i. Project Proposal

A. Project Background

1. On May 8, 2013, an agreement was officially signed between Cities Development Initiative for Asia (CDIA) and AECOM Asia Co., Ltd. Under the agreement, AECOM is to provide technical services for the Preliminary Feasibility Study of Hunan Yongzhou Integrated Solid Waste Management Project. This assignment is financed by CDIA with the implementation period of 7 months. According to the “Regulations for Protection of Xiang River in Hunan Province” and the “12th Five-year Plan for Construction of Facilities for Proper Treatment of Domestic Wastes in Hunan Province”, the Integrated Solid Waste Management Project in Yongzhou has been included in the list of priority projects to be implemented by the Yongzhou Municipal Government. The project aims to achieve integrated collection, treatment and disposal of municipal solid waste in Yongzhou to achieve the objectives of recycling, reduction and proper treatment of municipal solid waste, and enhancing the sustainable development of Yongzhou City.

B. Project Scope

Current Facilities

2. Yongzhou has one existing solid waste treatment plant (i.e. Tantang Landfill), 32 garbage transfer stations (including 20 in Lengshuitan District and 12 in Lingling District), and 21 garbage transportation trucks. The daily garbage transportation, treatment, and disposal capacity is 600 tons / day, which is projected to expand to 1,000 tons/day by 2015 and 1,200 tons/day by 2020. The municipal solid waste collection, transportation, and treatment in Yongzhou is mainly operated and managed by the Municipal Administration and Law Enforcement Bureau of YMG (also known as the YZ City Solid Waste Center). The current practice is that the municipal solid waste is collected and transported in carts or trucks to the garbage transfer stations and then compressed, transported by container trucks or garbage compression trucks to Tantang Landfill for disposal. Tantang landfill is a properly designed / operated sanitary landfill without recycling facilities. Other than the current Tantang Landfill, Yongzhou has two abandoned uncontrolled landfills: Shanglingqiao Landfill in Lengshuitan District (closed in 2008) and Zhugemiao Landfill in Zhugemiao (closed in 2010).

3. The current practices of Yongzhou solid waste treatment have the following major issues:

3.1. Solid waste collection service coverage areas is not complete within existing urban districts, causing water and ground pollution; the collection, transfer and transfer station system is outdated, without leachate, odor collection and treatment facilities; and the unsorted solid waste causes low levels of resource recovery.

3.2. The two abandoned uncontrolled landfills without proper capping, gas emission collection, and leachate treatment system, causes serious pollution to the surrounding environment with adverse impact to groundwater and Xiang River/Xiao River water quality.

3.3. Yongzhou urban areas now produce 70 tons of kitchen waste per day (45 tons for Lengshuitan District, 25 tons for Lingling District). Kitchen waste recycling is not well managed as large amounts of kitchen waste flow to illegal sales channel, causing serious threats on food safety.
Project Components

4. This project proposal is designed based on the projected population and solid waste generation for Year 2020. The Project will serve an urban population of 1,000,000 in the urban center of Yongzhou (including 574,000 in Lengshuitan District, 306,000 in Lingling District and 120,000 in the Middle New Eco-city) and a rural population of approximately 200,000 in the surrounding towns and townships within 30km from the urban area. Based on government policies and the current status of solid waste treatment in Yongzhou, the Integrated Solid Waste Management Project includes the following components:

4.1. Solid Waste Collection, Sorting and Transferring System: The system will have a total capacity of 1,200 tons/day, including 570 tons/day from Lengshuitan District, 310 tons/day from Lingling District, 120 tons/day from Middle New Eco-city, and 200 tons/day from the surrounding towns and townships.

4.2. Uncontrolled Abandoned Landfill Closures: Proper closures of the Shanglingqiao Landfill in Lengshuitan District (800,000 m³ of domestic solid waste) and the Zhugemiao Landfill in Lingling District (500,000 m³).

4.3. Kitchen Waste Collection and Treatment: The Project will have a total treatment capacity of 120 tons/day, including 100 tons/day of kitchen refuse and 20 tons/day of gutter oil.

4.4. Municipal Wastewater Sludge Treatment: Facility with capacity of 90 tons per day (80% water content) to receive and treat sludge from the 6 municipal wastewater treatment plants in the urban area.

4.5. Solid Waste Incineration Project: The Project will include a 700 tons/day municipal solid waste incinerator facility with presorting, energy recovery, and minimization system to be constructed in the existing Tantang landfill site area. The expected ultimate capacity is 1050 tons/day to be implemented in two phases with phase one capacity of 700 tons/day.

C. Technical Solutions

5. The municipal solid waste is collected and transported in carts and garbage trucks to the garbage transfer stations and then compressed and transported in container trucks and garbage compression trucks to Tantang Landfill for disposal. The two abandoned uncontrolled landfills will be properly treated with in-situ site closure method. These will be managed by Yongzhou government. While the existing solid waste is all collected and disposed in Tantang landfill with proper leachate treatment facilities, the Project Proposal takes into consideration minimizing adverse environmental impacts, effective transportation routes, maximizing the use of existing landfill assets, and consolidating solid waste treatment and disposal activities. The recommended solution is a centralized treatment system to be adopted in this integrated solid waste management scheme, in which all the domestic solid wastes, kitchen wastes, and municipal sludge of the urban areas are collected, transported, and treated at Tantang Landfill for recycle, reduction, and resource recovery. All the treatment facilities will be located at the existing Tantang landfill site area. This centralized scheme including an incineration plant and solid waste sorting facilities to be built in Tantang so that all the domestic solid wastes transported to Tantang are sorted into combustibles and non-combustibles. The combustibles are incinerated in the incinerator with green power generation while the non-combustibles are disposed in the landfill; the kitchen wastes are treated with anaerobic fermentation process with the residual used as fertilizers and biogas generated from fermentation for power generation; the residual heat produced from
anaerobic fermentation as well as from the incineration facility will be used for thermal drying of municipal sludge.

6. This scheme requires the construction of the following treatment facilities during Phase 1:

   6.1. Current solid waste collection and transportation system need to be upgraded and new facilities and services will be provided; the total investment is approximately CNY100 millions (financed by Yongzhou government special fund);

   6.2. One incineration plant with a capacity of 700 tons/day (2 units x 350 tons per day per unit) and a capital cost of approximately CNY286 millions to be constructed at Tantang;

   6.3. One kitchen waste treatment plant with a capacity of 100 tons/day and a capital cost of approximately CNY65 millions to be constructed at Tantang;

   6.4. Thermal drying municipal sludge pretreatment system with a capacity of 90 tons/day (with a water content of 80%) and a capital cost of approximately CNY30 millions;

7. An integrated / centralized treatment is preferred not only because of its lower operation costs, but also for its advantages in comprehensive management. With the relevant treatment facilities all located at Tantang Landfill, environmental impacts will be minimized and energy / heat generated from kitchen waste and incineration plant can be fully utilized. This fully manifests the advantages of beneficial reuse and treatment, as well as integrated practices. The proposed Tantang Centralized Treatment facility is expected to become an eco-park with iconic demonstrative effects on the application of integrated solid waste treatment approaches in China.

D. Estimated Capex, Opex and Project Financing

8. The centralized treatment approach includes the construction of a solid waste incineration plant with a treatment capacity of 1,050 tons/day at Tantang Landfill with 25 to 30 years’ service duration. Based on the increasing solid waste production trend, the plant will be constructed in two phases, with Phase I involving a treatment capacity of 700 tons/day, and scheduled to operate and generate power in 2016. Financial analysis is evaluated based on a treatment capacity of 700 tons/day (operating at 600 tons/day during initial stage). The system will be designed with redundancies to accommodate future economic growth and urbanization needs. Phase II is proposed with additional 350 tons/day (by adding the 3rd train) in the future.

Capital cost

9. The estimated unit capital costs of sludge drying, incineration, and kitchen waste treatment facilities to be constructed under this Project are CNY 330,000/ton, CNY 400,000/ton, and CNY 650,000/ton respectively, excluding relevant project preparation fees, land acquisition, site utilities and Environmental Impact Assessment preparatory fees.

Operating cost

10. The estimated unit operating costs for sludge drying, solid waste incineration, and kitchen waste treatment facilities are estimated at CNY 90/ton, CNY 111.6/ton, and CNY 178/ton respectively. The average operating cost is about CNY 37/ton, which includes the projected revenue of electricity sales from solid waste incineration. Further verification on above estimate is to be conducted during next project Feasibility phase based on the system
design, equipment procured and associated operation, maintenance and system repair needs.

**Operating income**
11. Income from solid waste incineration facility mainly includes electricity sales and solid waste tipping / treatment fees. According to the incineration projects implemented in the cities with similar level, the reasonable market range for solid waste treatment fees is between CNY100/ton to CNY120/ton can be adopted and considered (assume CNY100/ton in financial calculation).

**E. Key Financial Indicators**

**Financial indicators**
12. The key financial indicators of the Project include rate of return of internal investment (also known as internal rate of return, IRR) and period of recovery of dynamic investment and net present value (NPV). The initial result of internal rate of return (IRR) of the Project is 10.8%. The financial data and key indicators are shown in the Tables 1 and 2.

**Input-Output Analysis**
13. According to the Yongzhou government policy and preliminary financial analysis of the PPP scheme, with the total capital investment of CNY 381 million (50% capital investment and 50% from bank loans with interest of 8%), Tantang Landfill contract operation plus BOT of new facilities (BOT+O&M) can generate a higher IRR of 10.8% by taking account of the factors of - future increase of treatment tariff, an assumed annual growth of 3%, an average yearly price inflation of 3%, and the three-year tax exemption and three-year half reduction of corporate income tax.

<table>
<thead>
<tr>
<th>Table 1: PPP Financial Data</th>
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</thead>
<tbody>
<tr>
<td><strong>Key Assumption</strong></td>
</tr>
<tr>
<td>Contract Period</td>
</tr>
<tr>
<td>WACC</td>
</tr>
<tr>
<td>Capital Investment</td>
</tr>
<tr>
<td>Loan</td>
</tr>
<tr>
<td>Bank Interest Rate</td>
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<tr>
<td>Growth Rate of MSW</td>
</tr>
<tr>
<td>Taxation</td>
</tr>
<tr>
<td>First 3 years</td>
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<tr>
<td>Year 4 to 6</td>
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<tr>
<td>Remaining Year</td>
</tr>
<tr>
<td><strong>Input-Output Analysis</strong></td>
</tr>
<tr>
<td><strong>Treatment fee Revenue</strong></td>
</tr>
<tr>
<td>Tantang Landfill</td>
</tr>
<tr>
<td>Kitchen waste</td>
</tr>
<tr>
<td>Municipal sludge</td>
</tr>
<tr>
<td>MSW Incinerator</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Other Revenue</strong></td>
</tr>
<tr>
<td>MSW incineration power generation</td>
</tr>
</tbody>
</table>
F. Project Execution

Operation and Management Structure: BOT + O&M

14. In order to achieve centralized treatment, it is necessary to integrate solid waste incineration, kitchen waste treatment, municipal sludge treatment, and Tantang Landfill into treatment project. After detail discussions with Yongzhou government, this Project will be operated and managed by means of PPP (public private partnership) scheme (contract O&M of existing landfill facilities + BOT investment in new facilities), where Tantang Landfill is operated and managed by a professional enterprise contracted by Yongzhou Municipality while the enterprise provides cash to address the financial needs of all new facilities. By such arrangements, the asset of Tantang Landfill is still remained to the government.

<table>
<thead>
<tr>
<th>Expenditure:</th>
<th>Treatment amount (t/d)</th>
<th>Operation cost (CNY/t)</th>
<th>Daily expenditure (CNY/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tantang Landfill + leachate treatment</td>
<td>600</td>
<td>52</td>
<td>31,200</td>
</tr>
<tr>
<td>Kitchen waste</td>
<td>100</td>
<td>178</td>
<td>17,800</td>
</tr>
<tr>
<td>Sludge</td>
<td>90</td>
<td>90</td>
<td>8,100</td>
</tr>
<tr>
<td>MSW incinerator</td>
<td>600</td>
<td>111.6</td>
<td>66,960</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>124,060</strong></td>
</tr>
</tbody>
</table>

Note:

1. The ratio of capital investment bank loan: it is depends on the financial capability of the borrower, the normal range is 70%-30%. In normal case, if the debt ratio is over 50%, then the bank may require to set mortgage against the borrower’s assets and the right of fee collection of the project.

2. The interest rate: the current interest rate for infrastructure project is 6.5% to 8%pa.

Table 2: Key Financial Indicator Data (CNY)

<table>
<thead>
<tr>
<th>Financial Indicator</th>
<th>Income</th>
<th>CNY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Operating revenues</td>
<td>销售收入</td>
<td>3,948,233,815</td>
</tr>
<tr>
<td>Total costs (Opex)</td>
<td>运营费用</td>
<td>(2,359,071,455)</td>
</tr>
<tr>
<td>EBITDA</td>
<td>折旧摊销及息税前利润</td>
<td>1,589,162,360</td>
</tr>
<tr>
<td>EBIT</td>
<td>息税前利润</td>
<td>1,208,162,360</td>
</tr>
<tr>
<td>Net income</td>
<td>税后利润</td>
<td>838,397,736</td>
</tr>
<tr>
<td>Dividends</td>
<td>分配股利</td>
<td>763,301,912</td>
</tr>
<tr>
<td>CAPEX</td>
<td>资本支出</td>
<td>381,000,000</td>
</tr>
<tr>
<td>ROE</td>
<td>资本金回报率</td>
<td>11.3%</td>
</tr>
<tr>
<td>ROCE</td>
<td>已动用资本回报率</td>
<td>23.8%</td>
</tr>
<tr>
<td>IRR (Free cash flow)</td>
<td>项目内部回报率</td>
<td>10.8%</td>
</tr>
<tr>
<td>NPV (Free cash flow) at WACC</td>
<td>净现值</td>
<td>26,942,389</td>
</tr>
</tbody>
</table>
15. As stipulated by the “Methods for Management of Concession Agreement of Municipal Public Utilities” issued by the Ministry of Housing and Urban-Rural Development (MOHURD) on March 19, 2004, solid waste treatment utilities may be operated under concession agreements, typically for a period of 25 to 30 years.

16. This PPP scheme covers the proposed BOT arrangement of solid waste incineration, kitchen waste treatment, municipal sludge treatment, and Contract Operation of Tantang Landfill. The rights of construction and operation of the Project for a certain period of concession will be given to an experienced investor (i.e. a project company), who is responsible for financing, designing, procuring, constructing, and commissioning and operating all of the new components of the Project within the period of BOT agreement. Upon the completion of the new components, the Project will provide treatment and operation services to the government according to the agreement while the government will pay solid waste treatment / tipping fees to the project company according to the agreement and assure that the electricity generated from the solid waste incineration plant is purchased by the power company. The investor to recover the project investment, operation and maintenance cost, and obtain a reasonable return. Upon expiry of the BOT agreement, the investor will hand over the ownership and right of operation of all invested project components to the government.

**Legal Framework**

17. Under the proposed BOT + O&M PPP scheme, the key legal documents involving the Project will include, but not limited to, the following contracts and agreements, applicable laws and standards, and the power generation preferential policies for the Project:

17.1. Delegated Management Agreement
17.2. BOT Contract Agreement
17.3. Concession Agreement of Landfill Contract Operation;
17.4. Contract of power purchase;
17.5. Agreement of grid connection and dispatching;

18. To assure the sustainability of the Project, the government shall take full account of the following principles upon authorization of concession agreement:

18.1. “Take or Pay” Principle: This principle is an important means of credit security for BOT and Contract O&M projects. During the operation period of this project, the government or its authorized department to ensure solid wastes supply at the minimum volume and receive solid waste treatment service, as well as pay solid waste treatment / tipping fees to the investor (or Project Company) as stipulated in the agreement. If the government or its authorized department fails to provide solid wastes to the investor (or Project Company) at the agreed volume, the government or its authorized department will still pay the agreed solid waste treatment fees. Setting the “minimum (yearly) supply of solid waste” is a key approach to execute the “Take or Pay” Principle

18.2. Exclusivity: In order to abide by the “Take or Pay” Principle and “let all projects serve their purposes”, the government usually develops a reasonable planning of solid waste treatment facilities based on the actual circumstances to achieve the exclusivity of solid waste incineration and treatment in a certain geographical area. The exclusivity of BOT model is also reflected in the various rights of priority in expansion of existing projects or construction of new treatment projects in the same area.

18.3. Preferential policies: Solid waste incineration projects also receive a series of preferential tax policies. For example, three-year exemption and three-year half reduction of enterprise income tax are stipulated in the “Regulations of Implementation of the Enterprise Income Tax Law of the People’s Republic of China” (2007); domestic solid waste incineration projects are included in the catalogue according to the “Notice on Publication of the Catalogue of Environmental Protection, Energy and Water Saving Projects Enjoying Preferential Enterprise Income Tax (Trial Version)” (Financial Tax [2009]166); solid waste incineration and power generation projects also receive the preferential policies on exemption and reduction of income tax and exemption of value-added tax according to the stipulations of the “Notice on the Value-added Tax Policy for Comprehensive Utilization of Resources and Other Products” (Financial Tax [2008]156).

18.4. Price adjustment formula: Since the power grid-connection price upon bid invitation is an assumed parameter, the price adjustment formula for the solid waste treatment fees should be linked with the actual grid-connection price. In addition, the operating costs should adjusted with the price index and adopt the progressive method instead of a year-to-year adjustment.

19. Yongzhou has implemented the urban WWTPs adopting the BOT model, the government has experiences in the implementation procedure and operation of the PPP model; therefore, there will not be significant risks to the investors in terms of the adoption of this PPP scheme.

**Risks of BOT Projects and Associated Project Control**

Risk Category

20. From the government’s perspective, the key risks to address are social and environmental risks. The government will have to address increasing pressure in terms of solid waste treatment needs if the selected investor does not have the required capability to
complete the project on time. Additionally, during the period of operation and management, serious environmental pollution may result from failure to follow the strict national environmental protection standards.

21. From the investor’s perspective, the key risks include technical risks (in terms of construction and operation), solid waste supply risks (in terms of quantity and quality), payment risks (concerning solid waste treatment fee and electricity fee), and policy risks (e.g. more stringent national environmental protection standard and changes of urban planning).

Principle of Risk Sharing
22. The following principle of risk sharing will be adopted to enable the more competent party to undertake the respective category of risks. For example:

22.1. The technical risks concerning the engineering design, operation, and maintenance of the solid waste incineration plants and facilities should be undertaken by the investors (or project companies) since they have more professional staff and expertise than the government in addressing such risks;

22.2. The solid waste supply risks, payment risks, and policy risks should be undertaken by the government or its authorized department who have certain abilities of administrative coordination;

22.3. Unpredictable risks (e.g. force majeure) should be shared by the government and the investor following the relevant stipulations of the Concession Agreement.

Key Approaches of Risk Control
23. The following approaches and methods may be adopted for control of the above risks:

23.1. The project requirements that the government raises to the project investor including the technical requirements of the incineration plant and the various treatment facilities should be clearly specified in the bidding documents. In addition, the project terms and conditions provided by the government should also be made available to the investor for the purpose of risk appraisal and economic analysis;

23.2. The Concession Agreement should be included as part of the bidding documents to clearly specify the responsibility, rights, and interests of the government and the investor to avoid unnecessary disputes;

23.3. Various performance assurance mechanisms should be established based on the project requirements and its implementation stages, such as “bid security” for the bidding period, “project completion security” for the construction period, “operation security”, “payment security” for the operation period, and “hand-over security” for the hand-over of the Project.

G. Project Preparation Works

Organization Activities

(1) The government authorizes the lead department to perform project planning based on integrated approach and delegate the right of Concession Agreement on behalf of the government;

(2) Surveys should be organized to identify the quality and quantity and future growth of solid wastes;
(3) An experienced consultant should be recruited as the financial consultant and investment / bidding agent of the Project;

(4) Market investigation should be conducted to identify potential investors and technologies.

**Procedure of Project Execution**

(5) The government selects an investor for the Project through public bidding or by other transparent means;

(6) The investor sets up a special project company based on the relevant requirements of the bidding document;

(7) The government delegates an authorized representing department for the Project;

(8) The authorized government department signs and executes, on behalf of the government, the Concession Agreement with the project company;

(9) The project company signs an agreement with YZ Government on solid waste delivery with the solid waste suppliers;

(10) The project company signs an agreement of electricity sales with the electricity authority;

(11) The project company signs agreements of project financing with the loan provider / banks;

(12) The project company signs project implementation contracts with the design institute, equipment suppliers, and construction and installation companies; in-depth discussions will be conducted over the publications of project manager associations.

**Project Preparation and Tendering Schedule**

24. The following table lists the time schedule during the project implementation period.

<table>
<thead>
<tr>
<th>Implementation Stage</th>
<th>Implementation Actions</th>
<th>Duration</th>
</tr>
</thead>
</table>
| Preparation Stage    | • The government delegates an authorized department andgrant concessions for representing the government in the future;  
|                      | • Hire project consultants and tender agent;                                           | 3-6 Months |
|                      | • Investigate potential investor and technology.                                        |            |
| Tender and financing Stage | • Issue the tender notice;  
|                      | • Field investigation;  
|                      | • Evaluation of the bidders;  
|                      | • Contract negotiation;  
|                      | • Contract signing;  
|                      | • Establish special project company;  
|                      | • Financing from the financial institution.                                            | 6-8 Months |
| Design Stage         | • Signing contract with design institutes, equipment suppliers, engineering, installation companies, etc.. | 2-3 Months |
H. Project Benefits

Benefits from Abandoned Uncontrolled Landfill Closure

(1) The landfill closure will reduce the surface water and groundwater contamination caused by leachate. The annual reduction of COD, BOD5, ammonia, and SS amount is projected to be 130 tons, 52 tons, 39 tons and 26 tons, respectively. The project will improve the local agriculture and aquaculture production conditions. After completion of the project, the nearby local farmers' income will increase by about 8%.

(2) The reduced landfill leachate contamination in surrounding soils will allow farmers to grow high-value agricultural products.

(3) Annual emissions of landfill gases, H2S and NH3, to the atmospheric environment will reduce by 0.527 tons and 2.722 tons, respectively.

(4) Improve the public health and sanitation conditions of surrounding communities. Currently the residents living near the two landfills are mostly women, children, and elderly (male labors are mostly migrant workers outside). The implementation of this project will benefit the health conditions of the women, children, and elderly.

(5) The greening of landfill surface after closure will improve the ecological environment in the surrounding areas.

Benefits from Kitchen Waste Treatment

(6) Reduce the illegal reuse of waste kitchen oil, improve public health. The timely and effective recovery and management of kitchen waste can effectively control mosquitoes breeds and rodent infestation, reducing disease transmission, improving the health conditions.

(7) Fermentation of the kitchen waste will produce biogas, reducing the fossil fuel usage. 1,058 tons of waste oil can be separated and recycled each year, while reducing environmental pollution.

(8) Individually sealed way of collection and transportation will improve the sanitation conditions of the kitchen waste collection system and create a better health conditions.

Benefits from Incineration Project

(9) Maximally reduce the solid waste quantity, which reduces the need for additional landfill space and improves the conservation of land resources.

(10) Waste heat is fully utilized, which reduces the use of fossil fuels and carbon emissions. (Carbon emissions of incineration process are 1/6 of that from landfill disposal only).

(11) Solid Waste pathogens will be completely eliminated, reducing the negative impact to environmental and public health.