



Technical Assistance Report

Project Number: 42013
May 2008

People's Republic of China: Urban Wastewater
Reuse and Sludge Utilization Policy Study
(Cofinanced by the Multi-Donor Trust Fund
for the Water Financing Partnership Facility)

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 12 May 2008)

Currency Unit	–	yuan (CNY)
CNY1.00	=	\$0.143
\$1.00	=	CNY6.988

ABBREVIATIONS

ADB	–	Asian Development Bank
DFR	–	draft final report
EA	–	executing agency
FYP	–	five-year plan
m ³	–	cubic meter
MOC	–	Ministry of Construction
O&M	–	operation and maintenance
PRC	–	People's Republic of China
TA	–	technical assistance
UWM	–	urban wastewater management
WWTP	–	wastewater treatment plant

TECHNICAL ASSISTANCE CLASSIFICATION

Targeting Classification	–	General intervention
Sector	–	Water supply, sanitation, and waste management,
Subsectors	–	Water supply and sanitation, waste management
Themes	–	Sustainable economic growth, environmental sustainability, capacity development
Subthemes	–	Fostering physical infrastructure development, urban environmental improvement, institutional development

NOTE

In this report, "\$" refers to US dollars.

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I. INTRODUCTION

1. During the Country Programming Mission in December 2007, the Government of the People's Republic of China (PRC) requested the Asian Development Bank (ADB) to provide advisory technical assistance (TA) for an Urban Wastewater Reuse and Sludge Utilization Policy Study. The TA has been included in the ADB nonlending program for the PRC for 2008.¹ The Fact-Finding Mission visited Beijing from 25 February to 12 March 2008. This report is based on the understanding reached with the Government during the mission regarding the impact and outcome, methodology and key activities, cost estimates, financing plan, and implementation arrangements for the TA, as well as the mission's observations. The TA design and monitoring framework is in Appendix 1.

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. The urban population grew from 160.0 million in 1975 to about 577.1 million in 2006.² The urbanization rate increased from 17.0% to 43.9% in the same period and is expected to reach 55.0% (or an urban population of about 700 million) by 2030. This rapid urbanization was fueled largely by the transformation of suburban areas from farming to non-farming activities and by the massive migration of surplus rural labor to urban areas. The number of cities in the PRC increased from 192 in 1978 to 656 in 2006, and there are now also 19,522 towns. Sustainable urbanization is a key policy priority in the Government's 11th Five-Year Plan (11FYP) (2006–2010).

3. Water resources vary considerably from north to south across the PRC. In 2005, annual water resources available for the northern region of Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia totaled 70.87 billion cubic meters (m³) versus a staggering 693.9 billion m³ for the southern region of Henan, Hubei, Hunan, Guangdong, Guangxi, and Hainan.³ Per capita water resources were 524 m³ per year in the north and 2,370 m³ in the south, and the water quantities supplied were 329 m³ and 480 m³, respectively. The small surplus of resource over supply in the northern provinces will soon vanish. The wastewater from the urban areas poses a major environmental threat to the country's rivers, lakes, and aquifers. Of the 36.3 billion m³ of urban wastewater produced in the PRC in 2006, only about 55.67% was treated; the rest was discharged untreated into rivers and lakes, causing widespread pollution. Wastewater discharged into key river basins, however, must meet class 1A standards—it can be reused without further treatment.

4. Until the urban centers mushroomed there was enough water for modest needs and, hence, people saw no need to recycle. Investments went elsewhere and little thought was given to wastewater reuse. With tariffs for public water supplies pushed down to a minimum by social pressures, there was hardly any incentive to treat sewage effluents to a standard acceptable for reuse. As it is, many cities have problems collecting even the standard wastewater treatment charge. Possible health risks in the public's view have also militated against wastewater use. In 2006, the PRC used 961 million m³ of recycled wastewater. The 11FYP target for northern PRC alone by 2010 is 1,825 million m³ (5 million m³ per day). This water will be used in irrigation, public amenities, street cleaning, toilet flushing, and non-potable domestic and industrial uses.

¹ The TA first appeared in the business opportunities section of ADB's website on 12 May 2008.

² The urban population in the PRC is made up of people who are officially registered residents of cities and towns.

³ PRC National Bureau of Statistics. 2006. *China Statistical Yearbook 2006*. Available: <http://www.stats.gov.cn/tjsj/ndsj/2006/indexeh.htm>

5. Wastewater treatment plants (WWTPs) in the PRC produced about 5.5 million tons of dry sludge in 2006.⁴ A significant proportion was used in agriculture and the rest was dumped in landfills or disposed of by other means.⁵ In the past, the disposal of wastewater sludge was not seen to create unacceptable environmental problems, largely because the quantities were relatively small and some disposal options were not vigorously regulated. Dumping in sacrificial, non-engineered, landfills was accepted, provided it was monitored to some extent and the results were recorded. Sludge treatment options are now being tested by the Government. Meanwhile, dumping continues to be the least-cost option, diminishing attempts to secure the safe, beneficial use of sludge on agricultural land or to recover energy. Recent requirements for environmental protection and advances in landfill technology have, however, hiked dumping cost, prompting a more active search for alternative disposal options.

6. To arrest pollution and improve the quality of the environment, the Government has set the long-term goal of building a resource-efficient and environment-friendly society, specifically by reducing major pollutants per unit of gross domestic product by 10% during the 11FYP period. Cities will be required to treat at least 70% of their wastewater by the end of the period. The 508 new WWTPs developed by the Government in 1998–2005 have boosted capacity by 53.44 million m³ per day. But a recent government audit of these WWTPs indicated that they lack funds for operation and maintenance (O&M) because of the low tariffs. An additional CNY332 billion (\$46.76 billion) in government funding has been set aside in the 11FYP for urban wastewater management (UWM), including expanded wastewater collection and treatment, sludge treatment, and wastewater reuse. The Government has shown strong commitment to market-based reforms for UWM, aware of the need for tariff reforms to raise funds for the construction and O&M of tertiary treatment plants for the reuse of wastewater. The State Council decision issued in December 2005 adopting a scientific approach to development and strengthening environmental protection requires the implementation of tariffs for UWM based on full cost recovery plus a small margin of profit. It also allows local governments to subsidize O&M of waste management facilities when revenues are not enough to cover the full costs. The Ministry of Construction (MOC) is responsible for developing national policies and guidelines for wastewater management, including sewage sludge treatment and disposal. MOC also oversees development plans and investments in wastewater management, while city municipality departments plan, implement, and operate the wastewater projects and facilities.

7. The proposed TA will focus on the development of the following: (i) planning procedures and regulations, sustainable pricing structures, technology applications, and institutional capacity for promoting wastewater reuse; and (ii) a national policy for the application of technologies for the safe disposal of sludge, emphasizing the opportunity to reclaim energy in one form or another. These policies will embody the concept of carbon credits in pricing structures and will seek to minimize the carbon footprint. The structures, policies, and guidelines thus developed will be pilot-tested for effectiveness in three selected cities and refinements from the practical experiences gained in the cities will be reflected in the concluding report.⁶ The pilot cities chosen will have treatment facilities with which the TA team can work to reuse wastewater or reclaim energy from sludge, or both. International expert opinion will be obtained in the development of national policies, and international case studies will be prepared to illustrate the marketing, sale, and reuse of wastewater, and the treatment and use of organic carbon compounds in sewage sludge to generate energy, and of nutrient components to improve soil conditions.

⁴ Equivalent to about 27.6 million tons of wet sludge at 80% moisture content.

⁵ Co-disposal with municipal solid waste, incineration, spreading for municipal greening.

⁶ The case study cities will be selected by MOC before the TA is implemented. In the selection of the cities, areas where future ADB projects will be implemented will be considered. The choices will be discussed and the final selection will be made during the TA contract negotiations.

8. The urban sector is an ADB investment priority in the PRC. ADB has built a strategic partnership with MOC over the last 10 years. The partnership is built on a series of highly relevant and successful TA projects, which yielded national policy frameworks and guidelines for the key urban issues facing large and medium cities in the PRC. Among these were two TA projects that supported water tariff reforms, TA aimed at strengthening urban solid waste management, and TA for the development of urban wastewater tariffs.⁷ The recommendations from these TA projects have been applied in later ADB-financed loan projects in the urban sector. Two TA projects—Urban Wastewater and Solid Waste Management for Small Cities and Towns, and Policy Study on Market-Based Instruments for Water Pollution Control—are providing ongoing support to the Government.⁸

9. The proposed TA is consistent with the 11FYP and is aimed at assisting the Government in developing policies, strategies, and action plans to promote and effectively implement urban wastewater reuse and sludge management. It is aligned with ADB's country partnership strategy for the PRC, which is concerned with managing the environment, catalyzing investment, and improving governance, among others.⁹ It conforms to ADB's Water Policy and the recently adopted Water Financing Program, both of which seek to improve urban water investments through technical assistance and investments in water supply, sanitation and wastewater management, and environmental improvement. The TA will have a positive impact on the living environment of urban residents, including the poor, through water and resource conservation and waste and energy recycling. It also supports ADB's clean energy policy, its Renewable Energy, Energy Efficiency, and Climate Change (REACH) Program and the Carbon Market Initiative.¹⁰ Introducing tertiary wastewater treatment, especially when based on engineered wetland principles, and reclaiming the energy potential in sewage sludge are positive steps toward clean energy and climate change mitigation. Moreover, the TA will support implementation of the law recently passed by the Government to increase the production of energy from sustainable sources, and its recommendations could also lead to the preparation of investment projects where ADB could provide further financing assistance.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

10. The TA will strengthen the wastewater reuse and sewage sludge utilization management system in the PRC and make it more effective and efficient. Its outcome will be the adoption of a set of policies and tariff guidelines to promote the reuse of wastewater, and technical and market-based approaches to encourage sustainable sludge disposal, including energy recovery, by municipalities in the PRC.

B. Methodology and Key Activities

11. The TA will be implemented in three phases. Phase 1 (3 months), will involve (i) reviewing planning strategies and procedures, pricing policies, quality standards, and monitoring and

⁷ ADB. 1997. *Technical Assistance to the People's Republic of China for the Water Supply Tariff Study*. Manila; ADB. 1999. *Technical Assistance to the People's Republic of China for the Water Tariff Study II*. Manila; ADB. 2000. *Technical Assistance to the People's Republic of China for Strengthening Urban Solid Waste Management*. Manila; and ADB. 2001. *Technical Assistance to the People's Republic of China for Preparing the National Guidelines for Urban Wastewater Tariffs and Management Study*. Manila.

⁸ ADB. 2007. *Technical Assistance to the People's Republic of China for Urban Wastewater and Solid Waste Management for Small Cities and Towns*. Manila; and ADB. 2007. *Technical Assistance to the People's Republic of China for Policy Study on Market-Based Instruments for Water Pollution Control*. Manila.

⁹ ADB. 2008. *People's Republic of China: Country Partnership Strategy 2008–2010*. Manila.

¹⁰ ADB. 2006. *Renewable Energy, Energy Efficiency, and Climate Change Program*. Manila.

regulation of treated wastewater for reuse in the PRC; (ii) summarizing international best practice for the reuse of wastewater, including the planning and tariff structure; (iii) reviewing and summarizing the standards and methods used within the PRC for treating, using, and disposing of sewage sludge, and the related energy recovery and costs; (iv) summarizing international best practice for sludge disposal options and for reclaiming energy from sewage sludge, including parameters for options; and (v) preparing an inception report.

12. In phase 2 (5 months), the TA team will concern itself with (i) formulating a structure for defining urban planning policies and implementation guidelines relating to wastewater reuse; (ii) formulating a policy framework for a tariff structure covering the range of options for urban wastewater reuse including the potential to promote investments through public-private partnerships; (iii) formulating a regulatory framework for monitoring the reuse of wastewater and implementing the tariff guidelines; (iv) identifying capacity-building needs and preparing an institutional strengthening and training program; (v) developing a policy, guidelines, and recommended courses of action for applying appropriate technologies to deal with the treatment and disposal of sewage sludge, including energy recovery (biogas, co-incineration) and soil improvement options (fertilizer); (vi) developing application modality and associated legal changes necessary to facilitate the use of energy from sludge treatment and end uses; (vii) organizing and managing an international study tour of best practice in the foregoing topics; (viii) designing three pilot applications to test the recommended guidelines for appropriate wastewater reuse and sludge treatment, including energy recovery (where applicable), and preparing cost estimates and a detailed implementation plan; (ix) developing technical, thematic, and safeguard assessment guidelines for evaluating pilot trials during implementation; (x) preparing an interim report; and (xi) organizing a workshop in each pilot city.

13. In phase 3 (10 months), MOC will be assisted in (i) implementing the pilot projects, including awareness campaigns, and revising the guidelines on the basis of the results of the pilot trials; (ii) preparing a comprehensive best-practices policy note on planning, tariff strategies, and regulations for wastewater reuse and guidelines for sludge disposal, emphasizing energy recovery and land improvement options; (iii) recommending appropriate measures to strengthen operational management; (iv) drafting and finalizing the final report; (v) disseminating the findings of the report to all levels of government and stakeholders; and (vi) organizing an international symposium to share findings and experiences.

14. Major risks to the successful implementation of the TA are (i) inadequate counterpart support and performance, (ii) inadequate or ill-timed provision of necessary data, (iii) delayed submission of required studies, (iv) delayed appointment and mobilization of consultants, and (v) inadequate performance by the consultants. To mitigate the risks, the recruitment and performance of the consultants will be monitored closely. The Government has agreed to provide adequate counterpart support and all necessary data according to an agreed-upon timetable. Close coordination among the consultants, the executing and implementing agencies, and ADB will further moderate the risks.

C. Cost and Financing

15. The TA is estimated to cost \$1,200,000 equivalent. The proposal is for ADB to finance \$1,000,000 with grants from its TA funding program (\$700,000) and from the Multi-Donor Trust Fund for the Water Financing Partnership Facility to be administered by ADB (\$300,000).¹¹ MOC will provide the remaining \$200,000 in local costs covering part of the technical staff costs and also in-kind counterpart costs and services including counterpart staff, office space, furniture,

¹¹ Contributors: the governments of Australia, Austria, and Norway.

administrative support and interpretation services, logistics, and local (city) transportation. The detailed cost estimates are in Appendix 2.

D. Implementation Arrangements

16. MOC will be the Executing Agency for the TA and will coordinate for the purpose with the relevant central, provincial, and municipal government authorities. It will assign appropriate counterpart staff to assist the consultants,¹² and form a project steering committee to guide and support the proposed TA. The committee will be chaired by the MOC vice minister concerned and will include the directors general of the Departments of Urban Development, Science and Technology, and International Relations of MOC and relevant officers of the ministries and agencies concerned.

17. The TA will be implemented over an 18-month period, from November 2008 to April 2010. Consulting services totaling 73.5 person-months (13.5 international and 60.0 national) will be required. The international consultants will provide expertise in urban planning and management, water governance and pricing policy, sludge treatment and energy recovery options, environmental management, and soil science. The national consultants will have expertise in urban planning, policy and regulatory frameworks, water pricing and tariff structuring, wastewater and sludge treatment processes, environmental management, financial and economic analyses, and institutional capacity development. The terms of reference for the consultants are in Appendix 3.

18. The consultants will be hired through a firm according to ADB's *Guidelines on the Use of Consultants* (2007, as amended from time to time) on the basis of the quality of the proposal (90%) and the cost (10%) of the services to be provided (quality- and cost-based selection method) using the full technical proposal procedures. The 90:10 weighting is considered appropriate because the TA is a complex multidisciplinary assignment that requires innovation and creativity, and the quality of the consulting services will have a high impact on the ensuing policies and guidelines. All reports by the consultants will be prepared in English and translated into Chinese. The consultants will maintain close working relations with ADB and with MOC and will regularly discuss progress and findings. Tripartite meetings involving ADB staff, the consultants, and MOC will be held to provide guidance to the consultants and to review their reports.

19. The MOC will provide a suitably furnished office with utilities and telecommunication access; intercity transport for the consultants; materials, maps, data, and documents required for the TA; and the cost of utilities for the use of the consultants, counterpart professional staff, and support staff. The TA equipment will be procured by the consultants according to ADB's *Procurement Guidelines* (2007, as amended from time to time) and transferred to MOC after the TA.

IV. THE PRESIDENT'S DECISION

20. The President, acting under the authority delegated by the Board, has approved (i) ADB administering a portion of technical assistance not exceeding the equivalent of \$300,000 to be financed on a grant basis by the Multi-Donor Trust Fund for the Water Financing Partnership Facility, and (ii) ADB providing the balance not exceeding the equivalent of \$700,000 on a grant basis to the Government of the People's Republic of China for the Urban Wastewater Reuse and Sludge Utilization Policy Study, and hereby reports this action to the Board.

¹² MOC's excellent track record in implementing the earlier TA projects has strengthened its capacity to implement the proposed TA.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>Impact</p> <p>A strengthened and more effective and efficient system for managing wastewater reuse and sewage sludge utilization in the PRC.</p>	<p>The policy framework and the operational model(s) recommended by the TA are cleared by the steering committee for nationwide application by 2015.</p> <p>The recommended model has led to substantive quantities of treated wastewater being reused and economic energy recovery from sludge from pilot city WWTPs by 2015.</p> <p>The recommended model has significantly reduced raw water demand and minimized the release of greenhouse gases against the 2008 baseline.</p>	<p>Report from MOC</p> <p>Report from local government and water companies in the pilot cities.</p> <p>Report from MWR and water companies in the pilot cities.</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • Government accepts need for planning and tariff reform to encourage wastewater reuse and ensure appropriate treatment and use of sewage sludge. • Local governments in the pilot cities remain committed to piloting and demonstrating the recommended model. • Local planning reflects the options for and constraints on wastewater reuse and sewage sludge disposal.
<p>Outcome</p> <p>The adoption of a set of policies and tariff guidelines to promote the reuse of wastewater, and technical and market-based approaches to encourage sustainable sludge disposal, including energy recovery, that could be widely adopted by municipalities in the PRC.</p>	<p>Planning and pricing policies and technical methodologies are confirmed to be appropriate for adoption by municipalities in the PRC.</p> <p>The implementation strategy is promoted by the Government as national good practice and the basis for national policy in the 12th Five-Year Plan (2011–2015).</p>	<p>Resolution of the steering committee</p> <p>TA completion report</p>	<p>Assumption</p> <ul style="list-style-type: none"> • Government remains committed to instituting tariff reform to reduce water demand and improve environmental protection.
<p>Outputs</p> <p>A study report that provides advice on:</p> <ol style="list-style-type: none"> 1. pricing and planning policies; 2. stakeholder coordination strategies; and 3. regulatory guidance. 	<p>Tariff calculation methodologies and policy options for different categories of cities are developed by the second quarter of 2009.</p> <p>A comprehensive best-practices policy note on planning, tariff strategies, and regulations for</p>	<p>Inception report and first tripartite review meeting (month 3)</p> <p>Interim report and second tripartite review meeting (month 8)</p>	<p>Assumptions</p> <ul style="list-style-type: none"> • Government provides counterpart support as committed.

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>A designed operational model for pilot-testing operations in the selected case-study cities to expand wastewater reuse and sludge utilization mechanisms</p> <p>A study report summarizing operational and performance data from pilot testing in selected cities and providing recommendations for future application of tariffs for wastewater reuse and selection of appropriate technology for energy recovery from sewage sludge</p>	<p>wastewater reuse is issued by the second quarter of 2009.</p> <p>A guideline on sludge disposal, emphasizing energy recovery and land improvement options, is issued by the second quarter of 2009.</p> <p>Framework for selection of appropriate piloting trials developed by the second quarter of 2009.</p> <p>Application of operational model in selected cities by the third quarter of 2009.</p> <p>Institutional capacity-building program and information dissemination program are developed for the implementation of urban wastewater reuse and energy recovery from sludge for cities across PRC by the third quarter of 2010.</p>	<p>Draft final report of the consultants/ADB team (month 16)</p> <p>Comments from MOF, MOC, ADB, and tripartite review (month 18)</p>	<ul style="list-style-type: none"> Cities are able to fully participate in pilot testing within program time frame.
<p>Activities with Milestones</p> <p>Activities</p> <ol style="list-style-type: none"> Review PRC policies, strategies, and investment priorities regarding the development of urban wastewater management; review standards for wastewater reuse and treatment of sludge from WWTPs; review projections of water demand and wastewater and sludge generation. Review and summarize practices in PRC related to wastewater reuse and energy recovery from sludge. Review planning policies and tariff structures for wastewater reuse in PRC and summarize international best practice. Formulate national policy framework for urban planning and options for tariff structure covering urban wastewater reuse. Formulate a regulatory framework for implementing the tariff guidelines, identify capacity-building needs, and prepare an institutional strengthening and training program. Organize and manage an international study tour to include wastewater reuse, biogas generation, co-incineration, soil improvement, and fertilizer production from sewage sludge. Review international best practice for the treatment, utilization, and final disposal of sludge. 			<p>Inputs</p> <ul style="list-style-type: none"> ADB: \$1,000,000 grant (including 13.5 person-months of international consulting services and 60.0 person-months of national consulting services) Government: \$200,000 (in-kind contributions in the form of counterpart staff, office space and basic office facilities, plus coordination and logistics support for the consultants in the field)

Activities with Milestones	
Activities	
8. Prepare guidelines for selecting appropriate methods for treatment of sludge to maximize energy recovery and/or other uses, including economic justifications.	
9. Prepare a comprehensive best-practices policy note on planning, tariff strategies, and regulations for wastewater reuse and guidelines for sludge disposal, emphasizing energy recovery and land improvement options.	
10. Design a pilot project in 2–3 cities to test the planning policies and pricing structures for the reuse of water and the recommended guidelines for energy recovery from sewage sludge, including cost estimates and a detailed marketing, sales, and implementation plan, as well as an awareness campaign on public safety issues related to reuse of wastewater and sludge.	
11. Implement the pilot projects, and revise the guidelines on the basis of the results of the pilot trials.	
12. Develop and implement a program to disseminate the results of the TA, including the organization of an international symposium.	
13. Prepare comprehensive best-practice policy notes on tariff strategy for wastewater reuse and for the utilization and safe disposal of sewage sludge.	
Milestones	
1. Consultants' mobilization	November 2008
2. Submission of draft inception report	February 2009
3. Study tour	June 2009
4. Submission of draft interim report (recommending pilot cities and proposed interventions)	July 2009
5. Submission of draft final report	February 2010
6. Submission of final report, including policy note	April 2010
7. TA closing	September 2010

ADB = Asian Development Bank, MOC = Ministry of Construction, MOF = Ministry of Finance, MWR = Ministry of Water Resources, PRC = People's Republic of China, TA = technical assistance, WWTP = wastewater treatment plant.

COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Total Cost
A. Asian Development Bank (ADB) Financing^a	
1. Consultants	
a. Remuneration and Per Diem of National Consultants (60.0 person-months)	367.0
b. International Travel	68.0
c. Domestic Travel	20.0
d. Reports and Communications ^b	72.0
2. Equipment ^c	20.0
3. Study Tour ^d	54.0
4. Surveys, Symposium, and Workshops ^e	52.0
5. Contingencies	47.0
Subtotal (A)	700.0
B. Multi-Donor Trust Fund for the Water Financing Partnership Facility^f	
1. Consultants - Remuneration and Per Diem of International Consultants (13.5 person-months)	297.0
2. Contingencies	3.0
Subtotal (B)	300.0
C. Government Financing	
1. Office Accommodation and Transport ^g	85.0
2. Miscellaneous Administration and Support Costs ^h	50.0
3. Remuneration and Per Diem of Counterpart Staff	65.0
Subtotal (C)	200.0
Total	1,200.0

^a Financed by ADB's technical assistance funding program.

^b Includes translation of reports and one interpreter.

^c Includes desktop computers, photocopier, fax machine, and software. This provisional cost item is not subject to competitive bidding.

^d This provisional cost item is not subject to competitive bidding.

^e This provisional cost item is not subject to competitive bidding.

^f Contributors: the governments of Australia, Austria, and Norway and administered by ADB.

^g Includes telephone lines (one international) and city transport.

^h Includes secretarial services.

Source: ADB estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. General

1. The consultants will perform their tasks in close consultation with the Ministry of Construction (MOC) and other responsible central, provincial, and local government departments and agencies to ensure full acceptance of the outcome of the technical assistance (TA). The proposed TA will consist of seven closely related work packages, as detailed below, to be completed with 73.5 person-months of consultant input (13.5 person-months international, 60.0 person-months national). The consultants will have expertise in the following: (i) water governance and pricing (2 person-months international, 8 person-months national); (ii) urban wastewater engineering and urban planning (2 person-months international, 15 person-months national); (iii) sludge treatment (3 person-months international, 6 person-months national); (iv) incineration (1 person-month international); (v) energy transfer (6 person-months national); (vi) urban environment (2 person-months international, 5 person-months national); (vii) soil science (1.5 person-months international, 4 person-months national); (viii) finance (8 person-months national); (ix) public policy drafting and legal matters (2 person-months national); (x) wastewater and sludge marketing (2 person-months international); and (xi) institutional capacity building (6 person-months national).

2. The team leader/national urban wastewater engineer and urban planner (15 person-months) will, in addition to technical functions, have overall responsibility for the effective and timely implementation of the TA. This consultant will foster close coordination between international and national consultants and coordinate with the Executing Agency (EA), other related government agencies, the Asian Development Bank (ADB), and other international organizations doing related work in partnership with ADB. The team leader will periodically report progress to the EA and ADB, and submit high-quality reports to both.

3. The deputy team leader/international sludge treatment processing specialist (3 person-months) will, in addition to technical functions, work closely with the team leader to establish and maintain good coordination with the EA, other related government agencies, ADB, and other international organizations. This consultant will assist the team leader in reporting progress periodically and submitting high-quality reports to the EA and ADB, and will be responsible for ensuring the high quality of the English versions of the inception report, interim report, and draft final report.

B. Work Package 1: Data Collection and Analyses (Phase 1)

4. These work packages include, but are not limited to, the following tasks:

1. General

- (i) Reviewing and summarizing the policies, strategies, and investment priorities of the People's Republic of China (PRC) for urban wastewater management.
- (ii) Reviewing and analyzing previous relevant studies, reports, data, project information, and related information including lessons learned from past work on geographic water resource limitations, water supply, and urban wastewater management.
- (iii) Reviewing and analyzing previous relevant studies, reports, data, project information, and related information including lessons learned from past work on

wastewater reuse and sludge treatment (energy recovery, etc.), land applications (irrigation/fertilizer, etc.), and related management issues.

- (iv) Reviewing data collection and analysis with the MOC and other responsible agencies, and generating a list of data and information sources.

2. Wastewater Reuse

- (i) Reviewing existing information and studies on wastewater reuse in terms of regulations, standards, environmental assessment, and planning methodology.
- (ii) Reviewing water quality standards for applications of urban wastewater reuse.
- (iii) Reviewing the technologies currently employed for urban wastewater management, including tertiary treatment processes, assessing the possibilities for reuse and the potential for impact on the environment.
- (iv) Analyzing the present status and future trends in urban wastewater generation, collection, treatment, disposal, and reuse in the PRC.
- (v) Reviewing data on tariff structures and their application for wastewater reuse across the PRC.
- (vi) In the pilot study cities, reviewing the sources (domestic, industrial, etc.) and volumes of urban wastewater generated and reused, and the impact on the surrounding urban environment.
- (vii) In the pilot study cities, reviewing the development and planning aspects of urban wastewater treatment, in order to recommend suitable alternatives for wastewater reuse and the associated means of supply and/or distribution.
- (viii) In the pilot study cities, reviewing all water-related tariff structures and assessing the potential for revenue generation from the sale of reused wastewater and public-private partnerships.
- (ix) In the pilot study cities, carrying out a survey to gauge the willingness of different user groups to use treated wastewater and pay the expected tariffs, in order to analyze market demand.

3. Sludge Disposal

- (i) Reviewing existing information and studies on sludge disposal in terms of regulations, standards, environmental assessment, and planning methodology.
- (ii) Collating, reviewing, and summarizing data on sludge disposal practices across the PRC, identifying volumes produced before treatment, the treatment and disposal processes involved (where applicable), and volumes and routes for final disposal, and also highlighting lessons learned.¹
- (iii) In the pilot-study cities, reviewing and commenting on the characteristics of sewage sludge (constituents, toxins, etc.), the treatment process(es) involved, volumes of sludge for final disposal, the means of disposal, and the impact on the surrounding urban environment.
- (iv) In the pilot-study cities, reviewing all costs (capital and operational) associated with the treatment and disposal of sludge, and quantifying the potential for energy gain

¹ In the case of incineration, the quantity of residues for disposal or conversion to other uses may also be given.

from the treatment and disposal process in terms of caloric value and cost, including shadow carbon pricing.

C. Work Package 2: Comparison with International Best Practice and Recommendations for Strategic Approach (Phase 2)

- (i) Reviewing international best practice for wastewater treatment and, in particular, methods applied to realize its best economic reuse.
- (ii) Comparing the tariff structures and their application for wastewater reuse with international practice, and recommending changes and improvements.
- (iii) Identifying deficiencies in city planning and implementation of planning policies and the marketing of wastewater for reuse, including public perceptions, and the strategy required to redress such deficiencies.
- (iv) Summarizing technical options for sludge treatment based on proven international best practice.
- (v) For the pilot cities, reviewing and commenting on the efficiency of energy gain from the sludge disposal route, citing and comparing the findings with international best practice, and commenting on the practicalities of implementation.
- (vi) Organizing and managing an international study tour to include economically viable examples of wastewater reuse, as well as biogas generation, co-incineration, and fertilizer production from sewage sludge.

D. Work Package 3: Policy Changes Required, Pilot Testing in Selected Cities, and Analysis of Findings (Phase 3)

- (i) Reviewing and commenting on the institutional structures in pilot cities with particular reference to responsibilities for the treatment and reuse of wastewater, the treatment and disposal of sewage sludge, and the related pricing mechanisms and reporting, and recommending the necessary changes.
- (ii) For the pilot-study cities, recommending strategies to strengthen master plans and sector planning related to wastewater reuse and environmental conservation, and the steps required to implement the plans and their components.
- (iii) For the pilot-study cities recommending changes in procedures to optimize energy gains from sludge disposal routes, including any necessary revisions in governmental law or regulations to facilitate the sale and use of energy generated.
- (iv) For the pilot-study cities, developing an awareness campaign on public safety issues related to the use of wastewater and sludge.
- (v) Establishing a monitoring program that can be implemented in any city to develop a database for future investment projects for wastewater reuse or sustainable routes for the disposal of sewage sludge, or both.
- (vi) Preparing a methodology for the assessment of capital and operation and maintenance (O&M) costs associated with sludge treatment processes and including environmental impact costs and carbon credits.
- (vii) Preparing pricing structures, marketing policies, and plans for the sale of treated wastewater for reuse and the use of treated sewage sludge.

- (viii) Monitoring the implementation of marketing plans and sales contracts for the reuse of wastewater and utilization of sludge.
- (ix) Monitoring cost recovery mechanisms used in the pilot-study cities, and their adequacy for meeting O&M expenditures; recommending changes as necessary.
- (x) From initial data obtained from the pilot cities, recommending changes in institutional, technical, and pricing practices that will improve governance, sustainability, and environmental impact.

E. Work Package 4: Recommendations from Pilot Trials and Formulation of a National Policy Framework and Development Program for Urban Wastewater Reuse and Environmentally Beneficial Disposal of Sewage Sludge (Phase 3)

- (i) On the basis of the findings and analyses under work package 3, recommending changes in institutional structures, urban planning processes, development and operational responsibilities, selection and development of appropriate treatment processes, pricing policies, and urban planning and institutional structure management issues related to the supply of treated networks for wastewater for reuse.
- (ii) Preparing a comprehensive best-practices policy note on planning, tariff strategies, and regulations for wastewater reuse.
- (iii) On the basis of the marketing and analysis of sales of wastewater for reuse and the utilization of sludge, preparing guidance notes to increase revenue-generating contracts.
- (iv) Preparing guidelines for sludge disposal, emphasizing energy recovery and land improvement options.
- (v) Recommending changes in legal regulations involving the sale and use of electrical energy.
- (vi) Formulating an institutional framework for implementing the tariff guidelines, identifying capacity-building needs, and preparing an institutional strengthening and training program.
- (vii) Formulating comprehensive guidelines for the identification and selection of treatment options and process technologies to maximize the recovery of energy from sewage sludge that may be followed across the PRC.
- (viii) Formulating comprehensive guideline for the identification of suitability and treatment of sludge for land improvement and fertilizer applications, including associated soil science issues, that may be followed across the PRC.
- (ix) On the basis of the findings and analyses under work packages 2 and 3, recommending changes in institutional structures, operational responsibilities, pricing policies, treatment processes and procedures, urban planning and management, and options for final disposal routes for sewage sludge that can be applied generally across the PRC.

F. Work Package 5: Dissemination of Findings (Phases 1, 2, and 3)

1. Reporting

- (i) The consultants will submit the following reports: (a) an inception report within 12 weeks from the start of the TA, finalizing the approach, presenting a detailed work plan and implementation schedule for the TA, identifying any need for improvements in the concept paper prepared by MOC, and including the output from data collection and collation; (b) an interim report after 32 weeks from the start of the TA, presenting the recommendations for policy, methodology, and institutional and other requirements for the pilot testing in three cities, including costing, implementation arrangements, and design and monitoring criteria; (c) a draft final report (DFR) within 70 weeks from the start of the TA, covering detailed policy recommendations and draft national guidelines on institutional reform, tariff objectives and calculation methods, institutional and legal arrangements, and guidelines for the technical approach; and (d) a final report, 2 weeks after the receipt of comments on the DFR from the MOC and ADB (the comments will be issued no later than 6 weeks after the issuance of the DFR). Two weeks' input time is allowed for this activity.
- (ii) All reports will be written in English and translated into Chinese. Three copies of each report (in English) will be submitted to ADB and 10 copies (in both Chinese and English) to the MOC. The reports should address all aspects of the terms of reference to the level of detail appropriate for the given stage of the TA. The consultants will present key findings in the workshop and symposium. Members of the project leading group, representatives of the Ministry of Finance, National Development and Reform Commission, State Environmental Protection Administration, municipal governments in the pilot cities, local communities, and ADB staff will participate in the workshops and the tripartite meetings.

2. Workshop

- (i) Preparing an initial working paper containing draft recommendations on the recommendations for both a general approach and specifically targeted at the pilot cities for institutional reform, tariff policy framework, and methodology for increasing wastewater reuse and energy recovery from sewage sludge.
- (ii) Circulating the working paper to the central and local governments, government agencies, selected companies in the pilot cities, consumer representatives, and other relevant organizations at the central and local levels; inviting and recording feedback on the preliminary recommendations.
- (iii) Undertaking field visits to the selected case study cities to encourage early feedback.
- (iv) Using the detailed comments and feedback received to refine and strengthen the working paper, which will then be incorporated into the interim report.
- (v) Conducting a workshop in each of the pilot cities to present the interim report to policy makers and price bureaus at the central, provincial, municipal, and city level, and to stakeholders; facilitating the exchange of ideas and gathering further comments on the proposed recommendations.

3. Symposium

- (i) Arranging and conducting an international symposium to be led by MOC with support from ADB and potential ADB knowledge partners to present and discuss the

findings and recommendations of the study. The presentations will demonstrate the effectiveness and suitability of the changes suggested in maximizing the demand for and use of treated wastewater, and the efficiency of sludge disposal routes that will both generate energy and minimize the environmental impact of disposal, including carbon emissions.

- (ii) Incorporating comments and feedback from the symposium into the final report.
- (iii) Supporting the Government—particularly MOC, Ministry of Finance, State Environmental Protection Administration, and National Development and Reform Commission—in its efforts to disseminate the study’s findings to the State Council and other agencies, commissions, and ministries.