CLEAN DEVELOPMENT MECHANISM

CDM-EB86-AA-A11

Concept note

Use of the CDM in the urban sectors

Version 01.0

United Nations
Framework Convention on
Climate Change

TABLE OF CONTENTS **Page**

1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its eighty-second meeting, mandated the secretariat to prepare a concept note to explore the need for new approaches and/or broadening of existing methodological approaches, in the context of cities. The potential areas to cover in the concept note included: (a) buildings; (b) efficient street lighting, district heating and cooling systems; (c) transport; (d) efficiency and conservation in water supply; (e) waste and wastewater management; and (f) exploring integration of planning, policy, and training of facility managers.

2. This work relates to the activity '244 Top down development of Methodologies/Standardized baselines and tools' under 'Objective 1(c): Develop simplified and user - friendly standards and procedures that increase efficiency and ensure environmental integrity' with a resource allocation as referred to in table 4 on page 7 of the management plan (MAP) 2015 (EB81, annex 1).

2. Purpose

3. The purpose of this concept note is to investigate existing gaps in the available methodologies for mitigation actions in a citywide approach and propose potential solutions to address the gaps.

3. Key issues and proposed solutions

4. This concept reviews literature pertaining to climate initiatives for cities and existing methodologies. It discusses technologies/measures that can potentially be included in a citywide project/programme of activities (PoA) and identifies gaps in available methodologies[1].

5. For the purpose of this concept note, Urban CDM is defined as an approach to enhance the mitigation actions in a city, by covering the priority sectors for the entire city within one CDM project activity/PoA. Government departments and agencies including industry associations are likely to be the key agencies to coordinate actions. However, project developers from the private sector are expected to play an important role in partnership with the city government or independently.

3.1. Method of analysis

6. The concept note has been prepared with inputs from the Methodologies Panel (MP) and the Small-Scale Working Group (SSC WG). The following method and outline was used to identify desirable measures for cities based on literature review :

   (a) Enlist measures covered by CDM methodologies (e.g. matrix of measures and methodologies);

[1] Potential institutional arrangements for developing an "urban CDM" are not covered here and readers may consult other studies (e.g. the World Bank report titled "A City-Wide Approach to Carbon found at <http://www.citiesalliance.org/sites/citiesalliance.org/files/A_city-wide_approach_to_carbon_finance.pdf)>.

(b) Elucidate barriers, bottleneck and needs for improvement, including but not limited to data requirements (baseline setting, measurement/survey requirements);

(c) Discuss measures and methods covered by other initiatives that include greenhouse gas emission reductions (e.g. World Resources Institute (WRI), Verified Carbon Standard (VCS), International Organization for Standardization (ISO) standards);

(d) Discuss needs and options for improvement.

3.2. Why focus on cities?

7. Cities are engines of economic growth and social change and are associated with 67–76 per cent of global energy use and 71–76 per cent of global energy-related greenhouse gas (GHG) emissions.[2] Moreover, projections show that 50 per cent of energy-related global emissions growth between 2012 and 2030 will occur in cities. Inevitably, cities across the developing world – more so smaller cities and towns rather than large metropolises – will experience growth and change in the coming decades. The planning and investment decisions made today will determine the extent to which they evolve in a manner that is coherent with the connected, compact and resilient models of urban development required to address climate change.

8. Local and municipal governments around the world are therefore under severe pressure to plan and source funds for a wide range of urgent investments. The financial and institutional constraints experienced by these bodies has led the international donors to become involved in a range of efforts to assist them in meeting the infrastructure challenge. International climate funds including carbon finance represent a major funding avenue that can specifically seek to integrate the challenges posed by climate change into this equation. For example, the Global Environment Facility (GEF) recently introduced a more holistic urban focus for the first time (i.e. new focal area promoting 'integrated low-emission urban systems' with a budget allocation of USD 210 million for the period 2014–2018 (GEF 2014). Similarly, the Green Climate Fund (GCF) has recognized the multiple benefits it can support by financing activities for 'lower energy intensity of buildings, cities, industries, and appliances'.

3.3. Why focus on the CDM for cities?

9. A recent report[3] that assessed current trends in developing country approaches to climate policy noted:

> "Current developments show that market based mechanisms will play a more and more important role in future climate policy, especially on the domestic

[2] Seto, K. C., Dhakal, S., Bigio, A., Blanco, H., Delgado, G. C., et al., 2014. Chapter 12: Human Settlements, Infrastructure, and Spatial Planning. In *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. O. Edenhofer, R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, et al. (eds.). Cambridge University Press, Cambridge, UK, and New York. Available at: <https://www.ipcc.ch/report/ar5/wg3/>.

[3] Bjorn D. et al., Practicability of transitioning from CDM to future climate policy instruments, Perspectives (2015).

> level but also possibly internationally. New mechanisms do not need to be invented "from scratch", but can build on existing elements and knowhow of established mechanisms, such as the CDM. **The ongoing evolution of the CDM's regulatory framework and methodological toolkit shows that the CDM is becoming a laboratory for upscaling of market mechanisms.**"

10. Notably, another recent study[4] that covered the evolution of PoAs under the CDM summarized the results stating:

> "PoAs have established themselves firmly within the CDM framework, and are set to achieve significant improvements in line with the political objectives of the CDM regarding sectoral and geographical distribution – as long as political ambition allows for a sufficiently conducive market environment. Some PoAs can be considered to come close to sector-wide upscaling of mitigation actions, provided they will be fully implemented. Overall the concept enjoys a high degree of acceptance, and its value is recognized beyond the CDM."

11. Thus, although the CDM has achieved only limited reach for mitigation in the specific context of cities so far, the potential for CDM to reduce the volume of carbon dioxide (CO_2), methane and other gases that the cities release remains high. The initiatives that the Board has undertaken to simplify and streamline the rules for PoAs has been a significant factor in achieving a paradigm shift in the development of the PoA pipeline referred to above. Thus, focusing on the CDM for cities holds potential for further standardization in the area to result in reduced transaction costs with great potential for further project and PoA development.

3.4. Identification of priority sectors

12. GHG emission sources can vary from city to city depending on the specific consumption pattern of each city (as inferred from the city's GHGs emission inventory or similar reports).[5] Nevertheless, the following sectors have been generally emphasized in studies for the development of a low-carbon pathway for an urban environment:[6, 7, 8] transport, waste, energy generation and energy efficiency (e.g. buildings).

13. Further, a recent assessment of urban mitigation potential commissioned by the United Nations Special Envoy for Cities and Climate Change, Michael R. Bloomberg, with

[4] Federal Ministry of Environment, Germany (2015). Developing sectoral mechanisms in the transition period towards a new climate treaty.

[5] Sovacool, B.K., Brown, M.A., 2010. Twelve metropolitan carbon footprints: A preliminary global assessment. Energy Policy, 38, 4856-4869.

[6] Rogner, H.-H., D. Zhou, R. Bradley. P. Crabbé, O.Edenhofer, B.Hare (Australia), L. Kuijpers, and M. Yamaguchi. 2007. Introduction. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, NY: Cambridge University Press.

[7] UNEP 2012.Cities and Carbon Finance: A feasibility study on an Urban CDM.

[8] Chapter 12 of AR5 IPCC Working Group III (Human Settlements, Infrastructure, and Spatial Planning.

support from C40[9] covered 11 clusters of low-carbon measures in the buildings, transport and waste sectors (see appendix 1, Table 1), where cities have the greatest power to take action. The assessment found that those 11 clusters could generate annual GHG savings of 3.7 Gt CO_2e in 2030. These savings are around 15–20 per cent of the total global emission reductions needed for a 2°C pathway by 2030.

14. Further, a publication by Global Commission on the Economy and Climate[10] called for prioritizing "policies and investments in public, non-motorized and low-emission transport, building efficiency, renewable energy and efficient waste treatment. The paper noted significant economic opportunity to save USD 16.6 trillion by 2050 (see appendix 2 for the details of the indicative potential of each measure that results from a high-level analysis made by the study with several assumptions).

15. For the purpose of this note, the following sectors are selected for identifying technologies/measures that may be suitable for the urban CDM besides assessing their coverage in the existing CDM methodology portfolio, i.e. transport, waste, energy generation and energy efficiency (e.g. buildings).

3.5. Identification of technologies/measures and methodologies

16. UNEP conducted a feasibility study on the urban CDM in 2012, in which it identified the priority sectors, as well as a list of CDM methodologies that may potentially be applied for the urban CDM. These methodologies were identified based on a set of criteria including the relevance to the priority sectors, number of applications of the methodology, comprehensiveness of the methodology (i.e. contributing to the transformational shift to a low-carbon city/low-carbon development), applicability to multiple sectors and city involvement in existing CDM projects.

17. More recently, the Korea Environment Institute (KEI) (2014) developed an "Urban CDM Tool-Kit" taking into account the feasibility study carried out by UNEP. Twenty-eight CDM methodologies were selected in the tool-kit, to highlight the relevance of the methodologies in urban settings.

18. Other studies in the area have also generally assessed feasibility and impact potential as key selection criteria for identifying climate actions in the urban context.[11] Decision support tools for climate action prioritization have been developed including:

    (a) Feasibility: (i) stakeholder acceptability; (ii) technical feasibility; (iii) ease of implementation; (iv) financial viability; and (v) mainstreaming potential (can be integrated with existing local government planning/policy development);

    (b) Impact: (i) effectiveness; and ii) multi-sectors/objectives (interactions).

[9] See: Erickson, P. and Tempest, K., 2014. Advancing Climate Ambition: Cities as Partners in Global Climate Action. Produced by SEI in support of the UN Secretary-General's Special Envoy for Cities and Climate Change and C40.

[10] Gouldson, A., Colenbrander, S., Sudmant, A., Godfrey, N., Millward-Hopkins, J., Fang, W. and Zhao, X., 2015. Accelerating Low-Carbon Development in the World's Cities. Contributing paper for Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate. New Climate Economy, London and Washington, DC. Available at: <http://newclimateeconomy.report/misc/working-papers>.

[11] <http://www.blueap.eu/site/wp-content/uploads/2014/06/CLIMACTPrio_ICLEI2014_Olivotto.pdf>.

19. Taking into account the above studies, the secretariat developed a matrix to evaluate the CDM methodologies and identified gaps in CDM methodologies for city-wide climate actions in the above sectors, as included in appendix 3. In summary, 97 methodologies are identified for potential application for the urban CDM, with a breakdown as follows: 24 for buildings (energy efficiency), 23 for waste, 14 for transport, and 36 for energy supply.

20. In order to supplement the list of methodologies and technologies identified above, an assessment of technologies applied in the pipeline[12] of nationally appropriate mitigation actions (NAMAs) was also carried out. The objective was to check whether there were technologies/measures that are of interest to the host countries but currently not covered in the CDM. However, this assessment did not reveal any technology/measure currently missing in the CDM methodologies. It was also noted that the planned NAMAs generally focused on mitigation actions in only one sector, e.g. building. Only one NAMA was found that aimed to implement activities across sectors covering municipal waste, urban transport, sustainable energy and urban forestry.[13]

3.6. Options for improvements

21. **Further standardization of baselines:** The perceived complexity of the underlying CDM methodologies has often been cited in the context of the urban CDM, in terms of monitoring and determination of a baseline emission scenario.[14] Stakeholders have also proposed that more standardization for baselines be provided (see appendix 4 for details). To address these issues, more aggressive approaches to top-down development of standardized baselines may be pursued. Further, the approaches described in the paragraphs below may be considered.

22. **Development of default values** from the existing pipeline: The introduction of simplified approaches including default values in the methodological tool “Emissions from solid waste disposal sites” had a positive impact on project development. Building on that experience, options to use the monitored waste composition in registered projects in future projects for waste management (e.g. biogas, composting) [in the same [city][region][country] may be considered to relax monitoring requirements for waste composition. Such an approach can also account for the fact that the estimated value of biogas generation (in which the waste composition is required as input variables), is normally higher than the quantity of biogas that is actually generated. Similarly, certain types of buildings (e.g. schools or public buildings such as government offices) may be amenable to standardisation of parameters based on data from existing projects (e.g. usage patterns). More assessment in this regard is included in appendix 5.

23. **Development of benchmark based on the Common Carbon Metric:** The Common Carbon Metric (CCM)[15] developed by the UNEP-SBCI (Sustainable Building and Climate Initiative) also informed the development of “ISO 16745:2015 Environmental performance of buildings — Carbon metric of a building during the use stage”. CCM

[12] <http://www.nama-database.org/>.

[13] City-wide mitigation programme of Greater Amman Municipality. <http://www.nama-database.org/images/5/5b/Mobilizing_NAMAs_in_RCREEE_member_states.pdf>.

[14] Cities and Carbon Finance: A feasibility study on an Urban CDM, UNEP 2012.

[15] <http://www.unep.org/sbci/activities/ccm_Pilot.asp>.

provides protocols for data collection according to predefined criteria (e.g. building type, usage, climate) and derives energy/GHG benchmark (in the form of kWh/m^2/yr; kWh/occupant/yr) from the database of participating countries/programmes. CCM has also aligned its categorization of building types to the CDM categorization. It is recommended to explore the use of the benchmark/database in CCM to standardise parameters in CDM methodologies including the development of standardized baselines.

24. **Developing benchmark based on the database in the TRACE**: The database built into the Tool for Rapid Assessment of City Energy (TRACE) may be a useful source. TRACE[16] is a diagnostic tool to evaluate energy efficiency opportunities that are under direct control of municipal governments. It builds and maintains a database for key sectors in a number of cities around the world. For example, for Colombo, Sri Lanka the database provides pertinent data such as:

    (a) Energy consumption per capita as 935.8 kWh/capita/annum, fuel efficiency for public transport of around 0.33 MJ/p-km;

    (b) Colombo and surrounding municipalities have a total of 25,198 poles covering 100 per cent of the 966 kilometres of road; Total electricity consumed by street lights is 13.7 GWh annually, and electricity per pole is about 543.77 kWh.

25. The use of values in the TRACE database could be useful in developing the urban CDM methodologies, if not directly but with due calibration based on limited field surveys, which may allow avoiding expensive monitoring surveys that are currently specified in the methodologies. In addition, TRACE also allows comparison of one city with its peer cities of similar characteristics (e.g. population, climate, etc.). Although some caution is necessary (e.g. adjustments for uncertainty), it may be one way to further explore solutions to the persistent data paucity problem in the sector, particularly in underdeveloped regions. More details for TRACE can be found in appendix 4.

26. **Default values** for energy efficiency activities: As can be inferred from appendix 2 and tables 1 and 3, **appliance and lighting efficiency** measures have huge potential for emission reduction in residential and commercial buildings (nearly 20 per cent of the global potential for emission reduction in urban sectors). Standardization work in the past has resulted in the development of default values (e.g. usage hours) and other simplifications in the area of energy-efficient residential lighting, leading to the development of a large number of PoAs and projects in the area. However, there is potential to extend the work to efficient lighting in commercial and public buildings and street lighting to standardize parameters such as usage hours to facilitate project/programme development. Furthermore, standardization of parameters for the appliance **efficiency** may be prioritized.

27. **Developing transport methodologies:** There are gaps in the available methodologies for **transport**. For example, as detailed in tables 1 and 3, the shift to non-motorized transport (e.g. bicycle lanes) and measures to avoid traffic congestion are not currently covered. There is further work to be done for passenger and freight transport covering mode shift, transit efficiency, vehicle efficiency and electrification. Although some methodologies have covered some elements of these issues there is a need for broadly applicable approaches across small and large-scale methodologies with due standardization of parameters to enable easy project/programme implementation. There

[16] <http://esmap.org/TRACE>.

are also gaps in available methodologies for logistics improvements in freight transport. These issues related to methodological approaches for transport are covered in a separate concept note being presented to the Board.

28. **Methodologies for waste management**: Similarly, a whole range of options for **waste management** is not covered currently in CDM methodologies, i.e. there is scope to integrate systematic waste management: reduction (in production and consumption), reuse and recycling, and disposal.

29. **Combination of methodologies and consideration of interactive effect:** For projects or programmes aimed at urban sectors, it may be desirable to include multiple technologies cutting across sectors. From a methodological perspective, it may be realized either by developing an integrated methodology with a wide coverage of technologies/measures, or through combination of different methodologies. Based on the accumulated experience of consolidating large-scale methodologies, the option of flexible combination of methodologies may be more practical than developing an integrated methodology although the latter option would possibly reduce the need for post-registration changes (PRCs) in case new technologies are to be added in the future. However, a comprehensive programme design and more flexibility to undertake PRCs may address the issue together with a flexibility to apply for combination of methodologies. However further work may be still required to devise simple ways to determine the net effects of the combined measures in the urban context (e.g. through net to gross adjustments). The Board has approved a tool for determination of interactive effects with limited applications. Further work may be required to simplify, broaden and standardize this tool for wider applications in the urban context to facilitate the combination of multiple methodologies in the area.

30. **Additionality:** As detailed in the appendix 4, studies have also pointed out that more effort is needed to include additional technologies in the positive list for automatic additionality. In addition, pragmatic approaches for the consideration of financial aid to the municipality needs to be developed in the context of demonstration of additionality. The Board has mandated further work on simplifying requirements for additionality; the above issues may be prioritized under that mandate.

3.7. Recommendations

31. The following recommendations are made based on the above analysis:

    (a) Explore further standardisation of methodologies related to urban sector through:

        (i) Inclusion of default values/benchmarks (where required region specific values), based on data from registered CDM projects;

        (ii) Inclusion of default values/benchmarks (where required region specific values), based on data from Common carbon metric of UNEP-SBCI and/or TRACE database maintained by the World Bank (require due calibration of values where required);

        (iii) Building on the successful introduction of default usage hours under the residential lighting efficiency methodologies, introduce default factors for lighting efficiency and appliance efficiency methodologies;

        (iv) Development of top-down/bottom-up standardised baselines;

(b) Develop transport methodologies to cover the gaps identified (e.g. non-motorised transport);

(c) Expand the scope of waste management methodologies including reduction (in production and consumption), reuse and recycling, and disposal;

(d) Simplify the tools for the consideration of interactive effects;

(e) Simplify the additionality requirements (e.g. pragmatic approaches for the consideration of financial aid to the municipality) and expand the positive list for additionality where feasible.

4. Impacts

32. The proposed steps can potentially broaden the coverage of the CDM for urban projects and reduce transaction costs for the project participants. The proposed work does not foresee any cost implications for third-parties/stakeholders. On the other hand, if implemented, the proposals in this concept note foresee a decrease of costs on the long term.

5. Subsequent work and timelines

33. The Board may wish to provide guidance to the secretariat at EB 86 on the proposal contained in this concept note or alternatively task the secretariat, the MP and the SSC WG to further work on the issue to concretise the proposals and present a revised concept note to the Board at a future meeting. For the former case, specific proposals will be included in the 2016 work plan of the MP and the SSC WG besides CDM MAP projects that Board will undertake in 2016, for the consideration of the Board at a future meeting of the Board.

6. Recommendations to the Board

34. It is recommended that the Board agree to the recommendations in this concept note and provide guidance to the secretariat with regard to implementation.

Appendix 1. Urban mitigation potential and measures

Table 1. Urban mitigation potential and measures

Buildings	
New building heating efficiency	New buildings are constructed at passive heating levels (e.g. <30 kWh/m^2 from 2020 onwards)
Heating retrofits	Old buildings are upgraded such that the retrofit reduces building energy intensity by 30–40% compared with the baseline scenario
Appliances and lighting	Efficient lighting and appliances
Solar photovoltaic (PV)	Building-mounted solar PV
Transport	
Urban planning and reduced passenger travel demand	Land-use planning can reduce motorized passenger travel activity (pkm per capita) by as much as 7% in OECD countries and 25% in developing countries
Passenger mode shift and transit efficiency	Expansion of public transport can lead to 20% lower pkm through mode share of light-duty vehicles (LDVs) and higher mode share for rail and bus transport
Passenger car efficiency and electrification	A combination of more efficient and electric private vehicles can result in >45% improvement in private vehicle efficiency globally
Freight logistics improvements	Freight transport logistics improvements can lead to a 5% reduction in tkm per capita by 2030
Freight vehicle efficiency and electrification	Global freight energy efficiency improves
Waste	
Recycling	Recycling rates can rise to collect 80% of recoverable materials in all regions by 2050
Landfill gas capture	All regions can potentially experience 2% annual growth in methane capture facilities that also generate grid electricity

Appendix 2. Potential urban abatement and the associated economic case by sector in 2030

Table 2. Potential urban abatement and the associated economic case by sector in 2030

Sector	Measure	Annual abatement 2050 ($GtCO_2e$)	Share of total abatement (%)	Energy savings (Mtoe)		Total incremental Investment[1] (2015-2050; trillion USD)	Energy cost savings[2] 2015 billion USD)		NPV[3] (trillion USD)	Average payback[4] (years)
				2030	2050		2030	2050		
Buildings - residential	New building heating efficiency	1.2	15%	168	375	5.3	267	957	2.1	8.4
	Heating retrofits	0.5	7%	142	175	6.4	209	501	-0.3	20
	Appliances and lighting	0.9	11%	92	211	0.1	147	529	3.7	0.2
	Fuel switching / solar PV	0.2	3%	6	23	0.7	156	100	0.2	11

[1] Undiscounted, with reference learning factors.

[2] Undiscounted, with energy prices increasing at 2.5 per cent per year.

[3] With a 3 per cent discount rate, with energy prices increasing at 2.5 per cent per year, and reference learning curves.

[4] With each measure's payback weighted by total investment.

Sector	Measure	Annual abatement 2050 ($GtCO_2e$)	Share of total abatement (%)	Energy savings (Mtoe)		Total incremental Investment[1] (2015-2050; trillion USD)	Energy cost savings[2] 2015 billion USD)		NPV[3] (trillion USD)	Average payback[4] (years)
Buildings - commercial	New building heating efficiency	0.5	7%	77	196	6.6	120	479	-2.1	21
	Heating retrofits	0.2	3%	66	87	4.0	103	260	-0.7	23
	Appliances and lighting	0.7	8%	67	176	0.4	962	584	3.0	1.0
	Fuel switching / solar PV	0.2	3%	2	7	0.2	3.9	24.9	0.0	13
Subtotal buildings		4.5	57%	619	1250	23.7	961	3435	6.0	17.4
Transport - passenger	Urban planning reduced travel demand	0.5	6%	56	122	-	101	553	2.9	-
	Mode shift and transit efficiency	10	12%	118	263	6.9	210	676	1.4	16
	Car efficiency and electrification	0.9	11%	92	207	2.5	198	777	3.8	4.9
Transport - freight	Logistics improvements	0.2	2%	15	44	-	14.6	66.0	0.4	-
	Vehicle efficiency and electrification	0.3	4%	47	99	1.0	94.4	348	2.2	4.5

Sector	Measure	Annual abatement 2050 ($GtCO_2e$)	Share of total abatement (%)	Energy savings (Mtoe)		Total incremental Investment[1] (2015-2050; trillion USD)	Energy cost savings[2] 2015 billion USD)		NPV[3] (trillion USD)	Average payback[4] (years)
Subtotal transport		2.8	35%	328	735	10.4	618	2420	10.6	11.9
Waste	Recycling[5]	0.3	4%	-	-	-	-	-	-	-
	Landfill gas	0.3	4%	0	1	0.03	0.7	3	0.0	20
Subtotal waste		0.6	8%	0	1	0.0	0.7	2.6	0.0	20
Total		8.0	100%	947	1986	34.2	1579	5858	16.6	15.7

Source: Analysis from the University of Leeds and Stockholm Environment Institute.

[5] It was not possible to undertake a robust economic assessment of this measure due to significant variability between different contexts.

Appendix 3. Selection of CDM methodologies for urban CDM

1. A list of clean development mechanism (CDM) methodologies that can potentially be applied for the urban CDM has been identified (as shown in table 3 below), based on the following selection criteria:

    (a) **Priority sectors**: the selected major sectors are buildings, transport, waste, industry (excluding heavy industry) and electricity production; only the methodologies applicable to these priority sectors are considered;

    (b) **Applicability** in the city context: this is the first screening criterion. Most CDM methodologies are applicable to both urban and rural areas. For the purpose of this analysis, methodologies without an obvious application in the city context are excluded;

    (c) **Feasibility**: the actual application or the number of usages of the methodologies. Feasibility may vary from city to city since the feasibility assessment is generally dependent on the specific city context (e.g. financial/political/technical capacity). This matrix also takes into account the fact that some methodologies are relatively new (adopted since 2011);

    (d) **Impact**: based on the understanding of the cities' multi-functions and multiple objectives, the impact of climate actions is selected as a key influential criterion. The following subcriteria are applied;

        (i) **Time frame**: whether the technologies/measures are short-term interventions in nature (i.e. "end-of-pipe" fixes or short-term measures (e.g. efficient light bulbs)); or midterm interventions (e.g. energy efficiency and fuel switching measures for buildings); or relatively long-term interventions (e.g. modal shift);

        (ii) **Multi-sector coverage**: a methodology covers a wider range of sectors or technologies;

    (e) **Co-benefits**: a methodology that addresses suppressed demand or has benefits for women/children or other co-benefits (e.g. air quality, health, local economy, ecosystem or social value).

2. Additionally, a literature review has been conducted and the greenhouse gas (GHG) emission mitigation measures that have been mentioned therein but not yet covered in the CDM are also included in table 3. It can be seen that all the measures in the last column can be considered as policy-based measures or measures focusing on behavioural changes (e.g. training, campaigns).

Table 3. List of CDM methodologies that can potentially be applied in the urban CDM

Sectors	Mitigation measures covered	CDM methodologies	Measures not covered by the existing methodologies
Building	• Energy-efficient appliances • Energy-efficient system • Energy-efficient building material • Energy-efficient building design • Renewable energy	AM0046; AM0070; AM0071; AM0091; AM0094; AMS-I.I.; AMS-II.C.; AMS-II.E.; AMS-II.J.; AMS-II.M.; AMS-III.AE.; AMS-III.AR.; AM0113; AMS-I.K.; AMS-II.O.; AMS-I.J.; AMS-II.R.; AM0060; AM0086; AMS-II.K.; AMS-II.L.; AMS-III.AV.; AMS-II.N.; AMS-II.Q.	• City planning for new buildings
Waste	• Recycling • Methane avoidance (end-of-pipe approach) • Landfill gas capture for energy generation • Capture of biogas from wastewater treatment plants	AM0020; ACM0001; AM8003; AM0093; AMS-III.G.; AMS-III.AF.; ACM0022; AMS-III.AX.; AMS-III.AO.; AM0053; AM0057; AM0069; AMS-III.E.; AMS-III.F.; AMS-III.L.; AMS-III.O.; ACM0014; AM0080; AMS-III.H.; AMS-III.I.; ACM0024; AM0112; AMS-III.AO.	• Systematic waste management: reduction (in production and consumption), reuse and recycling, and disposal
Transport	• Modal shift of transport with more efficient, lower GHG alternatives (e.g. electric trams, LNG buses, mass transit systems replacing GHG-intensive modes) • Public transportation efficiency improvements	ACM0016; AM0031; AMS-III.U.; AM0090; AMS-III.C.; AMS-III.S.; AMS-III.AA.; AMS-III.AP.; AMS-III.AQ.; AMS-III.AT.; AM0101; AM0110; AMS-III.AY.; AMS-III.BC.	• Transport/urban planning to increase efficiency of system and reduce distances travelled • Regulations for car traffic (e.g. congestion charges, incentives for car-pooling and other alternatives to individual transport), parking policies) • Modal shift to non-motorized modes (walking, cycling)

Sectors	Mitigation measures covered	CDM methodologies	Measures not covered by the existing methodologies
Energy	• Energy efficiency in energy generation • Fuel switch (low emission) • Renewable energy • Street lighting and related services (e.g. installing efficient lights including solar powered lights) • District heating and cooling systems • Co/tri generation	ACM0002; AM0019; AM0072; AMS-I.A.; AMS-I.B.; AMS-I.C.; AMS-I.D.; AMS-I.F.; AMS-I.J.; AM0100; ACM006; ACM0018; AM0007; AM0036; AMS-I.E.; AMS-II.G.; AM0058; ACM0012; AM0049; AMS-III.Q.; ACM007; ACM0013; AM0014; AM0048; AM0061; AM0062; AM0084; AMS-II.B.; AMS-III.AC.; AMS-III.AL.; AMS-III.B.; AMS-III.AG.; AMS-III.AH.; AMS-III.AM.; ACM0020; AMS-III.AS.	• Energy efficiency policy for new energy capacity development • Efficient energy supply (training or performance targets) programmes for energy providers

Appendix 4. Example tools for identifying and tracking actions for climate change

1. A number of initiatives are ongoing in this area (e.g. Local Government Climate Roadmap (COP13), Compact of Mayors, US Mayors' Climate Protection Agreement, and Global Cities Covenant on Climate (Mexico City Pact). Others include Global protocol for community scale emissions (GPC), GPC-Accredited Professional program, CDP Cities program, Climate Action Portal (NAZCA), carbonn Cities Climate Registry (cCCR) and Cities & Climate Change initiative.

2. A list has been included in table 4 below, with the main aim of informing the preparation of this note.

Table 4. Example tools to identify climate actions at the city level

Tool	Brief description	Key features
Gold Standard: Financing Cities of the Future: Tools to Scale-up Clean Urban Development	Developed based on a case study in New Delhi. The study lists four greenhouse gas (GHG) emission sources, i.e. Energy, Water and Sanitation, Solid Waste Management, and Transportation.	(a) GHG emission accounting is carried out based on desk-based literature review and community-specific survey; (b) Provided two options for monitoring the GHG emissions, i.e. direct and indirect monitoring. While the direct monitoring will be based on the CDM/GS methodology, the details of the method to carry out indirect monitoring is not provided; (c) Programmatic approach (i.e. PoA) and Result Based Finance (RBF) are two approaches proposed for scaling-up.
Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC)	- Protocol targeting GHG inventory preparation at the city level; - Jointly developed by C40 Cities Climate Leadership Group, ICLEI Local Governments for Sustainability and the world resource institute (WRI).	(a) Inventory preparation consistent with the approach in the IPCC; (b) Five main sectors covered: stationary energy; transportation; waste; industrial processes and product use, and agriculture, forestry and other land use; (c) Largely utilize the approach and default values (where relevant) provided by the IPCC.
Carbonn Cities Climate Registry: 2013 Annual report	Global reporting platform of local climate action, enabling cities and local governments to demonstrate their power and potential to reduce climate risks.	(a) Inventory-based (GPC); (b) Including both technical and/or behavioural change (public engagement, awareness-raising activities).

Tool	Brief description	Key features
Carbon Offset Tool-Kit and Usage Scenarios for GHG Reduction in Urban Settings (Korea Environment Institute)	It identifies CDM methodologies that are applicable to an urban setting and provides several proposals for further improvement of the CDM.	(a) Identified 28 CDM methodologies for a city context; (b) Suggestion for improvement of CDM to fit to the city context: (i) Balance between usability and rigidity; (ii) More options for automatic additionality; (iii) Financial aid from municipality excluded for additionality demonstration; (iv) Further simplified monitoring: system-level (not individual); (v) More application of standardized baseline; (vi) Further simplified applicability condition.
Indian Smart Cities	The Government of India has decided to support the development of 100 Smart Cities in the country, in order to modernize Indian cities.	Very high-level guideline outlining the key pillars for the functions and service that a smart city should deliver.
Common Carbon Matric (CCM) UNEP-SBCI	Measuring energy use and reporting GHG emissions from building operations.	(a) CCM protocol and Excel-based tool; (b) Energy: kWh/m2/yr or kWh/occupant/yr; (c) In its 2nd phase, performance metrics being computed for: (i) >150 individual buildings (total area: 7.4 km^2); (ii) 7 larger stocks (or Wholes) (total area: 177 km^2); (iii) Expanded list of residential and non-residential building types based on UNFCCC building categorizations; (iv) Normalize building performance by degree day; (v) Input fuel consumption data by month through the top-down and bottom-up approaches; (d) Informed the ISO 16745:2015 Environmental performance of buildings — Carbon metric of a building during the use stage.

Tool	Brief description	Key features
Tool for Rapid Assessment of City Energy (TRACE) The World Bank	- A diagnostic tool designed to evaluate energy efficiency opportunities which are under direct municipal government control; - Six sectors covered: (i) water and wastewater, (ii) transport, (iii) municipal buildings, (iv) street lighting, (v) solid waste management, and (vi) power and heat; - Allowed to compare with peer cities of similar characteristics.	(a) Provides a benchmarking tool for the six sectors; (b) Benchmark derived following a guided data gathering process to collect the city-specific background data, e.g. lighting data captures the amount of energy used to light public spaces and roadways such as (i) electricity consumed per kilometre of lit roads (kWhe/km); (ii) percentage of city roads; (iii) electricity consumed per light pole (kWhe/pole); (c) Deployed in more than 25 cities in Africa, Asia, Eastern Europe, and Latin America; (d) City authorities can also choose the comparison cities based on population size, climate conditions, human development index, and other criteria.

Appendix 5. Possible further standardization based on CDM project pipeline

1. The clean development mechanism (CDM) project pipeline consisting of a large volume of projects in different sectors may provide valuable input to inform the simplification of methodological requirements for project development. In that regard, a list of registered projects and programmes of activities (PoAs) that are registered and had issuances of CERs, in the city context has been assessed, with the aim to explore possible areas of standardization based on the monitored data. The results are provided in table 5 below.

2. It should be noted that the list is not exhautive. More effort will be needed for a thorough check of all other methodologies.

Table 5. Example CDM methodologies for further standardization

Approved methodology	No. of projects registered	No. of projects issued	No. of PoAs registered	No. of PoAs with CERs issued	Parameter for potential standardization
Residential sector (energy demand for heating/cooling; electric appliances, cooking) and service and commercial buildings (energy demand for heating/cooling; electric appliances)					
AMS-II.C. Demand-side energy efficiency programmes for specific technologies	6	3	9	1	To include the default value for daily usage hours as in AMS-II.J for commercial facilities and residential applications.
AMS-II.E. Energy efficiency and fuel switching measures for buildings	17	3	1	-	Model-based approach has been used in the registered project. Depending on the building type, the parameter of energy consumption per square metre may be standardized to be used by projects involving the same building type in the country.

Approved methodology	No. of projects registered	No. of projects issued	No. of PoAs registered	No. of PoAs with CERs issued	Parameter for potential standardization
AMS-II.G. Energy efficiency in household cooking	34	4	43	8	Baseline parameters such as baseline woody biomass consumption and pre-project stove efficiency could be standardized.
Waste sector (waste – municipal solid/liquid – handling and management, landfills)					
AM0025 Avoided emissions from organic waste through alternative waste treatment processes	64	11	1	-	The methodology could provide standardized country-specific waste composition, taking into consideration factors such as urban/rural context, revenue, etc.
ACM0001 Landfill gas project activities	192	84	6	1	Standardization of waste composition is possible using pre-project data.
AMS-III.F. Avoidance of methane production from biomass decay through composting	54	12	5	1	The methodology could provide standardized country-specific waste composition, taking into consideration factors such as urban/rural context, revenue, etc.
AMS-III.G. Landfill methane recovery	14	2	1	-	Some standardization has been done in the solid waste disposal (SWDS) tool.
AMS-III.H. Methane recovery in wastewater treatment	108	35	5	-	It may be possible to standardize country-specific chemical oxygen demand (COD) values for the domestic sector, apart from the industrial sector such as Palm Oil Mill Effluent (POME) For others, COD level would vary from facility to facility and would be difficult to standardize.

Approved methodology	No. of projects registered	No. of projects issued	No. of PoAs registered	No. of PoAs with CERs issued	Parameter for potential standardization
Transportation (electric vehicles, public transport, modal shift, etc.)					
AM0031 Bus Rapid Transit Project	10	5	-	-	The other workstream under Project 244 is considering standardization (e.g. pkm per transport mode) and further simplification of survey requirements and additionality demonstration requirements in transport sectors.
ACM0016 Mass Rapid Transit Projects	9	3	1	-	
AMS-III.C. Emission reductions by low greenhouse emission vehicles	6	1	1	-	

Source: UNEP DTU database on CDM project activities and programmes of activities available at <http://cdmpipeline.org/> 1 August 2015.

- - - - -

Document information

Version	*Date*	*Description*
01.0	28 September 2015	Initial publication as an annex to the annotated agenda of EB86.

Decision Class: Regulatory
Document Type: Information note
Business Function: Methodology
Keywords: combination of methodologies, data collection and analysis, streamline, urban