



Technical Assistance Report

Project Number: 48265-001
Research and Development Technical Assistance (RDТА)
December 2014

Financing Low-Carbon, Climate-Resilient Urban Infrastructure in Asia and the Pacific

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Asian Development Bank

ABBREVIATIONS

ADB	–	Asian Development Bank
DMC	–	developing member country
CDIA	–	Cities Development Initiative in Asia
TA	–	technical assistance

NOTE

In this report, \$ refers to US dollars.

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RESEARCH AND DEVELOPMENT TECHNICAL ASSISTANCE AT A GLANCE

1. Basic Data		Project Number: 48265-001	
Project Name	Financing Low Carbon, Climate-Resilient Urban Infrastructure in Asia and the Pacific	Department /Division	RSDD/RSDD-CD
Country	REG	Executing Agency	Asian Development Bank
Borrower	Not applicable		
2. Sector		Subsector(s)	
✓ Water and other urban infrastructure and services		Urban policy, institutional and capacity development	
Energy		Energy efficiency and conservation	
		Total	ADB Financing (\$ million)
			0.45
			0.30
		Total	0.75
3. Strategic Agenda		Subcomponents	
Inclusive economic growth (IEG)	Pillar 2: Access to economic opportunities, including jobs, made more inclusive	Climate Change Information	
Environmentally sustainable growth (ESG)	Global and regional transboundary environmental concerns	Adaptation (\$ million)	0.38
Regional integration (RCI)	Pillar 4: Other regional public goods	Mitigation (\$ million)	0.38
		CO ₂ reduction (tons per annum)	1
		Climate Change impact on the Project	Low
4. Drivers of Change		Components	
Governance and capacity development (GCD)	Client relations, network, and partnership development to partnership driver of change	Gender Equity and Mainstreaming	
Knowledge solutions (KNS)	Institutional development	Some gender elements (SGE) ✓	
Partnerships (PAR)	Organizational development		
	Application and use of new knowledge solutions in key operational areas		
	Knowledge sharing activities		
Private sector development (PSD)	Bilateral institutions (not client government)		
	Implementation		
	International finance institutions (IFI)		
	United Nations organization		
	Conducive policy and institutional environment		
5. Poverty Targeting		Location Impact	
Project directly targets poverty	No	Rural	Low
		Urban	High
6. TA Category:		B	
7. Safeguard Categorization Not Applicable			
8. Financing			
Modality and Sources		Amount (\$ million)	
ADB		0.75	
Sovereign Research and development technical assistance: Technical Assistance Special Fund		0.75	
Cofinancing		0.00	
None		0.00	
Counterpart		0.00	
None		0.00	
Total		0.75	
9. Effective Development Cooperation			
Use of country procurement systems		Yes	
Use of country public financial management systems		Yes	

I. INTRODUCTION

1. The technical assistance (TA) will produce a study on low-carbon, climate-resilient urban infrastructure development options, costs, and benefits in developing member country (DMC) cities or urban agglomerations with current populations of 750,000 or more. For six selected “archetype” cities, a master plan-level assessment of current and projected infrastructure needs by 2030 will be undertaken and the climate exposure and risk of these needs will be analyzed. The TA will quantify the infrastructure financing needs of selected cities, including filling existing infrastructure gaps and projected infrastructure needs, using investment in low-carbon infrastructure where feasible and climate-resilient infrastructure in all cases. The TA will identify appropriate financing mechanisms and structures to support the implementation of the identified infrastructure.

2. By focusing on archetype cities or agglomerations that are representative of a larger group of cities in Asia and the Pacific and have demonstrated willingness to explore low-carbon and climate-resilient infrastructure alternatives, the TA will permit a quantification of financing needs for the implementation of low-carbon, climate-resilient urban infrastructure in cities across the region. Ultimately, the TA will facilitate the identification of opportunities and approaches to finance for low-carbon, climate-resilient development using a range of financial sources, mechanisms, and structures.

3. The TA is aligned with Strategy 2020, which identifies climate change as part of the broader agenda of promoting environmentally sustainable growth in Asia and the Pacific.¹ Strategy 2020 also promotes livable cities that are competitive, socially inclusive, and environmentally sustainable. The Midterm Review of Strategy 2020 states that the Asian Development Bank (ADB) will continue to support DMCs in tackling climate change, which includes helping DMCs to engage with and access various sources of climate finance.² Furthermore, DMC policy makers attending various ADB events, such as the First Annual ADAPT Asia Pacific Forum in 2012, Asia Low Emission Development Strategies Partnership Workshop on Climate Finance, and the subregional launching of the Economics of Climate Change publications, have also requested that ADB support this type of initiative.³

II. ISSUES

4. Many countries in developing Asia are projected to become major global economic powerhouses this century. The region is also fast becoming a major driver of greenhouse gas emissions worldwide, and at the same time is increasingly exposed to the risks of climate change. However, significant opportunities exist to develop interventions for sustaining optimal levels of low-carbon and climate-resilient developments that have not yet been locked or are still in the early stages of planning and implementation. Developing countries require massive additional investment to transition to a low-carbon and climate-resilient development path. Mitigation in developing countries could cost \$140 billion–\$175 billion per year during 2010–2030. Adaptation costs for developing countries in Asia and the Pacific during 2010–2050 are estimated at \$40 billion per year.

¹ ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank, 2008–2020*. Manila.

² ADB. 2014. *Midterm Review of Strategy 2020: Meeting the Challenges of a Transforming Asia and Pacific*. Manila.

³ The TA first appeared in the business opportunities section of ADB’s website on 17 December 2014.

5. Currently, more than 40% of Asia's population resides in urban areas, and by 2050 two-thirds of Asia's population will be urban. More than 520 million vulnerable people across the region are estimated to live in squalor in urban slums, with poor services. Urban areas account for 60%–80% of DMC energy consumption and 75% of carbon emissions. They are also frequently exposed to climate-related hazards, such as floods and storm surges.

6. Given the urban growth expected in Asia, particularly of small and medium-sized cities, there is a great deal of development and infrastructure yet to be built, so there are significant opportunities for low-carbon growth from the outset. As the recent study of the Intergovernmental Panel on Climate Change Fifth Assessment Report Working Group III emphasizes, cost effective, large-scale solutions to mitigation are not going to be achieved through individual sector or technology solutions, but rather through systemic and cross-sector mitigation strategies.⁴ Not only have cities contributed the largest share of the world's greenhouse gas emissions, they also concentrate many of the people most at risk from the effects of climate change.

7. In Asia, it is estimated that 138 out of the 193 cities with populations of 1 million–5 million are exposed to natural hazards, while 15 of 26 cities with populations of 5 million–10 million and 11 of 13 cities with populations greater than 10 million are also exposed, of which many are coastal cities.⁵ In some DMCs, vulnerability is often increased because of informal settlements, lack of adequate infrastructure, and limited institutional capacity. High levels of vulnerability require adaptation strategies that focus on resilience to acute as well as chronic climate impacts. An analysis of climate change plans on sectors relevant to infrastructure investments conducted by the Cities Development Initiative in Asia (CDIA) revealed that, “79% include energy supply and distribution followed by buildings and water services (59%), planning and urban land use (48%), transport (48%), flood protection (41%), outdoor lighting (31%), and waste management (24%)” Most strikingly, the same study adds that, “none of the city climate change plans analyzed provided data on financial investments needed to implement the plan or for the infrastructure investments”.⁶

III. THE RESEARCH AND DEVELOPMENT TECHNICAL ASSISTANCE

8. Given the continuing evolution of the climate finance architecture, DMC cities in Asia and the Pacific must develop strategic approaches to climate compatible urban infrastructure investment. The TA will help to fill knowledge gaps with regard to both city-level investment needs as well as appropriate financing mechanisms for low carbon, climate resilient urban infrastructure.

A. Impact and Outcome

9. The impact will be an increase in investment in urban infrastructure using climate finance mechanisms in DMC cities. The outcome will be an improved information basis for project designs for large-scale low-carbon and climate-resilient infrastructure in DMC cities. This will help decision makers, development partners, investors, and other stakeholders to think strategically about infrastructure needs and options as well as the sources and mechanisms to access financing from a variety of financing sources—public and private, domestic and

⁴ IPCC. 2014. *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. New York.

⁵ UN, DESA. 2014. *World Urbanization Prospects: The 2014 Revision, Highlights*. New York.

⁶ CDIA. 2012. *Climate Change and Infrastructure in Asian Cities*. Pasig City, Philippines.

international (including multilateral development bank financing), as well as climate finance sources such as the Green Climate Fund. The design and monitoring framework is in Appendix 1.

B. Methodology and Key Activities

10. The first output will be the classification of DMC cities according to key characteristics and the identification of the main climate risks, infrastructure options, and the six “archetype” cities. An online database cataloguing all cities in Asia and the Pacific with a population of more than 750,000 classified into six main categories according to population size, geographical location (coastal or inland, temperate or tropical, etc.), projected demographic development by 2030 and by 2050, and other relevant factors; and greenhouse gas emissions and climate vulnerabilities, and possible options for climate-resilient and low-carbon urban development will be compiled.⁷

11. The second output will be the identification of the needs and opportunities for large-scale implementation of low-carbon, climate-resilient urban development in the six archetype cities. A report containing six profiles, one for each archetype city, containing a macro-level description of (i) urban infrastructure gaps and expansion requirements to 2030, including an initial estimate of greenhouse gas emissions associated with development under a business-as-usual” scenario; (ii) current and projected urban infrastructure climate exposure based on spatial climate change projections for 2030, and for 2050; and (iii) current and projected opportunities to transition to low-carbon infrastructure options by sector, including an initial estimate of greenhouse gas emissions associated with low-carbon development will be produced.

12. The third output will be the identification of financing models and mechanisms to address investment needs and capitalize on the identified opportunities in each archetype city. A report containing six profiles, one for each archetype city, will be compiled. The report will contain (i) a macro-level estimate of the costs, benefits, and associated financing requirements of selected low-carbon and climate-resilient infrastructure investment options to 2030; (ii) an assessment of options with regard to the financing models which may be developed or applied in order to mobilize the required financing for the identified options, including ADB financing; (iii) a basic financing model derived from (i) and (ii) above; and (iv) a description of possible strategies and approaches to (a) access financing sources, (b) mobilize the private sector, and (c) address existing gaps in institutional and technical capacity to implement investments.

13. The fourth output will be the identification of the costs and benefits associated with large-scale implementation of low-carbon, climate-resilient urban infrastructure in DMC cities by 2030. A report containing an indicative estimate of the costs and benefits of implementing low-carbon, climate-resilient urban infrastructure across all DMC cities with a population greater than 750,000 (current) will be produced.

14. The fifth output will be the development of a concept proposal to scale up investments in low-carbon, climate-resilient infrastructure in DMC cities. A report will be produced containing a description of options for clustering investments and accompanying financing strategies to achieve economies of scale and a globally significant reduction of greenhouse gas emissions

⁷ The six archetype cities will include at least one city from a Group A or B Asian Development Fund-eligible country. Based on initial assessments, this would likely be Kathmandu, Nepal. Based on informal discussions with ADB Pacific Department, the TA will also likely cover Suva, Fiji.

and urban climate vulnerability. The report should make recommendations for effective DMC city access to new forms of climate finance, including from the Green Climate Fund. The report should also describe potential roles for financing partnerships focused on accelerated scaling-up of investment and assistance to DMC cities.

15. Data collection will include the review and analysis of existing literature, data inventories, and other resource materials, including national and city development plans, climate change plans and studies, greenhouse gas inventories, vulnerability assessments, estimates of urban financing needs, and other relevant sources. Key informant interviews may be conducted to triangulate data collected and to corroborate TA findings.

16. The main assumption of the TA is that there are a large number of cities that are suitable for large-scale implementation of low-carbon and climate-resilient infrastructure. Major risks are that (i) DMC governments constrain the ability of city governments to access external financing; (ii) the lack of necessary information on infrastructure needs and climate vulnerability of archetype cities to carry out assessments; and (iii) delay in international climate change agreements required for the establishment of financing mechanisms which are accessible to DMC cities to pursue low-carbon, climate-resilient development. Risks will be partially offset through selection of cities so as to ensure availability of information needed for assessments.

C. Cost and Financing

17. The TA is estimated to cost \$750,000, which will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-V). The cost estimates and financing plan is in Appendix 2.

D. Implementation Arrangements

18. ADB will serve as the executing and implementing agency for the TA, with the Climate Change and Disaster Risk Management Unit of the Regional and Sustainable Development Department serving as the focal point. The implementation period of the TA will be from January 2015 to February 2016.

19. The TA supports ADB's Urban Operational Plan for 2012–2020, which emphasizes integrated planning to catalyze climate-friendly, resilient, inclusive, and environmentally sustainable urban development.⁸ The TA also supports ADB's Sustainable Transport Initiative Operational Plan, which features urban transport and climate change and energy efficiency as key areas of intervention, and promotes integrated urban planning, land use planning, and lower emission transport solutions.⁹

20. The TA will draw lessons from the CDIA that ADB has jointly established with development partners. The CDIA continues to help Asian cities structure urban infrastructure projects, including low-carbon, climate-resilient infrastructure. The TA will establish links with ongoing ADB efforts to scale up climate-resilient investment in urban infrastructure, including the Urban Climate Change Resilience Trust Fund under the Urban Financing Partnership Facility, as well as relevant programs in regional departments, such as the Southeast Asia Department's Secondary Cities Development Program II (Green Cities) and the Central and West Asia Department's Economics of Climate Change in Central and West Asia. The TA will

⁸ ADB. 2013. *Urban Operational Plan*. Manila.

⁹ ADB. 2010. *Sustainable Transport Initiative Operational Plan*. Manila.

seek to establish opportunities for knowledge exchange with regional or national research institutions or centers of excellence on urban development.¹⁰

21. The TA will finance consulting services, workshops, and report preparation. Target archetype cities will be proposed after discussions with regional departments, the Private Sector Operations Department, DMC authorities, and other stakeholders. The workshops serve as a platform to present, validate, and consolidate insights regarding the interim and final results of the TA.

22. The TA will require 29 person-months of international and 24 person-months of national individual consultant inputs. The consultants will be engaged through a firm in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time). The quality- and cost-based selection method, based on a quality–cost ratio of 80:20, and simplified technical proposals will be used. Disbursements under the TA will be made in accordance with ADB's Technical Assistance Disbursement Handbook (2010, as amended from time to time). Appendix 3 provides the outline terms and reference for the consultants.

IV. THE PRESIDENT'S DECISION

23. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$750,000 on a grant basis for Financing Low-Carbon, Climate-Resilient Urban Infrastructure in Asia and the Pacific, and hereby reports this action to the Board.

¹⁰ Possible partner research institutions and centers of excellence include the Asian Disaster Preparedness Center, International Council for Local Environmental Initiatives, Institute for Social and Environmental Transition, and Institute for Global Environmental Strategies.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact Investment in urban infrastructure using climate finance mechanisms in DMC cities increased	Number of DMC cities employing climate finance mechanisms for investment projects supported by ADB and development partners increased (baseline: 0, by 2020: 10)	Mayors' reports and other documents published by DMC cities DMC reports Donor country and development partner reports Green Climate Fund reports	Assumption DMCs are committed to low-carbon growth and building resilience to climate change Risks Lack of international agreement on climate change required to provide financial incentive to DMC cities
Outcome Information basis for project designs for large-scale climate investment in low carbon and climate resilient infrastructure in DMC cities improved	Project designs of investments by ADB and development partners in at least 2 of the 6 DMC cities incorporate climate financial mechanisms identified in the city profiles	Communications from ADB operations departments, DMC cities, development partners, donors, and investors	Assumptions City stakeholders are willing to take a strategic long-term approach towards urban transformation and infrastructure finance. National governments are supportive of city efforts to access finance from a variety of sources. Local actors, especially financial institutions and the private sector, are willing to engage with cities regarding low-carbon and climate-resilient infrastructure. Risks Cities are constrained in their capacity to access finance because of insufficient creditworthiness or other restrictions which limit their capacity to engage with finance sources. Technical challenges of proposal formulation
Outputs 1. DMC cities classified, main climate risks and infrastructure options identified, and archetype cities identified	One online database cataloguing DMC cities according to key characteristics and other relevant factors; climate risks and possible options for climate-resilient and low-	Online database, minutes of the interim and final review workshops, and the inception, interim, and draft final reports submitted by the	Assumption DMC city stakeholders are willing to provide information and collaborate

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
<p>2. Needs and opportunities for large-scale implementation of low-carbon, climate-resilient urban development in archetype cities identified</p> <p>3. Financing models and mechanisms to address investment needs and capitalize on opportunities identified</p> <p>4. Costs and benefits associated with large-scale implementation of low-carbon, climate-resilient urban infrastructure identified</p> <p>5. Conceptual proposal for scaling up investment developed</p>	<p>carbon development; selection of 6 archetype cities.</p> <p>One report containing six profiles, one for each archetype city, with a macro-level description of</p> <ul style="list-style-type: none"> (i) infrastructure gaps and expansion; (ii) current and projected urban infrastructure climate exposure; (iii) current and projected opportunities to transition to low-carbon infrastructure options. <p>One report containing six profiles, one for each archetype city, with</p> <ul style="list-style-type: none"> (i) a macro-level estimate of the costs, benefits, and associated financing requirements of selected low-carbon and climate-resilient infrastructure investment options; (ii) an assessment of options with regard to applicable financing models; (iii) a basic financing model derived from (i) and (ii) above; and (iv) a description of possible financing strategies and approaches. <p>One report containing an indicative estimate of the costs and benefits of implementing low-carbon, climate-resilient infrastructure in all DMC cities with a current population greater than 750,000.</p> <p>One report containing a description of options for clustering investments and accompanying financing strategies.</p>	<p>consultants.</p>	

Activities with Milestones	Inputs
<ul style="list-style-type: none"> 1.1. Inception report submitted (month 1) 1.2. Inventory of cities submitted (month 2) 1.3. Consultations with ADB regional departments, the Private Sector Operations Department, DMC city representatives, development partners, and other stakeholders regarding city selection (by month 2) 2.1. Baseline assessment for infrastructure gaps and needs, including analysis for current and projected exposures and opportunities for transitioning to low carbon infrastructure (month 3) 2.2. Development of six archetype city profiles based on the baseline assessment (month 4) 3.1. Development of financing models based in cost-benefit analysis and assessment of financing options (month 5) 3.2. Development of six archetype city profiles based on the financing models developed, including possible strategies and approaches for accessing and mobilizing funding, and addressing institutional and technical capacity gaps (month 6) 3.3. Interim report submitted (by month 7) 3.4. Interim workshop (by month 8) 4.1. Report on costs and benefits of implementing low-carbon and climate resilient infrastructure submitted (month 9) 4.2. Draft final report including proposed conceptual framework for scaling-up investment and assistance to DMC cities (by month 10) 5.1. Final workshop (by month 12) 5.2. Final report (within 1 month of receiving comments from ADB) 5.3. Publication of the final report (month 14) 	<p>ADB: \$750,000 (TASF-V)</p>

ADB = Asian Development Bank, DMC = developing member country, TA = technical assistance, TASF = Technical Assistance Special Fund.

Source: Asian Development Bank.

COST ESTIMATES AND FINANCING PLAN

(\$'000)

Item	Amount
Asian Development Bank^a	
1. Consultants	
a. Remuneration and per diem	
i. International consultants (29 person-months)	493.0
ii. National consultants (24 person-months)	144.0
b. International and local travel	40.0
2. Workshops	20.0
3. Miscellaneous administration and support costs ^b	8.0
4. Publications	20.0
5. Contingencies	25.0
Total	750.0

^a Financed by the Asian Development Bank's Technical Assistance Special Fund (TASF-V).

^b Includes honorarium and travel costs for resource persons and facilitators, participants' travel costs, staff travel costs as resource persons and/or speakers, and logistics costs.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. A team of international and national consultants will be engaged through a firm with extensive experience in conducting climate change mitigation and adaptation projects in Asia and the Pacific to assist in technical assistance (TA) implementation will preferably have an ongoing or past affiliation with regional or national research institutions or centers of excellence on urban development. The data collection and analytical methods used for the TA should build upon the foundation of existing studies done by the Asian Development Bank (ADB) and other organizations. The TA will require about 29 person-months of international and 24 person-months of national consultant inputs.

A. International Consultants

2. **Senior climate change specialist and team leader** (7 person-months, intermittent). The specialist will have at least a master's degree in economics, environmental science, urban planning and management, or a related discipline, and 15 years' experience related to urban environment and climate change. Knowledge of ADB and experience in Asia and the Pacific, particularly in urban and environmental management, are highly desirable. The specialist will be responsible for the following tasks:

- (i) Coordinate and plan overall TA implementation, including coordinating inputs of other consultants, and identifying and coordinating team members and participating institutions.
- (ii) Consult with ADB regional departments and the Private Sector Operations Department to identify potential study cities.
- (iii) With support from research assistants, develop an initial list of cities in developing member countries with a current population greater than 750,000 and expected to grow more than 40% by 2030. Based on that list, develop a conceptual urban classification system (desk study) that categorizes developing member country urban agglomerations according to
 - (a) current status of infrastructure (including buildings) and what the main infrastructure gaps are,
 - (b) projected infrastructure development needs,
 - (c) current and projected risks to climate change impacts, and
 - (d) potential for greenhouse gas reductions.
- (iv) Group cities based on their fit within the various categories. Some urban areas will be high in all categories (group 1); some will be high in only (a), (b), and (c) (group 2); and some will be high in only (a), (b), and (d) (group 3). Group 1 urban areas will likely require a blend of public sector, public-private partnership (PPP), and private sector financing; group 2 urban areas are likely to have less potential for PPP and private sector funding; and group 3 areas are likely to have greater potential for PPP and private sector investment.
- (v) Identify six urban agglomerations that represent each group; provide a diversity of geography, climate-related hazards, and current and projected populations; and can also serve as a representative sample for purposes of extrapolation to the full set of cities.
- (vi) With support from the TA team, extrapolate the results of city-level study results to the full developing member country urban agglomeration projection to establish a quantified picture of the magnitude of the infrastructure finance needed, with a clear delineation of the financing required to meet current infrastructure gaps and projected infrastructure needs, the costs of making these

investments climate resilient, and the potential for greenhouse gas reductions, and cost.

- (vii) Plan and implement TA workshops.
- (viii) With assistance from the other consultants, produce all project reports and outputs.

3. **Urban planner and engineer** (6 person-months, intermittent). The consultant will have a minimum of a master's degree in civil engineering, urban planning, urban development, or a related discipline, and 15 years of work experience. The consultant will be responsible for the following tasks:

- (i) With support from the urban sustainable transport specialist and research assistants, for each of the selected urban areas, prepare overview assessments of
 - (a) climate change vulnerabilities by type of infrastructure and costs of adaptation;
 - (b) infrastructure gaps and costs of filling the gaps;
 - (c) identified sustainable infrastructure requirements for each city that subscribe to low-carbon and climate-resilient principles, with infrastructure development requirements and costs with time frame; and
 - (d) support required by the finance specialist in costing options.
- (ii) Participate in and present at TA workshops.

4. **Senior finance specialist** (6 person-months total, intermittent). The specialist will have at least a master's degree in economics, finance, public policy and management, or a related discipline, and 15 years' experience related to financing urban infrastructure. The specialist must hold a professional accounting certification (chartered accountant or certified public accountant) and have experience in credit risk evaluation. Experience in Asia and the Pacific is desirable, as is knowledge of public and private sector climate change mitigation and adaptation finance. The specialist will be responsible for the following tasks:

- (i) For each selected city,
 - (a) prepare financial rates of return for different types of investments identified by the other specialists in order to identify the types and scale of investments that will (1) generate an adequate return to attract private sector participation, and (2) have a significant economic and social return but are not likely to attract private sector participation;
 - (b) assess the creditworthiness of the cities and, on that basis, the potential for mobilizing needed financial resources;
 - (c) assess options for financing the infrastructure development needs, including national and multiple country investment vehicles and/or facilities, mega public-private partnerships, etc.; and
 - (d) propose a set of financing models tailored to the various categories, and consult with a range of potential participants including institutional investors, national development banks, and others to refine the models.
- (ii) Participate in and present at TA workshops.

5. **Climate change adaptation specialist** (4 person-months, intermittent). The specialist will have at least a master's degree in economics, urban development, or a related discipline, and 10 years of experience, with previous engagements on conducting climate change risk assessments and urban climate adaptation issues in developing countries. The specialist will ideally be affiliated with a regional climate research consortium or facility with active projects in Asia and the Pacific, such as Coordinated Regional Climate Downscaling Experiment, Regional

Integrated Multi-Hazard Early Warning System for Africa and Asia, or Consortium of International Agricultural Research Centers, or have direct access to the datasets of such organizations. The specialist will be responsible for the following tasks:

- (i) provide expertise on and inputs into opportunities and benefits to enhance city climate resilience, and identify and consult with selected experts to validate these assessments;
- (ii) synthesize necessary local spatial climate change projections based on existing data to assess urban infrastructure exposure to climate change by 2030 and 2040–2050; and
- (iii) assist the urban planner and engineer with identification of climate change vulnerabilities by type of infrastructure and assessment of the costs of adaptation.

6. **Energy efficiency specialist** (3 months, intermittent). The specialist will have a minimum of a master's degree in civil engineering, architecture, energy management, or a related discipline, and 10 years of work experience. Previous engagement on projects that make use of energy frameworks that are already established and well documented in literature, such as Long-range Energy Alternatives Planning System, Energy Transition Model, and others on developing country settings, is highly desirable. The specialist will be responsible for the following tasks:

- (i) provide expertise on and inputs into opportunities for and benefits of enhancing energy efficiency in cities, and identify and consult with selected experts to validate these assessments;
- (ii) assess projected energy demand and potential energy and energy-related infrastructure needs by 2030; and
- (iii) assist the urban planner and engineer with identification of energy efficiency potential by type of infrastructure and assessment of the costs of implementing energy efficiency interventions.

7. **Urban sustainable transport specialist** (2 person-months, intermittent). The specialist will have a minimum of a master's degree in transport engineering, civil engineering, urban transport planning, urban development, or a related discipline, and 15 years of work experience. With support from the research assistants, for each of the selected urban areas the specialist will prepare overview assessments of

- (i) the risk and exposure to climate change of existing transport infrastructure and facilities, including costs of adaptation;
- (ii) transport infrastructure gaps and the costs of filling the gaps; and
- (iii) for each city, sustainable transport infrastructure requirements that subscribe to low-carbon and climate-resilient principles, including requirements and costs with time frame.

8. **Climate-resilient building design specialist** (1 person-month, intermittent). The specialist will have at least a master's degree in civil engineering, architecture, or a related discipline, and 10 years of work experience. The specialist will be responsible for the following tasks:

- (i) provide expertise on and inputs into opportunities for and benefits of climate-resilient building design, and identify and consult with selected experts to validate these assessments; and
- (ii) assist the urban planner and engineer with identification of options for enhancing the climate resilience of buildings, and assessment of the costs of implementing climate-resilient building design interventions.

B. National Consultants

9. **Project coordinators** (7 person-months, intermittent). The coordinators will have at least 10 years of experience in project administration and at least a bachelor's degree in a related discipline. Experience with ADB is highly desirable. The coordinators will be responsible for the following tasks:

- (i) support the team leader in organizing and coordinating the implementation of the TA;
- (ii) support coordination and scheduling of inputs by consultants;
- (iii) develop project implementation schedules and apply adaptive management approaches to ensure smooth delivery of the TA outputs;
- (iv) support the recruitment of consultants;
- (v) support financial administration of the TA;
- (vi) coordinate and organize workshop logistics, including the preparation of invitations, financial arrangements, and logistics;
- (vii) support the team leader in organizing and facilitating meetings and consultations;
- (viii) support in the preparation of project knowledge products and information dissemination, including background research and synthesis and editing of information;
- (ix) coordinate arrangements for the publication of reports, including desktop publishing, editing, printing, and dissemination; and
- (x) perform any other tasks needed to ensure the smooth implementation of the TA.

10. **Country research associates** (13 person-months total, intermittent). The research associates will have a minimum of a master's degree in civil engineering or urban development or equivalent, and 5 years of work experience. The research associates will be responsible for the following tasks:

- (i) support the team leader in all activities, but with a particular focus on data collection and analysis as indicated in the team leader terms of reference;
- (ii) support other team members as directed by the team leader; and
- (iii) establish and maintain a data management and communication management system appropriate for the duration of the TA and for purposes of reporting and, if determined desirable and undertaken by ADB, facilitate a periodic update of the data.

11. **Sustainable infrastructure specialists** (4 person-months, intermittent). The specialists will have a minimum of a master's degree in engineering, or a related discipline, and 15 years' working experience. The specialists will be responsible for the following tasks:

- (i) provide expertise on and inputs into opportunities for and benefits of implementing sustainable infrastructure in cities, and identify and consult with selected experts to validate these assessments;
- (ii) assist the urban planner and engineer with identification of greenhouse gas mitigation potential by type of infrastructure and assessment of the costs of implementing infrastructure; and
- (iii) assist the urban planner and engineer and climate change adaptation specialist in developing risk minimization measures for existing vulnerable and exposed urban infrastructure, and safeguards on infrastructure identified in (i) and (ii).