



Technical Assistance Report

Project Number: 48105-001
Policy and Advisory Technical Assistance (PATA)
June 2015

People's Republic of China: Construction and Demolition Waste Management and Recycling

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Asian Development Bank

CURRENCY EQUIVALENTS

(as of 5 May 2015)

Currency unit	–	yuan (CNY)
CNY1.00	=	\$0.1610
\$1.00	=	CNY6.1000

ABBREVIATIONS

ADB	–	Asian Development Bank
CDW	–	construction and demolition waste
MOHURD	–	Ministry of Housing and Urban–Rural Development
PRC	–	People’s Republic of China
TA	–	technical assistance

NOTE

In this report, “\$” refers to US dollars.

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POLICY AND ADVISORY TECHNICAL ASSISTANCE AT A GLANCE

1. Basic Data		Project Number: 48105-001	
Project Name	Construction and Demolition Waste Management and Recycling	Department /Division	EARD/EASS
Country Borrower	China, People's Republic of People's Republic of China	Executing Agency	Ministry of Housing and Urban-Rural Development
	Project formerly named Study on the Utilization Mechanism and Management Policies of the Recycling of Construction and Demolition Wastes		
2. Sector	Subsector(s)	ADB Financing (\$ million)	
✓ Water and other urban infrastructure and services	Urban hazardous waste management		0.08
	Urban solid waste management		0.33
		Total	0.40
3. Strategic Agenda	Subcomponents	Climate Change Information	
Inclusive economic growth (IEG)	Pillar 2: Access to economic opportunities, including jobs, made more inclusive	Climate Change impact on the Project	Low
Environmentally sustainable growth (ESG)	Eco-efficiency Environmental policy and legislation Urban environmental improvement		
4. Drivers of Change	Components	Gender Equity and Mainstreaming	
Knowledge solutions (KNS)	Application and use of new knowledge solutions in key operational areas Knowledge sharing activities	No gender elements (NGE)	✓
5. Poverty Targeting		Location Impact	
Project directly targets poverty	No	Nation-wide	High
6. TA Category:	B		
7. Safeguard Categorization	Not Applicable		
8. Financing			
Modality and Sources		Amount (\$ million)	
ADB		0.40	
Policy and advisory technical assistance: Technical Assistance Special Fund		0.40	
Cofinancing		0.00	
None		0.00	
Counterpart		0.00	
None		0.00	
Total		0.40	
9. Effective Development Cooperation			
Use of country procurement systems		No	
Use of country public financial management systems		No	

I. INTRODUCTION

1. The Government of the People's Republic of China (PRC) has requested policy and advisory technical assistance (TA) from the Asian Development Bank (ADB) to enhance the PRC's policies and practices related to the management and recycling of construction and demolition waste (CDW).¹ A TA fact-finding mission on 17–19 March 2015 reached an agreement with the government on the impact, outcome, outputs, implementation arrangements, costs, financing arrangements, and terms of reference for the consulting services of the TA. The design and monitoring framework is in Appendix 1.²

II. ISSUES

2. The continuous economic growth of the PRC since the start of its economic reforms in 1978 has been accompanied by rapid urbanization. Increased urbanization will remain an essential pillar supporting future growth and development in the PRC, but it also poses a variety of environmental challenges. One of the problems is the large quantities of CDW being generated as a by-product of the construction boom.³ The Ministry of Housing and Urban–Rural Development (MOHURD, formerly known as the Ministry of Construction) estimates that about 350 million tons of CDW is generated in the PRC per year, or 10 times the amount of domestic solid waste. CDW quantities are projected to increase significantly over the next 2 decades with the lifetime of buildings expiring. Most of this waste is delivered unsegregated (i.e., mixed with other waste streams) to suburban or rural areas for disposal in open storage or landfill. This practice, often illegal, incurs high transportation costs, occupies valuable land, reduces recycling potential and wastes natural resources, and represents an environment concern.⁴

3. While CDW is unavoidable and zero waste is not practical, it should be managed following the internationally accepted waste management method hierarchy comprising four strategies: waste reduction, reuse, recycling, and disposal.⁵ The CDW reduction performance of construction contractors in the PRC is still poor, as it is mainly driven by short-sighted economic and practical considerations rather than environmental and resource efficiency concerns. A small-scale private sector business is thriving for the direct reuse of valuable construction materials such as copper, aluminum, reinforcing steel, wood, and others. Market potential for CDW recycling in the PRC is significant; in residential real estate alone, the PRC is building about 1.8 billion square meters per year, or more than one-third of all the buildings in the world, producing and consuming 55% of the cement globally, and consuming 45% of the national energy in doing so.⁶ Forecasts for the short to midterm future remain positive, with construction exceeding 5.2% of gross domestic product.⁷ CDW recycling may prove to be a significant opportunity to reduce greenhouse gas emissions in the construction sector. The emission reduction benefit of using recycled concrete, for example, results from the avoided emissions associated with mining and processing aggregate that recycled concrete is substituting.

¹ The TA is included in ADB's country operations business plan. ADB. 2015. *Country Operations Business Plan: People's Republic of China, 2015–2017*. Manila.

² The TA first appeared in the business opportunities section of ADB's website on 28 May 2015.

³ CDW includes materials produced during the construction, alteration, extension, and demolition of buildings, structures, and pipelines (MOHURD. 2006. *PRC Regulations on Management of Urban Construction Waste*. Beijing).

⁴ Typical emissions from landfilling CDWs are chemicals leaching from wood, drywall, and concrete, such as chromium, copper, lead, arsenate, and potentially asbestos or asbestos containing materials.

⁵ H. Yuan and L. Shen. 2011. Trend of the Research on Construction and Demolition Waste Management. *Waste Management*. 31. pp. 670–679.

⁶ The PRC builds the equivalent in square meters of living space of a city like Rome in about 2 weeks.

⁷ European Union Small and Medium Enterprises Centre. 2013. *The Construction Sector in China*. Beijing.

Greenhouse gas savings for using recycled concrete in place of virgin aggregate (crushed stone, gravel, and sand) is estimated at 0.01–0.03 metric tons of carbon dioxide equivalent per ton. Figures are similar for asphalt, and significantly higher for metals such as aluminum.

4. National and municipal governments around the world are enacting legislation that encourages recycling of CDW. In Europe, the Waste Framework Directive has been revised by the European Union to include a requirement that 70% of each member state's CDW be reused or recycled by 2020. Countries such as Denmark, Germany, Ireland, the Netherlands, and the United Kingdom have already surpassed the 70% benchmark. Asian economies that have achieved very high CDW recycling rates include Hong Kong, China; Japan; Singapore; and Taipei, China.

5. Experience from these economies suggests that while much of CDW is recycled for purely economic reasons, avoidance of landfill disposal of materials such as concrete, wood, gypsum drywall, and asphalt shingles has benefits well beyond financial ones.⁸ Avoidance of landfilling also provides for a greater degree of environmental protection, a smarter use of natural resources, energy savings, and a net decrease in greenhouse gas emissions.

6. For a stable and competitive CDW recycling market to be established, experience shows that various instruments must be established, including (i) technical regulations (i.e., guaranteeing steady supply of CDW of high quality through establishment of standards and norms for deconstruction works and CDW products); (ii) waste treatment regulations controlling or banning CDW landfilling, creation of mono landfill for CDW as reservoirs for future recovery of inert materials, and enforcement of regulations related to illegal dumping; and (iii) market-based instruments enabling the creation of a robust CDW recycling market that can withstand various risks in the waste market (such as a tax on landfills or raw construction materials, a subsidy for recycling center establishment and operation, or tax incentives for the utilization of recycled materials). Advanced concepts that promote the polluter pays principle have been successfully introduced in the construction industry of some of these economies, including extended producer responsibility or stewardship programs, which encourage construction material manufacturers to redesign products and systems to reduce wastage, facilitate recovery and recyclability after usage, and ensure compatibility with post-recovery applications.

7. The government has demonstrated continuous commitment to tackling the problem of CDW management and promoting a circular economy and resource efficiency. In 2006, MOHURD issued the Regulations on Management of Urban Construction Waste to standardize the methods for handling construction wastes. Technical regulations for CDW management and recycling followed, mainly through the Ministry of Science and Technology, including standards and norms for recycled materials and treatment regulations (i.e., landfill ban for unsorted CDW). CDW recycling targets are also (implicitly) defined in the Twelfth Five-Year Plan for the Building Material Industry, which established strict goals for emission reduction, requiring construction and building materials producers to cut their annual energy consumption and carbon dioxide emissions per unit of industrial value added⁹ by 18%–20% during the 5-year period.¹⁰

⁸ The United States CDW recycling industry, for example, was responsible for the direct support of 19,000 jobs in the United States in 2012. Facility owners have invested over \$4.5 billion in the development and construction of CDW recycling infrastructure. The direct annual output (revenue) of the CDW recycling industry was estimated to be about \$7.4 billion, and when considering indirect and induced economic output, the industry represented a contribution of over \$17 billion.

⁹ Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources.

8. Despite its great potential and the government's effort to promote it, CDW recycling rates do not exceed 5%–10%. Actual demand for recycled materials is relatively low in the absence of incentives to buy recycled materials (as compared to natural aggregates), and concerns over the quality assurance of recycled materials. CDW recycling centers have been established in several cities in the PRC, but these often struggle to make a profit. The low quality of raw CDW (resulting from the absence of clear technical regulations on CDW segregation at source), low costs of natural aggregates, low CDW disposal fees (often fully subsidized) at municipal solid waste and CDW landfills, and illegal CDW disposal are understood to be key limitations to the promotion of CDW recycling in the PRC.

9. The TA is a timely response to the government's request for ADB assistance to identify suitable policies and mechanisms to regulate CDW management and promote CDW recycling in the PRC. The TA is closely aligned with ADB's strategic priorities of the Midterm Review of Strategy 2020¹¹ and the strategic pillar of environmentally sustainable growth in the country partnership strategy, 2011–2015 for the PRC.¹² By supporting the PRC's efforts to promote resource conservation, emission reduction, and environmental protection, this TA is fully aligned with ADB's Environment Operational Directions, 2013–2020,¹³ and the Urban Operational Plan, 2012–2020.¹⁴ The TA is also consistent with the priorities of the government's Twelfth Five-Year Plan, 2011–2015; the PRC's emphasis on the realization of ecological civilization and commitment to curb costs associated with resource depletion and environmental damage (as announced at the Third Plenum);¹⁵ and the recently proclaimed concept of "greenization" of production, economy, and lifestyle.¹⁶

III. THE POLICY AND ADVISORY TECHNICAL ASSISTANCE

A. Impact and Outcome

10. The impact will be improved CDW management policies and practices in the PRC. The outcome of the TA will be an agreed set of policy recommendations to regulate CDW management and promote CDW recycling.

B. Methodology and Key Activities

11. The TA will have four major outputs to contribute toward the achievement of the outcome and impact: (i) an assessment report on CDW management in the PRC, (ii) a review of international good practice in CDW management and recycling, (iii) policy lessons and recommendations, and (iv) a TA synthesis report.

12. Output 1 will investigate, through literature review, questionnaire surveys, and case studies of CDW recycling success stories in PRC cities, the policies and current practices of CDW management at construction and/or demolition sites, the perceptions in relation to

¹⁰ Ministry of Industry and Information Technology. 2011. *Twelfth Five-Year Plan for the Building Material Industry, 2011–2015*. Beijing.

¹¹ ADB. 2014. *Midterm Review of Strategy 2020: Meeting the Challenges of a Transforming Asia and Pacific*. Manila.

¹² ADB. 2012. *Country Partnership Strategy: People's Republic of China, 2011–2015*. Manila.

¹³ ADB. 2013. *Environment Operational Directions, 2013–2020: Promoting Transitions to Green Growth in Asia and the Pacific*. Manila.

¹⁴ ADB. 2013. *Urban Operational Plan, 2012–2020*. Manila.

¹⁵ The Third Plenum held on 9–12 November 2013 announced the Decisions on Major Issues Concerning Comprehensively Deepening Reforms, including the need to promote resources conservation, ecological environment protection, and modernization featuring harmonious development between humans and nature.

¹⁶ Public announcement of the Political Bureau of the Communist Party of China Central Committee, March 2015.

recycled and conventional construction materials, and the barriers to increased application of recycled materials. The assessment will include an economic analysis to identify the probability of a CDW market failure in the PRC.

13. Output 2 will identify international good practices in CDW recycling policies and technologies. This will include in-depth case studies to be conducted in selected advanced economies with high CDW recycling rates, as well as a study tour to one of these countries. The international good practice report will document hindering and enabling factors for sustainable CDW management and recycling.

14. Output 3 will draft policy recommendations to regulate CDW management and promote CDW recycling. It will consist of (i) policy recommendations to regulate CDW supply, including technical guidelines for CDW segregation and processing, and capacity-building needs to improve CDW management at construction or demolition sites; and (ii) a set of policy instruments to promote demand for, and increase uptake of, recycled CDW in the construction industry. The policy recommendations will be identified and formulated in consultation with relevant ministries and professional associations. A cost-benefit analysis will quantify how much the implementation of these recommendations could benefit the PRC. The policy recommendations will be published in a synthesis report (output 4).

C. Cost and Financing

15. The TA is estimated to cost \$485,000, of which \$400,000 will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-other sources). The government will provide counterpart support in the form of remuneration and per diem for counterpart staff (including time and travel expenses), logistical support in the arrangement of workshops and conferences, a fully functional office space for consultants with secretarial assistance, and other in-kind contributions (Appendix 2).

D. Implementation Arrangements

16. The TA will be implemented over 15 months, from 25 June 2015 to 30 September 2016. MOHURD will be the executing agency for the TA. MOHURD will be responsible for coordination and providing information and other conditions necessary for the consultants to complete their tasks successfully. The director of MOHURD's Urban Environmental Management Division will serve as the executive director of the TA management office responsible for coordinating day-to-day operational matters among ADB, consultants, and related government agencies.

17. The TA will require consulting services with substantial expertise in waste management policy design and evaluation, CDW management and recycling, and construction materials engineering, for a total of 22 person-months (5 international and 17 national). The consultants will be engaged through a firm according to ADB's Guidelines on the Use of Consultants (2013, as amended from time to time) using quality- and cost-based selection criteria (with a quality-cost weighing rate of 90:10) and simplified technical proposal procedures.¹⁷ The draft outline terms of reference for consultants are in Appendix 3. The TA will cover remuneration, travel, and per diem of consultants, as well as the costs of workshops, seminars, equipment, surveys, and miscellaneous expenses. The proceeds of the TA will be disbursed in accordance with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). TA

¹⁷ The consulting services under the TA will be engaged on output-based (lump-sum) contracts.

disbursement will be handled by ADB. Equipment will be procured by consultants in line with ADB's Procurement Guidelines (2015, as amended from time to time) and turned over to MOHURD upon TA completion.

18. Initial TA findings will be disseminated at workshops and/or seminars, which will be attended by ADB representatives, MOHURD officials, and sector specialists to ensure the inclusion of diverse views. Other relevant authorities, professional associations, and national research institutions will be consulted on the initial TA findings and invited to key workshops. Major findings and lessons from the TA will be published in output-related reports (outputs 1 to 3) and a TA synthesis report that will become a knowledge product of this TA (output 4). Technical milestones will be monitored by reports to be prepared by the consultants, and reviewed by the executing agency and the ADB project officer.

IV. THE PRESIDENT'S DECISION

19. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$400,000 on a grant basis to the Government of the People's Republic of China for Construction and Demolition Waste Management and Recycling, and hereby reports this action to the Board.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
<p>Impact Improved CDW management policies and practices in the PRC</p>	<p>CDW recycling rate increased from less than 5% (2010) to 30% (2020)</p> <p>CDW management goals and recycling targets are specified in relevant national sector plan by 2017</p>	<p>Annual reports and statistics of MOHURD and the National Development and Reform Commission</p> <p>Relevant national sector plan</p>	<p>Assumption Continued central and local government support for CDW recycling policies and incentives to create demand</p>
<p>Outcome Agreed set of policy recommendations to regulate CDW management and promote CDW recycling</p>	<p>Policy recommendations and technical guideline to regulate CDW supply are endorsed by MOHURD by September 2016</p> <p>Set of policy instruments to promote demand for recycled CDW endorsed by MOHURD by September 2016</p>	<p>TA completion report</p>	<p>Assumption International good practice can be applied to the PRC after modifications.</p> <p>Risk Cross-ministerial and cross-sector coordination may affect consensus on proposed policies.</p>
<p>Outputs</p> <ol style="list-style-type: none"> 1. Assessment report on CDW management in the PRC 2. A review of international good practice in CDW management and recycling 3. Policy lessons and recommendations for the regulation of CDW management and the promotion of CDW recycling 4. TA synthesis report 	<p>Review report published in Chinese and English and available online by July 2016</p> <p>Review report drafted by month 6, published in Chinese and English and made available online by July 2016</p> <p>Draft policy recommendations and draft technical guideline completed and shared with MOHURD by September 2016</p> <p>TA synthesis report finalized by September 2016</p>	<p>Consultant's reports, TA review missions</p> <p>Technical reports, final report</p> <p>ADB project website</p>	<p>Assumptions Senior authorities in MOHURD prioritize implementing the TA.</p> <p>Relevant agencies and professional associations participate in the TA.</p> <p>Risks The provision of necessary data is inadequate or ill-timed.</p> <p>The performance of the consultant is inadequate.</p>

Activities with Milestones	Inputs
<p>General</p> <ul style="list-style-type: none"> (i) Mobilize team of experts, develop study framework, prepare inception report with detailed approach and implementation arrangements for the TA, and organize inception workshop by 30 November 2015 (ii) Organize midterm review mission and/or meeting, and prepare report by 30 June 2016 (iii) Prepare and submit the draft final report by 31 August 2016 (iv) Organize final review mission by 30 September 2016 <p>1. Review PRC policies and practices related to CDW management</p> <ul style="list-style-type: none"> 1.1 Assessment methodology (literature review, questionnaire surveys with practitioners, expert consultations) and case study cities agreed with MOHURD by 30 November 2015 1.2 A background review report on PRC policies, practices, and technologies related to CDW management and recycling is drafted by 31 March 2016, and published in Chinese and English and made available online by 31 July 2016 <p>2. Assess international good practice in CDW management and recycling</p> <ul style="list-style-type: none"> 2.1 Review report on international good practice relevant to the PRC for regulating CDW management and promoting CDW waste recycling is drafted by 30 November 2015 2.2 Case study countries for in-depth case studies of CDW management systems in selected advanced economies with high CDW recycling rates selected by 30 November 2015 2.3 An international study tour to one of the case study countries conducted by 31 January 2016 2.4 Draft case study reports and synthesis report of international good practice and enabling instruments for sustainable CDW recycling drafted by 31 March 2016 and discussed at interim workshop by 30 April 2016 <p>3. Draft policy recommendations for the regulation of CDW management and the promotion of CDW recycling</p> <ul style="list-style-type: none"> 3.1 Draft sub-report on policy recommendations and capacity building needs to regulate CDW supply completed by 30 June 2016 3.2 Draft sub-report (technical guideline) on best available technologies for CDW recycling completed by 30 June 2016 3.3 Draft sub-report on policy instruments to promote demand for recycled CDW (including cost–benefit analysis) completed by 30 June 2016 <p>4. Develop and implement strategy for TA findings dissemination</p> <ul style="list-style-type: none"> 4.1 Knowledge dissemination strategy defined and agreed by 30 April 2016 (interim mission) 4.2 Draft policy recommendations (output 3) presented and agreed at TA final workshop by 30 September 2016 4.3 TA synthesis report finalized by 30 September 2016, available online by 30 November 2016 	<p>ADB: \$400,000</p> <p>Note: The government will provide counterpart support in the form of counterpart staff, office accommodation, office supplies, secretarial assistance, and other in-kind contributions.</p>

ADB = Asian Development Bank, CDW = construction and demolition waste, MOHURD = Ministry of Housing and Urban–Rural Development, PRC = People’s Republic of China, TA = technical assistance.
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	97.5
ii. National consultants	107.5
b. International and local travel	35.0
2. Equipment ^b	8.0
3. Training, seminars, and conferences ^c	83.0
4. Surveys ^d	15.0
5. Miscellaneous administration and support costs ^e	40.0
6. Contingencies	14.0
Total	400.0

Note: The technical assistance (TA) is estimated to cost \$485,000, of which contributions from the Asian Development Bank are presented in the table above. The government will provide counterpart support in the form of remuneration and per diem for counterpart staff (including time and travel expenses), logistical support in the arrangement of workshops and conferences, a fully functional office space for consultants with free access to the internet and a photocopy machine, secretarial assistance, and other in-kind contributions. The value of government contribution is estimated to account for 18% of the total TA cost.

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

^b Equipment to be procured may include two computers and one printer. Upon completion of the TA, the equipment will be turned over to the executing agency.

^c From the total amount, \$35,000 will be allocated for training, workshops, and conferences (included as a provisional sum in the contract of the consulting firm) and \$48,000 will be allocated for the study tour(s) in ADB member countries only.

^d This item may include case studies and data acquisition.

^e This includes the translation costs associated with each deliverable of the TA, as well as report editing, printing, and dissemination.

Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. The policy and advisory technical assistance (TA) includes four key outputs: (i) an assessment report on construction and demolition waste (CDW) management in the People's Republic of China (PRC), (ii) a review of international good practice in CDW management and recycling (published in Chinese and English), (iii) a set of policy recommendations for the regulation of CDW management and the promotion of CDW recycling in the PRC (including cost–benefit analysis), and (iv) a synthesis report. The TA will be implemented over 15 months from 25 June 2015 to 30 September 2016, with a draft final report to be submitted within 10 months after mobilization of the consultants (31 August 2016).

2. The consultants will be engaged by the Asian Development Bank (ADB) through a firm according to ADB's Guidelines on the Use of Consultants (2013, as amended from time to time) using quality- and cost-based selection criteria (with a quality–cost weighing rate of 90:10) following the simplified technical proposal. It is estimated that the TA will require one international consultant (5 person-months) and four national consultants (for a total of 17 person-months). The international consultant will be a CDW policy specialist and will act as team leader. The national consultants will comprise a waste policy specialist and deputy team leader (7 person-months), a construction materials specialist (4 person-months), a CDW recycling technology specialist (3 person-months), and an environmental economist (3 person-months). The consultants will be responsible for producing the TA outputs and deliverables effectively and on time, and for organizing and carrying out all the tasks indicated. All reports are to be of high quality and produced in English and Chinese. A detailed work time line and deliverables with dates will be defined at inception, documented in the final inception report, and agreed between the Ministry of Housing and Urban–Rural Development (MOHURD) and ADB.

A. International Consultants

3. **Construction and demolition waste policy expert and team leader** (international, 5 person-months). The expert should have a postgraduate degree or equivalent in environmental policy, environmental management, public policy and policy administration, or environmental economics. The specialist should also have over 10 years of international professional experience in waste and/or environmental management policy design and evaluation. The expert should demonstrate good knowledge and strong research experience in cleaner production and resource efficiency in the construction sector, waste management, and policy formulation, including cost–benefit analysis of policy implementation. The specialist will have a proven record of managing research projects and TA concerned with the promotion of CDW recycling, and of producing high-quality publications that are internationally recognized. Demonstrated project-related policy research experience in the PRC is required. As team leader, the specialist will be responsible for coordinating and supervising project activities and outputs. The expert will undertake the following tasks:

- (i) Prepare a detailed study framework work plan for the TA in consultation with MOHURD, key stakeholders, and other experts.
- (ii) Provide guidance and ensure that the team's work progresses according to schedule and that TA inception, interim, draft final, and final reports and other outputs are submitted on time and are of a quality acceptable to MOHURD and ADB.

- (iii) Review and summarize findings and lessons from previous related ADB TA projects on waste management in the PRC.¹
- (iv) Provide detailed guidance and supervision to the national waste management specialist in designing and conducting a thorough assessment of current CDW policies and practices in the PRC, including methodology to estimate greenhouse gas emissions from current CDW management practices (TA output 1).
- (v) Research international good practice in terms of CDW management policies and systems that are of relevance to the PRC.² Identify lessons from case study countries, document economic benefits, and extract success factors of effective CDW management policy and practices. Prepare a report on international good practice in CDW management and recycling (TA output 2).³
- (vi) Based on TA outputs 1 and 2, identify key barriers to improved CDW management in the PRC, recommend policy instruments for the PRC to regulate CDW supply, and promote demand for recycled CDW. Support the national economist in conducting cost–benefit analysis of introducing these policy instruments. Consult relevant authorities and professional associations on the draft policy recommendations (output 3).
- (vii) Facilitate all workshops, conferences, and symposiums and present key findings, i.e., draft TA outputs 1, 2, and 3.
- (viii) Support MOHURD in defining and implementing a knowledge dissemination strategy.
- (ix) Based on TA outputs 1, 2, and 3, prepare a comprehensive synthesis paper as policy note for regulating CDW supply and promoting CDW recycling in the PRC, for discussion at the final TA workshop, and for publication as an ADB knowledge product (TA output 4).

B. National Consultants

4. **Waste policy specialist and deputy team leader** (national, 7 person-months, intermittent). The expert should have a postgraduate degree or equivalent in environmental policy, environmental management, public policy and policy administration, or environmental economics. The expert should have at least 10 years of professional experience in waste policy research. The expert should demonstrate good knowledge and research experience in CDW management and recycling in the PRC. Experience in advanced waste management concepts and instruments would be an advantage (footnote 1). The specialist will assist the team leader in the coordination and supervision of the TA, and will be responsible for day-to-day liaison with MOHURD and other government agencies to facilitate TA implementation. The expert will be able to communicate in English. The expert will undertake the following tasks:

- (i) Assist the team leader in developing the detailed study framework in consultation with MOHURD, key stakeholders, and other experts.
- (ii) Act as main liaison officer with MOHURD and other government agencies; organize workshops, seminars, and study tour(s).

¹ ADB. 2012. *Technical Assistance to the People's Republic of China for Management of Uncontrolled Landfills*. Manila; ADB. 2007. *Technical Assistance to the People's Republic of China for Urban Wastewater and Solid Waste Management for Small Cities and Towns*. Manila; ADB. 2000. *Technical Assistance to the People's Republic of China for Strengthening Urban Solid Waste Management*. Manila.

² Including, but not limited to, extended producer responsibility, stewardship programs, green procurement policies, disposal bans and/or surcharges, recycled content standards and/or regulations, and instruments linked to greenhouse gas emission reduction.

³ Countries that have advanced CDW management policies and practices include Canada; Denmark; Germany; Japan; the Republic of Korea; the Netherlands; Sweden; Taipei, China; the United States; and the United Kingdom.

- (iii) Assist the team leader in conducting inception, interim, and final workshops, and in compiling and finalizing the TA inception, interim, draft final, and final reports and other outputs.
- (iv) Lead the preparation of TA output 1, i.e., conduct a thorough assessment of CDW management policies and practices in the PRC, including (but not limited to)⁴ (a) sources, quantities, and flows of CDW in the PRC; (b) the legal, policy, and institutional framework; (c) current practices of CDW management at construction and/or demolition sites, including identification of factors affecting CDW reduction; (d) conduct at least two case studies in cities in the PRC with advanced CDW management policies and regulations; and (e) preparing a synthesis report on CDW management in the PRC for publication in both Chinese and English.
- (v) Through key stakeholder consultation,⁵ and with the national economist, assess the economic benefits of, and institutional barriers to, advanced CDW management concepts and policy instruments (footnote 2) to regulate the PRC CDW management and recycling sector.
- (vi) Collaborate with the team leader to assess the findings of the review of international experiences and good practices for feasibility and appropriateness in the PRC, and help formulate policy recommendations for the PRC (TA output 3).
- (vii) Take the lead in organizing TA review missions, seminars, workshops, and the international study tour.
- (viii) Coordinate organization of the final TA workshop (TA output 4), and provide support to the team leader in developing and publishing a comprehensive policy note for regulating CDW management and promoting CDW reuse in the PRC (TA output 4).
- (ix) Conduct other related work assigned by the team leader.

5. **Construction materials specialist** (national, 4 person-months, intermittent). The expert should have a postgraduate degree or equivalent in civil engineering or construction materials engineering. The expert should have at least 10 years of professional experience in the PRC construction sector and be knowledgeable in PRC building materials codes and standards. Familiarity with circular economy principles and their implementation, as well as experience in the promotion of recycled materials in the construction industry, are preferable. Advanced oral and written English skills are required. The expert will undertake the following tasks:

- (i) Review PRC building material codes and standards; compare with international good practice; conduct key stakeholder consultations (including, but not limited to, MOHURD and the National Development and Reform Commission); and identify technical, legal, and financial factors that potentially limit the uptake of recycled CDW in new construction projects.
- (ii) Conduct case studies in at least two cities in the PRC with high CDW recycling rates.
- (iii) Prepare a synthesis report as input to TA output 1, and help the team leader in formulating policy recommendations for the PRC (TA output 3) and TA synthesis report (TA output 4).

⁴ The assessment methodology will be proposed to, and discussed and agreed with, MOHURD and ADB during the inception mission. It is likely to include a literature review; questionnaire surveys and interviews with practitioners, academia, and professional associations; and case studies in cities in the PRC.

⁵ Including, but not limited to, MOHURD and the National Development and Reform Commission.

- (iv) Participate in and present relevant findings during TA review missions, workshops, and seminars.
- (v) Conduct other related work assigned by the team leader.

6. **Construction and demolition waste recycling technology specialist** (national, 3 person-months, intermittent). The expert should have a postgraduate degree or equivalent in civil engineering, environmental engineering, or waste management. The expert should have at least 10 years of professional experience in the PRC CDW recycling sector, and be familiar with CDW processing and recycling technologies. Oral and written English proficiency is required. The expert will undertake the following tasks:

- (i) Review technologies for CDW processing and recycling applied in the PRC and abroad; and identify the best available technology, successful practices, and experiences applicable in the PRC.
- (ii) Conduct case studies in at least two cities in the PRC, which apply best available technology for CDW recycling.
- (iii) Prepare a synthesis report on the best available technology for CDW recycling as input to TA output 1.
- (iv) Draft CDW recycling technology recommendations (technical guide, as part of output 3).
- (v) Help the team leader in formulating the TA synthesis report (TA output 4).
- (vi) Participate in and present relevant findings during TA review missions, workshops, and seminars.
- (vii) Conduct other related work assigned by the team leader.

7. **Environmental economist** (national, 3 person-months). The specialist should have a postgraduate degree related to environmental economics and over 5 years of work experience in the field. The expert should demonstrate experience in performing cost-benefit analysis and economic valuation of policies and regulations, preferably in waste management and recycling. Written English proficiency is required. The expert will undertake the following tasks:

- (i) Conduct a rapid economic assessment of common CDW management practices in the PRC.
- (ii) Identify key financial and institutional barriers that hinder the establishment of a CDW recycling market (as input to output 1).
- (iii) Review and assess the cost-effectiveness of policy tools applied to the PRC case study cities (as input to output 1).
- (iv) Evaluate and quantify the benefits and costs of CDW recycling policy tools recommended under output 3, using economic principles and statistical techniques.
- (v) Assist the team leader in formulating the TA synthesis report (TA output 4).
- (vi) Participate in and present relevant findings during TA review missions, workshops, and seminars.
- (vii) Conduct other related work assigned by the team leader.