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# City-Wide Programmes of Activities – An Option for Significant Emission Reductions in Cities?

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**Summary**

This paper analyses whether city-wide approaches to carbon finance under the Clean Development Mechanism (CDM) are a viable option for significant emission reductions in cities. For this purpose, the paper first provides an overview of emission sources and possible mitigation activities in cities and explores local governments' capacity and motivation to implement mitigation measures. The paper finds that there are vast mitigation options in cities that cities can tap with different modes of governance in the sectors energy, buildings, transport, waste and wastewater, water services and urban greening/agriculture. While many of these options have substantial co-benefits and some are even cost-effective, significant net costs would accrue for others.

The following chapter discusses the current role of developing country cities in the CDM to determine the impact the CDM currently has on the development of urban mitigation projects. Overall, it becomes clear that cities' engagement is so far very restricted, both in the project-based CDM as well as in Programmes of Activities (PoAs).

Subsequently, we identify the main barriers that hinder the engagement of cities in the carbon market. This includes general barriers for urban mitigation projects as well as those especially relevant for CDM activities. We find that institutional as well as financing issues are significant barriers, in addition to considerable CDM-inherent as well as sector-specific barriers.

Chapter 5 discusses a proposal on a city-wide PoA that might solve some of the barriers identified as developed by the World Bank. The proposal includes the option to aggregate emission reducing activities in various sectors within one city (horizontal aggregation) as well as in a specific (sub-)sector across various cities (vertical aggregation). The World Bank suggests using a combination of CDM methodologies and a simplified "estimation" approach for the quantification of emission reductions. The chapter also provides an overview of CDM methodologies suitable for urban projects and illustrates the current status of city-wide PoAs in CDM rules and international negotiations. It finds that while current provisions lay the ground for a variety of urban projects including methodology combinations, the World Bank's "estimation approach" is not applicable under current CDM rules. Finally, the chapter analyses the effect of a city-wide PoA on the barriers identified for the engagement of cities in the carbon market. It becomes clear that only some of the barriers can be removed with a city-wide PoA. The majority of the barriers identified, however, remain intact.

The paper closes with the question of whether approaches other than those possible – or possibly to be developed – under the CDM might be needed to tap mitigation options in cities. Such approaches could, for example, consist of a city-wide approach where, instead of adding up emission reductions from multiple individual projects, top-down greenhouse gas (GHG) inventories of cities covering direct as well as indirect emissions from all relevant sectors could serve as the basis for determining the activities' success. Such an approach would be similar to the proposals for "sectoral crediting" and "sectoral trading" that are currently being discussed in the climate negotiations.

# Contents

# 1 Introduction

While only representing 1% of the earth's surface, urban areas are home to around half of the global population and responsible for 60 to 80% of global greenhouse gas (GHG) emissions (Clapp et al. 2010). Even though currently cities in developing countries only contribute 25% to urban GHG emissions, the high growth rate of developing country cities makes it imperative to pay attention to their future climate impact (UN-HABITAT 2011). Between 2006 and 2030, 81% of the projected increase in energy use and 89% of the related $CO_2$ emissions will come from non-OECD countries (IEA 2008). The major share of this emission increase will be generated in cities. Since it is difficult to change the energy consumption once infrastructure and buildings have been established, it can be said that "Cities are where the Climate Change battle will be won or lost over the next decades" (World Bank Institute 2011).

Reducing cities' multi-source emissions does no only represent a great challenge in terms of governance but also requires substantial financial resources. Most cities, however, are experiencing permanent budget constraints, a situation which could even worsen in the future since cities and their infrastructure will be among those suffering most from the adverse effects of climate change. Cities therefore need to explore new sources to finance activities that reduce GHG emissions. One potential financing instrument is the Clean Development Mechanism (CDM), one of the "flexible mechanisms" defined under the Kyoto Protocol, which allows projects to generate certified emission reductions (CERs) that can be traded at the global carbon markets. So far, however, only very few CDM projects have been undertaken by city authorities. With the development of CDM Programmes of Activities (PoAs), which allow the aggregation of decentralised project activities (CDM Programme Activities, CPAs) under the coordination of one central actor, the PoA Coordinating/Managing Entity (CME), the potential for city-wide mitigation actions has greatly increased. Once the PoA has been registered by the CDM Executive Board, an unlimited number of CPAs can be added to a PoA at any point during the lifetime of the PoA. Nevertheless, there still are significant barriers to large-scale urban mitigation actions financed via the CDM.

This paper opens with an overview of emission sources in cities and local governments' capacity and motivation to implement mitigation measures. Subsequently, the current role of developing country cities in the CDM is analysed. While chapter 4 explains existing barriers for tapping mitigation options in cities with a focus on the CDM, chapter 5 illustrates proposals for a city-wide approach to carbon finance and explores such a concept's potential influence on existing barriers as well as the current status of CDM rules regarding city-wide PoAs. The paper closes with the question whether the CDM can be the tool to tap mitigation options in cities or whether other approaches might be better suited to reach significant emission reductions in cities.

# 2 Sources of Urban GHG Emissions and Mitigation Options

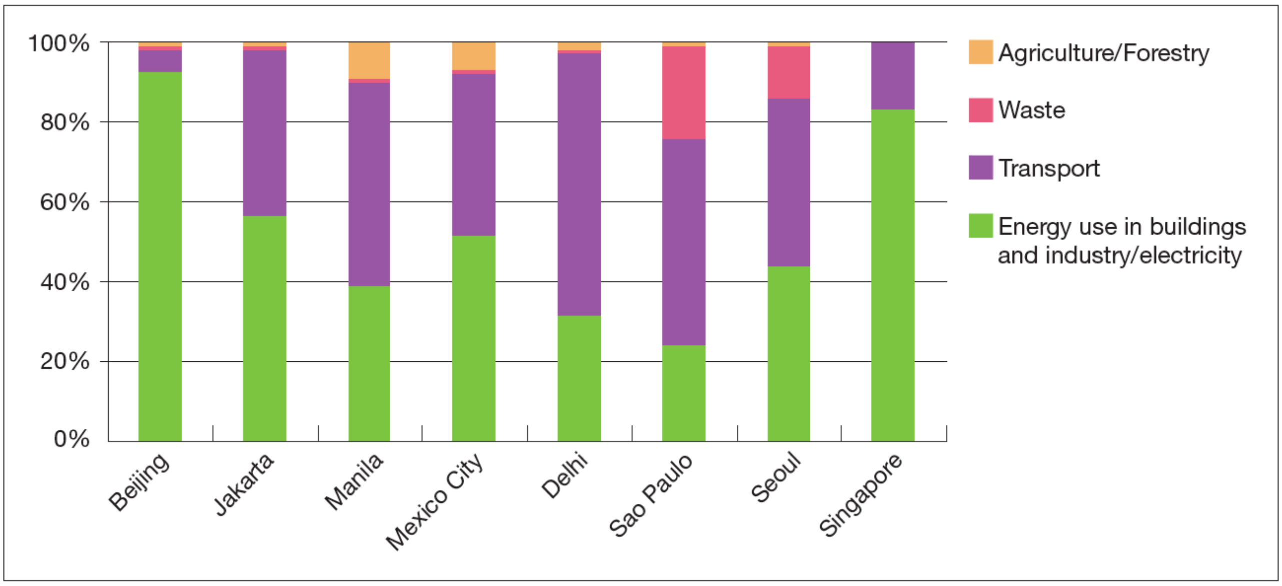
This chapter provides an overview of relevant emission sources in cities and explores local government's capacities in tapping these emissions. A sectoral analysis highlights different options for intervention as well as benefits such activities may provide beyond the mere reduction of GHG emissions.

## 2.1 Technical GHG Abatement Potential in Cities

When analysing cities' potential for mitigating climate change, a thorough understanding of the composition of their specific GHG emissions is crucial. However, monitoring of GHGs at cities level is still in its early stages of development and is particularly challenging in terms of defining its scope and boundary. The World Bank, UN-HABITAT and UNEP have developed different approaches for an international standard for GHG accounting within a city, providing a clear guideline to follow and make inventories of cities around the world comparable (World Bank 2010b). For emissions accounting and mitigation actions in cities, the sectors energy, transport, solid waste, water and wastewater, and urban forestry are most relevant.

Figure 1 depicts that cities vary in their GHG emissions profiles in terms of sources, indicating that cities start from different carbon endowments. The most relevant causes are the geographical location, industrial orientations as well as historical urban planning practice. Colder climates require higher fossil fuel consumption for heating and energy intensive industry causes higher GHG emissions than service-oriented sectors (Baeumler / Ijjasz-vasquez / Mehndiratta 2012). These differences indicate that not one package of mitigation measures can be readily applied across all cities.

**Figure 1: Carbon Emissions Profiles for Metropolitan Areas (Sovacool / Brown 2010)**




Similarly, the cities' overall size and their population density will largely influence their mitigation potential. Several studies revealed that compact cities tend to have smaller per-capita carbon footprints than sprawling cities due to increased transport requirements. Hence, especially middle-income countries with high urban growth rates and new infrastructure investment needs might have a high potential to reduce emissions in urban planning of new settlement areas (World Bank 2010b). However, in order to exploit these large GHG abatement potentials mitigation actions need to be accompanied by progressive economic and urban planning in terms of public transport networks, efficient water, wastewater and solid waste systems planning (World Bank 2010b).

## 2.2 Governance Aspects

When GHG emissions generated within the cities' geographical boundaries are to be reduced, the ability and willingness of local governments to induce changes in the respective sectors becomes crucial. Bulkeley and Kern (2006) have identified **four different modes of governance** cities have at their disposal for designing and implementing climate change policy responses. Each single mode of urban governance corresponds with a particular role cities are performing:

First, in their role as energy users and consumers (1), cities can **reduce their own energy consumption** and their ecological footprint, for example by improving energy efficiency in municipal buildings or by applying strict ecological criteria for their procurements (self-governing). Second, in their role as service providers (2), cities can **influence the infrastructure and the delivery of urban services** such as energy services, sewerage and waste management, public transport, street lighting or city parks (governing by provision). Third, in their role as authority (3), cities can influence the emission of GHGs by enacting energy efficient building standards, by planning the urban traffic or by providing permits for land development **(governing by authority).** Finally, **cities can support other stakeholders** in their climate protection activities, acting as facilitators (4), for example by facilitating subsidised energy audits for local companies and the provision of energy efficiency information or by supporting climate protection activities of private and civil society organisations (governing through enabling). Within this scope, city governments could also promote the uptake of support from programmes by the industry, the agriculture and the power sector, which are provided by the national government.

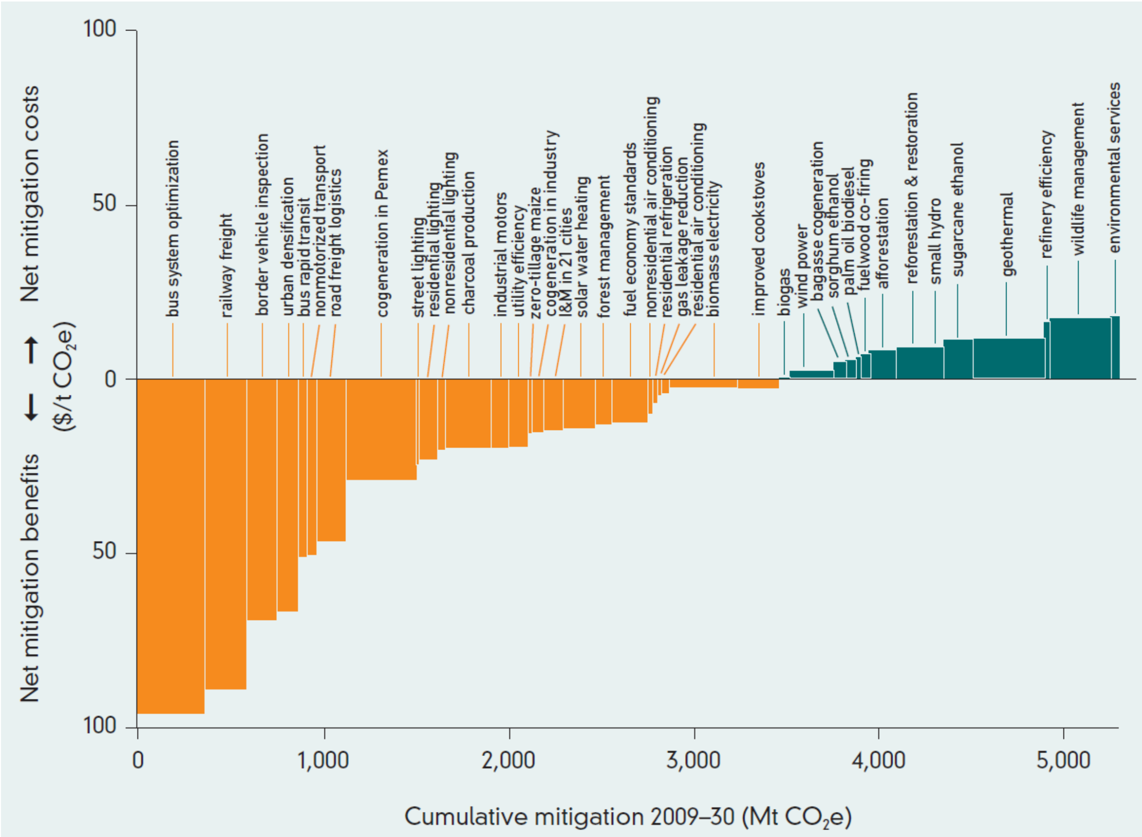
Every single one of these four governance modes has its strengths and limitations. However, research suggests that the self-governing and the enabling governance mode remain the dominant approaches particularly in industrialised countries, while cities in the developing world are more frequently making use of their role as providers of low carbon infrastructure and services. The regulation mode, in contrast, is only playing a limited role (UN-HABITAT 2011).

In practice, municipalities tend to combine different modes of governance according to the specific demands of the different policy sectors and the particular national and local contexts. Hence, mitigation measures at the local level cannot be planned only according to the existing GHG reduction potential but municipal governments' capacities and their options to implement specific measures as well as their development priorities have to be equally taken into account.

## 2.3 Cost Effectiveness and Co-Benefits

In addition to the question on governance, mitigation actions should also take into account the financing needs, particularly when considering the scarce financial resources of local governments in developing countries. However, a large number of mitigation actions provide "win-win" solutions, in that their financial benefits will outweigh their costs (McKinsey & Company 2009). Taking Mexico as an example, Figure 2 indicates that mitigation activities such as specific public transport and lighting interventions, energy efficiency in housing and selected industry projects as well as waste management, which are displayed in orange, are cost effective or neutral. For a lot of other mitigation options, however, revenues and savings do not cover the measure's costs (Johnson et al. 2009).

**Figure 2: Marginal Abatement Cost Curve (Johnson et al. 2009)**




The presence of substantial "no-regret" mitigation potential indicates that non-economic barriers are preventing the adoption of these measures. Therefore, even though the graph above indicates that cities have a variety of cost-efficient mitigation actions, the existing barriers for their implementation in every single country and city have to be carefully assessed on an individual level (see Chapter 4).

Such an assessment should also take into account potential positive and negative side-effects arising from the implementation of climate change mitigation activities in cities. If measures have substantial so-called co-benefits these can be used as a driver for the implementation of mitigation measures, and are of particular importance in countries with high levels of poverty where basic services are often lacking. In these countries climate change mitigation is – at its best – often only one of many pressing local development issues. Hence, especially cities in developing countries preferable opt to implement mitigation activities which do not only reduce GHG emissions but also contribute to the sustainable environmental, social and economic development.

Co-benefits can range from positive effects on education and health to poverty reduction by generating new sources of income. Thus, for example, energy efficiency measures in buildings can address energy security and poverty reduction if low–income population is targeted. Furthermore, mitigation measures in the waste or the transport sector can have a significant impact on health improvement due to the reduction of air pollution. The CDM has even generated political co-benefits by channelling national recognition and international partner cooperation to a local city context (Clapp et al. 2010). These and other potential positive as well as negative impacts should be taken into consideration when assessing the potential for implementing mitigation activities.

## 2.4 Relevant Sectors for Mitigation Actions in Cities

The following section scrutinises the potential of individual sectors for the implementation of urban mitigation actions. For each sector, potential mitigation measures are identified and practical examples provided. Furthermore, governance aspects as well as the potential for achieving co-benefits in the sectors of energy, transport, waste, water and urban greening/agriculture are discussed.

**Energy**

Mitigation activities in the energy sector can target the supply as well as the demand side and can generally be assigned to the categories of energy efficiency and renewable energy. While renewable energy projects comprise the generation of electricity from sources such as wind, hydro or solar, energy efficiency measures reduce energy demand at the supply and demand-side by introducing technological improvements or behavioural changes.

**Buildings** provide the largest opportunities for improving demand-side energy efficiency, both in the design of new buildings as well as in the retrofitting of existing ones. With the integration of renewable energy sources and the use of energy efficient equipment for heating, cooling, cooking and hot water supply, significant energy savings can be achieved. By establishing and implementing building energy efficiency codes, local authorities can make extensive use of their role as regulators. However, with local building codes being typically stricter than national ones, local opposition tends to be strong (Kamal-Chaoui / Robert 2009). Hence, cities may recur to their role as service providers and consumers and achieve GHG reductions with their building services or in the buildings and properties owned by the city. Furthermore, cities have the possibility to implement incentive programmes that reward building owners for modifications that reduce the energy consumption of houses. While minimum performance standards for energy consumption are generally set at the national level, municipalities can encourage the use of high-efficient material through interventions at the local level, such as green building incentive programmes that reward building owners for using environmentally-friendly construction materials (World Bank 2010a). Cities can also play a pivotal role in exploiting the vast potential for energy savings that can be achieved through behavioural changes through capacity building and awareness raising campaigns (World Bank 2010a).

**Street lighting** and related services do also hold important potentials for energy savings. Energy consumption from traffic lights, street lights and other public lighting account for up to 30% of the total GHG emissions of a city administration (Firman / Kenihan 2010). These emissions can be significantly reduced with the implementation of technological improvements, such as high efficiency lights (e.g. LEDs) and the installation of photovoltaic technology.

Significant emission reductions can further be achieved through the use of low-emission **district heating systems,** which distribute steam or hot water to several buildings over large areas. Cities can either install new district heating systems or reduce emissions from existing ones by improving their efficiency or switching from fossil fuels to renewable sources. In summer time, such systems can further be used for cooling purposes, with the hot water serving as energy source for absorption chillers (World Bank 2010a).

Many cities have access to large **renewable energy sources** such as biomass, wind or geothermal energy. In its role as service provider through municipal utilities, the city administration can use these energy sources for electricity generation and achieve important emission reductions as well as environmental and ecological benefits. Even if energy services are not provided by the city itself but by private or national companies, cities have several possibilities to foster the use of renewable energy sources. Through regulation, cities can exploit renewable energy sources in a decentralised way, for instance by requiring house owners to install solar water heaters. In its role as a consumer, cities can further purchase electricity from renewable energy sources (Kamal-Chaoui / Robert 2009).

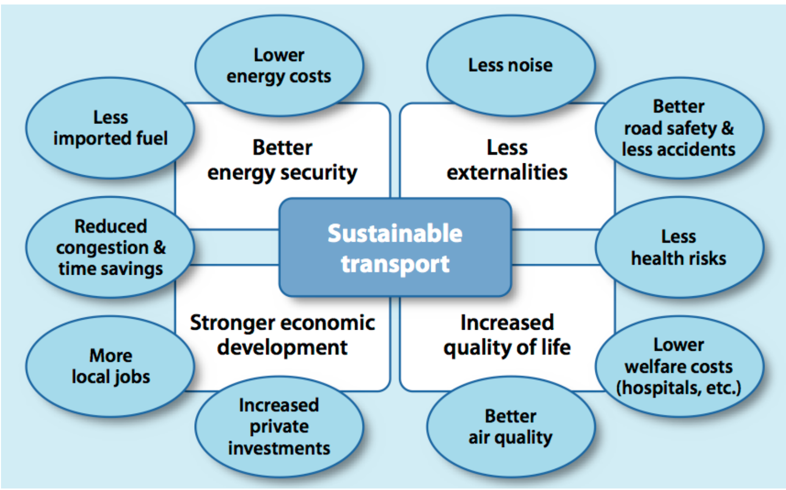
**Transport**

Currently, about 13% of global GHG emissions stem from the transport sector (Kahn Ribeiro et al. 2007). Without substantial policy changes it has been predicted that emissions in the transport sector will be around 80% higher than current levels by 2030 (Kahn Ribeiro et al. 2007). The majority of this growth will occur in urban areas of developing countries, where western infrastructure and lifestyle patterns are being adopted along with the rising level of income (World Bank 2010a).

The negative impacts of this development are becoming increasingly evident, particularly in large urban areas, where large parts of the population are suffering from air pollution and experiencing health problems. In order to mitigate GHG emissions and to avoid such negative impacts cities are developing strategies that can best be depicted using an approach known as A-S-I (from Avoid-Shift-Improve). Firstly, **"avoid"** stands for improving the transport system via urban planning to reduce the need for distances travelled. Secondly, **"shift"** indicates the need for transport to become more efficient in regards to the mode of transport used. Hence, it describes the switch from a $CO_2$ intense means of transportation to a less $CO_2$ intense one, such as shifting from car driving to cycling. Thirdly, **"improve"** refers to increasing the fuel efficiency of vehicles as well as to improving existent transport infrastructure (GIZ 2011). Every single A-S-I component comprises several individual mitigation activities with the potential to achieve substantial GHG reductions in cities. Regarding the shift component, for instance, it was estimated that an increase of public buses of 5 to 10% in Latin American cities would reduce GHGs within these cities by 4 to 9% (Kahn Ribeiro et al. 2007).

However, mitigation actions targeting the urban transport sector do not only reduce GHGs but usually also help to meet broader economic, social and environmental goals. An overview of co-benefits associated with transport mitigation activities is provided by Figure 3 below.

**Figure 3: Sustainable Transport Co-benefits (GIZ 2011)**




To reduce GHG emissions from the transport sector and in order to achieve respective co-benefits, local authorities in developing countries are implementing technological as well as behavioural measures. In the transportation sector, cities can make use of the whole range of governance modes (Kamal-Chaoui / Robert 2009). In its role as a regulator, cities can limit the individual motorised transportation, as in Seoul, Korea, where authorities introduced a weekly no driving day. A large number of activities comprise infrastructure projects such as the introduction of Bus Rapid Transport Systems, where authorities govern by provision. One crucial factor is what share of the available road space is given to which transport mode, that is, whether cars are prioritised over public transport, walking and cycling, or vice versa. By making use of these and other governance modes local authorities can induce significant emission reductions in the urban transportation sector.

**Waste and Wastewater**

According to the IPCC, the waste and wastewater sector is considered to cause about 2.8% of global GHG emissions (IPCC 2007). The largest part of the GHGs in the solid waste sector are methane emissions from landfills, which mainly occur in urban areas and are thus a particularly pressing problem for large cities in developing countries. With the population in developing countries constantly rising and the urbanization trend being unbroken, the amount of waste and respective emissions can be expected to increase further in the future.

There are a series of policy options to reduce these emissions, the most effective being the **reduction of waste** in the first place. The influence of the city authority in this regard is limited to information campaigns while stronger instruments such as pricing mechanisms to change existing patterns of production and consumption are better implemented at national level (World Bank 2010a). Hence, local authorities' activities mainly target the handling of waste. Here, cities can reduce waste disposal and methane emissions by providing **recycling and composting** practices or by setting fees to discourage waste. At the moment, however, cities in developing countries are particularly active in implementing landfill gas projects where methane is captured and used for energy generation (Kamal-Chaoui / Robert 2009). Under the CDM, these project types are the highest in number of all urban activities.

Wastewater treatment also holds significant potentials for mitigation activities since this process is associated with the production of sludge than can generate gases with particularly high GHG effect: methane and nitrous oxide emissions. These emissions can be reduced through the optimization of wastewater treatment and the reduction of leaks and losses. With these improvements the negative impacts resulting from the discharge of untreated wastewater, such as pollution of local water resources and associated health risks, can be further reduced (World Bank 2010a).

**Water Services**

The water sector is not only of concern to climate change adaptation, where conservation activities are being implemented to ensure the supply of this pivotal resource in the long term (Firman / Kenihan 2010). With considerable amounts of energy being consumed in domestic water distribution systems due to inefficient distribution networks and pumping stations, the water sector does also hold significant potentials for mitigation activities. Tapping these potentials by improving the efficiency of the distribution systems can lead to substantial water, energy and cost savings and make an important contribution to the conservation of local water resources. Other measures such as integrated water planning, rainwater catchment, local treatment and water-efficient household appliances may also represent viable means for local authorities to preserve their water resources while at the same time giving the possibility to achieve significant GHG reductions (World Bank 2010a).

**Urban Greening/Agriculture**

Even though the main motivation for greening urban spaces has been conservation and recreation potential for citizens, trees can also serve as carbon sinks by absorbing $CO_2$ from the atmosphere (Firman / Kenihan 2010). Thus, carbon sequestration, either in form of tree planting or preserving and conserving natural carbon sinks, represents a viable opportunity for mitigation measures in cities (UN-HABITAT 2011). In addition to GHG mitigation effects, urban forests provide important benefits to the local population, such as improved air and water quality, reduced noise pollution and reduction of urban heat islands (World Bank 2010a).

Urban forestry initiatives could be accompanied by activities that foster urban and peri-urban agriculture. Such initiatives could be used to counteract the consequences of the current suburbanisation trend that results in a reduction of agricultural areas in and around cities. Urban agriculture initiatives reduce transportation distances and thus achieve GHG emission reductions while at the same time improving food security as well as better health, nutrition and livelihood conditions for people living in and around cities (World Bank 2010a). One major challenge associated with urban forestry and agriculture activities is their long time horizon. Benefits accruing from such initiatives may take several years to materialise, in cases of urban forests even decades, making it difficult for local authorities to plan such activities.

**Conclusion**

As this brief sectoral exploration showed, there are several ways for cities to contribute to the overall goal of climate change mitigation. Hence, local authorities are confronted with the challenging task of properly selecting, designing and implementing the mitigation policies best fitting their particular situation. If implemented successfully, local mitigation actions can effectively complement national climate mitigation actions. Furthermore, an additional effect well beyond the original mitigation goal may be achieved: If local experiences are translated to the national or regional level, cities can perform the role of laboratories for future climate action, showing new mitigation options and highlighting existing challenges. This second pivotal function as well as the multiple benefits accruing from local climate action raises the question whether international climate finance has been able to support and stimulate local activities. The following section will approach this question by analysing local climate governance in the CDM as well as currently existing urban CDM projects.

# 3 The Current Role of Developing Country Cities in the CDM

While climate protection activities generally involve several stakeholders, local governments are in a pivotal position for promoting and coordinating such undertakings. Chapter 2.2 identified four different modes of governance cities have at their disposal, each one corresponding with a particular role cities can play to design, carry out or promote mitigation actions: the city as consumer, service provider, facilitator and governor by authority. While the actual degree of influence cities have may vary from city to city and ultimately depend on the individual governance structure, local governments can use part of these governance modes for engaging in CDM projects. Building on these governance modes, Sippel and Michaelowa (2009) differentiate three possibilities for the engagement of local governments in the CDM: First, local governments can develop and implement a CDM project targeting emissions produced by the local authority itself. Second, cities can act as providers and offer different services that reduce greenhouse gas emissions stemming from its citizens' behaviour. A third possible activity consists in the coordination and promotion of CDM projects of other local stakeholders. The fourth governance mode based on the local government's formal authority cannot be directly applied to the CDM since regulatory activities are not eligible under the CDM. However, the CDM and in particular PoAs can be applied for the implementation and enforcement of laws and regulations. With these governance modes, cities have several possibilities at their disposal for curbing greenhouse gas emissions by participating in the CDM.

## 3.1 The Current Role of Municipalities in the Project-based CDM

Despite vast technical project potentials and diverse opportunities for local governments to engage in CDM projects, development and implementation of urban project is still dominated by private companies and non-governmental organizations (NGOs) while municipalities' participation often remains marginal.

According to a study by the World Bank, only approximately 150 of the 1,900 CDM projects registered by December 2009 are being implemented in urban areas (World Bank 2010a). With a more restrictive definition of urban projects, Clapp et al. (2010) came to similar findings: from the 2,062 projects registered in March 2010, only 66 projects had been initiated by cities or were involving city authorities. Extending their research to the overall project pipeline, Sippel and Michaelowa (2009) analysed 5,342 projects submitted for validation in November 2009 and found that 57 projects had a municipality or a formal municipal company as project participant while another 35 projects, mostly from China, featured a project participant specified as “city”.

In the meantime, the number of projects having entered the validation process has risen to more than 11.000 by August 2012 (IGES 2012). The tendency of urban entities to only play a marginal role in CDM project development and implementation, however, remains unbroken. Our analysis of the IGES database showed that in total 34 projects have been proposed by municipalities or by companies that feature the word “municipal” in their official company name. Since this approach does only allow for a rough estimation as municipal projects not featuring the mentioned characteristics will not be captured, a sectoral analysis will be done in the following in order to paint a more complete picture of municipalities’ engagement in the CDM.

## 3.2 Sectoral Distribution of Urban CDM Projects

Not all urban sectors with high GHG emissions are equally suited for developing CDM projects and the actual potential for project development by urban authorities depends on the specific regulation of the respective sector. In many countries, municipalities are responsible for waste management as well as power generation and distribution. Furthermore, public transport is also frequently managed by local authorities who often also have strong influence on the sectors transport and buildings (Sippel / Michaelowa 2009).

Accordingly, these sectors hold the largest potentials for the implementation of urban CDM projects. This is reflected by findings from previous studies: According to Sippel and Michaelowa (2009) the waste sector has the largest fraction of urban projects, with projects using energy from landfill gas and landfill gas flaring projects dominating, followed by waste water projects. Renewable energy is another sector with large project numbers. Here, hydropower projects dominate the field, particularly due to the engagement of Chinese city companies (Sippel / Michaelowa 2009). Clapp et al. (2010) found that the majority (56) of the registered 66 projects initiated by cities or involving city authorities refer to urban landfill gas, while four projects target waste water treatment. Only two projects aim at improving energy efficiency in urban buildings and lighting while another two projects refer to energy distribution (Clapp et al. 2010).

Reflecting these findings, we looked at registered projects of those sectors holding the most promising potential for the future, namely: energy efficiency at the supply side, energy distribution, energy efficiency in buildings, households and lighting, and transportation. Other sectors have been omitted due to several reasons:. Sectors such as forests and agriculture are deemed not to hold large potential for projects by urban governments. In other sectors urban potential is already being widely exploited, such as the waste sector. We built our research on the data from Clapp et al. (2010) and analysed those projects which where added to the UNEP Risoe CDM pipeline in the selected sectors since March 2010. This approach not only increases effectiveness of the analysis but also allows to track historical trends. Following the classification by Clapp et al. (2010) we define urban projects as those where the urban government or its direct service provider is an important actor (project developer, manager) in the project according to the Project Design Document (PDD). Accordingly, the mere consultation of urban governments as a stakeholder was not regarded sufficient for activities to qualify as urban projects.

The results indicate that urban governments still have difficulties in tapping the large technical potentials in cities, despite numbers of urban projects slightly rising. With regard to projects targeting **energy efficiency at the supply side,** three urban projects have been registered since March 2010, when no such project had been registered. Two of the projects registered since target the reduction of greenhouse gases through the conversion of single to combined gas turbines, one in Santa Cruz (Bolivia) and one in Lima (Peru). The third project aims at reducing GHGs by installing high efficient coal-fired power generation units in Shanghai. While urban governments apparently did not play a key role in the development of the undertakings, municipal service providers have been engaged in project development. A similar observation can be made with regard to **energy efficiency projects in households.** While the total number of projects has risen from 6 (in March 2010) to 32 (in August 2012) with a large part being implemented in cities and urban areas, only one project is managed by a city administration. This project is administered by the City of Cape Town, South Africa and aims at implementing low cost urban housing energy upgrades. **Energy distribution projects** have also experienced a slight rise in the last years. While in March 2010 only two projects had been registered, six additional energy distribution projects have been registered by August 2012, all of them aiming at improving district heating in China. A clear upswing, though at a low level, of CDM projects was detected in the **urban transportation sector,** where a total of 14 projects have been registered. Furthermore, activities in the transportation sector are no longer limited to the introduction of new Bus Rapid Transit Systems but include the deployment of new transportation measures such as cable cars in Medellin (Colombia). Urban service providers play a key role in the design and implementation of these projects (UNEP Risoe 2012).

## 3.3 The Role of Municipalities in the Programmatic CDM

With the introduction of the programmatic approach in 2007 the CDM Executive Board expanded the project-by-project approach allowing several programme activities (CPAs) to be registered under one single programme. Since single CPAs can be added to the programme at a later stage, the programmatic approach gives more flexibility in implementation while allowing to reach small and dispersed emission sources, which would be too small to be targeted by a single CDM project. By introducing these two organizational levels, the programme level and the programme activities level, the programmatic approach does not only hold the potential to reduce the transaction costs for project implementation but also provides opportunities for the engagement of diverse actors, including local governments. Municipalities can therefore become active at the programme and at the programme activities level or even be active at both levels. As our analysis of the thirty PoAs registered by the CDM Executive Board by September 2012 reveals, local authorities are actively making use of the multiple possibilities for participating in the programmatic CDM (UNFCCC Website 2012).

One example for the engagement of **local governments at the programme activities level** is the Ugandan municipal waste compost PoA, which was registered by the CDM Executive Board in April 2010. The purpose of the programme is to avoid methane emissions from municipal waste landfills by composting the waste, which under common practice would have been disposed in landfills. The programme's Coordinating Entity is the National Environment Management Authority (NEMA), which supports the municipalities in technical and financial terms with the implementation of the single CPAs. Additional support is provided by the Government of Netherlands through the Community Development Carbon Fund (CDCF).

A similar structure is applied by the Korean "Programme to Promote Efficient Lighting in Local Areas", which was registered in November 2011 and aims to replace existing inefficient public streetlights with new light emitting diode (LED) lamps across Korea. The programme is being coordinated by the national Korea Energy Management Corporation (KEMCO) while individual CPAs will be implemented by local public entities, such as the Metropolitan Government of the City of Gwangju, who will implement the first CPA.

The possibility for **local authorities to engage as programme coordinators** is being used in the Vietnamese PoA “Installing Solar Water Heating Systems in the South of Viet Nam”. The programme aims at distributing Solar Water Heating Systems in households, kindergartens, small hotels and buildings and will be coordinated by the Energy Conservation Centre of Ho Chi Minh City (ECC), an organisation set up by the Peoples Committee of Ho Chi Minh City. As shown in Figure 4, ECC will also be responsible for the implementation of the CPAs.

**Figure 4: Possibilities for Participation in PoAs for Local Authorities and Examples**

| | | PoA coordination and management | |
|---|---|---|---|
| | | By Private or national public entity | By Local Authority |
| **CPA implementation** | By third party | | |
| | By Local Authority | Uganda, Korea | Vietnam |

Besides these possibilities for direct participation of local authorities, municipalities can also act as facilitators for programme implementation, as in the case of the South African low pressure solar water heater Programme. While the Solar Academy of Sub Saharan Africa (Pty) Ltd. (SASSA) will not only coordinate the PoA but is also responsible for CPA implementation, Memoranda of Understanding will be signed with municipalities for the implementation of the individual CPAs.

These examples show that there are several possibilities for the participation of local authorities in the implementation of PoAs. Municipal participation is, however, often limited to a stakeholder function, thus resembling the role of municipalities in the implementation of the project-based CDM. Also, the number of urban CDM projects has so far been very small. Therefore, the following chapter sheds light on the barriers existing for CDM and PoA mitigation activities in cities.

# 4 Barriers for the Engagement of Cities in the Carbon Market

CDM project and PoA development by municipalities is hampered by a number of barriers. These range from actor-specific problems such as limited competencies of city government departments and financing issues up to CDM-inherent obstacles such as a lack of suitable methodologies or overall problems of the PoA approach. In the present chapter, existing barriers for the engagement of cities in the carbon market have been sorted into institutional issues, financing aspects, CDM-inherent and sector-specific barriers.

## 4.1 Institutional Issues

When looking at cities as actors for climate change mitigation, a few overarching barriers can be identified: for example, the responsibility for GHG reduction activities historically was often perceived to be with the national government rather than local authorities (World Bank 2010). Moreover, municipalities often focus on measures with direct local impacts, such as urban development or economic growth. The immediate local benefits of GHG mitigation projects, however, are often difficult to quantify and city governments thus find it difficult to raise funds for these activities (ibid). This is also due to short election periods of municipal officials (see below).

General **capacity** constraints in terms of strategic planning, human resources and negotiation skills will also have a negative impact on planning and implementing of mitigation actions at local level. Often comprehensive strategic planning is non-existent and sectoral actions are rather driven by a short-sighted business-as-usual approach rather than far-sighted, progressive policy making (UNHABIAT, 2011). This also follows from a lack of strong leadership within some municipalities (Clapp et al. 2010). Developing mitigation activities and CDM projects, however, require technical know-how as well as the competency and expertise to deal with the complexities of PDD writing and steering the project through the CDM project cycle (Sippel / Michaelowa 2010). Even if these competencies are available within the municipality, they will most likely be scattered all over the institution; moreover, it will be difficult to assign skilled staff with the appropriate time budget for carrying out the time-consuming CDM-related tasks. What is more, skills development will take time, does not yield immediate results and is hindered by frequent rotation of municipal staff (Sippel / Michaelowa 2010).

In addition, the **political system** and the administrative organisation of the host country come into play: certain types of regulation might not be in the realm of the city council, such as fuel consumption standards or building codes. This also accounts for financing issues: the municipal governments might not be able to access funds directly. Another barrier encountered is the **overlapping authority within a sector**. For example in Indonesia it was found that waste management is split between up to four different local agencies. A joined coordination of a GHG reduction project will thus be very difficult (Clapp et al. 2010).

A further institutional problem is the **short-time horizon of legislative periods.** While CDM PoAs can last up to 28 years, city governments serve for short periods. The project's benefits therefore are often not attributable to the municipal official who introduced them – be it the CER revenues or the producible benefits of a new metro system (Sippel / Michaelowa 2010). Also, local governments prioritise mitigation measures with significant and visible **co-benefits** rather than those with the highest GHG reduction potential. This is also caused by the fact that frequently, environmental departments at local level are weak institutions that have to negotiate their strategies with other departments as well as funding and planning committees (Rode et al. 2012).

## 4.2 Financing Aspects

Many city governments are burdened with **budgetary constraints.** Therefore, carbon finance at first sight offers a helpful add-on. Yet opportunities to raise capital on private markets to pre-finance a mitigation project can be limited by a number of factors, such as the missing lending track record or the city's incapacity to generate economies of scale (ICLEI 2010). Moreover, limited financing resources as well as the longer time frame of investment project cycles compared to the **political and budgetary cycles** can also work as significant barriers (Clapp et al. 2010). The CDM makes this burden even heavier with its need to raise **upfront finance** and the built-in **transaction costs.** Compared to the overall cost of some mitigation projects, e.g. in the transport sector, the **incentive from receiving Certified Emission Reductions (CERs) via the CDM is relatively small.** While the additional workload necessary to develop and implement CDM projects arises in local administrations, revenues are frequently not realised by local authorities (see, e.g., principal-agent problem discussed in chapter 4.4 below) and frequently in the past, CER revenues were lower than estimated in the beginning of the project. This puts additional stress on local governments (Clapp et al. 2010). In addition, it might be difficult to quantify the part of the project which directly benefits the municipality as a lot of project effects may accrue in other locations or may not be perceived as resulting from the project. Therefore, city governments might be reluctant to engage in such projects (Spors / Ranade 2011). Furthermore, being public organisations, local governments make more risk-averse project choices disfavouring the implementation of mitigation projects which involve a new technology or unusual project setup (Clapp et al. 2010). Last but not least, country-specific financing aspects such as a bad investment climate and the existence of corruption may hinder city governments from engaging in mitigation projects.

## 4.3 CDM-Inherent Barriers

Moreover, there are significant barriers inherent to the CDM. First of all, substantial barriers for mitigation actions in the urban context result from the lack of **suitable methodologies** for CDM / PoA development, not only in the transport and energy efficiency sectors (Ranade 2011)**.** Thus, for a large number of mitigation activities identified in chapter 2, no methodologies have so far been approved by the CDM Executive Board and corresponding mitigation projects can thus not be taken up under CDM rules. Furthermore, CDM rules and requirements are rather complex and cannot be met without significant capacities as well as efforts in terms of time and money, hindering project development, registration and implementation. Though more standardized approaches such as the use of default values are being developed, this has not been enough to clear out this barrier for a lot of project types. For urban projects, so far, there are **hardly any standardized approaches** approved by the CDM Executive Board (Marr / Wehner 2012). The UNFCCC Secretariat is currently exploring possibilities for standardised baselines in transport but has encountered substantial difficulties. According to the general approach for standardised baselines, the baseline emission factor should be established without knowing a project activity in advance. In transport, however, emission sources are specific to the geographic area where the project is implemented. In addition, services are usually not comparable (a trip from A to B is usually not comparable to a trip from C to D). Standardised baseline emission factors are therefore very unlikely to be appropriate for a specific project. The Secretariat does see some scope for standardisation in project types where the service level in the project and the baseline is the same, such as vehicle improvements (UNFCCC - Secretariat 2012a).

Moreover, many types of projects which are highly relevant for urban mitigation such as projects in energy efficiency, renewable energy and transport involve particularly **high transaction costs** under CDM rules and provisions due to their rather dispersed, small sources of emissions. As a lot of these projects result in rather small amounts of emission reductions, they also yield relatively low CER volumes (see chapter 4.2). Thus, for example, transport emissions usually stem from a large number of small mobile sources and traffic growth depends on a variety of external factors. Even if reliable data is available, establishing a project's baseline and accurately monitoring its emissions pose enormous challenges to the project developer. Moreover, transport projects usually serve a variety of objectives, which makes it difficult to establish that a project would not have taken place without the CDM (Browne et al. 2005; Wittneben et al. 2009). Furthermore, the very stringent GHG monitoring regulations hinder many projects where the $CO_2$ reduction is hard to monitor, such as energy efficiency campaigns or public private partnerships in form of energy efficiency clubs. Therefore, the CDM generally tends to focus on larger, low-cost, low-risk projects (Clapp et al. 2010) and neglects many options that are key for mitigation actions in cities. While the project type of PoAs was developed to help tap into dispersed emission reduction potential, it still remains to be tested whether this approach does indeed offer good enough prospects for decentralised small-scale activities.

Finally, it needs to be mentioned that the future of the demand and therefore the **price for CERs** dependent on political debates at international and national levels. Only with substantial emission reduction targets by countries engaging in the purchase of CERs will there be a financial incentive to develop CDM projects and PoAs. For many projects, current CER prices already are too low to significantly improve profitability.

## 4.4 Sector Specific Barriers

As for the sectors and project activities a city-wide approach could cover, one should note several sector-specific aspects that might impede CDM project development (the selection is not exhaustive). Renewable energy applications, for example, are so far mostly being developed by small and medium enterprises. Open **access to the grid** for these actors is one of the main success factors of the German feed-in system. In many developing countries, however, independent providers are often shut out by state monopolies. Moreover, for many projects current CER prices are too low to significantly improve profitability.

In the residential, commerce and service sectors large emission reduction potentials can be tapped by energetic renovation of buildings and introduction of energy efficient heating, lighting and electric appliances. The main investors in these sectors are the private building owners and the users of electric appliances. The massive efficiency potential is not being used for a variety of reasons such as **lack of information or capital** or the **principal-agent problem:** when renovating a building, the energy cost savings accrue to the lessees but the costs are borne by the lessor. Efficiency improvements can therefore often be best achieved through government measures and regulations such as building codes which remove these barriers (Sterk 2008). Since regulatory activities are not eligible under the CDM but the CDM can only be applied for the implementation and enforcement of laws and regulations, the CDM has so far had very little success in this area. Out of currently 4,565 registered projects only 32 address energy efficiency in households (UNEP Risoe 2012). Some “soft” measures taken in cities, such as optimised architecture design for passive heating or cooling, or behavioural change coming from energy efficiency campaigns are not quantifiable in terms of GHG mitigation and thus not recognised and credited in the project provision (Cheng et al., 2008) (OECD 2010) (Wolf 2009).

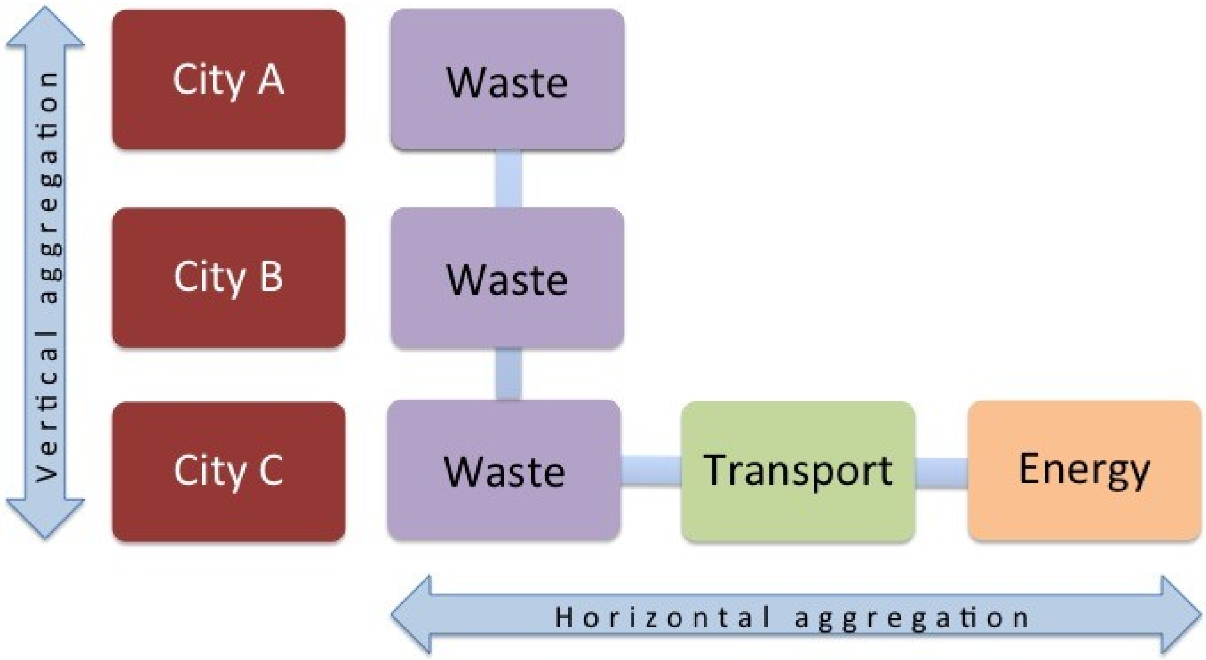
Significant GHG reductions could also be reached with integrated urban planning that considers climate change aspects. Such activities, however, are highly complex regarding their overall implementation which involves many different stakeholders and potentially a high number of mitigation measures from various sectors. This is probably the reason why there has not even been one single CDM project implemented in this field (World Bank 2010a). Nevertheless, there have been proposals on a city-wide PoA that might solve some of the barriers identified in this chapter. The following chapter presents such an approach and discusses its prospects and limitations regarding the removal of barriers as well as the current status of CDM rules and international negotiations regarding such an approach.

# 5 A City-Wide PoA – Opportunities with Limitations

## 5.1 An Option for Designing a City-wide PoA

One option for tapping the emission reduction potentials in cities could be the development of a city-wide approach to carbon finance. Such an approach has the aim to increase flexibility and options of greater access to carbon funds. It aggregates emission reducing activities vertically and / or horizontally to be implemented by a coordination office. While horizontal aggregation refers to the consideration of activities in various sectors within one city, vertical aggregation implies similar actions in a specific (sub-)sector, potentially across various cities (Figure 5). According to the proposal it would be possible to aggregate mitigation activities vertically and horizontally at the same time (World Bank 2010a).

**Figure 5: Horizontal and Vertical Aggregation of Mitigation Activities (own illustration)**




In 2010, the World Bank introduced a proposal on a city-wide approach to carbon finance that aggregates a variety of CDM methodologies from various sectors. Non-CDM methodologies are not considered in the Wold Bank's approach. Building upon experiences with CDM Programmes of Activities (PoAs), it aims at covering GHG mitigation from one or more sector(s) in one GHG mitigation programme. The sectors in question are energy, transport, solid waste, water and wastewater, and urban forestry. The option to successively add new activities to a programme is envisaged.

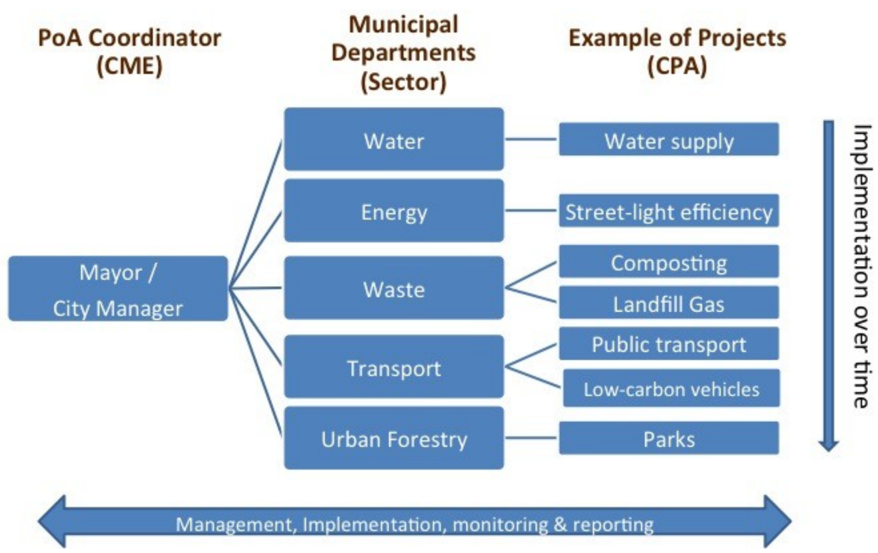
To establish a multi-sector city-wide approach, the World Bank suggests to proceed in the following steps:

1. Establish a coordination office
2. Establish geographical and sector boundaries for the programme
3. Create a greenhouse gas inventory
4. Identify the departments and agencies responsible in each of the sectors

5. Create appropriate incentives for relevant stakeholders
6. Identify interventions and establish program eligibility
7. Establish system for documentation and quality control
8. Implement and monitor interventions
9. Quantify emission reductions
10. Validate or verify emission reduction benefit (World Bank 2010a).

It would be very important to clearly establish responsibilities and coordination between all actors involved in a city-wide approach to carbon finance. Regarding coordination, different options are available. Generally, in the case of horizontal aggregation, activities could be coordinated by a local government agency. Coordination in cases of vertical aggregation could be done by central, regional or local government or utilities (World Bank 2010a). If a city-wide approach to carbon finance was implemented as a PoA, this would mean that the agency (if only horizontal aggregation was involved) or the mayor or city manager (for vertically integrated mitigation activities) could function as PoA Coordinating/Managing Entity (CME) and be responsible for managing, implementing, monitoring and reporting the city-wide PoA's activities. Over time, additional sectors could be added to the programme; responsibilities for activities in a specific sector could be shared with corresponding municipal departments; and in each sector, numerous programme activities (CPAs) could be implemented one by one (Figure 6).

**Figure 6: Structure of a City-wide PoA (Spors / Ranade 2011)**




The World Bank points out that in each city different mitigation activities could be aggregated. The decision on which activities to include in a city-wide approach does not only depend on the emission reduction potential of the activities but also on natural aggregators that may exist in a city. These can either be government agencies or stakeholders such as industry associations and are key for the development of a city-wide approach to carbon finance (World Bank 2010a). An overview of options for city authorities to influence emissions from their own activities as well as those from activities of other parties within the geographical boundaries of the city is provided in chapter 2.

Quantifying emission reductions over time is highly challenging and CDM methodologies have high requirements regarding the measuring, reporting and verification (MRV) of emission reductions as they have to be able to ensure the environmental integrity of the mechanism. This results in high transaction costs for project developers, especially in sectors such as transport and energy efficiency where, due to the large number of dispersed sources of emissions, MRV is particularly difficult. Furthermore, for many emission reducing interventions in a city there are no CDM methodologies available. Therefore, the World Bank suggests using a combination of CDM methodologies and a simplified "estimation" approach which is to be selected for each city individually. The estimation of emission reductions could be based on energy intensity indicators or other sector-specific common practices and voluntary carbon market methods (World Bank 2010a).

In a study for the United Nations Environment Programme (UNEP) and Gwangju City / Republic of Korea Marr and Wehner (2012) analysed approved CDM methodologies that could be used for an Urban CDM. They found that the methodologies compiled in Table 1 are widely used, feasible as well as applicable for the urban city context:

**Table 1: Main Approved CDM Methodologies Suitable for Urban Projects (Perspectives GmbH, based on UNEP Risoe (2011), in: Marr / Wehner 2012)**

| Methodology | Sector | No. of projects | No. of PoAs |
|---|---|---|---|
| **Residential sector (energy demand for heating / cooling, electric appliances)** | | | |
| AMS-II.C | Demand-side energy efficiency programmes for specific technologies | 28 | 12 |
| AMS-II.E. | Energy efficiency and fuel switching measures for buildings | 32 | 2 |
| AMS-II.J. | Demand-side activities for efficient lighting technologies (deemed savings) | 43 | 11 |
| **Service and commercial buildings (energy demand for heating/cooling; electric appliances)** | | | |
| AMS-II.C | Demand-side energy efficiency programmes for specific technologies | 28 | 12 |
| AMS-II.E. | Energy efficiency and fuel switching measures for buildings | 32 | 2 |
| AMS-II.J. | Demand-side activities for efficient lighting technologies (deemed savings) | 43 | 11 |
| **Demand-side activities for efficient lighting technologies (deemed savings)** | | | |
| ACM1 | Landfill gas project activities | 245 | 4 |
| AMS-III.G. | Landfill methane recovery | 49 | 0 |
| AM25 | Avoided emissions from organic waste through alternative waste treatment processes | 94 | 0 |
| AMS-III.E. | Avoidance of methane production from biomass decay through controlled combustion | 74 | 0 |
| AMS-III.F. | Avoidance of methane production from biomass decay through composting | 87 | 14 |
| AMS-III.H. | Methane recovery in wastewater treatment | 273 | 1 |
| **Transportation (car traffic, public transport, modal shift etc.)** | | | |
| AMS-III.C. | Emission reductions by low greenhouse emission vehicles | 14 | 1 |
| **Industry (energy efficiency measures at manufacturing facilities)** | | | |
| AMS-II.C | Demand-side energy efficiency programmes for specific technologies | 28 | 12 |
| AMS-II.D. | Energy efficiency and fuel switching measures for industrial facilities | 174 | 2 |
| AMS-II.H. | Energy efficiency measures through centralization of utility provisions of an industrial facility technology | 14 | 0 |
| **Energy industry (cogeneration with district heating/cooling and decentralised power generation; renewable energies; bio fuels)** | | | |
| ACM2 | Grid-connected electricity generation for renewable sources (no biomass) | 2310 | 2 |
| AMS-I.A. | Electricity generation by the user | 46 | 2 |
| AMS-I.B. | Mechanical energy for the user | 4 | 1 |
| AMS-I.C. | Thermal energy production with or without electricity | 516 | 20 |
| AMS-I.D. | Renewable electricity generation for a grid | 2185 | 11 |
| AMS-I.F. | Renewable electricity generation for captive use and mini-grid | 41 | 3 |
| AMS-I.J. | Solar water heating systems (SWH) | 0 | 1 |
| ACM6 | Grid-connected electricity from biomass residues | 313 | 0 |
| ACM18 | Electricity generation from biomass residues (co- fired) in power-only plants | 22 | 1 |
| AMS-I.E. | Switch from Non-Renewable Biomass for Thermal Applications by the User | 13 | 5 |
| AMS-II.G. | Energy Efficiency Measures in Thermal Applications of Non-Renewable Biomass | 7 | 12 |
| ACM12 | GHG reductions for waste gas or waste heat or waste pressure based energy system | 331 | 1 |
| AMS-III.Q. | Waste gas based energy systems (gas/heat/ pressure) | 112 | 0 |
| AMS-II.B. | Supply side energy efficiency improvements - generation | 26 | 0 |
| AM29 | Grid connected electricity generation plants using natural gas | 76 | 0 |
| AMS-III.B. | Switching fossil fuels | 81 | 1 |

Furthermore, there are some methodologies which have only been approved recently or which have not been used widely but are nevertheless applicable for urban projects (Table 2).

**Table 2: Additional Recent CDM Methodologies Suitable for Urban Projects (Perspectives GmbH, based on UNEP Risoe (2011), in: Marr / Wehner 2012)**

| Methodology | Sector | No. of projects | No. of PoAs |
|---|---|---|---|
| **Residential sector (energy demand for heating / cooling, electric appliances)** | | | |
| AM91 | Energy efficiency technologies and fuel switching in new buildings | 0 | 0 |
| AMS-III.AE. | Energy efficiency and renewable energy measures in new residential buildings | 0 | 1 |
| **Service and commercial buildings (energy demand for heating/cooling; electric appliances)** | | | |
| AM91 | Energy efficiency technologies and fuel switching in new buildings | 0 | 0 |
| **Transportation (car traffic, public transport, modal shift etc.)** | | | |
| ACM16 | Mass Rapid Transit Projects | 8 | 0 |
| AM31 | Baseline Methodology for Bus Rapid Transit Project | 14 | 0 |
| AMS-III.U. | Cable Cars for Mass Rapid Transit System (MRTS) | 1 | 0 |
| **Energy industry (cogeneration with district heating/cooling and decentralised power generation; renewable energies; bio fuels)** | | | |
| AMS-I.J. | Solar water heating systems (SWH) | 0 | 1 |

For a city-wide approach to carbon finance, some of these methodologies could be combined and used simultaneously. Methodologies such as small-scale methodology AMS-II.C for demand-side energy efficiency measures which can be applied to more than only one sector (residential, commercial and industrial sector) are particularly interesting for city-wide approaches.

## 5.2 The Current Status of City-wide PoAs in CDM Rules and International Negotiations

Over the last couple of years, there have been a number of discussions and developments in international climate negotiations on the application of multiple CDM methodologies at the same time for CPAs under one PoA. Thus, in December 2010, the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) decided in Cancún to request the Executive Board

„to reassess its existing regulations related to programmes of activities in order to:

(...) (b) Simplify the application of programmes of activities to activities applying multiple methods and technologies, including for possible city-wide programmes, while ensuring environmental integrity to the extent required by the Kyoto Protocol and decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol" (UNFCCC 2011).

Then, in February and March 2011, the CDM Executive Board launched a call for public inputs on PoAs. Regarding city-wide programmes, the main ideas which were received in response centred on "allowing the application of different methodologies, but also promoting the municipal authority (as CME) to take a strategic role identifying ER opportunities for implementation of PoAs, with geographical restriction to a smaller urban area, while ensuring transparency, credibility and environmental integrity" (UNFCCC - Secretariat 2011a).

In the following, first, the "Standard for application of multiple CDM methodologies for a programme of activities" was adopted in September 2011 (UNFCCC - Secretariat 2011b). This document was consolidated and superseded by the "Standard for demonstration of additionality, development of eligibility and application of multiple methodologies for programme of activities" as adopted by the Executive Board in November 2011, which currently determines in general the application of multiple technologies/measures and/or approved methodologies in one PoA. Regarding small-scale CDM methodologies, it stipulates that "Combinations of technologies/measures and/or methodologies for a PoA are eligible where it is demonstrated that there are no cross effects between the technologies/measures applied." (UNFCCC - Secretariat 2011c) In case of cross effects, additional methods have to be used to "ensure that the calculation of emission reductions is accurate" (ibid.). The tool does provide further indications on which combinations of small-scale methodologies are eligible, in particular:

1. the same combination of technologies/measures under the same combination of methodologies applied consistently in each and every CPA of a PoA,
2. a single methodology consistently applied in each CPA of a PoA but using multiple technologies/measures,
3. a principal technology/measure applied consistently in each CPA using multiple combinations of methodologies and
4. variations of combinations of technologies/measures and methodologies across CPAs of a PoA.

As long as combinations are not explicitly permitted in the methodologies, combinations of a large-scale CDM methodology with any other methodology require an assessment by the Methodologies Panel and approval by the CDM Executive Board.

At its 68$^{th}$ session in July 2012, the Executive Board adopted the "Guidelines for the consideration of interactive effects for the application of multiple CDM methodologies for a programme of activities". The Executive Board confirmed that in general, all approved methodologies may be applied for PoAs and specific guidance for this purpose is to be developed. Where no guidance exists yet, the "Standard for demonstration of additionality, development of eligibility and application of multiple methodologies for programme of activities" should be used (UNFCCC - Secretariat 2012b).

While these provisions lay the ground for a variety of urban projects including methodology combinations, the World Bank's "estimation approach" is not applicable under current CDM rules.

## 5.3 The Effect of a City-Wide PoA on the Barriers Identified for the Engagement of Cities in the Carbon Market

With the combination of the methodologies presented in chapter 5.1 and the World Bank's "estimation" approach, the opportunities to reduce city emissions could greatly improve, especially regarding dispersed mitigation activities. Even a city-wide approach to carbon finance without the "estimation" approach could manage to significantly increase the potential emissions reductions covered under one programme and can manage to aggregate various mitigation activities. With a city-wide PoA, significant synergies arise in the management and the administration of mitigation measures. This reduces the overall transaction costs of the envisaged activities (Neufeld / Schroeder 2011). Furthermore, similar CPAs can be replicated much faster. A city-wide approach could enable municipalities to participate on a larger scale in CDM activities than it has so far been the case and allow them to finance low-emission pathways with the help of international carbon finance (Oppermann 2011).

However, these advantages of city-wide PoAs mainly relate to the CDM-inherent barriers. The rest of the vast majority of the barriers identified for the implementation of mitigation activities in cities remain even with the use of a city-wide PoA. Some are even aggravated. Thus, each city-wide PoA has to be developed individually and the development as well as the registration and implementation of a city-wide PoA quickly become considerably more complex than single CDM projects or PoAs. However, as the environmental integrity of CDM projects and PoAs has to be guaranteed, CDM methodologies and procedures cannot be overly simplified. Ensuring environmental integrity will also be one of the challenges of the World Bank's "estimation" approach. The complexity of a city-wide PoA again can lead to delays in the CDM project cycle or even prevent the success of mitigation activities altogether, for example when the PoA Coordinating/Managing Entity (CME) cannot manage the requirements and emerging challenges anymore. Furthermore, so far, the rules for city-wide PoAs are not yet well defined. Therefore, it may occur that methodology combinations may only be approved with delay or may be rejected completely (Neufeld / Schroeder 2011).

A further barrier results from the fact that after 31 December 2012, CERs generated from new CDM projects and PoA(s) will only be eligible for the EU Emission Trading Scheme if they take place in Least Developed Countries (LDCs). As the time required for a project or PoA to be registered is quite long, it may now already be too late to start new projects and PoAs, including city-wide PoAs, in Non-LDCs. Therefore, the development of CDM rules and methodologies as well as the development of concepts for city-wide PoAs have to keep in mind the special needs of LDCs if city-wide PoAs are to play a significant role in mitigation activities in cities. Finally, the strength of the incentive provided by a city-wide approach would crucially depend on the price of CERs, resulting from the ratio between demand and supply. While the supply of CERs from developing countries is potentially massive, the demand is set politically by the targets adopted by industrialised countries. For significantly high prices, the targets for industrialised countries would have to be significantly higher than those which currently are on the table. The World Bank's latest State and Trends of the Carbon Market estimates that demand over the period 2013-2020 may lie in the range of 2,156 to 2,706 Gt $CO_2$-eq. while supply from CDM and JI may lie in the range of 2.3 to 4.8 billion credits (Kossoy / Guigon 2012). cdc climat research have even estimated that already in 2013/2014 the price of CDM and JI credits may fall to close to zero (Bellassen /Stephan / Leguet 2012).

An overview of the main barriers for the engagement of cities in the carbon market including the effect on these barriers on a city-wide PoA as well as further options to overcome these barriers is provided in Table A-1 in Annex A.

# 6 Conclusions

This paper has analysed the development of city-wide PoAs and has approached the question of whether they are a viable option for significant emission reductions in cities. For this purpose, the paper first provided an overview of emission sources and possible mitigation activities in cities and explored local governments' capacity and motivation to implement mitigation measures. It was found that there are vast mitigation options that cities can tap with different modes of governance in the sectors energy, buildings, transport, waste and wastewater, water services and urban greening/agriculture. While many of these have substantial co-benefits and some are even cost-effective (e.g. the introduction of bus rapid transit systems and energy efficiency measures in buildings), significant net costs would accrue for others.

The following chapter discussed the current role of developing country cities in the CDM to determine the impact the CDM has on the development of urban mitigation projects. Overall, it became clear that cities' engagement is so far very restricted in the project-based CDM as well as in PoA development and implementation. While there are several possibilities for the participation of local authorities, participation is often limited to a stakeholder function. Cities are most active in the waste sector but have so far hardly been able to tap mitigation options in other sectors such as energy efficiency and transport.

Subsequently, we identified the main barriers that hinder the engagement of cities in the carbon market.

General barriers for urban mitigation projects as well as those especially relevant for CDM activities were considered. It was found that institutional as well as financing issues serve as significant barriers. Among others, institutional barriers comprise general and technical capacity constraints, limited regulatory and financial capacity and authority and decision makers' short-term orientations and overall focus on other issues while financing issues relate to, inter alia, municipalities' difficulties in providing the upfront capital required for CDM/PoA activities and low motivation to engage in urban mitigation. Furthermore, there are considerable CDM-inherent barriers, e.g. missing methodologies, high transaction costs and low CER prices, as well as sector-specific barriers, such as limited access for renewable energy providers to the grid and the principle-agent problem in energy efficiency in buildings.

A proposal on a city-wide PoA that might solve some of the barriers identified as developed by the World Bank was presented in chapter 5. The proposal includes the option to aggregate emission reducing activities in various sectors within one city (horizontal aggregation) as well as in a specific (sub-)sector across various cities (vertical aggregation). The World Bank suggests using a combination of CDM methodologies and a simplified "estimation" approach for the quantification of emission reductions. The chapter provided an overview of CDM methodologies suitable for urban projects and illustrated the current status of city-wide PoAs in CDM rules and international negotiations. It found that while current provisions lay the ground for a variety of urban projects including methodology combinations, the World Bank's "estimation approach" is not applicable under current CDM rules. Finally, the effect of a city-wide PoA on the barriers identified for the engagement of cities in the carbon market was analysed. It became clear that only some of the barriers can be eased in parts with a city-wide PoA (e.g. the lack of suitable methodologies for dispersed mitigation activities, reduction of transaction costs via synergies in management and administration). The majority of the barriers identified, however, remain intact.

Their removal would require substantial interventions, such as dedicated long-term capacity building and provision of upfront finance to overcome cities' budget constraints. A detailed list of barriers and possible options to overcome them is contained in the annex. The prevalent barriers also motivate the question whether approaches other than those possible – or possible to be developed – under the CDM might be needed which are actually better suited to remove the existing barriers for significant urban mitigation action. Such an approach could, for example, consist of a city-wide approach where, instead of adding up emission reductions from multiple individual projects, top-down GHG inventories of cities covering direct as well as indirect emissions from all relevant sectors could serve as the basis for determining the activities' success. Mitigation targets could be set in relation to three different types of baselines as absolute emission targets, relative emission targets (e.g. in terms of emissions per unit of output) or policy-based baselines and mitigation actions could be planned top-down to reduce the city's total emissions. Multiple policies and measures could be introduced to reduce emissions below the baseline. Such an approach would be similar to the proposals for "sectoral crediting" and "sectoral trading" that are currently being discussed in the climate negotiations, though these approaches are usually thought of in relation to country-wide sectors (Sterk 2012). Such an approach could be implemented by local governments or might in some sectors be devolved to the private entities in the respective sector. Lessons may in the latter regard be provided by the city-level emission trading systems that have been established in Tokyo, Saitama and Kyoto in Japan and are going to be established in several Chinese pilot cities.

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# Annex A: Overview of Barriers

**Table A-1: Barriers for the Engagement of Cities in the Carbon Market, a City-wide PoAs Effect on Barriers and Further Options to Overcome these Barriers (Own compilation based on Clapp et al. 2010)**

| Barriers | Description | Effect of a City-wide PoA | Further Options to Overcome Barriers |
|---|---|---|---|
| **Institutional Issues** | | | |
| Low motivation | Responsibility for GHG reduction activities perceived to lie with national government<br>Local benefits difficult to quantify | Barrier remains | Capacity development and training<br>Identification of local benefits |
| General capacity constraint | Strategic planning limitations<br>Staff rotation hinders capacity development | Barrier remains | Long-term capacity development<br>Work with lower positioned staff which is less likely to undergo rotation<br>Work with NGOs and consultants as advisors |
| Technical capacity constraints | Lack of technical skills for development of mitigation activities and CDM projects | Barrier remains | Long-term capacity development<br>Cooperation with technical experts (consultants, organisations or scholars)<br>Use of standardised accounting tools |
| Limited regulatory and financial capacity | Regulation authority lies with provincial or national governments<br>Limited access to funds | Barrier remains | Cooperation with national governments<br>Communication from both sides<br>Enhancement of multi-level governance<br>Alignment of national & local mitigation strategies |
| Overlapping jurisdiction | Authority over a certain sector split between more than one agency | Barrier remains | Creation of institutional structure or task force which includes all the different and relevant agencies |
| Political | Short-term orientation of decision makers | Barrier remains | Work with remaining staff and bodies to ensure long-term commitment<br>Visible co-benefits |
| Focus on co-benefits rather than mitigation | Benefits have to go beyond GHG reductions | Barrier remains | Identification of environmental, economic and social co-benefits for each mitigation measure |
| **Financing Aspects** | | | |
| Budgetary constraints | Generally local governments are facing budgetary constraints and depend on provincial and national finances | Barrier remains | Identification of co-benefits<br>Capacity building of local governments to understand their fiscal options<br>Alignment with national strategies and programmes |
| Upfront capital | Limits of upfront capital due to missing lending track record and size of the projects | Barrier remains | Work with national or provincial programmes to receive national government guarantee<br>Upfront finance from buyer of CERs |
| Low motivation | Low revenues from many types of CDM projects<br>High transaction costs | Barrier remains | Development of standardized approaches<br>Assistance from the national government<br>Creation of more demand for credits |
| Regulatory and political barrier | Short political and budgetary cycles compared to investment project cycle | Barrier remains | National governments to provide further guidance on long term planning budgets<br>City leadership from mayor or other high ranking officials |
| **CDM-Inherent Barriers** | | | |
| Missing methodologies | No suitable methodologies for a large number of mitigation activities | Barriers could be eased in parts | Development of methodologies |
| High transaction costs | Project development, monitoring, reporting and verification necessitates a lot of technical expertise and money<br>Lack of standardized approaches | Barrier remains | National or provincial assistance<br>Collaboration with the private sector<br>Development of standardized approaches |
| Development of the | National developments and | Barrier remains | Increase mitigation targets in |

| | | | |
|---|---|---|---|
| carbon markets | international negotiations influence the demand and price for CERs<br>Currently, low price for CERs | | industrialised countries |
| **Sector Specific Barriers** | | | |
| Renewable energy | Access to the grid is often limited | Barrier remains | Influence of local governments to open access to the grid for small and medium enterprises |
| Energy efficiency | Lack of technological experience<br>Principle-agent problem | Barrier remains | Private sector involvement to create a business case<br>Lessons learned from best practice<br>Incentive schemes |
| Integrated urban planning | Project set-up highly complex | Barrier remains in parts | Lessons learned from best practice<br>Capacity building |