and even single buildings. In addition, it is not just important from an operational perspective but also for building confidence and transparency among those involved in the international climate regime (governments, funders, buyers and sellers of carbon credits etc.) and those observing it. For example, a robust MRV system allows fair comparisons to be made between projects and countries, and can support national (and sub-national) planning and decision making. (8)

For climate finance mechanisms, MRV is vital for providing the reliable data needed to track the actions and impacts of a GHG mitigation project and to inform the generation of carbon credits as a result. Throughout the next chapter of this Handbook, in which different types of climate finance mechanism are described, considerations regarding MRV will be drawn out. For readers wishing to find further guidance on MRV for climate finance, a selection of relevant publications is shown in the table below.

Table 3-1 ***Selected publications providing advice on MRV both generally and for specific types of climate finance***

Guidance on MRV for climate finance
While there is not one single reference for developing an MRV system, guidance has been produced with reference to specific climate finance mechanisms (see the next chapter for a description of the different mechanisms). Here is a selection of recent resources: • ***CDM Rulebook*** (Baker & McKenzie - online facility providing specific guidance on the various Clean Development Mechanism types, including the in-built requirements for MRV – see monitoring and verification sections in particular)[13] • ***MRV Manual for CDM Programme of Activities*** (KFW Bankengruppe PoA Support Centre, September 2013)[14] • ***The Handbook for Programmes of Activities: Practical Guidance to Successful Implementation*** (Climate Focus, 2013 – in particular, section 3.10)[15] • ***Sampling Manual: A guide to sampling under the CDM with special focus to PoAs*** (KFW, 2012)[16] • ***Measuring, Reporting, Verifying: A Primer on MRV for Nationally Appropriate Mitigation Actions*** (UNEP Risoe Centre, March 2012)[17] • ***Measuring, Reporting and Verifying Nationally Appropriate Mitigation Actions: Reflecting experiences under the Mitigation Momentum Project*** (Mitigation Momentum, 2013)[18] • ***MRV of NAMAs: Guidance for selecting sustainable development indicators*** (Center for Clean Air Policy (CCAP), October 2012)[19] • ***One Hundred Questions and Answers about MRV in Developing Countries*** (IGES, 2014 – this has been updated in light of the COP 19 negotiations. Section 4.4 sets out the 'what and how' of city GHG inventories)[20] • ***Global Good Practice Analysis*** (Mitigation Partnership and UNDP capacity Building Programme - documents mitigation-related good practice worldwide, including development of MRV systems)[21] *Note: **CDM** stands for Clean Development Mechanism, which currently encompasses the main carbon finance mechanisms, initiated under the Kyoto Protocol – see chapter 4.*

[13] CDM Rulebook: www.cdmrulebook.org/
[14] KFW: www.kfw-entwicklungsbank.de/PDF/Entwicklungsfinanzierung/Umwelt-und-Klima/Klimaschutzfonds/PDF-Dokumente-Klimaschutzfonds/MRV-Manual-for-CDM-PoA.pdf
[15] Climate Focus: www.climatefocus.com/documents/handbook_for_programme_of_activities_2nd_edition
[16] KFW : https://www.kfw-entwicklungsbank.de/migration/Entwicklungsbank-Startseite/Entwicklungsfinanzierung/Umwelt-und-Klima/Klima%C2%ADschutzfonds/PDF-Dokumente-Klimaschutzfonds/Perspectives_Sampling_Manual_Apr_2012.pdf.pdf
[17] UNEP Risoe Centre: www.uneprisoe.org/PUBLICATIONS
[18] Mitigation Momentum: www.mitigationmomentum.org/downloads/Mitigation_Momentum_MRV_Paper_JUNI2013.pdf

Waste composition is sampled to improve accuracy of GHG emission calculations as part of the MRV system of the v-NAMA project in Indonesia, coordinated by GIZ (see 4.5). Photo: V-NAMA Indonesia

MRV is more than just an approach for collecting and managing information; it is important for supporting mitigation activities (e.g. establishing baselines, gaining support and demonstrating results to funders etc.), and should indeed be considered as a support tool rather than a burden. (9) Importantly, it should not be considered as something to tag onto a project, but rather a system that should be established from the outset and which plays a part in most, if not all, project stages. Similarly, there are opportunities to learn from and feed into similar systems already in place, for example monitoring of energy consumption in buildings for financial purposes, or existing efforts to calculate emissions from a city as part of a wider climate change strategy.

Currently there are considerable gaps in the quality and completeness of the GHG emissions data that is collected and shared, particularly among developing countries, where resources and expertise for MRV can often be very limited. There is also a lack of transparent data to track the support received by developing countries for GHG mitigation. Given this context, MRV remains a key topic of discussion and development.

3.3 MRV for cities and buildings

Introducing MRV processes in cities can have benefits both at the national level (by contributing to emissions reporting and mitigation targets) and locally, for supporting climate change strategies and capacity building. Support should ideally be provided to cities from the national level in the form of incentives, MRV policy guidance and support for knowledge exchange between cities etc. However, while considerable progress has been made in establishing *national* GHG inventories (the calculation of GHG emissions, their composition and sources) and climate strategies in many countries, there is often a lack of transfer down to the city scale. (10) On the other hand, even where national support is not forthcoming, there are many examples of cities leading the way themselves. City scale GHG inventories are discussed further below.

Clearly GHG mitigation efforts must be linked to other local policy priorities, to gain acceptance, deliver the maximum benefits and for avoiding conflict and/or duplication of efforts. By training local governments in the principles of MRV and the measurement of GHG emissions (and reductions thereof), there is a clear potential to improve monitoring of urban metrics more generally (e.g. environmental and socio-economic data). This in turn can strengthen a city's capacity to access and attract financial resources based upon consistent and transparent evidence.

With city or sub-national scale MRV systems, communities can also provide an important and cost-effective contribution to monitoring, so long as techniques are appropriate to local context, whilst bringing co-benefits locally such as increased ownership and acceptance of GHG mitigation projects. (10)

As emphasised in the previous chapter, buildings account for a significant proportion of GHG emissions in urban areas and as such are given particular attention in this Handbook. While rapid urbanisation can provide opportunities for low carbon development and climate finance, it presents a considerable challenge for MRV.

Saint Lucia. Photo: ENERGIES 2050

[19] CCAP: http://ccap.org/assets/MRV-of-NAMAs-Guidance-for-Selecting-Sustainable-Development-Indicators_CCAP-Oct-2012.pdf
[20] IGES: www.iges.or.jp/en/climate-energy/mm/201309mrv.html
[21] Global Good Practice Analysis: www.mitigationpartnership.net/gpa

Three particular challenges include: setting systems boundaries (individual buildings, groups of building by type, wider urban environment etc.); establishing a business-as-usual emissions baseline; and satisfying the associated data requirements. Data availability and quality are particularly important topics in the urban environment, as discussed at section 2.2, and this can have significant implications for MRV. Several tools are however available to help address this, such as the Common Carbon Metric, which is already being put into practice for developing climate finance projects in Asia (Case Study 4).

In addition, GHG mitigation in the buildings sector often involves multiple technologies at once, making it complicated to disaggregate emissions reductions achieved by each technology and track the contribution from different funding sources. For example, a climate finance project may choose to apply the "whole building approach" in which opportunities for emission reductions are considered in all aspects of the building (materials, envelope, insulation, flooring, windows, heating/cooling etc.) and the interaction between these and the user. (10) While this can maximise mitigation potential, it inevitably complicates MRV.

Similarly, the MRV processes that are built into the UNFCCC's Clean Development Mechanism (CDM) for carbon finance projects are well established, but up until recently have been very 'single-technology' focused and rather cumbersome for smaller projects such as for buildings. Changes are however underway to allow for multiple technologies within one project and the use of benchmarks for estimating baselines and key parameters – more on this in chapter 4. In short, MRV in the building sector can learn from existing practice, but further work is needed to move from the 'technology' scale (i.e. individual measures implemented) to the whole building…and then onto the city scale.

Case Study 4 – Developing climate finance in the building sector that meets MRV requirements

Through an International Climate Initiative project (supported by the Germany's Federal Ministry of Environment, Nature Conservation, Buildings and Nuclear Safety (BMUB)), UNEP is working with the Building and Construction Authority of Singapore's Centre for Sustainable Buildings (BCA-CSB) and other partners to assist four Asian countries (Indonesia, the Philippines, Thailand and Vietnam) with the development of Nationally Appropriate Mitigation Actions (NAMAs) for the building sector. NAMAs are one of several vehicles for driving low carbon initiatives in the built environment and facilitating access to finance for such actions – see chapter 4.

The project will identify and evaluate opportunities for each country to reduce emissions for the building sector, for development into formal NAMA proposals. It seeks to embed a sector-specific approach within national climate plans and strategies, while supporting this with capacity building activities and a regional support network. A key goal is to develop a MRV methodology for the building sector, to ensure that all NAMA activities and their benefits are measured, reported and verified. The project will also help to put appropriate data collection in place, in order to inform mitigation scenarios, MRV requirements, and more generally to improve in-country data availability and build capacity for reporting in the buildings sector.

UNEP, through its Sustainable Buildings and Climate Initiative (UNEP-SBCI) develops practical tools and guidance for establishing GHG emissions baselines in the built environment, demonstrates these through pilot projects and assists government and industry to implement policies for sustainable cities and buildings. UNEP-SBCI's Common Carbon Metric (CCM – see case study 2) is being further refined through the NAMA project as the basis for a MRV methodology for the building sector. This will provide the participating countries with a tool for the ongoing monitoring of GHG emissions baselines and reductions. Already, Malaysia is using the CCM protocol to support the building component of its Low Carbon Cities Framework, currently in development.

Further information:

www.unep.org/sbci/pdfs/SBCI_NAMA_2pager.pdf

http://mitigationpartnership.net/nama-programme-building-sector-asia

Singapore's Building and Construction Authority is collaborating with UNEP-SBCI on the project. Photo: ENERGIES 2050

3.4 Calculating a city GHG emissions inventory

> ***"To address growing urban GHG emissions it is necessary to understand each city's emission patterns and identify the major sources of emissions as well as reduction opportunities from both direct and indirect sources."***
>
> *GHG Protocol initiative for City and Community GHG Accounting*[22]

Before climate finance can be accessed at the city scale, a GHG inventory must first be established for the city to provide an emissions baseline and to form the basis for ongoing monitoring and forecasting.

A GHG inventory is the calculation of the net GHG emissions from within a given boundary (e.g. a country, a city or a building), over a certain period of time (often a year) based on the emission sources (e.g. energy use in buildings, fuel for vehicles) and the composition of GHGs (e.g. largely carbon dioxide from electricity generation or methane from a landfill site). It may also consider 'carbon sinks' – the GHG emissions removed from the atmosphere by forests within the boundary for example. The two key types of data for a GHG inventory are **activity data** (e.g. the number of units of electricity consumed over the given period) and **emissions factors** - the global warming potential of each GHG emitted (e.g. tonnes of carbon dioxide equivalent per unit of electricity consumed).

At the city scale, the GHG inventory is likely to focus on the key sectors highlighted in the previous chapter: buildings, transport, waste, industry and electricity production. The results can help local government to understand the relative contribution of different sectors and sources and establish a baseline from which to identify priorities for GHG mitigation, set targets and track progress. This can all feed into the formulation of citywide climate change mitigation strategies within which climate finance projects can play a role.

The results of the inventory should be reported to relevant stakeholders (both internal and external, as appropriate) in order to drive action and track progress, and the inventory should be verified (usually by an external third party) – although there are not yet any international standards for this latter phase. The **Carbon*n* Cities Climate Registry** (cCCR) provides a facility for publicly reporting GHG inventory results – see section 2.4 for details.

The GHG inventory for New Delhi, India reported on the cCCR shows the residential sector accounts for a third of all emissions.
Photo: ENERGIES 2050

MRV and GHG inventories

MRV is a very important consideration in the development and use of a city-scale GHG inventory, since the results provide the evidence base on which mitigation strategies are built. As for MRV in general, key principles for a GHG inventory include relevance (closely linked to a city's geopolitical boundary), completeness, consistency, transparency, accuracy and measurability.

It is essential that data regarding the amount, composition and mitigation of cities' GHG emissions is traceable and is calculated using a consistent and robust methodology. However, **data availability** is again a challenge, both in terms of the types of data needed, but also the regularity of collection (generally on an annual basis) and the need for a certain level of quality. Key issues include a lack of regular data collection (often due to cost, priorities), data not being in the public domain, and where data is published it may only be

[22] GHG Protocol for cities: http://www.ghgprotocol.org/city-accounting

available in the native language, potentially making it inaccessible to international support or involvement. Where data gaps exist, these should be identified, and actions put in place to account for them.

Approaches to conducting a city GHG inventory

A range of **methodologies for city GHG inventories** exist and it should therefore be taken into account when making comparisons between cities that the methodology applied will affect the GHG emissions result. Certain aspects that may vary from one footprint to another include: the boundary that is applied (e.g. the 'city' only or wider metropolitan area), whether electricity production is included (particularly where imported) and transport crossing in/out of city boundaries (e.g. commuters).

Despite these variations, a set of common **recommendations for conducting a city GHG inventory** are shown below, based on a comparative study of four leading methodologies[23] and several case studies (11):

- The scope should be clearly defined, including which emissions sources are included and the spatial boundary;
- Including information on activity data (e.g. energy consumption) and the emissions factors applied helps with transparency, verification and understanding of the results;
- Clearly distinguishing between direct, in-boundary emissions and upstream emissions is important, especially as the latter (such as raw materials, goods and services) are often substantial and are increasingly recognised;
- Assessing and reporting data quality is helpful since this often varies within one inventory;
- Precautions should be taken to avoid double counting;
- Using terminologies and definitions that are consistent with national inventories facilitates comparisons and aggregation of results;
- Aggregating local government inventory results helps to maximise mitigation potential & funding opportunities;
- Including knowledge on key characteristics of a city (such as demographics, economy, industries and transport modes etc.), can considerably enhance the understanding and value of the inventory;
- Applying a holistic approach to designing and implementing a GHG inventory helps to encompass the multiple and interrelated sectors (and emissions sources) of a city.

Many cities have now conducted a GHG inventory and set reduction targets but there is currently no consistent global guidance. This hinders fair comparisons between cities and over time, reducing cities' ability to demonstrate the global impact of their collective local actions and secure financing of projects.

To address this problem, as described in the previous chapter, the **Global Protocol for Community Scale GHG Emissions** is under development by WRI to harmonise the approach for city GHG inventories, and local governments are encouraged to watch for the final standard.

Lomé, Togo. Photo: ENERGIES 2050

[23] *The four GHG inventory methodologies compared in the study are:*
ICLEI's Global reporting standard in the International Local Government GHG Emissions Analysis Protocol (LEAP)
Guidance from the European Commission's Covenant of Mayors
International Standard for Reporting GHG Emissions for Cities and Regions from UNEP, UNHABITAT and the World Bank
GHG Regional Inventory Protocol used by the European Network of Metropolitan Regions and Areas

4 Climate finance mechanisms

In this chapter, a range of relevant climate finance mechanisms are described and their relevance to cities and buildings is discussed.

While some of the mechanisms described here (such as large scale CDM) are well established, others are still very much in development (e.g. NAMAs, NMMs). There are opportunities to learn from the experiences of the former, when designing the latter, and to ensure that new mechanisms are better suited to emissions reduction activities in cities and buildings.

Mechanisms covered in this Handbook

For each climate finance mechanism described in the following sections, the same structure is used:

- How it works
- Relevance to cities & buildings
- MRV
- In practice – along with relevant case studies
- Pros and Cons for the urban context

While each mechanism is described in a discrete section, it is recommended to read them in the order presented, since one leads to the other with regard to the ongoing developments in climate finance.

The following table provides an overview of the mechanisms included in this Handbook, including key features of each and some practical examples.

Table 4-1 ***Climate finance mechanisms described in this Handbook***

Mechanism	Key features	Example
Clean Development Mechanism (CDM) - large scale	Offsetting mechanism which allows relatively large projects to generate carbon credits that can be traded, in return for reducing GHG emissions compared to business as usual.	• Bus rapid transit systems • Mass Rapid Transit Projects • Landfill gas capture and power generation
CDM - small scale and bundling	Enables smaller scale GHG mitigation activities to register for the CDM. Several identical projects operating under the same methodology, for the same period of time can be bundled under one registration.	• Solar cookers for households • Energy efficiency measures in households • Introduction of low-emission vehicles
CDM - Programme of Activities (PoA)	A more flexible version of the CDM in which GHG mitigation activities across multiple sites are coordinated under one overarching programme, reducing transaction costs for individual projects.	• Composting of municipal waste for multiple municipalities • Solar water heaters for houses in multiple locations
Citywide PoA	Building on the concept of Programme of Activities (PoA) by extending this to the city scale, incorporating multiple sectors and technologies.	• Emissions reduction across several sectors e.g. waste management, energy in buildings, urban transport
Nationally Appropriate Mitigation Actions (NAMAs)	Policies, programmes and projects that developing countries voluntarily undertake to contribute to GHG emission mitigation.	• National policy to improve building energy efficiency through a combination of actions
The New Market-based Mechanism (NMM)	A new instrument underdevelopment to help enhance the cost-effectiveness of GHG mitigation for both developed and developing countries.	• Yet to be established; examples of city scale emissions cap and trade could provide a model

While earlier on in this Handbook, the terms *climate finance* and *carbon finance* were broadly defined, and the former has been used to cover both cases in this document for simplicity, here it is useful to make some distinctions between the two. The key features (and differences) of each approach with respect to designing mechanisms are shown in the table below, along with which mechanisms covered in this Handbook fall into each category. While this categorisation of the mechanisms is not the most important point, it can be useful for understanding how the mechanisms operate.

Table 4-2 ***Differences between carbon finance mechanisms and climate finance mechanisms.***

Carbon finance	Climate finance
Definition: Any finance that is tied specifically to the reduction in GHG emissions. Any action supported by such finances must directly account for a measurable reduction in carbon, or carbon-equivalent	**Definition:** Any finance that supports mitigation aiming to reduce the contribution to climate change or, in the case of adaptation, provide for resilience in light of climate changes already anticipated
Includes: Certified Emissions Reduction (CER) credits of the CDM programme (large scale, small scale, Programme of Activities - PoA) and several of the voluntary carbon-offsetting programmes	**Includes:** funding for NAMAs, because it is often directed towards new policies or projects that, while aiming to reduce GHG emissions, also aim at broader social goals or improvements in public policy that are not easily measurable in terms of emissions reduction
Application in cities and buildings: Most suited to technology-based solutions in specific sectors, for example through the CDM methodologies for energy efficiency in buildings. For cities, developments are being made that allow for multi-technology, multi-sector PoAs	**Application**: Suitable for supporting policy-based improvements e.g. building codes, skills-training for construction workers and broader strategies such as for waste management or building energy efficiency programmes (which may also include credited aspects)
In combination: Utilising climate finance to support policy-based efforts combined with carbon finance to for technology-based activities will allow an actor to realise greater mitigation and sustainable development benefits overall. Such combinations may be reflected through the NMM, bu this is yet to be fully defined.	

Relevance for cities and buildings

Cities need to address a great number of challenges to reduce their multi-source emissions, both in terms of governance and technical issues – as discussed in section 2.2. Moreover, financial resources are a key issue, due to general permanent budget constraints and other important investment needs.

As indicated earlier, there are however significant opportunities for GHG mitigation in cities and buildings, and climate finance can provide a vehicle for accessing funding to support these activities. By offsetting some of the costs of GHG emission reduction projects, climate finance can offer cities an opportunity to access additional resources and scale up their mitigation efforts.

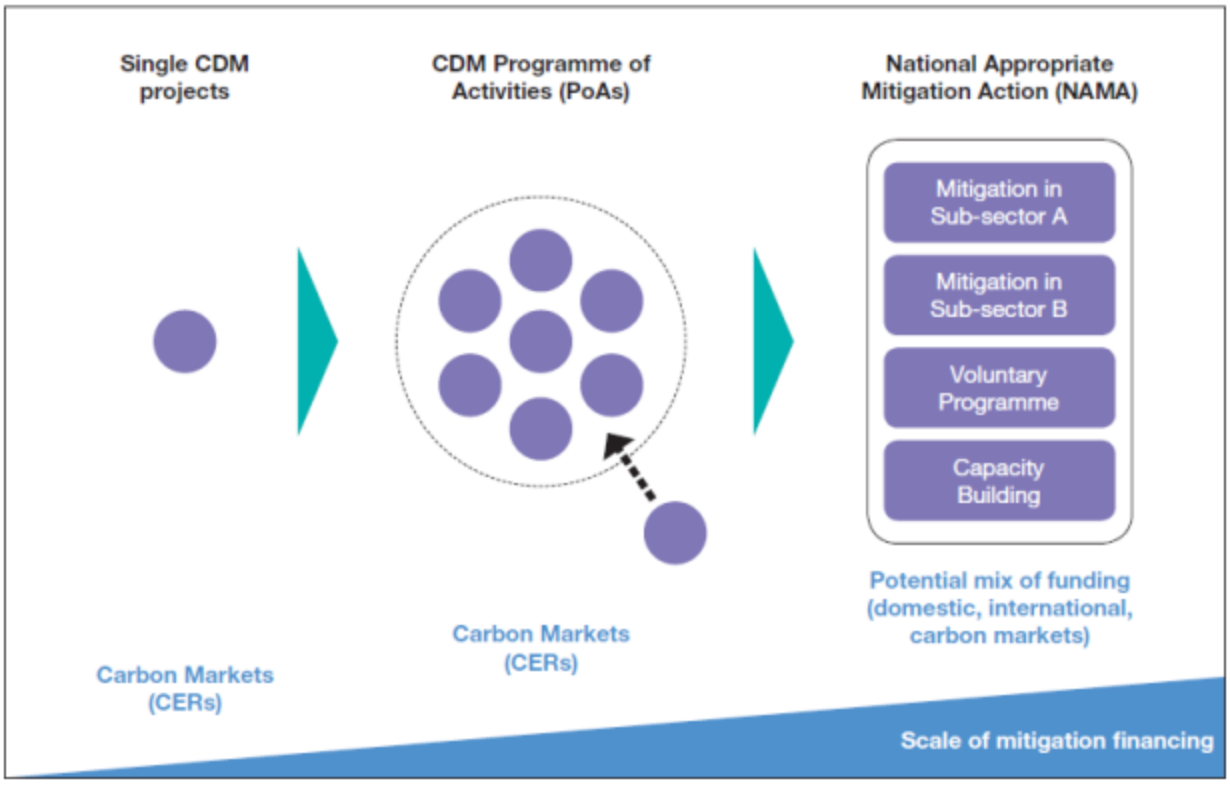
However despite this potential, climate finance projects centred on cities and buildings so far represent a very small proportion of the total accessing markets for trading carbon credits. This is largely because the established climate finance mechanisms do not specifically target local authorities, nor allow for the complexities of the urban context (this is discussed in more detail in the following sections). In addition, the task of attracting international finance may

New Delhi, India. Photo: ENERGIES 2050

be challenging for local authorities, particularly where funds are traditionally received and attributed at the national level. However this is starting to change.

For each of the climate finance mechanisms described in the following sections, the potential for application in the urban context is discussed. On the whole, it is the more recent mechanisms (such as the Programme of Activities and NAMAs) which have the greatest potential for achieving GHG emission reduction in cities. This reflects the transition which is under way to move from the traditional project-by-project approach of the CDM to the creation of more flexible programmes that allow for projects to be replicated across many sites, within different sectors and using a variety of technologies (mitigation measures) and being coordinated by (local) government bodies. This transition is illustrated in the figure below – and should become clearer as the reader progresses through the different climate finance mechanisms discussed in this chapter.

***Figure 4.1** Moving from individual CDM projects using a single technology through to multi-sector, multi-technology mitigation initiatives at the national or citywide scale*



Source: UNEP & Gwangju City (3)

Another important transition is towards, where possible, standardised approaches which shift the burden of methodological challenges to the national level body responsible for climate finance (the Designated National Authority - DNA) and away from project participants in order to facilitate more extensive uptake of carbon finance projects at the grassroots level.

Alongside climate finance, it is important to remember that GHG mitigation activities, particularly in buildings, can be very cost-effective in themselves and deliver significant co-benefits.

From a broader perspective, there is an abundance of different programmes that share many, if not all, of the same end goals as climate finance, but which operate under different labels and levels. From UNDP's Low Carbon Development initiative or APEC's Low Carbon Town, to broader efforts to develop Low-Emission Development plans or Nationally Appropriate Mitigation Actions (NAMAs), these all seek to promote sustainable development and reduce GHG emissions. A Low Carbon Town effort in a given city could easily be considered a NAMA and vice versa. But the important message here is not so much the title of the action but that it *brings about mitigation of GHG emissions*.

Overview of the CDM

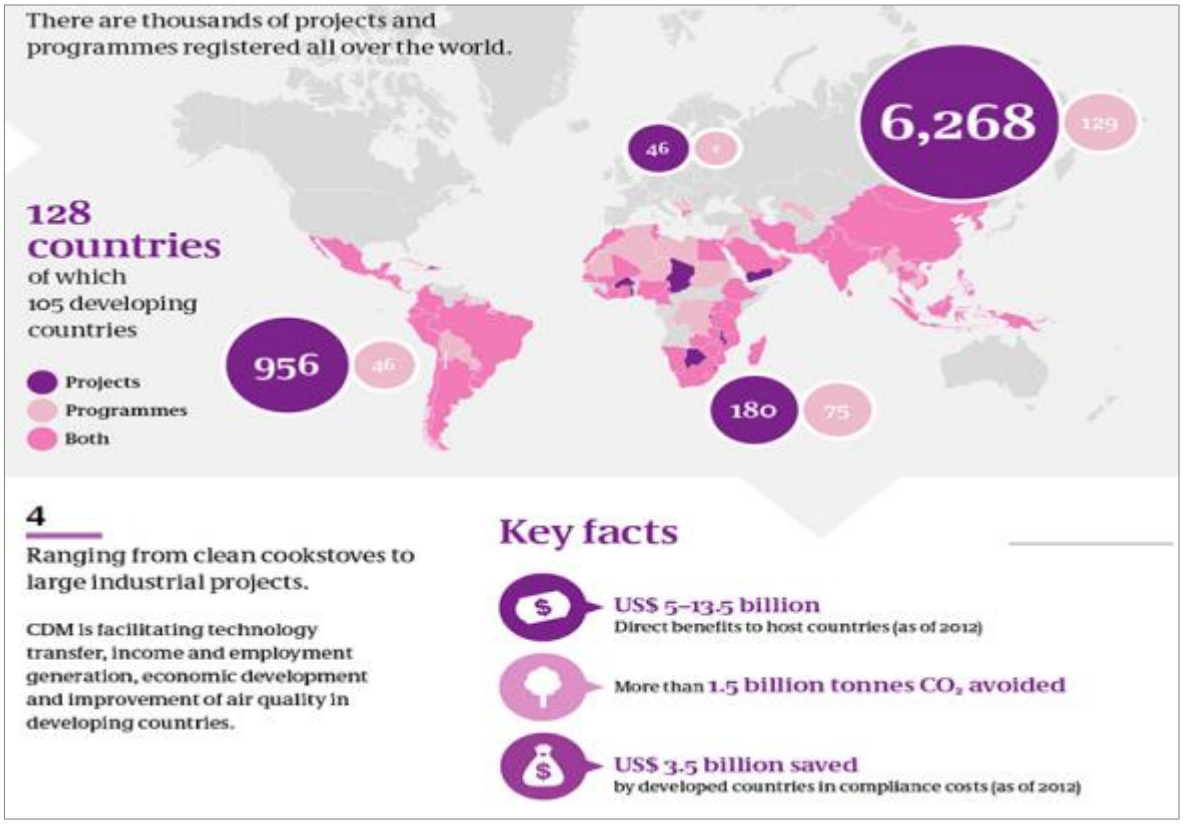
Before moving onto the individual types of climate finance it is useful here to outline the Clean Development Mechanism (CDM)[24], as this provides the framework for several of the mechanisms described here.

The CDM was created under the Kyoto Protocol and is overseen by the CDM Executive Board. The CDM aims to assist developing countries in mitigating their GHG emissions and to support industrialised countries in complying with their binding emission targets. This works through an offsetting mechanism, such that a project in a developing country which reduces GHG emissions compared to the "traditional" alternative (the business as usual scenario) generates Certified Emission Reduction (CER) credits that can be traded with developed countries on the global carbon markets. To ensure the viability of such projects, revenue generated must cover at least part of the incremental costs of the planned activities.

CDM schemes comprise both projects and more recently programmes – by April 2014 there were 7,475 registered projects and 250 registered Programmes of Activities in 105 developing countries.[25] The distribution of CDM projects and programmes is show in figure 4.2. The main forms of CDM so far are as follows - these are each discussed in the following sections:

- Single CDM project - large scale
- Single CDM project - small scale
- Bundle of several small scale CDM projects
- Programme of Activities (PoA) – one programme consisting of several component project activities.

Figure 4.2 ***CDM projects and programmes registered so far around the world***



Source: UNFCCC[26]

All CDM projects must use the dedicated methodologies approved by the CDM Executive Board, of which there are currently 201 active, covering a wide range of emissions reduction project types.[27] Each

[24] Background to the CDM: https://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php
[25] CDM news April 2014: https://cdm.unfccc.int/press/newsroom/latestnews/releases/2014/0407_index.html
[26] CDM Infographic: http://cdm.unfccc.int/CommonImages/infocus_210314.png
[27] For further details of approved CDM methodologies see http://www.cdmpipeline.org/cdm-methodologies.htm

methodology generally describes a particular technology being implemented. The word "technology" is used here in the sense of mitigation activities – whether that be a small scale domestic measure (e.g. solar water heaters, efficient cook stoves) or a large scale project or programme (e.g. a sustainable transportation system, landfill gas capture. The case study below describes a project which has identified those CDM methodologies which are most suitable to the urban environment and proposes improvements to increase their uptake among cities.

Case Study 5 - Developing a toolkit of urban CDM methodologies

The Korean Environment Institute (KEI) is developing a 'toolkit' of the CDM methodologies most suitable for application in the urban context, and proposing improvements to these to facilitate their implementation for cities. KEI reviewed a wide range of CDM methodologies that have been adopted by projects in cities and buildings so far to identify those with the highest applicability to the urban context. The selected methodologies (28 in all) were considered in more detail, and improvements proposed to overcome identified barriers.

The KEI approach sought to retain the strengths of the conventional CDM methodologies (e.g. strictness, impartiality and conservativeness), while simplifying them to increase applicability to the urban context. For example, key obstacles identified include data management, demonstrating additionality and establishing a baseline. These are particularly difficult for city-based projects since they have multiple actors and technologies, in contrast to single CDM projects.

Proposed improvements to the selected methodologies to help overcome these barriers include: adapting the UNFCCC's simplified methods for demonstrating additionality to the urban context; excluding municipal financial aids from additionality demonstration; allowing system-level monitoring i.e. at the level of overall facilities rather than individual installations; allowing multiple small scale methodologies for PoAs (something which is increasingly being adopted – see sections 4.3 and 4.4); providing representative baseline scenarios for the methodologies. The final results are to be brought together in an accessible 'toolkit' for cities

Further information: a project report of the toolkit is to be published, see KEI 2014. For a copy of the toolkit itself, please contact Dr Hyun-Woo Lee: hwlee@kei.re.kr

Guidance for CDM mechanisms and methodologies is provided on the UNFCCC web site[28] at which the consolidated Methodology Booklet can also be found, which provides a helpful, simple summary of each methodology. For newcomers to the CDM, a basic overview of the process can be found, for example, in section 1.2 of a practical guide from the German government's development bank, KFW (12).

The **CDM project cycle** comprises several stages before a project reaches the point at which CERs ('carbon credits') can be issued – see figure 4.3 below.

Key steps in this project cycle include the approval of the project design from both the host country (through the DNA) and from the CDM Executive Board. A project must also go through checks by a Designated Operational Entity (DOE), which is an independent auditor accredited by the CDM Executive Board.[29] It is worth noting that this comprises two checks: the *validation* of a project's feasibility and eligibility for CDM registration; and, following a project's registration and monitoring, the *verification* of whether it has achieved the planned GHG emission reductions and satisfied monitoring requirements - and therefore can be issued with CERs. (13)

Lomé, Togo. Photo: ENERGIRES 2050

[28] Guidance 'Rules and Reference': http://cdm.unfccc.int/Reference and Approved methodologies: http://cdm.unfccc.int/methodologies
[29] About DOEs : http://cdm.unfccc.int/DOE/index.html

As indicated by the project cycle below, progression through the CDM regulatory framework is rather complex. This can pose difficulties for projects in cities and buildings with their multiple, dispersed emissions sources and limited resources. Efforts are however underway to streamline aspects of the project cycle and to introduce standardized baselines and default values to simplify calculations where possible.

Figure 4.3 ***The CDM project cycle***

Another key challenge for CDM is the viability of projects when faced with a low CER credit price, which has fallen to around €0.30 to €0.40 per tCO_2e in 2013/14, compared to over €12 in 2011. This has followed reduced demand from developed countries, driven by the economic recession and slow progress on negotiating future climate change agreements so far. (14) The impact of this on the viability of a given CDM project will depend (among other things) on whether the revenue from selling CERs can still cover the implementation costs for the project activity (abatement cost) and the transaction costs incurred during the CDM process (e.g. producing the project design document, registration and validation fees, monitoring etc.).

For some projects, these costs can become prohibitive when the CER price is low (since the project would need to generate considerable emissions reductions just to cover costs). On a positive note for urban CDM, projects such as energy efficiency in buildings and some renewable energy installations can generally cope with a low CER price since the measures implemented often deliver cost savings in their own right (although smaller initiatives may remain vulnerable to CDM transaction costs). (14) In terms of buyers for CERs, it is also worth noting that the European Union (the biggest source of demand for CDM credits), will now only import CERs for its Emissions Trading Scheme from new projects (registered since 2012) that are in Least Developed Countries.

4.1 CDM large scale

Offsetting mechanism which allows relatively large projects to generate carbon credits that can be traded, in return for reducing GHG emissions compared to business as usual

- Applies a single mitigation activity / technology, in accordance with one approved CDM methodology, generally at one location
- Not particularly well suited to the urban context with its multiple, often small emissions sources, but does have some relevant applications, particularly in the transport and waste sectors

How it works

For an overview of the Clean Development Mechanism (CDM), please see the previous section. A large scale CDM project typically comprises one technology only, which aligns with one of the methodologies approved by the CDM Executive Board.

The project is generally managed by one developer in one location, although for some methodologies there may be numerous users (e.g. households) and/or appliances being implemented (e.g. number of boilers) (3).

As described in the previous section, all CDM projects are overseen by the CDM Executive Board and undergo rigorous processes of validation and verification in order to be registered and issue CERs. The project cycle for large scale CDM is that described in the previous section and in figure 4.3.

Relevance to cities & buildings

Based on the characteristics described above, single large-scale CDM projects have clear limitations for application at the city scale and within the building sector, due to the nature of their emissions sources: multiple, dispersed and often small. Transaction costs are also a challenge, since urban projects tend to have limited set-up funds available, and particularly in the case of buildings, which will generate fewer carbon credits compared to single large-scale installations.

An important aspect (as for all climate finance mechanisms) is the **demonstration of additionality**, that is, that the emissions reductions for which CERs are sold for carbon offsetting are *additional* to any that would have been made under a business-as-usual scenario (i.e. without the revenue from CERs, the projects wouldn't have gone ahead). For the complex urban environment this can be particularly challenging – for example in the case of new buildings or those projects involving a large number of individual end users.

It should be emphasised that, while large scale CDM is not well suited to the majority of urban projects (beyond the larger scale initiatives described below), there is considerable potential to translate the wealth of experience, methodologies and tools associated with it, when developing new CDM (or other) mechanisms targeting the urban environment, rather than starting from scratch.

Over 100 large scale methodologies have been approved[30]. Some examples of relevance to the urban context are as follows – including some that have been approved quite recently[31]:

- Buildings:
  - AM0091 "Energy efficiency technologies and fuel switching in new and existing buildings"
  - AM0105: "Energy efficiency in data centres through dynamic power management"
  - AM0046 "Distribution of efficient light bulbs to households"
  - AM0113 "Distribution of compact fluorescent lamps (CFL) and light-emitting diode (LED) lamps to households"
- Transport:
  - AM0031 "Bus rapid transit projects" – as per Case Study 6
  - ACM0016 "Mass Rapid Transit Projects"

[30] This includes *consolidated* methodologies, which bring together more than one approved or proposed methodologies which have similar characteristics, in effort to keep the methodologies available to participants concise.
[31] See CDM list of approved large scale methodologies: http://cdm.unfccc.int/methodologies/PAmethodologies/approved

  - AM0101 “High speed passenger rail systems”
  - AM0110 “Modal shift in transportation of liquid fuels”
- Utilities and waste:
  - ACM0001 “Flaring or use of landfill gas” – as per Case Study 7
  - AM0020 “Baseline methodology for water pumping efficiency improvements”
  - AM0086 “Installation of zero energy water purifier for safe drinking water application”
  - AM0083 “Avoidance of landfill gas emissions by in-situ aeration of landfills”
  - AM0093 “Avoidance of landfill gas emissions by passive aeration of landfills”
  - AM0112 “Less carbon intensive power generation through continuous reductive distillation of waste”
  - ACM0024 “Natural gas substitution by biogenic methane produced from the anaerobic digestion of organic waste”
  - There are also many methodologies concerning energy generation and distribution industries (both renewable and non-renewable), which are not detailed here.

MRV

Given that large scale CDM is the most established climate finance mechanism, there is a lot of experience and lessons learnt which can, and should, be drawn on for the practical design and implementation of carbon finance projects, the associated challenges and solutions, and in particular the existing capacity for MRV.

The MRV system associated with large scale CDM is an inherent part of the project cycle and the approved methodologies that must be adhered to. This includes requirements for calculating a GHG emissions baseline, estimating *expected* emissions reductions and monitoring *actual* emissions reductions once a project is in place (compared to a business as usual scenario). The results of monitoring must be reported to the CDM registry (where they can by openly consulted) and are subject to third party validation. Official guidance is provided on the CDM web site and associated reference guide ‘CDM Rulebook’.[32]

In practice

There are currently around 4,500 single large-scale CDM projects registered (May 2014).[33] Of these, only a small proportion is operating in the urban environment and/or buildings sector (although quite a lot in the waste sector). Some relevant examples from which specific experience in the urban context could be drawn include two Bus Rapid Transit (BRT) schemes, in Bogota, Colombia “TransMilenio” Phase II - IV (case study 6) and in Chongqing, China lines 1 - 4; a landfill gas capture project for municipal solid waste in Sao Paulo (case study 7), and an energy efficiency project at Masdar City in Abu Dhabi, for new residential, commercial and institutional buildings. For further details on the TransMilenio and Masdar City projects, see the *Feasibility study on an Urban CDM* from UNEP and Gwangju City. (3)

Pros and Cons for the urban context

Pros	Cons
• Well established • Inherent methodologies and MRV provisions • Considerable examples to learn from • Can yield significant GHG emissions reductions, where large scale urban projects are identified	• Resource intensive (transaction costs, technical capacity) - can be prohibitive for smaller projects • The process is time consuming • Considerable reforms needed to suit the multi-source, multi-sector urban context, allowing for a large number of dispersed emissions sources and, multiple technologies • Progress also needed proving additionality in such a complex environment • More methodologies needed for urban projects

[32] CDM guidance: https://cdm.unfccc.int/Reference/Guidclarif/index.html
CDM Rulebook, section on monitoring: www.cdmrulebook.org/115
[33] CDM registry: http://cdm.unfccc.int – another useful reference is the UNEP Risoe CDM Pipeline: www.cdmpipeline.org

Case Study 6 - Large scale CDM in the transport sector - TransMilenio bus rapid transit system, Bogotá, Colombia

The TransMilenio integrated bus rapid transit (BRT) system uses busways, stations and terminals adapted for large-capacity buses, and fare integrated operations with smaller buses in the outskirt areas of the city. The system has been established through a public-private partnership, with the public sector being responsible for the construction and maintenance of the transportation infrastructure and the private partner responsible for the bus fleet, ticket system and service management.

The system was implemented in December 2000. Before the system was in place the existing mass transportation system consisted of various types and capacities of buses with varying fares causing an inefficient transportation landscape with high bus flows; congestion; poor levels of service speed, reliability, comfort and security. In addition, the poorly maintained diesel and gasoline bus fleet resulted in air pollution and noise problems.

The Articulated Bus TransMilenio is an advanced state-of-the-art traffic management system alternative to daily traffic congestion. The system aimed to provide a sustainable, coordinated and efficient mass urban transport system. The bus fleet runs on lanes dedicated to the TransMilenio with fast boarding and ticket services. The fleet is controlled with a centralized system that prevents congestion. Clean vehicle technologies of the BRT system reduce GHG emissions by 40% and provide safer transportation with reduced travel time. The project has been registered with the CDM since 2006 and provided the model for the Bus Rapid Transit CDM methodology. Similar projects have since followed in other cities.

Bogota, Colombia. Photo: Alejandro Navarro

Further information: http://go.worldbank.org/DLIAKK1KZ0

Case Study 7 - Large scale CDM in the waste sector - Bandeirantes Landfill Gas to Energy Project, São Paulo

Population growth in the city of Sao Paulo, Brazil has resulted in increased fossil fuel use and waste generation; in 2004, approximately 950,000 tonnes of methane were emitted by municipal solid waste representing about 1% of Brazil's net GHG emissions that year. Methane is a GHG with 21 times the global warming potential of CO_2.

In response, the City of São Paulo developed the Bandeirantes Landfill Gas to Energy Project to capture methane and using it to produce renewable energy at an on-site power plant – with enough electricity to supply 400,000 inhabitants. As such, a former pollutant is turned into a source of clean energy. By the end of 2012, emission reductions of around 8 million tCO_2 were achieved. The project has also created more than 30 local jobs.

The project is registered as large scale CDM using the methodology ACM0001. CERs are generated based on the avoided GHG emissions from landfill gas capture and clean energy production. By the end of 2008, over 3 million CERs had generated more than US$ 35.5 million in credits. Another 1.42 million CERs for sold on Sao Paulo's Stock Market in early 2012. Revenue is re-invested in the community, for example creating parks to restore vegetation and control floods; building bicycle lanes; environmental education programmes.

The project is run through a public-private partnership between the City and Biogás, the company which operates the landfill and responsibility for the CDM project's financing and registration. An important lesson learnt was that it's important to involve local stakeholders in decision-making from an early stage.

The project has high replication potential as waste disposal is a common challenge and often has a high organic content. The City has replicated the success at another site and shared knowledge with cities such as Mexico City and Lagos.


Sao Paulo, Brazil. Photo: ENERGIRES 2050

Further information:

ICLEI case study "*Turning pollution into profit: the Bandeirantes Landfill Gas to Energy Project, Sao Paulo, Brazil*":
www.iclei.org/fileadmin/PUBLICATIONS/Case_Studies/ICLEI_cs_107_Sao_Paulo_2009.pdf
This case study is an abridged and authorized version of ICLEI Case Study No. 107. Please cite as per (15)

4.2 CDM small scale and bundling

Enables smaller scale GHG mitigation activities to register for the CDM

- Allows only those activities up to a certain threshold to register as CDM projects, using specially adapted small scale methodologies
- Better suited to urban projects such as energy efficiency in buildings
- Several identical projects operating under the same methodology, for the same period of time can be bundled under one registration

How it works

Small scale CDM was introduced to encourage the participation of GHG mitigation activities not suited to or viable under the requirements and costs of large scale CDM. Since it is limited to smaller scale operations, projects must not exceed certain **eligibility thresholds** which are set according to the nature of the project. These are: renewable energy generation up to 15MW output capacity, reduction in energy consumption compared to business as usual up to 60 GWh/yr, or GHG emissions reductions compared to business as usual up to 60 $ktCO_2$ equivalent/yr.[34]

As well as certain simplified requirements (see MRV below) another advantage of small scale methodologies is the ability to **bundle** a group of identical projects together. Bundling is defined as "*bringing together of several small-scale CDM project activities, to form a single CDM project activity or portfolio without the loss of distinctive characteristics of each project activity*".[35] As such, the bundle of projects shares one project design document, undergoes one validation and certification together, and has one overall monitoring plan (which uses sampling).

The bundling approach can achieve economies of scale, helping make otherwise unviable projects possible and indeed increase their chances of success through the associated support and learning network that could be delivered through coordinating several projects. There are however several limitations. It must be emphasised that bundling under the CDM requires that all project activities are identical (i.e. applying the same methodology), so that all necessary documents, registration and MRV can be applied just once to the group as a whole rather than to each individual component project. (3)

Relevance to cities & buildings

Within the approved methodologies for CDM projects, it is the small scale methodologies that are perhaps the most relevant to the city and buildings context. Some relevant examples of small-scale methodologies approved by the CDM Executive Board include the following:

- **AMS-I.C.** ***Thermal energy production with or without electricity*** - installation of renewable energy technologies that supply users with thermal energy such as solar thermal water heaters, solar cookers and energy derived from renewable biomass, and which displace fossil fuel use;
- **AMS-II.C.** ***Demand-side energy efficiency activities for specific technologies*** - includes installation of new, energy-efficient equipment in one or more sites, such as lamps, refrigerators, motors, air conditioners etc. and can apply to new buildings or as retrofit);
- **AMS-II.E.** ***Energy efficiency and fuel switching measures for buildings*** - technical energy efficiency measures such as efficient appliances, better insulation and also at fuel switching e.g. from oil to gas; it applies to a single building or group of similar buildings, whether new or retrofit;
- **AMS-III.C**. ***Emission reductions by electric and hybrid vehicles*** - introducing new electric and/or hybrid vehicles that displace the use of fossil fuel vehicles in passenger and freight transportation;
- **AMS-III.AA**. ***Transportation Energy Efficiency Activities using Retrofit Technologies*** - engine retrofit of existing/used vehicles for passenger transit vehicles resulting in increased fuel efficiency;
- **AMS-III.AY. *Introduction of LNG buses to existing and new bus routes*** - where existing or planned bus routes use/would have used buses driven by fossil fuels and these are replaced by LNG (Liquefied Natural Gas) buses for passenger transportation.

[34] Small scale methodologies - CDM Rulebook : http://cdmrulebook.org/152
[35] CDM Executive Board meeting 21, Annex 21, paragraph 3

Other methodologies within the key urban sectors of buildings and transport which have been approved more recently are summarised in the table below.

***Table 4-3* Recently approved small scale CDM methodologies within the buildings and transport sectors**

Building sector
• AMS-I.J. "Solar water heating systems (SWH)"
• AMS-I.K. "Solar cookers for households"
• AMS-II.N. "Demand-side energy efficiency activities for installation of energy efficient lighting and/or controls in buildings"
• AMS-II.O. "Dissemination of energy efficient household appliances"
• AMS-II.Q. "Energy efficiency and/or energy supply projects in commercial buildings"
• AMS-II.R. "Energy efficiency space heating measures for residential buildings"
• AMS-III.AE. "Energy efficiency and renewable energy measures in new residential buildings"
• AMS-III.AR. "Substituting fossil fuel based lighting with LED/CFL lighting systems"
Transport sector
• AMS-III.S. "Introduction of low-emission vehicles/technologies to commercial vehicle fleets"
• AMS-III.BC. "Emission reductions through improved efficiency of vehicle fleets"
• AMS-III.U. "Cable Cars for Mass Rapid Transit System (MRTS)"

For a full and up to date list of approved methodologies, see the CDM website and Methodology Handbook[36].

Despite the growing number of small scale methodologies in these relevant sectors, because these remain focused on one technology at a time, they are (in isolation) still quite poorly suited to the emissions reduction potential of cities as a whole, which is characterised by many, small, dispersed emissions sources for which a variety of technologies need to be implemented. Also, the burden from transaction costs (particularly from the registration process and MRV) can still be too high compared to the expected income from CERs, despite the relatively simplified methodology compared to large-scale CDM.

Regarding **bundling** of small scale CDM projects, this can help to facilitate projects in the urban context, for example residential and transportation sectors, with the chance to replicate many small projects thus expanding small scale CDM to the city scale. However, city scale bundles are still limited to single technology initiatives, whereas in practice a range of available measures may be more appropriate and beneficial. In addition, all participating projects must be identified from the outset, as the bundle cannot be adjusted to add or remove projects once registered. This clearly increases the challenges of identifying and coordinating projects, particularly given that timescales (i.e. the crediting period) must also be aligned and details such as location, users and technical details must all be determined before registration.

While these requirements do not entirely rule out bundling for city-scale initiatives, they perhaps limit it to activities which are already coordinated in some way, such as waste or water treatment schemes managed under a local plan. In contrast, a residential project for example, would be more likely to hit difficulties when seeking buy-in from multiple, individual users in advance to implement the same measure, at the same time.

A recent development has been the increasing possibility to **combine** several different small scale methodologies within one project, either through pre-approved combinations or by proposing new ones, in line with associated guidelines (the methodologies are generally closely linked). Practical implementation of this approach is demonstrated in case study 8 below for a project improving the thermal performance of buildings in low-income homes in South Africa. Another example from Moldova implements three methodologies for a biomass heating project for public buildings in rural districts (AMS-I.C - Thermal energy

[36] CDM Methodologies web page: https://cdm.unfccc.int/methodologies
Methodology Handbook: https://cdm.unfccc.int/methodologies/documentation/index.html

for the user, AMS-II.E - Energy efficiency and fuel switching measures for buildings, and AMS-III.B - Switching fossil fuels).[37] Taking this a step further, the CDM Programme of Activities attempts to tackle several of the barriers raised here – this is described in the next section (4.3).

MRV

Small scale CDM operates on the same principles and project cycle as large scale CDM (along with its inherent requirements for MRV), however projects are entitled to use **simplified modalities and procedures**. These include a simplified project design document with specific guidance for small scale projects, simplified methodologies for calculating baseline GHG emissions, and simplified requirements for monitoring and the monitoring plan.

An important improvement underway for MRV in small scale methodologies is the development of **standardised baselines**. These are used in conjunction with a CDM methodology, but simplify the process of calculating the emissions baseline. They also allow additionality to be demonstrated automatically, according to specific characteristics, such as fuel, technology, output etc. (16) They are generally country and sector specific and either provide a factor from which the baseline can be calculated based on a broad type of mitigation activity in that sector, or for the sector as a whole.[38]

This approach aims to considerably reduce the methodological burden for project participants, which is very positive for the urban context. While the methods for establishing the factors used in a standardised baseline are still developing, they may use performance benchmarks to help define additionality, generally based on the average reductions made by the top 20% performers among existing projects in the relevant sector or methodology. By March 2014, four had been approved in different countries, so far concerning emissions factors within the power sector and fuel-switching projects – however more are expected soon. [39]

In practice

There are several examples of urban projects successfully implementing small scale CDM methodologies, such as the following. The CDM project reference number is shown in brackets for each so that readers can find further information on the CDM registry (examples taken from (17) and the CDM registry):

- South Africa (Cape Town) - Low-cost urban housing energy upgrade project [79] – this project uses a combination of methodologies, see case study below;
- Moldova - Energy conservation and GHG emissions reduction in public buildings [173];
- India (West Bengal) - Improvement in energy consumption of a hotel [686];
- Colombia (Medellin) – Cable cars for public transport in hilly areas, linked to metro system [3224]
- India (Delhi) - Installation of low GHG emitting rolling stock cars in metro system [1351];
- India – several projects encouraging the use of electric vehicles [e.g. 6713, 6711, 6712, 6708]
- China (Jiangsu Province) – Replacing incandescent lamps in households with compact fluorescent lamps [3659]

Cable cars for public transport in Medellin, Colombia.
Photo: ENERGIES 2050

Case study 8 below provides a more detailed look at an innovative project in South Africa, which is improving the thermal performance of 2300 low income homes in the Khayelitsha township in Cape Town, through the application of three small scale methodologies in combination.

[37] CDM project reference : 0159
[38] For details and an update at March 2014 (session 4-1):
http://cdm.unfccc.int/methodologies/Workshops/urban_meth_built_environ/index.html
[39] Approved standardised baselines so far : https://cdm.unfccc.int/methodologies/standard_base/new/sb7_index.html

Case Study 8 - Combining several scale CDM methodologies – the Kuyasa low-cost urban housing energy upgrade project, South Africa

The Kuyasa project focuses on energy efficiency (EE) building retrofits. It seizes the opportunity for EE gains presented by the low thermal performance of low-income housing, as well as the potential for replication given the very regular design of such buildings. A total of 2,309 low-income houses in the outskirts of Cape Town were equipped with several EE interventions. Following an initial pilot phase in ten houses, the project was registered under the CDM in 2005 [reference: 0079], the first in South Africa, and the first project in Africa to include several CDM methodologies together.

The project is a collaboration between the local government of Cape Town, Dutch NGO SouthSouthNorth and the local community. The goals are to improve the living conditions of the low-income inhabitants while reducing fossil fuel-based energy consumption, energy costs and GHG emissions.

The project combines three small scale CDM methodologies (AMS-I.C. ver. 5, AMS-II.C. ver. 5 and AMS-II.E. ver. 5) in order to implement the following interventions:

- Ceiling insulation to improve thermal performance – achieving an average 19.4% saving of energy used for space heating during the 4 – 6 month annual heating period
- Solar water heaters (with a hot water storage tank of 100 litres), to improve water heating efficiency
- Energy efficient lighting provided by replacing incandescent lights with compact fluorescent lighting (CFLs)

Local contractors were trained as plumbers and electricians to install and provide maintenance services for these measures. Additionally unemployed residents were recruited and trained in carpentry, plumbing and electrical skills. Beyond the main government funding for implementing the project, the main ongoing source of revenue was from the sale of Certified Emissions Reduction (CER) credits through the CDM.

The project has been able to save 7.40 million kWh (34%) and 6,437 tons of CO_2 emissions (33%) on an annual basis, representing an aggregated savings of 155 million kWh and 135,187 tons of CO_2 emissions. Further, the insulated ceilings resulted in improved thermal comfort and improved indoor quality in the houses.

Installation of solar water heaters on houses as part of the Kuyasa project, South Africa. Photos: Nic Bothma

Further information:
www.esmap.org/sites/esmap.org/files/Kuyasa_EECI_Housing_FinalCaseStudy_Africa.pdf
www.growinginclusivemarkets.org/media/cases/SouthAfrica_Kuyasa_2010.pdf

Pros and Cons for the urban context

Pros	Cons
• Suitable to smaller installations such as buildings • Simplified procedures and methodologies help with project registration • Bundling allows a measure to be replicated over many sites by bringing them under the same CDM project • More methodologies relevant to the urban context are being approved • The combination of multiple, related methodologies is now permitted	• Generally restricted to one technology at a time, although combinations are becoming more frequent • Despite simplified procedures, transaction costs and technical capacity can still be prohibitive for small projects generating fewer CERs • Bundled projects must all use the same methodology, be identified from the start, and operate over the same period • The CDM registration process is still relatively slow

4.3 CDM Programme of Activities (PoA)

A more flexible version of the CDM in which GHG mitigation activities are implemented across multiple sites but coordinated under one programme

- Allows many CDM activities applying the same methodology (or approved combination of methodologies) to be coordinated under one umbrella programme, which is registered as a single CDM project
- More component activities can be added as the programme develops
- The process for including component activities is much simplified compared to CDM registration

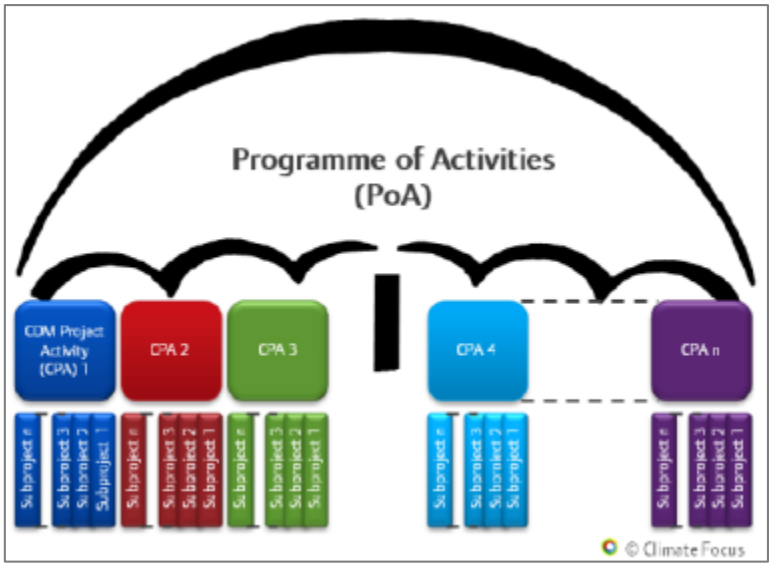
How it works

Programmes of Activities (PoAs) were introduced by the UNFCCC in 2007 as a facility under the CDM which allows GHG emission reduction activities to be implemented across multiple sites and be coordinated under one overarching programme, which is then registered as a CDM project (figure 4.4). Most PoAs bring projects together using small scale (or even micro scale) methodologies, but large scale is also permitted. The boundaries of a PoA may operate at a local, regional or national level and may cross country borders.

The important distinction between a PoA and a traditional CDM project is that only the overarching programme needs to go through the CDM registration process, taking this burden away from individual projects activities. This enables the participation of very small projects that would otherwise not produce enough CERs to offset the transaction costs of the registration process (and would be unlikely to have the necessary expertise).

To register, a PoA must define the type of sites (e.g. buildings) that are eligible for the project and the approved methodology that will be implemented. This must then be demonstrated through a first real activity. Once the overarching PoA is registered, an unlimited number of individual activities can be added to the programme (the process of 'inclusion'), which are referred to as **Component Project Activities (CPAs)**. For example, the installation of solar thermal equipment in households could be registered as the programme of activities (PoA), and then replicated across many homes (through CPAs), with coordination being provided by the overarching PoA. (18) Each CPA can consist of a single project or a number of smaller sub-projects.

Figure 4.4 ***A PoA is structured as an overarching 'umbrella' programme for CPAs and their sub-projects***



Source: Climate Focus (19)

Individual CPAs need only to be checked by a DOE (i.e. not the CDM Executive Board itself), to show that they are complimentary to the PoA and comply with its eligibility criteria. **Eligibility criteria** are a very

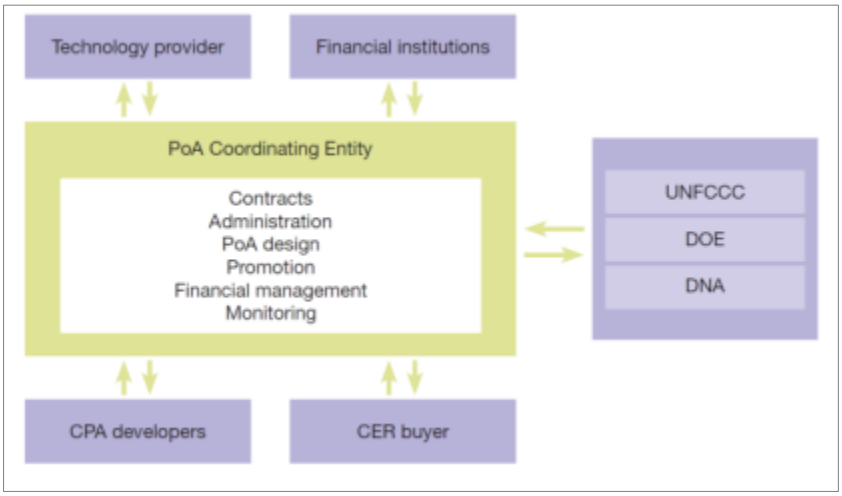
important part of PoA design, since CPAs will be judged against them for *inclusion*. Guidelines from the CDM Executive Board set out minimum requirements for eligibility criteria,[40] which must then be tailored to the planned PoA. Guidance from Climate Focus (19) provides 'blueprint text' to help CMEs define eligibility criteria for a PoA, along with specific suggestions for certain key project types (and the associated CDM methodologies).[41] In summary, the basic eligibility criteria for CPAs in a PoA require that they should (19):

- not be a local/regional/national policy or standard;
- use approved baseline and monitoring methodologies;
- define the appropriate boundary;
- avoid double-counting;
- account for leakage;
- ensure that emission reductions are real, measurable and verifiable; and,
- ensure that emission reductions are additional to any that would occur in the absence of the project.

It should be emphasised that the GHG mitigation activities of a PoA must still use approved CDM methodologies. Combining different methodologies among CPAs within a PoA is permitted, and is now fairly well established, again allowing greater flexibility for projects in the urban environment. Eligibility criteria and MRV processes such as sampling must reflect such combinations (i.e. allow for each methodology used).[42]

A PoA is coordinated by a private or public organisation, known as the **Coordinating/Managing Entity (CME)**. The CME must be appointed from the start since it is the focal point of the PoA and acts as an intermediary in all key interactions with the UNFCCC, DNAs and DOEs, on behalf of CPAs.[43] The figure below illustrates the generic structure of a PoA, highlighting the central role of the CME.

Figure 4.5 Generic PoA organisational structure, including the role of the CME



Source: UNEP & Gwangju City (3)

Relevance to cities & buildings

There is considerable potential for PoAs in cities, particularly in the buildings sector, where relatively small scale projects with proven technology can be replicated across many sites through retrofitting existing buildings (e.g. upgrading light fittings) or through the specification of new buildings (e.g. requirements through buildings codes for energy efficient lighting). PoAs also provide an opportunity for city authorities to coordinate such activities in line with local climate policy.

[40] CDM EB Standard: Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities v03.0: http://cdm.unfccc.int/Reference/Standards/index.html
[41] Broad project types included: micro/small scale hydropower, stoves (efficiency), stoves (fuel switch), lighting, buildings, solar water heaters, and various methane avoidance projects - animal waste, landfill, waste water and composting.
[42] Information on applying multiple methodologies in a PoA: http://cdmrulebook.org/468
[43] DNA: designated national authority - organization granted responsibility by a Party to authorise and approve participation in CDM projects. DOE: designated operational entity - independent auditor accredited by the CDM Executive Board to validate project proposals or verify whether implemented projects have achieved planned GHG emission reductions.

Indeed, at least 25% of registered PoAs concern energy efficiency demand side projects, a key target area for buildings and cities. The equivalent figure among normal CDM projects is around 1% to 3%, illustrating how PoAs may already be helping to overcome some of the barriers inherent in the traditional project-based CDM. PoAs are also targeting dispersed renewable energy generation and waste management. On the other hand, the transportation sector is so far poorly represented (around 1% of registered PoAs), despite this being an important sector in the urban context regarding the potential both for GHG mitigation and co-benefits for inhabitants.[44]

Importantly for urban residents, PoA helps to directly engage participants within the community and to implement the kind of measures that maximise sustainable development co-benefits (e.g. for health, education, standard of living), since these would often be too small-scale and under-resourced to register individually under the CDM alone.

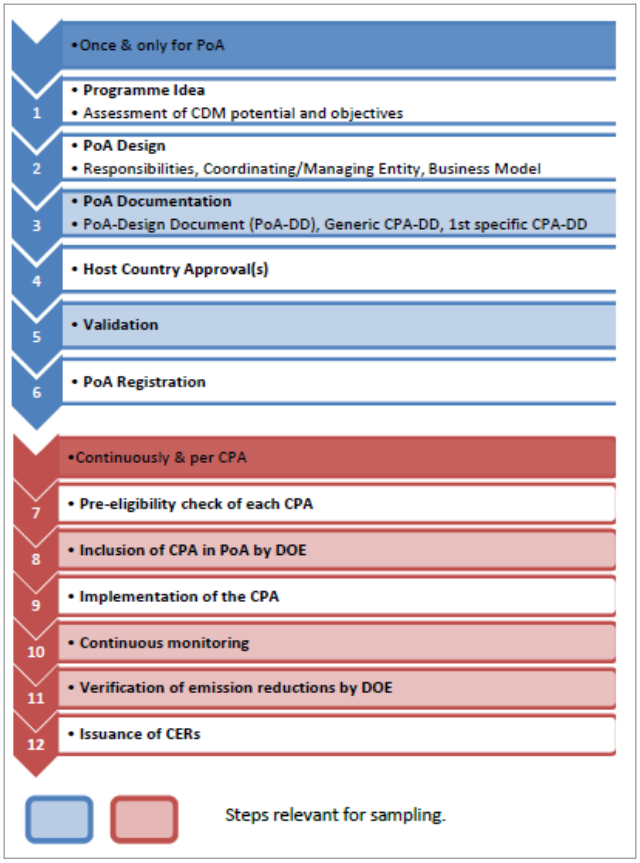
MRV

The MRV of a PoA – as for all CDM projects – is crucial to facilitate the sale of carbon credits. All GHG emission reductions achieved must be monitored, reported and verified, both for the total emissions reductions from the PoA over a given period, and broken down by CPA. (18) Given the multiple, often dispersed project participants in a PoA, a sampling approach may be used, so that not every site or installation (e.g. each household) involved needs to measure emissions reductions, but rather a representative sample from sites within each CPA or among CPAs is used. A well-designed sampling strategy is an important step towards reducing transaction costs for the PoA.

Guidance for designing a sampling strategy is provided by the CDM Executive Board[45] including descriptions of the recommended sampling methods, when to use them and how to construct a sampling plan. Further guidance has also been developed by KFW (12) and Climate Focus (18) including case studies and lessons learnt.

Figure 4.6 sets out the stages for setting up a PoA and its CPAs, highlighting the points at which sampling is relevant – emphasising the importance of designing a good sampling approach.

Figure 4.6 Steps in setting up a PoA and CPAs, and the points at which sampling is relevant for MRV



Source: KFW (12)

In practice

Compared to bundling small scale CDM projects (discussed in section 4.2), a PoA offers much greater flexibility. For example, the crediting period can vary among CPAs (and therefore the point at which they are included), whereas in a bundle, all sub-projects receive the same crediting period. This allows a PoA to get established with a set of initial CPAs and then add more as it progresses, avoiding the need to secure buy-in from all potential project participants in advance of registration. For further guidance on PoAs the online 'PoA Platform', provides explanations, a question and answer facility and a comprehensive list of links to relevant

[44] Figures from CDM statistics at April 2014: http://cdm.unfccc.int/Statistics/Public/index.html/
[45] 'Guidelines for sampling and surveys for CDM project activities and Programme of Activities' (currently version 03.0): http://cdm.unfccc.int/Reference/Guidclarif/index.html

resources, such as 'The Handbook for Programmes of Activities: Practical Guidance to Successful Implementation' from Climate Focus (18).

By April 2014, 250 PoAs were registered in 71 countries, with more in the pipeline.[46] Urban examples are given in table 4.4 and case studies below. Encouragingly, more than 30% of PoAs are in Africa, compared to just 2% of regular CDM projects. Guidance for the African context is available from Climate Focus.[47]

Table 4-4 Examples of PoAs registered in cities and buildings

Name and reference n°	Location	CME	Methodology	Estimated emissions reduction	Description[48]
Thailand energy efficiency improvement for street lightings [8055]	Thailand – several regions	Provincial Electricity Authority	AMS-II.L. *Demand-side activities for efficient outdoor and street lighting technologies*	23 tCO_2e/yr	Improving energy efficiency in street lights by replacing High Pressure Sodium units with LEDs, yielding almost 65% energy savings from lower energy consumption and longer lifetime. Aligns with energy efficiency and emission reduction goals of the Power Development Plan of Thailand.
MicroEnergy Credits - Micro-finance for Clean Energy Product Lines [8142]	Mongolia – individual projects at household level	MicroEnergy Credits (social enterprise)	AMS-II.E. ver. 10 *Energy efficiency and fuel switching measures for buildings*	50,133 tCO_2e/yr	Dissemination of clean energy Products, including efficient stoves and heating equipment and home insulation. Reduces emissions by reducing the amount of fuel required to heat to homes and other buildings.
Egypt Vehicle Scrapping and Recycling Program [2897]	Egypt – national with CPAs managing schemes in different cities	Egyptian Ministry of Finance	AMS-III.C. ver. 11 *Emission reductions by low-greenhouse gas emitting vehicles*	20 tCO_2e/yr	Supports enforcement of Traffic Law #121 (2008) which aims to improve safety, air quality, and GHG mitigation by taking older mass transit vehicles off the road. The PoA provides a programme for the safe dismantling and recycling of the vehicles (taxis, microbuses, and buses).

Case Study 9 - PoA in the waste sector: Uganda Municipal Waste Compost Programme

This PoA [ref: 2956] promotes solid waste composting in urban areas to reduce the environmental and health impacts of landfills, whilst reducing GHG emissions (from methane). The CME is the National Environment Management Authority (NEMA) and the PoA is implemented by several municipalities across Uganda. The small scale CDM methodology applied is AMS III F version 6 "Avoidance of Methane emissions through controlled biological treatment of biomass". The technology itself is aerobic windrow composting, with a facility being set up at each participating municipality, each representing a component project activity (CPA) within the umbrella PoA. CDM revenues are shared between NEMA (for the capital costs) and the municipalities involved (for the operational costs of running the compost facilities). For municipalities, this income should be supplemented by income from selling the compost produced.

The PoA was registered in April 2010, the first registered in Uganda and the third in Africa. Monitoring so far shows that the first eight CPAs which are operating are delivering GHG emission reductions, although considerably less than anticipated. Indeed, the project has faced considerable challenges, including a lack of technical capacity at the local level, high set up costs, and long waiting times during CDM validation and registration for the overall PoA. In response, capacity building training has been delivered through the CDM Capacity Development Project to all three management levels (CME, CPA/municipal, onsite working team) along with representatives from future CPAs.

Further information:
World Bank: https://wbcarbonfinance.org/Router.cfm?Page=Projport&ProjID=48162
Uganda Climate Change Unit: http://www.ccu.go.ug/index.php/cdm

[46] CDM news April 2014: https://cdm.unfccc.int/press/newsroom/latestnews/releases/2014/0407_index.html
[47] Handbook for PoAs in Africa: www.climatefocus.com/documents/the_handbook_for_programme_of_activities_in_africa_practical_guidance_to_succesful_implementation
[48] For more details including POA project design documents: http://cdm.unfccc.int/ProgrammeOfActivities/registered.html

Case Study 10 - PoAs for solar water heating – experience from Tunisia and South Africa

CDM funds Solar Water Heaters through a PoA, Tunisia [PoA ref: 4659]

The Solar Water Heater Programme in Tunisia aims to install solar water heaters (SWHs) in households with funds provided by selling CERs via a PoA coordinated by the Tunisian National Agency for Energy Conservation (Agence Nationale pour la Maîtrise de l'Energie - ANME). The Tunisian Company of Electricity and Gas (STEG) is responsible for communicating with households who are willing to install a SWH and the Attijari Bank that grants the loans to PoA applicants.

The PoA will run between January 2011 and January 2035 and it aims to install 30,000 SWHs per year. Several types of systems are used. SWH units will be supplied and installed by companies certified by ANME, to ensure that high quality equipment is used. The PoA also includes awareness raising campaigns including technical workshops with sector professionals and solar certifications to increase the demand for solar water heating and strengthen the SWH sector in Tunisia.

Further information: UNFCCC
https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/7KX218NCPREWQ4YSB90MUI5T6FHZJA/view

SASSA Low Pressure Solar Water Heating CDM Project, South Africa [PoA ref: 4302]

This PoA aims to provide sustainable hot water solutions to communities, contribute to the socio-economic development of communities by job creation and community driven projects and to reduce GHG emissions to mitigate climate change. The CME is company Solar Academy of Sub Saharan Africa (Pty) Ltd – *SASSA*. The PoA has resulted in large scale application of renewable energy technology to low income housing: from 2010 to 2012 the programme rolled-out over 80,000 solar waters. It aims to install a total of 248,000 units across the country as more CPAs are added. Public funds supporting the programme have successfully been supplemented with revenue generated from the sale of Certified Emissions Reduction (CER) through the CDM PoA. By the end of 2013, the PoA was reducing emissions by around 50,000 tCO_2e per year.

Example of a solar water heater installed by the PoA. Photo: SASSA PoA Design Document

Further information: UNFCCC
https://cdm.unfccc.int/ProgrammeOfActivities/poa_db/BP3K4JNA57VDET28XY9FILZCOHR6QS/view

Pros and Cons for the urban context

Pros	Cons
• Encourages GHG mitigation activities across multiple sites with many project participants, coordinated by one over-arching body • Extends access to the CDM to smaller projects which would not be viable alone • Registration with the CDM is handled at the PoA level, while the approval process for inclusion of CPAs is simpler and quicker • The final number of or timescale for CPAs need not be known at the outset, allowing more CPAs to be added to the PoA as it develops • Transaction costs, investment risks and uncertainties are reduced for individual CPAs • MRV is conducted on a collective basis using sampling • Combinations of technologies (and therefore methodologies) is provided for	• Finding a capable, experienced CME which can show bankability is crucial to success of a PoA but can be challenging (as such, partnerships are common) • CPA approval can still be relatively slow • Uncertainty over the number of CPAs that will join can make securing agreements for purchasing CERs more complicated • CPAs can be reliant on the success of one another in terms of securing CER issuance • The up-front transaction costs for the PoA itself are significant given the additional paperwork and preparatory work • There is so far little experience of many technologies being applied within one city - most apply one or a few technologies in several locations, but generally in one sector

4.4 Citywide PoA

Builds on the concept of a Programme of Activities (PoA) by extending this to the city scale, incorporating multiple sectors and technologies

- Allows climate finance for GHG mitigation in cites to be scaled up to several sectors as part of a citywide strategy
- Practical experience is only just being piloted, but the CDM Executive Board is gradually adopting measures to facilitate this approach
- Would allow climate finance to be tailored to a city's GHG emissions profile

How it works

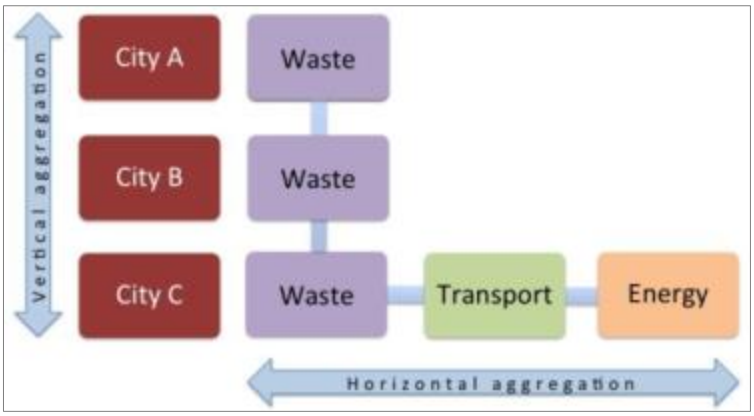
Momentum has recently gathered for a mechanism with a more systematic approach to climate finance in cities, which would allow for several technologies to be implemented across multiple sectors in order to deliver emissions reductions from different sources and integrate climate finance into broader climate change strategies. In addition, there is a need to better align climate finance projects with normal urban planning and management processes, which are focused on the provision of urban services. (20) In response to these needs, a mechanism for 'citywide PoA' is being developed.

The concept of multi-sector, 'city wide CDM' was first proposed in 2010 by the World Bank (21) and has since been approved by the CDM Executive Board, in the form of a PoA. As mentioned in previous sections, certain combinations of different CDM methodologies have already been approved and new ones can be proposed; this will help with the development of citywide PoA – and is indeed fundamental to the concept.

A citywide PoA aims to capture cities' GHG mitigation potential by increasing the number of activities implemented under one programme and the sectors involved. It also hopes to achieve efficiencies in the administrative processes and associated transaction costs. On the other hand, the registration and implementation of a multi-sector, multi-technology citywide PoA could rapidly become much more complex than for a traditional CDM project or PoA. A crucial step in programme design is therefore to clearly establish responsibilities both for the top-level running of the programme by the CME (managing, monitoring and reporting activities) and the practical implementation of activities within specific sectors and/or districts. (4)

The structure of a citywide PoA could take two forms, as illustrated in the figure below: one in which activities in several sectors are coordinated, within one city ('horizontal aggregation' in the figure) or one in which activities across a single sector are replicated across several cities ('vertical aggregation'). (4) While the first approach is clearly of most interest to city managers wishing to implement climate finance across their city (and is the form largely referred to in this section), the second approach could be relevant where a sector-based initiative is to be replicated across many locations and can benefit from coordination under one programme. Note that both of these forms would still be registered under one umbrella programme.

Figure 4.7 ***The 'citywide' PoA concept could take two forms: single city, multi sector vs. multi city, single sector***

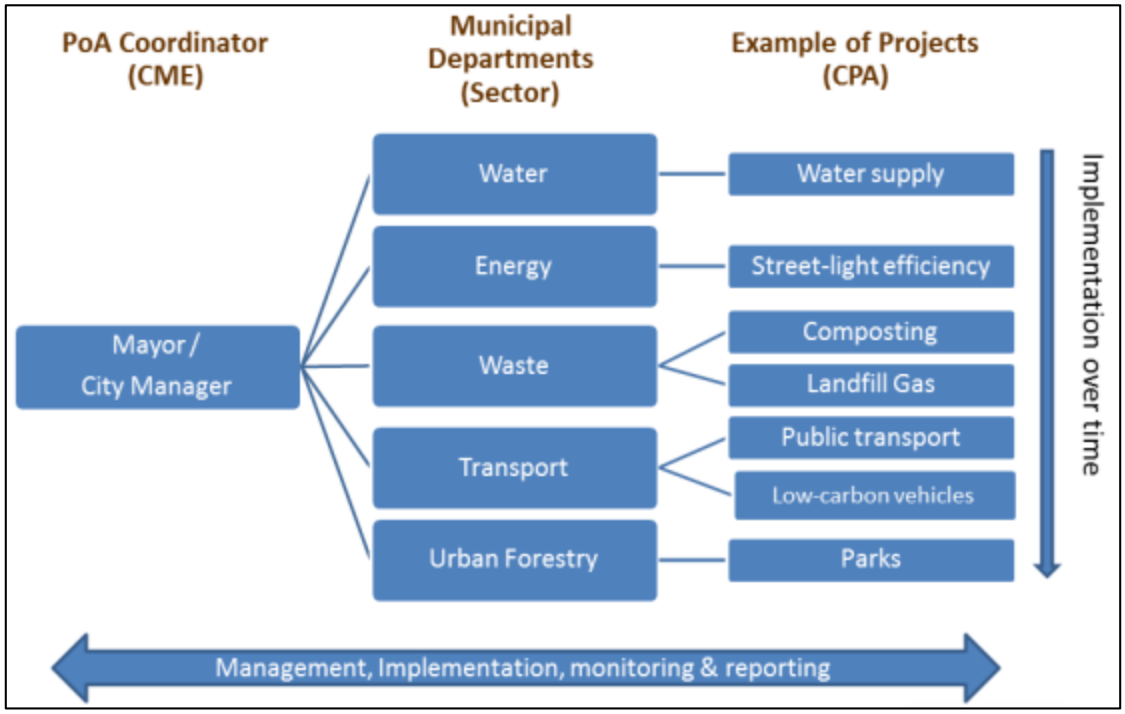


Source: Wuppertal Institute (4)

Relevance to cities & buildings

The goal of the citywide PoA approach is to give local governments and other actors the opportunity to coordinate a PoA that encompasses their whole city and is **tailored according to the city's GHG emissions profile** and climate change strategies. As discussed in chapter 2, GHG emission profiles vary for every city (i.e. the relative contribution from different sectors to a city's total emissions), and so a citywide climate finance scheme needs to allow sufficient flexibility to involve **multiple sectors** and different emission reduction activities. Figure 4.8 provides an example of how a citywide PoA could be structured, highlighting the likely sectors that could be involved and examples of the sort of opportunities that CPAs could target.

Figure 4.8 ***Example of the structure for a citywide PoA***



Source: Spors & Ranade (20)

Such an approach would therefore help cities gain access to carbon finance for all the sectors and mitigation activities involved and not only for one sector-specific technology at a time. It should be emphasised that it is still fairly early days for citywide PoA – both in terms of experience in practical implementation and indeed the definition of the necessary rules and guidance to drive it.

MRV

Given the potential complexity of a citywide PoA with its various and dispersed GHG emission sources, the tasks of establishing an emission baseline and monitoring mitigation can present a considerable challenge, particularly given the strict MRV requirements of the CDM. While several proposals and studies on approaches to MRV in this situation have been put forward, guidance is not yet fully established.

Another consideration is that as part of a citywide PoA, local government may wish to incorporate policy-based activities, such as building codes and labelling, renewable energy obligations, urban planning, green transport incentives, appliance certifications, or indeed supporting actions such as awareness campaigns. While these are clearly complimentary to the more technology-based activities currently covered by CDM projects, there are not yet approved methodologies or a MRV framework in place to allow for such activities. This is largely because it is very difficult to allocate and measure GHG emissions reductions resulting from these sorts of activities. However, see the following section on NAMAs for developments on this subject.

In practice

The concept of citywide PoA has been piloted through the Amman Green Growth Program in Jordan.[49] This is coordinated by the municipality and aims to reduce GHG emissions at the city level by working in several sectors: solid waste management, energy efficiency, renewable energy in streets and residential buildings, urban transport, urban forestry and water management – all coordinated under one programme. (3)

Amman, Jordan where the citywide PoA concept is being developed. Photo: ENERGIES 2050

While there are so far very few other examples of multi-sector citywide PoA in practice, lessons can be learnt from existing PoAs which combine several methodologies and/or cover several cities or municipalities, as for the Uganda Municipal Waste Composting Programme, described in the previous section (case study 9). Another example comes from the Mexican Sustainable Housing Project, which has achieved success in settlements across Mexico and facilitates improvements in the energy performance of new homes – see case study 11.

Case Study 11 - Mexico's Sustainable Housing Project - Combining CDM methodologies in a nationwide PoA

It is estimated that during 2005-2030 there will be a need for 16 million new dwellings in Mexico. In response to this and the need to mitigate the inevitable rise in energy demand that will come with it, the Mexican Housing Commission (CONAVI) developed a CDM PoA aiming to lock-in energy efficiency for new affordable homes.

The PoA assists residents in purchasing homes that are energy efficient and use renewable energy technologies. As such it also helps to reduce fuel poverty by helping low income households to access low cost clean energy. The programme provides subsidies through 'green mortgages' and other financial assistance for the purchase of primary residences throughout Mexico.

The green mortgage programme enables home owners to acquire loans above their approved amount if the home complies with a specific set of criteria related to energy efficiency, renewable technologies and broader sustainability goals. Key technologies targeted by this CDM include CFL lighting, thermal insulation, solar PV and solar thermal as well as broader sustainable building criteria. This scheme now involves some of the largest home mortgage companies in Mexico.

Following the success of this PoA, it is being extended as part of a NAMA being designed by CONAVI (22), with funding from the NAMA Facility (see section 4.5).

Photo: SADASI EcoCasa

Further information:
UNFCCC: http://cdm.unfccc.int/ProgrammeOfActivities/Validation/DB/I0P69ZLWTD2RK1K8MTKSO3LPR4H5Q7/view.html
CONAVI: http://www.conavi.gob.mx/viviendasustentable
NAMA: http://www.nama-database.org/index.php/NAMA_for_sustainable_housing_in_Mexico

[49] Amman citywide PoA summary: https://wbcarbonfinance.org/Router.cfm?Page=Projport&ProjID=65753

Further insights are provided by the leadership of Gwangju City, South Korea, where preparations are being made to test out and implement an approach to citywide PoA, which would integrate climate finance with wider urban planning. Progress so far is summarised here in case study 12.

Case Study 12 – The Gwangju Low Carbon Green City Approach

Gwangju Metropolitan City is fifth largest city in Korea. Gwangju has shown leadership in promoting the low-carbon city approach since joining the Urban Environment Accords (UEA) in 2005, which was signed by 52 cities in San Francisco on the occasion of World Environment Day. These accords comprise 21 concrete actions across seven sustainable development themes at city level, including energy, waste reduction, urban design, biodiversity, sustainable transport, environmental health, and water.

Gwangju has committed to an aggressive GHG reduction policy in seven major sectors, including energy, wastes, urban planning. It plans to reduce GHG emissions by 40% by 2020 and by 50% by 2030 in comparison to business as usual. It also plans to increase the use of renewable energy by 11% by 2030 through the systematic implementation of a solar city project, a compact city project focusing on transportation, green buildings, and other initiatives. It also plans to work on becoming zero-energy through a resource circulation system, and introduce green cars and clean fuel.

Gwangju has been developing a ***Low Carbon Green City Approach***, and is working closely with UNEP, Korea Environment Institute, UEA member cities, UNFCCC and the World Bank. As part of this approach, Gwangju aims to develop ***Urban CDM*** as a vehicle for carbon finance initiatives at the city scale (i.e. a market-based mechanisms to drive GHG emissions reduction) and GHG accounting to support this (i.e. GHG inventory, baseline, projections, monitoring).

This approach is intended to feed into the wider urban planning system and carbon reduction strategies. It is cross-sectoral with plans to create a network of CDM projects across city sectors using different technologies to achieve GHG emissions reductions. By creating an integrated system like this, costs and benefits can be calculated at the city scale (both financial and socio-economic). Gwangju's proposals build on the existing CDM system, but with a more holistic, integrated framework that sits within urban planning and development and allows for combining methodologies and technologies and the potential for sustaining a carbon market at the city scale. Gwangju sees Urban CDM in the form of an expanded, citywide PoA.

Further information:
UEA Secretariat (2014) *UEA/Gwangju Approach to Low-Carbon Green City*. Discussion paper presented to UNEP / UNFCCC workshop on Urban Methodologies for the Built Environment, 27-28 March 2014 (session 5, presentation 2): http://cdm.unfccc.int/methodologies/Workshops/urban_meth_built_environ/index.html
Urbanization Knowledge Partnership: http://www.urbanknowledge.org/partner_gwangju.html
Gwangju UEA summit: www.gjsummit.com/sub/sub.php?subKey=06010000 and www.unep.org/newscentre/default.aspx?DocumentID=2656&ArticleID=8900

Pros and Cons for the urban context

Pros	Cons
• The citywide PoA aims to address many of the barriers to climate finance for cities that exist among the current CDM approaches • It has great potential for maximising the GHG mitigation potential of cities; including from the building sector and other key emissions sources • It could encourage the integration of climate finance into wider climate change strategies • While it is still early days, practical examples are starting to develop • The CDM Executive Board has made some progress towards facilitating this approach (e.g. permitting a multi-sector PoA)	• Many of the intended activities within a multi-sector PoA currently lack an appropriate CDM methodology • MRV guidelines to cope with the potential complexity of this approach are yet to be adopted • Policy or support based activities (as opposed to technology based ones) would be an important part of a citywide programme but are not yet provided for among CDM methodologies and MRV for such activities poses a particular challenge

4.5 Nationally Appropriate Mitigation Actions (NAMAs)

Policies, programmes and projects that developing countries voluntarily undertake to contribute to GHG emission mitigation

- Still early days, but already being designed in many countries and guidance is being developed based on this experience
- Must align with national and/or local development priorities
- GHG mitigation is the priority, but sustainable development benefits should also be delivered

How it works

Nationally Appropriate Mitigation Actions (NAMAs) are policies, programmes and projects that developing countries voluntarily undertake to contribute to the global effort to reduce GHG emissions. (23) NAMAs must be aligned with national and/or local development priorities. The NAMA concept is a cornerstone in international climate policy post-2012.

While international definitions and guidelines on how to develop NAMAs are yet to be agreed, proposals so far and decisions made at the COP climate negotiations have set some common characteristics and initiated further progress. An outline is presented here of understanding and experience so far, whilst signposting other relevant resources.

NAMAs may be standalone initiatives or form part of a wider plan for low carbon transition. They tend to be based around policy rather than CDM style projects (although these may be incorporated as part of a NAMA); as such they are considered as a form of *climate* finance (as defined at the start of chapter 4). As shown in figure 4.9, a NAMA is likely to comprise several types of activity (targets, plans, policies, projects) along with supporting aspects such as capacity building. (24)

Figure 4.9 ***Potential components of a NAMA***

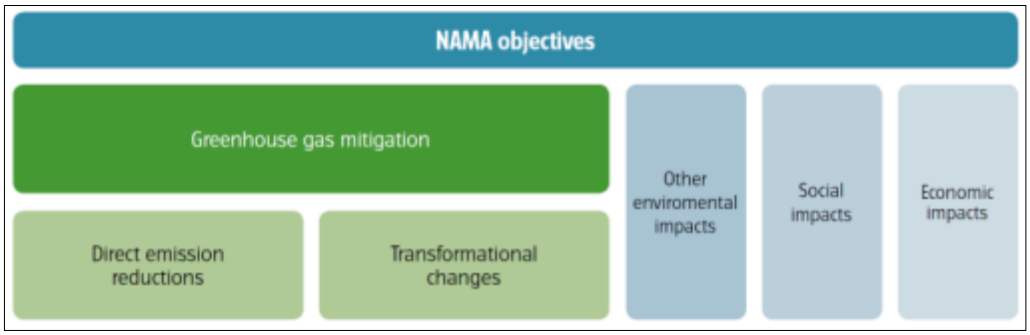
Source: Ecofys (24)

While the primary objective of a NAMA is GHG mitigation, it should also deliver sustainable development co-benefits (environmental, social, economic), as shown in the following figure. NAMAs may also bring about longer term benefits through 'transformational changes' in a country's overall capacity for GHG mitigation, for example by establishing new legal frameworks, monitoring systems, financial mechanisms etc. (9)

Importantly, NAMAs should be considered as part of low-carbon, climate-resilient development, by recognising that development comes as a priority, within which GHG mitigation and adaptation should be

accommodated and planned for. As such, there is support for national climate change policies to be developed with NAMAs in mind as a key funding and delivery mechanism.

***Figure 4.10* Desired impacts to consider for a NAMA - for GHG mitigation and sustainable development.**



Source: Mitigation Momentum (9)

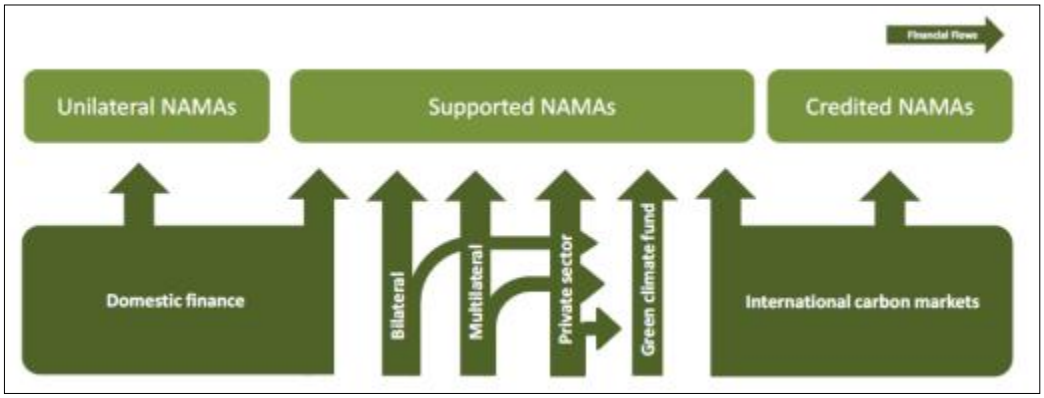
An emphasis on 'learning by doing' has been placed on NAMA development and as such guidance is so far relatively limited. However, *Guidance on NAMA Design* has been produced by the UNFCCC and partners, based on country experiences so far and includes advice on design, financing, MRV and good practice. (25) In addition, a practitioner's guide *Developing Financeable NAMAs* has been published by the International Institute for Sustainable Development (26), which provides methodologies for identifying and prioritizing opportunities for NAMA and the preparations necessary for submitting these to the UNFCCC. It also emphasises that local validation and acceptance is crucial to ensuring NAMAs are appropriately designed.

Three main types of NAMAs have been discussed, as follows (26) and illustrated in figure 4.11:

- **Unilateral NAMAs** - using only domestic resources and finance;
- **Supported NAMAs** - requesting international support such as technology transfer, finance and capacity building;
- **Credited NAMAs** – in which credits for achieving GHG emissions reductions can be earned for sale to industrialised countries through the global carbon market.

Although note that these are not mutually exclusive (e.g. 'supported NAMAs' seeking international support may well have unilateral elements as well, funded through domestic sources). (27)

***Figure 4.11* The broad types of NAMAs**



Source: IISD (26)

To support NAMAs, commitments have been made by developed countries to provide finance, technology transfer and capacity building. Funding has been made available by the UK and Germany through the 'NAMA Facility' which was launched with initial funding of €70 million to support ambitious NAMAs, with a focus on the kind of transformational change mentioned above.[50] Another €50 million of funding is being

[50] NAMA facility: www.nama-facility.org/news.html

made available for proposals in 2014. International funds from Nordic countries are also supporting NAMA efforts in several countries aiming to support existing national efforts to improve energy efficiency in buildings.

An overview of NAMA development is provided by regular status reports from the Mitigation Momentum project, along with areas in which progress is still needed. (28)

Relevance to cities & buildings

NAMAs clearly hold considerable potential for driving GHG mitigation in the urban context, provided that national initiatives are translated to sub-national actions and the necessary capacity is developed to enable access to finance, implementation of appropriate MRV systems, and coordination of projects to facilitate replication and reduce transaction costs.

While NAMAs describe by definition "national" mitigation actions to contribute towards a national voluntary mitigation target, the policies included will inevitably rely to a certain extent on local delivery. As such, local governments should logically play a role in NAMA design. Cooperation between the different levels of government (national, provincial, municipal) is therefore important when it comes to the development of NAMAs – see case study 14 below for practical examples of building such cooperation. This does of course come with inherent barriers, such as institutional differences (culture, politics, priorities etc.), a lack of financial and/or political incentives, problems with communication and coordination and gaps in technical skills and data at the local level. Efforts are therefore needed to overcome barriers such as these; table 4.5 presents suggestions for providing incentives, enabling integration and building capacity (29).

Table 4-5 ***Actions for overcoming barriers to involving sub-national governments in NAMA design and delivery***

Providing incentives	Enabling integration	Building capacity
Financial: Grants; access to loans; contracting agreements; performance based finance; transfer of fiscal powers; revenue from new business models and cost savings; access to carbon-market mechanisms.	**Integrate NAMAs into existing plans and processes:** Take account of existing plans and processes at the sub-national level; coordinate design of NAMAs with sub-national future plans or reforms.	**Strengthening skills and knowledge:** Training of sub-national actors (at design and delivery and for MRV); support for employing additional staff or consultants to conduct training and/or fill skills gaps; facilities e.g. training centre; enabling knowledge exchange.
Political and co-benefit: Aligning NAMAs with political priorities and locally-relevant co-benefits (e.g. job creation, economic growth, education, standard of living); considering local climate adaptation needs; improving energy security.	**Build links between national and sub-national government staff:** Enabling communications between government levels – both formal and informal; building effective working relationships; building common understanding and finding common ground.	**Improving data and information:** Identifying data requirements and understanding current data availability; collection of new data or re-analysis of existing data; incorporating GHG emissions data collection into existing processes; facilitate access to / sharing of existing local data (e.g. through Local Intelligence Networks); collection and collation of data at national level to provide a resource for actors at local level, where appropriate.
Reputational: Introducing competition at the municipality level related to mitigation performance (e.g. as demonstrated by European Green capital competition) and among staff (opportunity for recognition and careers progression linked to performance).	**Facilitating bottom-up approaches:** Empower sub-national actors to drive NAMA design; begin with regional projects "RAMAs" which could be combined under NAMAs; encourage replication of successful projects across other municipalities.	

Adapted from GIZ (29) *by ENERGIES 2050*

There is clear potential for cities to engage in NAMA design and delivery, by implementing components of NAMAs locally – and indeed this is likely to be an essential element of any NAMA targeting urban GHG mitigation. NAMAs can also offer a means of overcoming barriers between city sectors and increasing engagement between local governments and the private sector, communities and other critical stakeholders.

The next step requires more concrete projects in the urban context, in order to gain experience and refine guidance for NAMA design. Work is underway, for example as described in case study 4, UNEP is leading a project to assist countries to develop NAMAs in the building sector in Asia. Similarly, the Mitigation Momentum project is assisting NAMA proposals in five countries; one in Tunisia, focuses specifically on energy conservation in buildings through energy efficiency and renewable energy (case study 13).

MRV

Both the NAMA itself and any support provided to it should be subject to MRV, to ensure transparency. Note that MRV requirements for unilateral NAMAs (those using only domestic resources and finance) may be less demanding than for those receiving international finance or producing carbon credits. (8)

At present, methodologies for MRV in NAMAs and other policy-based activities are among the least developed of MRV schemes. (10) While official MRV guidelines for NAMA are awaited, some initial guidance is available, as shown in table 3.1 (chapter 3) and the UNFCCC guidance mentioned above (25). Experience may of course be drawn from existing systems such as the CDM and the measurement of progress towards national and international indicators (e.g. Millennium Development Goals).

In contrast to the CDM, NAMAs are so far free to develop individual methodologies for the proposed projects, in line with the country specific context, priorities and capacity, so long as they meet the requirements of MRV and NAMA funders. The may also use existing methodologies developed under the CDM (or elements thereof). Over the coming years it is anticipated that a certain degree of standardisation may be introduced to help with the MRV and replication of NAMAs, but this should not threaten the diversity and innovation of different countries' approaches. (9)

It is important to share and learn from existing experience of establishing an MRV system in NAMAs. An example can be drawn from one established in Chile for a self-supply renewable energy NAMA, coordinated by the Chilean government's Renewable Energy Centre. MRV has been set up to operate and interact at three levels: installation level (on site), programme level (monitoring indicators, validating and aggregating site data and reporting) and national/international level (reporting for the domestic registry and international purposes, aggregating data on support received for the NAMA). (9)

Several tools and programmes are helping to build capacity for MRV of NAMAs, including the following: (9)

- **NAMA tool**, GIZ - guides users through a ten-step process for designing NAMAs[51]
- **Low Emission Capacity Building Programme** (LECB), UN Development Programme[52]
- **Enhanced Capacity for Low Emissions Development Strategies** program[53], US Government
- **Measurement and Performance Tracking** (MAPT) World Resources Institute (WRI) –producing tools to help developing countries track progress towards climate, energy and development targets[54]
- **International Partnership on Mitigation and MRV**[55] runs capacity building summer schools, technical workshops and a peer-to-peer programme.

In practice

The UNFCCC has launched the official **NAMA registry** – an online facility for publishing NAMA proposals and to facilitate matching of finance, technology and capacity building support for their implementation. [56] Users can browse those NAMAs which have submitted information and which are seeking support for both preparation and implementation. Another collaborative NAMA database has been set up by EcoFys, to encourage knowledge sharing. By May 2014, this database held information on 95 NAMAs and 24 feasibility

[51] GIZ NAMA tool: http://mitigationpartnership.net/nama-tool-steps-moving-nama-idea-towards-implementation
[52] UNDP's LECB programme: http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/climate_strategies/undp_projects_thatcontributetogreenlecrds/national_sub-nationalstrategies/low_emission_capacitybuildingprogramme.html
[53] EC-LEDS: http://en.openei.org/wiki/Enhancing_Capacity_for_Low_Emission_Development_Strategies_(EC-LEDS)_Program
[54] WRI MAPT overview: http://www.wri.org/project/low-carbon-development/measurement-and-performance-tracking and case studies: https://sites.google.com/site/maptpartnerresearch/
[55] International Mitigation Partnership: http://mitigationpartnership.net/
[56] **NAMA registry**: www4.unfccc.int/sites/nama

studies in 35 countries (many of which have not yet been submitted to the official UNFCCC registry). (23) Note however that the level of detail available for the projects varies considerably. The leader in the development of NAMA proposals and project ideas so far is Latin America, with 50% of all NAMA proposals and feasibility studies by the end of 2013; meanwhile 26% were from the Middle East and Africa. (30)

Regarding the sectors targeted by NAMAs which have submitted information to the official UNFCCC registry, 36% concern energy supply, followed by 19% in transport and 14% in both buildings and waste sectors (figures from the end of 2013). Examples from the building sector include: a sustainable housing programme in Uruguay, the introduction of metering systems to inform billing among district heating systems in Serbia, the use of solar energy for domestic hot water, also in Serbia (Belgrade), and Dominica's "Low Carbon Climate Resilient Development Strategy" which intends to include the building sector as part of the wider programme. (31) However these figures provide indications only - it is still early days for NAMAs.

The case studies below share experience from developing NAMAs in Tunisia, Indonesia and South Africa.

Case Study 13 - Tunisia's NAMA for energy efficiency measures in the building sector

Tunis, Tunisia. Photo: ENERGIES 2050

The Tunisian Government is developing a NAMA targeting energy conservation and GHG emissions mitigation in the building sector. The main project stakeholders are the Ministry of Environment and Sustainable Development, the National Agency for Energy Conservation and others from government, industry and civil society.

The NAMA is embedded in the wider National Energy Strategy and focuses on creating a funding vehicle which will provide subsidies, soft loans or other incentives to building owners. A 'menu' of energy conservation options will be provided to homeowners; once these are implemented, the associated emissions reductions will be estimated based on energy bills or perhaps benchmarking.

This project includes extension of an existing funding vehicle for solar water heaters and roofing insulation. It offers additional incentive schemes for comprehensive coverage of building energy efficiency measures including a research component focusing on innovative technologies for air conditioning. Additionally, training and capacity-building activities aim to develop a knowledge and skills base required for widespread and long term implementation of energy efficiency technologies.

Further information: www.mitigationmomentum.org/downloads/MM_Flyer_Tunisia_201311.pdf

A rather different approach has been trialled in Case Study 14, which focuses on engaging sub-national government and other local stakeholders in NAMAs. This describes a programme for 'vertically integrated' NAMAs (v-NAMA) underway in South Africa and Indonesia, with financial support from the German Ministry for the Environment, implemented by GIZ,[57] to develop a practical approach for integrating multiple levels of government in the process of NAMA design and implementation. An important part of these programmes is to involve multi-stakeholder consultation and in-country capacity building.

The v-NAMAs in preparation concern the public building sector in South Africa and the solid waste management sector in Indonesia. Following considerable preparatory efforts to ensure the engagement of national and sub-national stakeholders, the programmes in each country have been developing key practical elements of a v-NAMA such as the baseline, business-as-usual scenario, mitigation options, abatement costs, co-benefits, risk assessment, incentives, plan of action, capacity building plan and a MRV system. They will form the basis for NAMA proposals to be submitted to the UNFCCC. Based on this experience, practical guidance will be produced including recommendations for the design and implementation of v-NAMAs.

A waste management NAMA being developed in Indonesia allows residents to exchange recyclable waste for cash at community 'Waste Banks'. Photo: v-NAMA Indonesia

[57] Deutsche Gesellschaft für Internationale Zusammenarbeit

Case Study 14 - Engaging sub-national government in NAMA design, in Indonesia and South Africa

v-NAMA Indonesia – waste management sector

This programme is developing a v-NAMA for GHG emissions reduction through waste management with the goal of preparing a proposal for national adoption. It is being implemented on behalf of BMUB[58] by GIZ[59] in collaboration with stakeholders from national, provincial and local government in Indonesia. The waste management system in Indonesia is undergoing a significant overhaul and so this programme is using this window of opportunity to incorporate GHG reduction and climate finance. The programme addresses all stages of the waste treatment process to maximize GHG mitigation potential. It also supports the National and Regional Action Plans on GHG Emissions Reduction.

There are five pilot locations, one of which is Jambi City, where waste generation is expected to triple from 2013 to 2030. Plans here include the formulation of a waste management policy, construction of a new sanitary landfill with capture and use of landfill gas, provision of recycling facilities, and public awareness/participation (including the 'Waste Bank' concept where locals can exchange certain types of waste for cash and financial services). Along with GHG mitigation, v-NAMA also aims to deliver considerable co-benefits such as improvements in public health and environmental protection.

A traditional open dump site (L) and the new sanitary landfill being constructed at Jambi City (R). Photos: v-NAMA Indonesia

v-NAMA South Africa – public buildings sector

The South African v-NAMA programme on energy efficiency in public buildings is also being implemented under the GIZ v-NAMA initiative funded by the BMUB. V-NAMA forms part of one of the eight South African Near-term Priority Flagship Programs, indicated in the National Climate Change Response White Paper. It focuses on provincial and municipal public buildings such as administration buildings, schools and hospitals. Approximately 75 buildings in four provinces (Eastern Cape, Free State, Gauteng and KwaZulu-Natal) and ten municipalities have been selected to estimate GHG mitigation potential, develop energy efficiency actions and contribute to the development of MRV-systems as well as business models. The MRV-system will be based on existing reporting mechanisms in the field of energy in South Africa, with an emphasis on practicability and avoiding double counting. A support mechanism will be set up to help inexperienced and smaller municipalities with energy efficiency proposals, procurement and MRV requirements. Leveraging private sector investments through ESCOs and shared-savings-contracts forms a core element of the v-NAMA financing strategy.

Gauteng (here represented with its biggest city Johannesburg) is one of the provinces taking part in v-NAMA for energy efficiency in public buildings

A workshop participant during the v-NAMA stakeholder consultation process

Photos: GIZ / Tobias Zeller

Further information for both projects: http://mitigationpartnership.net/v-namas-%E2%80%93-involving-sub-national-actors-national-mitigation-strategies-through-vertically-integrated

[58] German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
[59] Deutsche Gesellschaft für internationale Zusammenarbeit

Pros and Cons for the urban context

Pros	Cons
• Increased flexibility to allow country-specific design and the inclusion of policy-based activities • Aims to increase the integration of the participation of developing countries in GHG mitigation by integrating climate finance with national policy • Presents considerable opportunities for cities and buildings given the broader range of activities that could be included and the potential to link NAMAs to climate change strategies • May be focused on one sector at a time or encompass multiple sectors • If done well, NAMAs could improve the engagement of sub-national government in climate finance and build the technical capacity to take a leading role in implementing mitigation activities	• Still early days, with a lack of official top-down guidance leaving countries to find their own way • Increasingly complex compared to traditional CDM in terms of MRV, particularly given the potential size of NAMAs and the inclusion of policy-based activities for which MRV methodologies are not well developed • Sub-national involvement relies on engagement from the national level, which comes with inherent barriers such as a lack of coordination and financial political incentives

Mopti, Mali. Photo: ENERGIES 2050

4.6 The New Market-based Mechanism (NMM)

A new market-based instrument to help enhance the cost-effectiveness of GHG mitigation actions for both developed and developing countries

- A new instrument, still at the conceptual stage, for which the rules will be determined in the coming years
- Likely to be an offsetting mechanisms, run at the national level, encouraging GHG mitigation across sectors
- May link into existing mechanisms, such as credited NAMAs

How it works

Unlike the climate finance mechanisms described so far, the 'New Market-based Mechanism' is very much at the conceptual stage. It is included as an indication of future developments in climate finance, particularly in the context of the new international climate agreement anticipated for implementation in 2020.

In recent international climate negotiations, a need has been recognised for a new instrument that helps to *enhance the cost-effectiveness of, and to promote, mitigation actions, bearing in mind the different circumstances of developed and developing countries*. (32) This instrument has been termed the New Market-based Mechanism (NMM) and is intended to help developed countries meet their mitigation targets through offsetting, but also to be available to developing countries on a voluntary basis, with an emphasis on achieving a *net decrease* in GHG emissions overall. (33)

Opinions on how the NMM should function vary considerably among the countries which are party to the UNFCCC and as such rules are yet to be established.[60] However, some progress was made in defining it at COP 18 in 2012 with agreement on certain key principles, including the following points (34), (33):

- Participation of Parties[61] in the mechanism would be voluntary;
- It will operate under the guidance and authority of the COP[62] alongside existing mechanisms (i.e. the CDM and NAMAs
- The mechanism should deliver real, permanent and verified GHG mitigation, that avoids double counting and is additional to that which would have occurred without it;
- The goal remains a net decrease and/or avoidance of GHG emissions and the promotion of sustainable development;
- It should include requirements for the accurate measurement, reporting and verification (MRV) of GHG mitigation;
- It should stimulate GHG mitigation across broad segments of the economy;
- Participation of private and public entities should be facilitated.

Discussions on the NMM continued at the COP 18 climate negotiations at Warsaw, Poland 2013. Photo: ENERGIES 2050

[60] Summary of the NMM discussions so far and proposals from different countries: http://pub.iges.or.jp/modules/envirolib/upload/3352/attach/new_mech_charts.pdf
[61] Parties - countries partaking in the UNFCCC
[62] UNFCCC decision 2/CP.17, paragraph 83

Agreement on developing a NMM was reached at COP 17 in Durban in 2011. Photo: ENERGIES 2050

It is considered likely that the NMM will function as an offsetting mechanism operating at the national level, although projects could be regional or local, so long as their recognition under UNFCCC and CER issuance occurs at the national level (35). Indeed, the development of the NMM may signal a key step away from the traditional project-based CDM towards a range of flexible but more *standardised approaches*, in which key procedures are simplified in order to encourage wider take up (for example establishing the emissions baseline and demonstrating additionality for emission reductions). (16)

Defining the NMM has so far been a slow process, and so the implementation of such a mechanism is still considered to be several years off. The UNFCCC's Subsidiary Body for Scientific and Technological Advice has been tasked with elaborating the NMM's design and function. At the Bonn Climate Change Conference in June 2014, this body asked for further submissions from Parties on key elements of the NMM (design, governance etc.) with the intention of reaching further decisions at COP 20 in Lima later in 2014.

Relevance to cities & buildings

As noted above, the NMM should apply to broad segments of the economy, which would suggest that cities, as a microcosm of key GHG emitting sectors, would be well-placed to coordinate such an approach. How well the NMM provides for the participation of cities remains to be seen.

While the NMM is still largely conceptual, among the various design options proposed so far, there are potential opportunities for GHG mitigation and climate finance to be enhanced in the urban context:

One proposed option is for carbon credits to be issued and traded on a sector-basis, thus encouraging GHG mitigation within sector-specific context, and as such, could target key urban emissions sources, including buildings. This would still be coordinated by the host country, perhaps through nationally driven initiatives, but could be implemented within sectors (and their associated installations / activities) via local government or other local stakeholders.

Another proposed option is to use *Credited NAMAs* - those in which credits for GHG emission reductions can be earned for sale to industrialised countries through the global carbon market. In this case, the NMM could provide a vehicle for accessing international climate finance to support nationally driven policies – as discussed in the previous section this could target actions such as improving energy efficiency in buildings as part of a national scale policy but delivered at the local scale.

Where citywide PoAs are already in place, there may also be potential to incorporate these into a national scheme operating under the NMM, to align them with national policy and perhaps facilitate replication elsewhere. This would however require careful design to avoid double-counting and thus ensure the environmental integrity of the original PoA and the broader national NMM approach.

MRV

As for all mechanisms, the ability to accurately measure, report and verify emissions will be a critical requirement for the NMM. While it is early days for the NMM, it is hoped that expertise and methodologies developed over the last 15 years of CDM will be of use in its design, particularly regarding the inclusion of *standardised approaches*. A wealth of tools and approaches have already been developed for the CDM to tackle key issues such as baseline setting, demonstrating additionality, allowing for changes in technology, incorporating stakeholder consultation and accounting for progress made in mitigating climate change now and in future (i.e. a lower-carbon business as usual scenario). (16)

In practice

There will be considerable need for capacity building in developing countries to facilitate implementation of the NMM, particularly regarding MRV. Several readiness building initiatives are already underway: (33)

- **World Bank Partnership for Market Readiness** - working in 15 emerging economies, to facilitate participation in international carbon markets and implement innovative market solutions domestically.
- **Nordic Partnership Initiative** – funding projects in Peru and Vietnam which focus on access to new mechanisms, capacity building, data strengthening and MRV systems.
- **EU funded project to pilot sectoral carbon market mechanisms** – project focusing on five sectors in five countries, to inform the future NMM through hands-on experience, including the design of sectoral mechanisms and capacity building activities such as training workshops.
- **EU-UNDP Low Emission Capacity Building Programme**[63] – programme working with the public and private sector in developing countries, to understand their capacity building needs and respond to these, for examples through developing systems for GHG inventories, MRV, implementing climate change policies, facilitating access to carbon finance. This is also relevant to NAMAs (section 4.5).

Case study 15 highlights an innovative market-based approach developed in Tokyo, Japan to drive emission reduction in the building sector through carbon credit trading within the city. This provides a useful example of the kind of system that could be implemented under the NMM on a sectoral basis, at the city scale.

Case Study 15 - A city scale cap-and trade emissions programme to drive energy efficiency in buildings, Tokyo

Tokyo metropolitan area is responsible for over 59 million tCO_2e per year - over 4% of the country's total GHG emissions and more than that of some entire European countries. Commercial buildings account for around 40% of emissions and this is increasing. In response, the Tokyo Metropolitan Government is implementing comprehensive energy efficient programs for buildings. A major of part of this is a Cap and Trade Programme, which sets GHG emission limits for existing commercial buildings. This is Japan's first such scheme and is run by the Tokyo Bureau of Environment.

Any facility that consumes 1,500 kilolitres of fuel per year (oil equivalent) is covered, which encompasses around 1,340 facilities in the metropolitan area. Facilities must reduce their emissions according to a target set for each compliance period; for 2010-2014 this is a 6% to 8% reduction. For 2015-2019 this target is intended to rise to a 17% reduction. As with other cap-and-trade systems, facilities that reduce beyond what is required can auction their additional reductions off at market as a carbon credit.

The programme has strong domestic support from both public and building sector stakeholders and it has proven to be a great success. By the end of its third year of operation, the scheme achieved a 22% reduction in emissions among the covered facilities, compared to baseline. The city's strong energy conservation programme is playing a key role in supporting these targets and is responsible for the careful review of reported emissions.

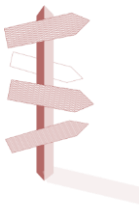
Tokyo, Japan.
Photo: Zelda Blackadder

Further information:
Tokyo Metropolitan Government www.kankyo.metro.tokyo.jp/en/climate/cap_and_trade.html
This case study is an abridged and authorized version of ICLEI Case Study No. 144: "Tokyo, Japan: Reducing emissions through green building". www.iclei.org/fileadmin/PUBLICATIONS/Case_Studies/ICLEI_cs_144_Tokyo.pdf - Please cite as per (36)

Pros and Cons for the urban context

It is too early to pull out the likely pros and cons for the NMM in cities and buildings. Local governments should watch with interest as the definition and design of the NMM develops over the coming years, and as progress is made towards an international climate agreement for 2020. Hopefully the potential for GHG mitigation at the city scale and particularly from the building sector will be recognised and incorporated into the NMM as a key part of the roadmap towards achieving net emissions reduction on the global scale.

[63] EU-UNDP LECBP
http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/climate_strategies/undp_projects_thatcontributetogreenlecrds/national_sub-nationalstrategies/low_emission_capacitybuildingprogramme.html



5 Next steps for urban climate finance

Cities as well as buildings have a unique and significant emission reduction potential but, in both cases, they often lack the knowledge and financial resources necessary to realise it.

In this Handbook, key mechanisms for accessing international climate finance have been discussed, along with their relevance for implementing GHG mitigation measures in the complex urban environment. It is intended that this will provide a helpful resource for city managers and other stakeholders when considering options to support the delivery of climate change mitigation strategies and other sustainable development goals.

Climate finance clearly has a role to play in the transition to low carbon cities; as such, the development of innovative mechanisms, which are suited to the urban context, is crucial. It is urgent to develop methods that help all cities, regardless of their size and GHG emissions profile, to gain access to climate finance, while maximising the social, environmental and economic benefits that can be achieved alongside it.

The next international climate agreement under development will also need to inspire and spur nations and their cities into action. Cities' next challenge will be to support leaders and to scale-up GHG mitigation projects and share lessons learnt and replicate best practice.

Among others, the following actions need to be put at the top of global and local political agendas to tackle the challenges ahead:

- Ensuring that cities have a prominent place in climate negotiations and access to climate finance
- Advocating for support at the global level for carbon mechanisms suitable for the urban context;
- Convincing governments to establish instruments, targets and incentives aimed at reducing the climate change impact of cities and buildings;
- Developing an urban CDM methodology and reporting framework which applies a common language and harmonized metrics for establishing baselines and demonstrating additionality;
- Transferring technical expertise (e.g. for MRV) to local actors;
- Continuing to experiment on standardized baselines with a focus on dispersed urban projects;
- Creating a fees framework that has lower transaction costs for smaller cities;
- Setting up a robust MRV framework for GHG mitigation in the urban context (with particular attention to the issues of systems boundaries, baseline setting, and data requirements).

UNEP and its partners will continue working on these key issues. Thanks to the Global Initiative on Resource Efficient Cities (GI-REC) and to the Sustainable Buildings and Climate Initiative (SBCI), additional knowledge and initiatives will be developed and tested.

Another important step will be to bring together existing approaches in order to arrive at a common but adaptable methodology for climate change mitigation and sustainable development in cities. The Francophonie's Initiative for Sustainable Cities, co-founded by the OIF-IFDD and ENERGIES 2050, fits into this logic and the next steps will be important for increasing the opportunities for meaningful action.

Cities will definitely be at the heart of solutions to address climate change. The upcoming challenge is to transform knowledge into action, constraints into opportunities and finding ways to bring the built environment to the forefront of the negotiation process.

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About the UNEP Division of Technology, Industry and Economics

Set up in 1975, three years after UNEP was created, the Division of Technology, Industry and Economics (DTIE) provides solutions to policy-makers and helps change the business environment by offering platforms for dialogue and cooperation, innovative policy options, pilot projects and creative market mechanisms. DTIE plays a leading role in three of the six UNEP strategic priorities: **climate change, harmful substances and hazardous waste, resource efficiency**.

DTIE is also actively contributing to the **Green Economy Initiative** launched by UNEP in 2008. This aims to shift national and world economies on to a new path, in which jobs and output growth are driven by increased investment in green sectors, and by a switch of consumers' preferences towards environmentally friendly goods and services.

Moreover, DTIE is responsible for **fulfilling UNEP's mandate as an implementing agency for the Montreal Protocol Multilateral Fund** and plays an executing role for a number of UNEP projects financed by the Global Environment Facility.

For more information, www.unep.org/dtie

About UNEP-SBCI

In 2007, UNEP launched the Sustainable Buildings and Climate Initiative (UNEP-SBCI), focused on global building sustainability and climate change. The UNEP-SBCI is a partnership between multinational corporations, local and national governments, NGOs, and building sector representatives from across the globe, which is successfully developing practical tools and guidance for establishing GHG emissions baselines in the built environment, demonstrating these through pilot projects and assisting government and industry to implement policies for sustainable cities and buildings.

UNEP-SBCI identified early on the need to position the building sector prominently in climate negotiations and national strategies, and to facilitate the sector's participation in carbon and climate finance.

For more information, www.unep.org/sbci

About UNEP GI-REC

The Global Initiative on Resource Efficient Cities (GI-REC) is a UNEP-led initiative launched in June 2012 at the Rio+20 Summit. The initiative currently works with different stakeholders to promote energy efficient buildings, efficient water use, sustainable waste management and other activities. The ultimate goal of GI-REC is to mainstream resource efficiency and sustainable consumption and production into policies and tools at the city level and to change consumer and industry behaviour accordingly.

GI-REC provides a range of support to cities to assist with realizing the economic, social and environmental benefits of resource efficiency and sustainable consumption and production. GI-REC develops partnerships with key stakeholders, including local and national governments, international organizations, NGOs, private companies, etc.

For more information, www.unep.org/pdf/GI-REC_4pager.pdf

About ENERGIES 2050

ENERGIES 2050 is a non-profit NGO which works both locally and internationally on the ***Great Transition*** - the shift towards a more humane, plural and united society, bringing peace and respecting the common goods of humanity. One of the many important topics within this challenge is the ***Energy transition*** - embedding energy efficiency and renewable energy generation into society. Fields of action include **climate change**; **sustainable development, consumption and production**; and **low carbon cities and buildings**, among others. Pillars of work include implementing demonstrative and replicable projects and technical research; publishing articles and reports; organising and participating in conferences and workshops; education and training; and communicating to a wide audience, to inform and mobilise.

ENERGIES 2050 works in partnership with several international institutions, including UNEP and the Institute of la Francophonie for Sustainable Development (IFDD) a subsidiary organ of the International Organization of la Francophonie (OIF). ENERGIES 2050 is also an active member of the UNEP-SBCI.

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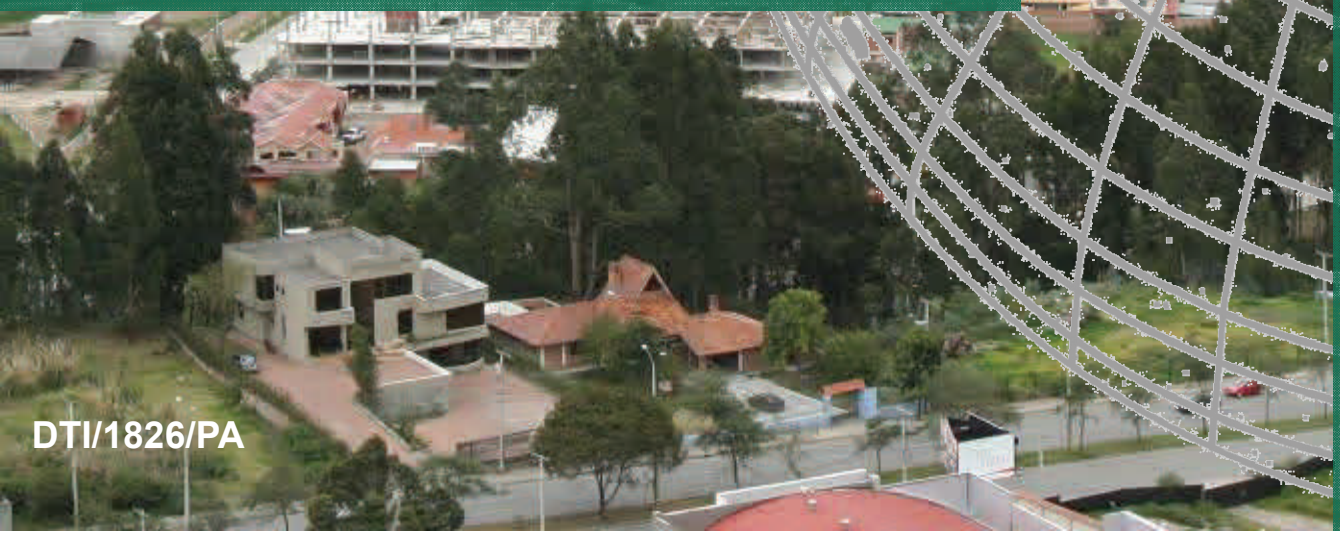
This Handbook provides local policy makers and other interested readers with an overview of climate and carbon finance mechanisms, both existing and in development, and their relevance to the urban context. It has been prepared in response to a recognised need for a user-friendly guide to such mechanisms, their potential to help reduce greenhouse gas emissions from cities and buildings, particularly in developing countries, whilst generating income and other sustainable development benefits.

It aims to help raise awareness among local stakeholders regarding climate and carbon finance and its potential in the built environment. It also aims to help local authorities to use carbon mechanisms as an opportunity to increase the energy performance of their district whilst creating additional revenue, improving resource efficiency and as part of their wider climate strategies.



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