CURRENCY EQUIVALENTS
(as of 10 May 2012)

Currency unit  –  yuan (CNY)
CNY1.00  =  $0.1584
$1.00  =  CNY6.3108

ABBREVIATIONS

ADB  –  Asian Development Bank
CCS  –  carbon capture and storage
CCUS  –  carbon capture, utilization and storage
CHNG  –  China Huaneng Group
CHRI  –  China Huaneng Research Institute
CO₂  –  carbon dioxide
CSC  –  construction supervision company
EIA  –  environmental impact assessment
EMD  –  environmental monitoring division
EMP  –  environmental management plan
EMS  –  environmental monitoring station
EMU  –  environment management unit
EPB  –  environmental protection bureau
HGC  –  Huaneng GreenGen Co.
HIPMC  –  Harbor Industrial Park Management Committee
HTICL  –  Huaneng Tianjin IGCC Co. Ltd.
IGCC  –  integrated gasification combined cycle
MEP  –  Ministry of Environmental Protection
PIU  –  project implementation unit
PRC  –  People’s Republic of China
SEIA  –  summary environmental impact assessment
TSP  –  total suspended particulates
TEPB  –  Tanggu Environmental Protection Bureau

WEIGHTS AND MEASURES

gce  –  grams per coal equivalent
ha  –  hectare
KWh  –  kilowatt-hour
m  –  meter
m³  –  cubic meter
m³/h  –  cubic meters per hour
mm  –  millimeter
MW  –  megawatt
t/d  –  tons per day

NOTE

In this report, "$" refers to US dollars

This environmental safeguards monitoring report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB’s Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.
### BASIC PROJECT INFORMATION

<table>
<thead>
<tr>
<th><strong>ADB Loan No.</strong></th>
<th>Loan 2616-PRC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Title</strong></td>
<td>Tianjin Integrated Gasification Combined Cycle Power Generation Plant Project</td>
</tr>
<tr>
<td><strong>Borrower</strong></td>
<td>People’s Republic of China</td>
</tr>
<tr>
<td><strong>Executing Agency</strong></td>
<td>China Huaneng Group</td>
</tr>
<tr>
<td><strong>Implementing Agency</strong></td>
<td>Huaneng Tianjing IGCC Co., Ltd.</td>
</tr>
<tr>
<td><strong>Total Estimated Cost</strong></td>
<td>$419.59 million ($135 million from ADB’s ordinary capital resources and $5.0 million grant from Climate Change Fund)</td>
</tr>
<tr>
<td><strong>ADB Loan</strong></td>
<td>$135 million from ADB’s ordinary capital resources and $5.0 million grant from the Climate Change Fund</td>
</tr>
<tr>
<td><strong>Counterpart Financing</strong></td>
<td>Equity of $84.0 million and domestic loan $195.59 million</td>
</tr>
<tr>
<td><strong>Loan Approval Date</strong></td>
<td>8 February 2010</td>
</tr>
<tr>
<td><strong>Loan Agreement Signed Date</strong></td>
<td>28 May 2010</td>
</tr>
<tr>
<td><strong>ADB Loan Effectiveness Date</strong></td>
<td>25 August 2010</td>
</tr>
<tr>
<td><strong>Project Complete Date</strong></td>
<td>30 June 2012 (Loan) and 31 Dec 2015 (Grant)</td>
</tr>
<tr>
<td><strong>Original Loan Closing Date</strong></td>
<td>31 December 2012</td>
</tr>
<tr>
<td><strong>Total Number of Months for Implementation</strong></td>
<td>3 years (36 months) starting from 2009 to 2012</td>
</tr>
<tr>
<td><strong>Elapsed Months from Loan Effectiveness Date</strong></td>
<td>18 months</td>
</tr>
<tr>
<td><strong>Exchange Rate</strong></td>
<td>CNY 1 = $0.1464</td>
</tr>
<tr>
<td></td>
<td>$1.00 = CNY6.83</td>
</tr>
<tr>
<td><strong>Date of Latest ADB Loan Review Mission</strong></td>
<td>Early February 2012</td>
</tr>
<tr>
<td><strong>Type of This Report</strong></td>
<td>The Second Environmental Safeguards Monitoring (EMP Monitoring) Report</td>
</tr>
<tr>
<td><strong>Period Covered by This Report</strong></td>
<td>January 2011–February 2012</td>
</tr>
</tbody>
</table>
TIANJIN INTEGRATED GASIFICATION COMBINED CYCLE POWER PLANT PROJECT IN THE PEOPLE’S REPUBLIC OF CHINA

PROJECT LOCATION

Provincial Capital
City/Town
Other Town
Expressway
National Highway
Other Road
Railway
River
Provincial Boundary

Boundaries are not necessarily authoritative.
TIANJIN INTEGRATED GASIFICATION COMBINED CYCLE POWER PLANT PROJECT IN THE PEOPLE'S REPUBLIC OF CHINA
I. INTRODUCTION

A. Background

1. This report is the second environmental management plan (EMP) monitoring report of the Tianjin Integrated Gasification Combined Cycle (IGCC) Power Plant, covering the period of January 2011–February 2012. It is prepared by the Huaneng GreenGen Co. Ltd. (hereafter referred to as GreenGen), with the assistance from Mr. Zhu Chao, the loan implementation consultant of the Tianjin IGCC Power Plant Project. The first EMP monitoring report was prepared on October 2009 and submitted to the Asian Development Bank (ADB). The first EMP monitoring was reviewed by the ADB.

2. The report is prepared in accordance with the environmental monitoring program as part of the EMP. The field sampling, laboratory analysis, and site inspection were undertaken by the newly established monitoring facility at GreenGen\(^1\), the Tanggu environmental monitoring station (EMS), China Hydropower Research Institute (CHRI), Harbor Industrial Park Management Committee (HIPMC), Tianjin and Tanggu District Environmental Protection Bureaus (EPBs).

B. Project summary

3. The project is to develop a commercial-scale IGCC plant with 250 megawatt (MW) capacity. The main components of the project are located in the Harbor Industrial Park, Tanggu District, Tianjin, the People's Republic of China (PRC), as shown in maps 1 and 2.

4. The environmental impact assessment (EIA) for the Tianjin IGCC power generation plant was completed by Tianjin Environmental Protection Research Institute in May 2007 and approved in July 2007. The summary environmental impact assessment (SIEA) was prepared by GreenGen and endorsed by the Asian Development Bank (ADB) in 2008. The SIEA for Tianjin Integrated Gasification Combined Cycle Power Plant Project is available at the ADB website.\(^2\)

5. The Tianjin IGCC power generation plant is the first IGCC plant in the PRC. The IGCC power generation plan will supply (i) base-load electricity to the local grid, and (ii) steam and heat to other facilities within the Harbor Industrial Park. Upon full-scale operation, 1.5 billion kilowatt-hours of electricity will be generated annually.

6. The project includes the construction of the following:

   (i) Coal gasifier with a processing capacity of 2,000 tons per day;\(^3\)
   (ii) Gas turbine and steam turbine combined cycle, consisting of one 171 MW of gas turbine, one 110 MW of steam turbine, and waste heat boiler;
   (iii) Syngas purification system, with a processing capacity of 160,739 normal cubic meter per hour (Nm\(^3\)/h);
   (iv) Sulfur recovery system;

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1 GreenGen established a monitoring facility as a part of environmental capacity building activities.
2 http://www2.adb.org/Projects/reports.asp
3 The coal gasifier used is a two-stage dry pulverized coal gasifier. The production process includes coal grinding and drying, pulverized coal compression and feeding, coal gasification, slag removal, dust removal, wet scrubbing, ash flushing water treatment, and wastewater treatment.
(v) Flaring system with torch of 80 meters high and 900 millimeters in diameter;
(vi) Other items including air separation facility; water supply; power supply; ash removal system; wastewater treatment and discharge system; water recycling system; boiler water supply system; and fire water system;
(vii) Storage and transport system, including coal transport, storage and distribution system; emergency ash yard; onsite temporary solid waste yard; oil tank; and oil pump room;
(viii) Temporary workers’ accommodation; and
(ix) Permanent office and residential building.

C. Design Adjustment

7. The project has made minor project design changes in water supply and recycling systems, boiler water makeup system, and sulfur recovery system. The changes would result in improving the resource efficiency of the project, lessening the expected environmental adverse impacts, and reducing construction costs. The technical design improvement has been approved by the Ministry of Environmental Protection (MEP) on 29 March 2010, which was informed to the ADB. The summary of the design changes are presented in Table 1.

8. The technical design improvement led to significant reduction in water consumption by redesigning the water cycle of the power generation island. The amount of sea water consumption for the power generation island is significantly reduced as discharged water from the power generation island is recycled and used for the gas-steam turbine cooling tower. Detailed information on water reduction is provided in Table 1.

Table 1: Design Changes in the Tianjin IGCC Plants

<table>
<thead>
<tr>
<th>Adjustment Item</th>
<th>Original Design</th>
<th>Adjusted Design</th>
<th>Environmental Impacts</th>
</tr>
</thead>
</table>
| Water recycling system  | Sea water is directly used for the power generation island and then, is sent to the gas-steam turbine cooling tower (CC tower). Wastewater from CC tower is discharged to Bohai sea. | Sea water is purified and then sent to CC tower. Water discharged from CC tower is recycled and used for the power generation island. | • Sea water consumption is reduced from 19,600 m³/h to 501 m³/h;  
  • Desalted water is reduced from 342 m³/h to 269 m³/h; and  
  • Discharged wastewater to the central wastewater treatment plant reduced from 95 m³/h to 15.8 m³/h. |
| Boiler water makeup system | Desalted sea water is directly sent to the boiler water makeup system with one stage osmosis device.                                      | Water discharged from the CC tower is sent to the boiler water makeup system. After the boiler water make-up system with two stage osmosis device, the water is recycled and used for steam generator. | 14 m³/h of desalted sea water intake is reduced.                                                          |
| Sulfur recovery system  | Shell-Paques biological recovery technology is used for sulfur recovery.                                                                        | LO-CAT II technology is used for sulfur recovery system.                                                | No significant environmental impact is identified. However, the cost for sulfur recovery is reduced. |
| Flaring                 | Syngas flaring tower is located in the Tianjin Akali chemical plant. The Tianjin IGCC and the Akali chemical plants will share the flaring tower. | The Tianjin IGCC plant built its own syngas flaring tower within the project site.                     | The Tianjin IGCC plant will have better control and management for emergency flaring.                  |
9. The China Huaneng Group (CHNG), the executing agency (EA) of the project, identified a pilot “Carbon Capture, Utilization, and Storage (CCUS)” project at the Tianjin IGCC project site. The pilot CCUS project will capture up to 100,000 tons of pre-combustion carbon dioxide (CO₂) from the Tianjin IGCC plant, use up to 20,000 tons of CO₂ for enhanced oil recovery, and store the rest in a geological site. On 12 January 2012, a memorandum of understanding was signed between CHNG and the ADB. An agreement has been reached which contains the inclusion of the pilot CCUS project in the Tianjin IGCC loan project—the provision of grant by the ADB to finance the transport and storage of CO₂. To include the pilot CCUS in the current Tianjin IGCC project, the ADB will undertake a major change in scope. Once the detailed design of the pilot CCUS is completed, comprehensive due diligence will be conducted. As for a current schedule, the detailed design would be finalized in the second quarter of 2012 and the comprehensive environmental due diligence would be conducted in the third quarter of 2012.

D. Project Cost Associated with the Environmental Management Plan

10. The total project investment is CNY3.206 billion ($493.23 million). The total environmental investment of the Project is CNY257.10 million ($39.55 million), accounting for 8% of the total project investment. The environmental investment covers three waste-treatment facilities, an environmental monitoring station, accident precautions and emergency measures, and other facilities.

E. Implementation Organization

11. CHNG is the EA of the project. CHNG established GreenGen in 2005 for management support. GreenGen established Huaneng Tianjin IGCC Co. Ltd. (HTICL) in 2008 to develop the Tianjin IGCC plant project. HTICL is the implementing agency (IA) of the project. GreenGen has provided management support and oversight to HTICL. Establishing HTICL as a separate project entity (i) brought transparency, (ii) improved accountability and corporate governance, while taking a task force approach to project development that can ensure a strong management focus. GreenGen provided management support and oversight to HTICL, while supporting project implementation, particularly in relation to financial management, financial control, and accounting, and ensuring good governance of the project. GreenGen has been also responsible for liaising with CHNG. Figure 1 below describes the implementation arrangement of the project.

12. HTICL established a project implementation unit (PIU). PIC has regularly monitored and reviewed the project progress. HTICL also established an environmental management unit (EMU) to coordinate implementation of the environmental management plan (EMP) with contractors and the Tianjin Environmental Protection Bureau (EPB). The EMU oversaw the environmental management and monitoring during construction, including the environmental supervision of contractors. Actions taken by project institutions are provided in the Section III.
II. IMPLEMENTATION PROCESS

A. Overall Project Implementation Progress

13. The total duration of the project implementation is 36 months. As of 29 February 2012, 18 months have elapsed from the date of loan effectiveness (25 August 2010), accounting for 50% of the total duration of project implementation based on the original loan agreement.

B. Detailed Engineering Progress

14. The construction of the Tianjin IGCC power generation plant started on 6 July 2007. By February 2012, all the civil works and equipment installation had been completed. Individual testing of each component has commenced and in progress until the second quarter of 2012. A trial operation of all components of the project is scheduled during the month of June 2012, aiming to complete 72 hours of continuous testing.

15. Besides construction of the main components of the project, site cleansing and re-vegetation have been implemented: Most site treatment, including surface hardening with cement and ceramic tiles and re-vegetation with trees and grass has been completed. All the environmental protection facilities were installed, including residential and industrial wastewater systems, sulfur recovery system, and others. Table 2 summarizes the engineering progress of the Tianjin IGCC power generation project.

<table>
<thead>
<tr>
<th>Project Components</th>
<th>Summary Progress</th>
<th>Contractor/Implementer</th>
<th>Implementation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Huaneng Group Project Executing Agency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GreenGen Company Ltd.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Provide management support to CHNG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Supervise and oversight the HTICL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Huaneng Tianjin IGCC Co. Ltd. Project Implementing Agency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Components</td>
<td>Summary Progress</td>
<td>Contractor/Implementer</td>
<td>Implementation Status</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>I. Civil Works</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| A. Chemical Island Civil Works | 1. Air Separation Unit  
Air separation equipment was installed. Trial operation has been conducted.  
Sinopec No. 4 Construction Co.  
Completed  
2. Coal Gasifier  
Coal gasification system was installed. Trial operation of gasification will be conducted in May 2012.  
Sinopec No. 4 Construction Co.  
Civil work is Completed; Test is scheduled in May 2012.  
3. Fuel Delivery System  
Fuel delivery system has been installed. It is ready for use.  
Sinopec No. 4 Construction Co.  
Completed  
4. Syngas Cleaning  
All the equipment of syngas purification system have been installed. Necessary chemicals were loaded in the system and are ready for operation.  
Sinopec No. 4 Construction Co.  
Completed  
5. Sulfur and Ash Removal Facility  
Sulfur and ash removal facility have been constructed and are ready for operation.  
Sinopec No. 4 Construction Co.  
Completed  
6. Seawater Intake Pumping Station  
A pumping station for seawater intake has been constructed.  
No. 2 Engineering Co. of China Communication No.1 Shipment Bureau  
Completed  
7. Seawater supply pipeline  
Seawater supply pipeline has been installed.  
Henan Zhongyi Chemical Equipment Installation Co.  
Completed  
8. Seawater Cooling Tower Anticorrosion  
Anticorrosion measure for seawater cooling tower has been implemented.  
Dalian Good Anticorrosion Engineering Co.  
Completed  
9. Waste Water Disposal  
Both industrial and residential wastewater disposal systems have been constructed and are ready for operation.  
Jiangxi Jianglian Energy & Environment Co., Ltd.  
Completed  
| B. Power Island Civil Works | 1. Combined cycle Block  
The construction of the gas-steam combined cycle island has been completed in September 2011. The trial operation of the gas turbine was successfully conducted on 2 October 2011 using fuel oil. On 1 November 2011, the trial operation of the gas-steam combined cycle was conducted using fuel oil. The electricity generated was successfully fed into the local power grid.  
Tianjin Power Construction Co.  
Completed  
2. Heating  
Heat supply system has been constructed.  
Tianjin Power Construction Co.  
Completed  
3. Water Supply and Treatment facilities  
Water Supply and treatment facilities have been constructed. They are ready for use.  
Jiangxi Jianglian Energy & Environment Co., Ltd.  
Completed  
|
### II. Earth Works

1. **Site treatment**
   - Site treatment including surface hardening with cement and ceramic tiles and re-vegetation with trees and grass has been completed.

### III. System Testing/Trial Operation

1. **Coal gasification testing**
   - Preparatory work for coal gasifier is underway. The trial operation will be conducted in the middle of May 2012.
   - **Contractor/Implementer:** Huaneng Group Clean Energy Technology Research Co.
   - **Implementation Status:** Under progress

2. **Gas turbine testing and trial**
   - The trial operation of gas turbine was successfully conducted on 2 October 2011 using fuel oil.
   - **Contractor/Implementer:** Shanghai Electric Power Group
   - **Implementation Status:** Completed

3. **Gas-Steam combined cycle testing and trial**
   - On 1 November 1 2011, the trial operation of the gas-steam combined cycle was conducted using fuel oil. The electricity generated was successfully fed into the local power grid.
   - **Contractor/Implementer:** Xi’an Thermal Power Research Institute.
   - **Implementation Status:** Completed

4. **Air Separation system testing and trial**
   - The trial operation of the air separation system was conducted on 13 August 2011.
   - **Contractor/Implementer:** Xi’an Thermal Power Research Institute.
   - **Implementation Status:** Completed

5. **Gasifire testing and trial**
   - Ignition test for the combustion nozzles of the gasifier was successfully conducted on 16 December 2011. Oxygen injection into the gasification devise was tested on 17 December 2011.
   - **Contractor/Implementer:** Huaneng Group Clean Energy Technology Research Co.
   - **Implementation Status:** Completed

6. **All project systems**
   - Once the individual systems testing are completed, the trial operation for the whole plant will be conducted in 2012.
   - **Contractor/Implementer:** Huaneng Group Clean Energy Technology Research Co.
   - **Implementation Status:** Under preparation

### III. IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PLAN

#### A. Background

16. The EMP was developed aligning with the ADB safeguard policy environmental impact assessment (EIA) report of the Tianjin IGCC Project that was approved by MEP in July 2007. The EMP was agreed between the ADB and CHNG as a part of the loan agreement.

17. The loan covenants of the project stipulate the following agreements on environmental safeguards:

   (i) **HTICL, the implementing agency, will ensure that construction, operation, maintenance, and monitoring of project facilities is in strict conformity with (a) all applicable national and provincial environmental laws and regulations, the ADB’s Environment Policy (2002), and other national, provincial, and local laws and regulations and standards on environmental protection, health, labor, and occupational safety; and (b) all environmental mitigation and monitoring**
measures detailed in the design and construction contracts, the operational
guidelines, and the approved EIAs, summary EIA, and the EMP for the project.

(ii) HTICL will ensure that an adequate number of full-time personnel and sufficient
resources are provided to monitor the implementation of the environmental
monitoring program, under the guidance of the Tanggu Environmental Protection
Bureau (TEPB).

(iii) HTICL will ensure that TEPB will review any changes to the project design that
may have a potential for causing negative environmental impacts, so that
environmental monitoring and mitigation measures are adjusted accordingly in
consultation with ADB.

(iv) HTICL will submit regular monitoring reports to ADB and semi-annual
environmental reports in a format acceptable to ADB, until the loan closing date.

B. Implementation of Environmental Management and Monitoring Plan

18. The EMP indicates the roles and responsibilities of institutions involved in project. Table
3 summarizes the roles and responsibilities of institutions and the progress of their actions in
regard to the EMP.
Table 3: Summary of Institutional Arrangement and Actions Taken by Institutions

<table>
<thead>
<tr>
<th>Roles and Responsibilities</th>
<th>Actions Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHNG</td>
<td>• CHNG, the EA, has overseen the Tianjin IGCC power generation plant project.</td>
</tr>
<tr>
<td>• The executing agency</td>
<td></td>
</tr>
<tr>
<td>• Holds final responsibility of the EMP implementation</td>
<td></td>
</tr>
<tr>
<td>GreenGen</td>
<td>• GreenGen provided management support to project implementation to HTICL, particularly in relation to financial management, financial control, and accounting, and ensuring good governance of the project.</td>
</tr>
<tr>
<td>Huaneng Tianjin IGCC Co. Ltd.(HTICL) (IA)</td>
<td>• HTICL established the PIU, which regularly monitors and reviews the progress of the project.</td>
</tr>
<tr>
<td>• Establish an EMU</td>
<td>• HTICL established the EMU. The EMU oversaw environmental management and monitoring during construction and operation, including the environmental supervision of contractors. Mr. Liu Zhenghua, Deputy General Manager, was appointed for the management of the EMU, and Mr. Wu Zhihong and one staff with the project division were responsible for routine environmental management and monitoring during project construction period.</td>
</tr>
<tr>
<td>• Responsible for EMP implementation</td>
<td>• The EMU circulated the EMP to all construction contractors and included EMP due diligence as a part of contracts.</td>
</tr>
<tr>
<td>• Hire environmental monitoring units for EMP monitoring</td>
<td>• The EMU supported/supervised the contractors to be responsible for implementing the necessary environmental mitigation measures during the construction.</td>
</tr>
<tr>
<td>• Prepare EMP monitoring reports and submit them to ADB</td>
<td>• The EMU emphasized capability building in environmental management and monitoring. As part of their capacity building activities, HGC purchased state-of–art equipment for air quality, water quality, and noise monitoring. HGC established one testing laboratory within HGC, and hired eight staff for environmental monitoring. HGC installed continuous monitoring systems to monitor (i) tail gas emissions from waste heat boilers, and (ii) wastewater discharge from coal gasification wastewater.</td>
</tr>
<tr>
<td>Construction supervision companies (CSCs)</td>
<td>• In June 2011, HTICL hired several eligible companies for site treatment. They planted trees and grass, installed ceramic bricks, and built new landscape in the project area. By the end of February 2012, 80% of the project area completed the re-vegetation.</td>
</tr>
<tr>
<td>• Supervises all contractors to follow the EMP in order to ensure environmental protection measures to be properly implemented during the construction.</td>
<td>• As for CSCs, Beijing Zhongdalian Consulting Co. and China Chengda Engineering Co. were selected through competitive bidding. They provided close supervision to all contractors to follow the EMP and environmental protection measures and the construction process of environmental facilities.</td>
</tr>
<tr>
<td></td>
<td>• The CSCs have performed daily check to supervise the project construction. Coordination meetings among contractors, implementing agencies, and the CSCs have been conducted on a daily basis during the construction.</td>
</tr>
<tr>
<td></td>
<td>• The CSCs issued notices of action correction to contractors upon the occurrence of any noncompliant activity with the EMP.</td>
</tr>
<tr>
<td></td>
<td>• The CSCs, together with the implementing agency and contractors, had weekly and monthly meetings to discuss issues on work safety, environmental protection, and others. As for</td>
</tr>
<tr>
<td>CHNG = China Huaneng Group, CSC = construction supervision company, EMD = environmental management division, EMP = environmental management plan, EMU = environmental management unit, EPB = environmental protection bureau, HIPMC = Harbor Industrial Park Management Committee, IGCC = integrated gasification combined cycle, HGC = Huangeng GreenGen Co., PIU = project implementation unit.</td>
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</tbody>
</table>
| environmental protection, dust control, noise control, waste and wastewater treatment have been major topics.  
  - The CSC have prepared weekly and monthly supervision reports throughout the entire construction period, which indicate the status on construction quality, implementation progress, work safety and environmental protection. |
| **Contractors**  
  - Responsible for implementing the EMP during the construction  
  - The construction contractors were bound by their contracts to prepare their own EMPs for their construction site and follow them in their activities.  
  - The two major contractors are: (i) Tianjin Power Construction Co., responsible for the construction of power plant and utility facilities; and (ii) Sinochem No. 4 Construction Co., responsible for the construction of the coal gasification and air separation system. Both companies established an EMD which is headed by the Vice Presidents of each company. The EMD of Tianjin Power Construction Co. has three staff members, while Sinochem No. 4 Construction Co. has three to four staff members working at the so-called 'technology and quality department', who are responsible for the management of engineering quality and environmental protection. |
| **Environmental Monitoring Stations (EMS)**  
  - Conduct EMP monitoring and provide data to the IA  
  - The Tanggu EMS has conducted the monitoring of air, water quality, noise, ecological impacts, and solid waste treatment in the project area. The monitoring results have been sent to Tanggu EPB and the implementing agency.  
  - The China Hydropower Research Institute has conducted monitoring on water and soil loss in the project area. The monitoring results have been submitted to the Tianjin Water Bureau and the implementing agency.  
  - Tianjin Tanggu EPB and Harbor Industrial Park Management Committee have undertaken site inspections. The inspection results have been sent to the implementing agency. |
| **A loan implementation environmental consultant**  
  - Prepare environmental safeguards monitoring (EMP monitoring) reports  
  - Review environmental monitoring data and environmental management reports  
  - Mr. Zhu Chao was hired as a loan implementation consultant to review monitoring data and to prepare the EMP monitoring reports.  
  - Mr. Zhu prepared and submitted the first environmental monitoring report to the ADB on October 2009.  
  - Mr. Zhu has reviewed environmental monitoring data and is preparing the second environmental monitoring (EMP monitoring) report, which covers January 2011 and February 2012. |
| **Local EPB**  
  - Ensures the project comply with the PRC environmental laws, regulations, and standards  
  - The Tanggu EPB, together with HIPMC, conducted site inspections of the project site. |
C. Implementation of Mitigation Measures

19. The EMP lists measures to mitigate environmental adverse impacts of the project. This section provides the summary of the EMP and the highlights of the EMP implementation.

20. This section also presents the environmental clauses in the construction contracts between the IA and construction contractors. By including environmental mitigation measures in the construction contract, the implementing agency aimed to ensure that construction activities contained environmental management actions to minimize adverse environmental impact during construction phase.

1. Environmental Clauses in Construction Contracts

21. It is confirmed that all construction contracts contain the provisions on work safety and environmental protection. The environmental protection and work safety clauses are summarized in Box 1.

<table>
<thead>
<tr>
<th>Box 1. Important clauses in construction contracts</th>
</tr>
</thead>
</table>
| **Work safety:** The contractors are required to strictly follow the PRC laws and regulations on work safety. Precautionary measures should be taken in order to prevent any preventable accident. The contractors shall appoint their own work safety supervisor to take charge of occupational health and safety management. The contractor is liable for any bodily harm and property damage caused by construction activities on site and/or in the vicinities. The contractors shall report to the project owner and supervision engineer timely in case of the occurrence of any work safety accident. If an accident is serious, the contractors shall also report to a department of concern at the local government. In such case, an accident investigation will be carried out.

The contracts shall take proper measures to protect their workers’ health and safety. The contractors shall provide proper safety training to their workers; ensure all the workers to be well equipped with protective clothes and equipment. The contractors shall prepare and implement an emergency preparedness and response plan in relation to the use of flammables, explosives, and toxic and corrosive substances.

**Environmental protection:** The contractors are required to comply with all relevant laws and regulations on environmental protection in the PRC. They shall take precautionary measures to minimize any potential impacts on the environment. When they cause any impacts on the environment, they shall take full responsibility for restoring and rehabilitating the environment to its original environmental condition at their own cost.

The contractors shall prepare their own EMP and submit the plan to the construction supervision companies (CSCs) for approval before the commencement of construction. The contractors are required to take all the necessary measures to protect the environment in the project area. During the project construction, the contractors shall (i) timely dispose any rain water and wastewater; (ii) properly arrange all the devices and construction materials; and (iii) remove and transport all the waste materials, including temporary building structures that are no longer in use. The contractors are prohibited from bringing unapproved explosives, combustibles, and poisonous matters to the project site.

**Physical cultural relics:** All physical cultural relics that might be discovered at the construction sites would belong to the ownership of the state. The contractors shall immediately report any
such discovery to the CSCs and the local relics protection authority without any delay. The contractor shall take effective measures to protect the unearthed physical and cultural relics.

22. Contractors prepared and kept daily environmental records during the entire construction period. Mr. Chao, the loan implementation consultant for environmental issues, has reviewed all the daily environmental records at construction contractors and found no violation with the environmental clauses in the contracts.

2. Pollution Control and Mitigation Measures during the Project Implementation

23. The EMP indicates pollution control and mitigation measures for environmental assurance during the project construction and operation. As mentioned earlier, all the project components of the Tianjin IGCC power generation plant have been constructed. Presently, the implementing agency has been conducting technical check-up through individual testing of the project components. The entire component testing is scheduled by the end of May 2012. Table 4 presents the EMP during construction and the summary of actions taken by the project.
Table 4: The Environmental Management Plan (EMP) of the Tianjin IGCC Project and the Implementation Status of the EMP during the Construction Phase

<table>
<thead>
<tr>
<th>Impact</th>
<th>Mitigation Measures</th>
<th>Location</th>
<th>Responsibility</th>
<th>Implementation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Soil</td>
<td></td>
<td></td>
<td>Local EPB, HTICL-EMU, supervision</td>
<td>• Soil loss will be effectively controlled. Compacted topsoil was laid timely, and re-vegetation of exposed surface was implemented as planned;</td>
</tr>
<tr>
<td>1. Soil erosion</td>
<td>Laying compacted topsoil and re-vegetation of exposed surfaces as quickly as possible after construction as each area is completed; Installing sediment fences for temporary soil stockpiles; and Allowing sediment to settle in sedimentation ponds or storm water channels prior to discharge into Bohai Sea. Impact to soil from construction traffic will be minimized by confining traffic to predetermined roads. Spoil generated from construction activities will be stockpiled, dewatered, and used for landscaping where possible or removed from site to approved disposal areas. Sediment fences will be installed around spoil stockpiles.</td>
<td>Construction site</td>
<td>Contractors</td>
<td>China Hydropower Research Institute</td>
</tr>
<tr>
<td>2. Soil contamination</td>
<td>Installing oil separators at wash-down and refueling areas; Installing appropriate hazardous waste and hydrocarbon storage facilities at site, including secondary containment at fuel storage sites. All septic waste will be collected and removed from site. Spill cleanup equipment will be provided at each construction site, and training will be conducted regarding response procedures for emergency spills. All hazardous and other waste will be removed from site to approved waste disposal sites. There will be no onsite landfill.</td>
<td>Construction site</td>
<td>Contractors</td>
<td>China Hydropower Research Institute</td>
</tr>
</tbody>
</table>
### B. Wastewater

<table>
<thead>
<tr>
<th>1. Disposal of septic wastewater</th>
<th>During construction, septic water will be collected and disposed offsite, disposed of in the industrial park wastewater treatment facilities, or treated and recycled onsite. There will be no onsite septic seepage disposal system or direct discharge of sanitary waste to surface water.</th>
<th>Work camps</th>
<th>Contractor</th>
<th>Local EPB, HTICL-EMU, supervision company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Construction wastewater was treated by settling pond, the treated wastewater is reused onsite; • Septic wastewater was treated by septic tank, and treated wastewater is discharged to the Harbor Industrial Park Wastewater Treatment Plant.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Disposal of wash-down water</th>
<th>All equipment wash-down areas will have oil separators</th>
<th>Wash-down areas</th>
<th>Contractor</th>
<th>Local EPB, HTICL-EMU, supervision company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Oil separators were installed in all wash-down areas.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### C. Air Quality

<table>
<thead>
<tr>
<th>1. Dust generation</th>
<th>All major access roads will be paved, and water trucks will suppress dust on unpaved roads. Temporary soil stockpiles will be covered. Excavation will be limited when wind is greater than Grade 4. Construction workers will be forbidden to burn coal or firewood onsite.</th>
<th>Construction site, access roads</th>
<th>Contractor</th>
<th>Local EPB, HTICL-EMU, supervision company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• All major access roads were paved and water trucks were used to suppress dust; • Temporary soil stockpiles were covered properly; and • Coal and firewood were not burnt onsite</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### D. Noise

<table>
<thead>
<tr>
<th>1. Noise impacts</th>
<th>Equipment and machinery used in construction shall strictly conform to PRC and local noise standards. All equipment will be properly maintained to minimize noise. Noise emissions from the site will meet relevant national standards. Onsite noise monitoring will be undertaken to ensure compliance. Mitigation measures during construction for noise impacts on workers will include standard occupational health and safety practices to relevant PRC standards.</th>
<th>Project site</th>
<th>Contractor</th>
<th>Local EPB, HTICL-EMU, supervision company</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Equipment and machinery used during project construction conformed with PRC and local noise standard; • All equipment was maintained to minimize noise; • The noise emission met the requirements of the national standards; and • Personal protection measures were taken to reduce noise impact on workers.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### E. Solid Waste and Hazardous Materials

<table>
<thead>
<tr>
<th>1. <strong>Hazardous and nonhazardous waste</strong></th>
<th>All residential rubbish and waste building materials will be collected, stored onsite in appropriate storage facilities, and transported off site to approved disposal facilities. No onsite landfills will be developed. Impacts from the transportation and disposal of spoil may include spillage along access roads, creating hazards to vehicles and increased dust or mud on access roads. Trucks used for transporting spoil will be covered, and any spillage will be cleaned up immediately. Hazardous waste generated during construction will be collected and stored separately on site in approved facilities. Hazardous waste will be removed from site to approved hazardous waste-disposal facilities by a licensed waste transportation company.</th>
<th>Project site</th>
<th>Contractor</th>
<th>Local EPB, HTICL-EMU, supervision company</th>
</tr>
</thead>
</table>

- All residential rubbish and waste building materials were collected, stored onsite in appropriate storage facilities, and transported offsite to approved disposal facilities;
- No onsite landfill was developed.
- Trucks used for transporting spoil were covered;
- Hazardous waste from construction works was collected and stored separately onsite in approved facilities, and removed from site to approved hazardous waste-disposal facilities by a licensed waste transportation company; and
- Regular inspection for epidemic disease control and hygienic environment has been conducted.

### F. Social Impact

<table>
<thead>
<tr>
<th>1. <strong>Impact to livelihoods of residents</strong></th>
<th>Where possible, local labor will be used during construction. Local suppliers will be used where possible. Mitigation measures will include providing health education to workers and hygienic worker accommodation.</th>
<th>Nearby residents and construction workers</th>
<th>HTICL-EMU</th>
<th>HTICL-EMU</th>
</tr>
</thead>
</table>

A local company, Tianjin Power Construction Company, was selected to construct gas-steam combined cycle island for the project.

EMU = environmental monitoring unit, EPB = environmental protection bureau, HTICL = Huaneng Tianjin IGCC Co. Ltd.
D. Implementation of Environmental Monitoring Program

24. As part of the roles and responsibilities of the EMU in the EMP monitoring plan, The EMU has coordinated the EMP monitoring activities performed by the monitoring facility at GreenGen, the Tanggu Environmental Monitoring Station (EMS). The compliance monitoring based on the PRC laws and regulations is undertaken by the Tanggu EMS, the Tanggu EPB, the Tianjin Water Resource Bureau (WRB), HIPMC, and CHRI.

25. The EMP monitoring methods can be categorized into two. Field sampling is mainly for air quality, water quality, and noise and laboratory analysis of the field samples, which is undertaken by a licensed environmental institute. The field sampling and laboratory analysis for air, water and noise has been conducted by HTICL. Visual inspection was conducted for soil erosion, restoration of vegetation, and solid waste disposal. Field inspection has been performed by onsite environmental engineers of the contractors, CSCs, and HTICL-EMU officers.

26. As for air quality, the Tanggu EMS performed the monitoring during project construction on February 2012. Tanggu EMS is a certified monitoring station by Tianjin Quality and Technical Supervision Bureau, comprising of qualified monitoring personnel. The monitoring methods used in the monitoring station strictly follow the national standards and analysis devices comply with technical requirements of relevant state standards. Raw data collected from monitoring sources went through three layers of review systems: After correction and verification, a technical person in charge performed final data determination. The final monitoring results were reported to the local environmental management department on a regular basis.

27. The air quality monitoring station located in the Harbor Industrial Park has a continuous analyzer. Another monitoring station is under construction and is scheduled to be fully operational in early 2012. The air quality monitoring results by the continuous analyzer will be sent automatically to the database in the Tanggu EMS. The Tanggu EMS has prepared monitoring reports and submitted them to the Tanggu EPB.

28. As for soil, CHRI is designated to monitor soil erosion caused by the project. CHRI has Grade-A Certification on Soil Erosion Monitoring, which was issued by the Ministry of Water Resources on July 2008. CHRI has prepared soil erosion monitoring reports and submitted them to the Tianjin WRB.

29. Table 5 provides the EMP monitoring framework of the Tianjin IGCC power generation project and the summary of implementation status.

<table>
<thead>
<tr>
<th>Item</th>
<th>Authority</th>
<th>Monitoring Framework</th>
<th>Monitoring Frequency</th>
<th>Implementation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. During Construction</td>
<td></td>
<td></td>
<td></td>
<td>PM$_{10}$, SO$_2$, NO$_2$, have been monitored through a continuous analyzer during January 2011 and February 2012. Through an active integrated sampler, TSP concentration samples were collected during the month of February 2012.</td>
</tr>
<tr>
<td>Item</td>
<td>Authority</td>
<td>Monitoring Framework</td>
<td>Monitoring Frequency</td>
<td>Implementation Status</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>1. Solid Waste</td>
<td>Local EPB</td>
<td>Disposal of hazardous and other waste</td>
<td>Monthly inspection</td>
<td>Daily check was conducted by supervision companies, quarterly checked by local EPB and the Harbor Industrial Park Management Committee.</td>
</tr>
</tbody>
</table>

**B. During Operation**

<table>
<thead>
<tr>
<th>1. Wastewater discharge quality</th>
<th>Local WRB</th>
<th>pH, SS, COD, BOD5, metals, scan, NH3-N, water flow, TPH</th>
<th>Weekly, online COD monitoring</th>
<th>N/A (operation has not started)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Air quality</td>
<td>Local EPB</td>
<td>CO, SO2, NOx, PM10</td>
<td>Twice every year at site boundary</td>
<td>N/A (operation has not started)</td>
</tr>
<tr>
<td>2. Emission monitoring</td>
<td>Local EPB</td>
<td>CO, H2S, SO2, NOx, PM10</td>
<td>Online monitoring for flue gas from gas turbine</td>
<td>N/A (operation has not started)</td>
</tr>
<tr>
<td>3. Air quality at the slag yard</td>
<td>Local EPB</td>
<td>Noise at site boundary</td>
<td>Twice every year</td>
<td>N/A (operation has not started)</td>
</tr>
<tr>
<td>4. Ground water quality at slag yard</td>
<td>Local EPB</td>
<td>TSP</td>
<td>Twice every year</td>
<td>N/A (operation has not started)</td>
</tr>
<tr>
<td>5. Filtrate at slag yard (discharge point)</td>
<td>Local EPB</td>
<td>H2S</td>
<td>Monthly</td>
<td>N/A (operation has not started)</td>
</tr>
</tbody>
</table>

BOD5 = biological oxygen demand (5 day), CO = carbon monoxide, COD = chemical oxygen demand, EPB = environmental protection bureau, H2S = hydrogen sulfide, NH3-N = ammonia, NO2 = nitrogen dioxide, NOx = nitrogen oxide, pH = acidity measure, PM10 = particulate matter below 10 microns, SO2 = sulfur dioxide; SS = suspended solids, TPH = total petroleum hydrocarbons, TSP = total suspended particles, WRB = water resources bureau.

*Ongoing wastewater-monitoring parameters will be determined in consultation with the local WRB after analysis of initial screening.*


30. As for air quality monitoring, additional SO2 and NO2 monitoring was conducted during the project construction phase. PM10 has been also monitoring using a continuous analyzer. As for solid waste, daily check was performed in order to ensure proper disposal of both hazardous and nonhazardous waste by the CSCs. The Tanggu EPB and HIPMC also conducted quarterly inspections on solid waste disposal. It is concluded that the environmental monitoring program has been implemented properly as agreed in the EMP monitoring plan.

**E. Information Disclosure**

31. A project information bulletin board is erected at each construction site as well as at the main gate of the Tianjin IGCC plant. The bulletin board contains a description about the project component, layout map, construction safety, labor standards, environmental and health standards, name of the contractor(s) and supervision companies.

32. GreenGen initiated and assigned a staff to address all potential complaints for both construction and operation phases. The designated staff is assigned to set up a complaint registry, promptly investigate any complaint associated with the project, and record the details and nature of a complaint, the complainant, the date and actions taken as a result of the investigation. The designated staff coordinated with local environmental bureaus, both Tianjin and Tanggu EPB to deal with any complaints raised by local organizations and residents.

33. Based on discussion with local government environmental management departments and the IA, it is confirmed that by the end of February 2012 there has been no environmental
infringement recorded during the project construction. No environmental complaint from local residents and others was received.

IV. ENVIRONMENTAL MONITORING

34. The project environmental monitoring framework defines the types of monitoring during construction and operation. This section presents the progress of environmental monitoring framework in details and the summary of environmental monitoring results.

A. Monitoring Under the Environmental Monitoring Framework of the Project

1. Air Quality Monitoring

35. During project construction, total suspended particulate (TSP) is identified as a main pollutant of concern. As indicated in the EMP, a local EPB is responsible for TSP monitoring on a monthly base. During January 2011 and February 2012, air quality has been monitored by the Tanggu EMS. The monitoring point is located 100 meters northeast of the project site, which is within the boundary of the Harbor Industrial Park. PM$_{10}$, SO$_2$, and NO$_2$, have been monitored through a continuous analyzer during January 2011 and February 2012. Monitoring results, summarized in Table 6, show that air quality based on daily average still meets the Class II air quality standard (GB3095-1996). Through an active integrated sampler, HGC also collected TSP concentration samples in three different locations within the project construction site during the month of February 2012. Three locations are right next to the power generation cooling tower, cooling tower of coal gasification island, and air separation workshop.

36. As Table 7 shows, the results of TSP monitoring confirmed that TSP concentration did not exceed the Class II air quality standard. As the class III standard of the Ambient Air Quality Standard (GB3095-1996) is generally applied for industrial area in the PRC, it is concluded that the project area have better air quality than other similar industrial areas. It is also concluded that the project construction did not cause any serious adverse impact on ambient air quality.

### Table 6: Air Quality Monitoring Results

<table>
<thead>
<tr>
<th>Date</th>
<th>PM$_{10}$</th>
<th>SO$_2$</th>
<th>NO$_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily average</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 November 2010</td>
<td>0.11496</td>
<td>0.04457</td>
<td>0.03984</td>
</tr>
<tr>
<td>13 December 2010</td>
<td>0.09848</td>
<td>0.03571</td>
<td>0.05072</td>
</tr>
<tr>
<td>8 February 2011</td>
<td>0.09144</td>
<td>0.04029</td>
<td>0.05483</td>
</tr>
<tr>
<td>23 May 2011</td>
<td>0.09911</td>
<td>0.01057</td>
<td>0.04456</td>
</tr>
<tr>
<td>27 June 2011</td>
<td>0.09499</td>
<td>0.01114</td>
<td>0.03101</td>
</tr>
<tr>
<td>27 July 2011</td>
<td>0.09128</td>
<td>0.00686</td>
<td>0.02711</td>
</tr>
<tr>
<td>27 August 2011</td>
<td>0.04544</td>
<td>0.01257</td>
<td>0.02013</td>
</tr>
<tr>
<td>18 September 2011</td>
<td>0.10135</td>
<td>0.04257</td>
<td>0.03635</td>
</tr>
<tr>
<td>24 October 2011</td>
<td>0.07966</td>
<td>0.02743</td>
<td>0.03121</td>
</tr>
<tr>
<td>5 November 2011</td>
<td>0.10742</td>
<td>0.10143</td>
<td>0.03409</td>
</tr>
<tr>
<td>25 December 2011</td>
<td>0.08805</td>
<td>0.02657</td>
<td>0.03779</td>
</tr>
<tr>
<td>Class II standard (GB3095-1996)</td>
<td>0.10</td>
<td>0.06</td>
<td>0.12</td>
</tr>
<tr>
<td>Class III Standard</td>
<td>0.15</td>
<td>0.10</td>
<td>0.12</td>
</tr>
</tbody>
</table>

m$^3$ = cubic meter, mg = milligram, NO$_2$ = nitrogen dioxide, SO$_2$ = sulfur dioxide, PM$_{10}$ = particulate matter below 10 microns.

Source: Tanggu Environmental Monitoring Station, 2011.
Table 7: TSP Monitoring Results (Daily Average)  Unit: mg/m³

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Monitoring date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power generation cooling tower (CC tower)</td>
<td>0.10</td>
</tr>
<tr>
<td>Cooling tower of coal gasification island (IG tower)</td>
<td>0.13</td>
</tr>
<tr>
<td>Air separation workshop</td>
<td>0.10</td>
</tr>
<tr>
<td>Class II standard (GB3095-1996)</td>
<td></td>
</tr>
<tr>
<td>Class III standard</td>
<td></td>
</tr>
</tbody>
</table>

Note: CC tower is the power generation cooling tower, IG tower is the cooling tower of coal gasification island.
Source: Huaneng GreenGen Co.

2. Solid Waste Monitoring

37. As indicated in the EMP monitoring plan, the CSCs have conducted daily check on proper disposal of hazardous and nonhazardous waste. Daily checks done by the CSCs confirmed that all residential rubbish and waste building materials were collected, stored onsite in appropriate storage facilities and transported offsite to appropriate disposal facilities. No onsite landfill was operated.

38. Trucks used for waste transportation were covered at all times. Any spillage during transportation was cleaned up immediately. Hazardous waste generated during the construction period was collected and stored separately onsite in a secure facility that was designated for temporary storage. A licensed waste management contractor transported it to the hazardous waste treatment facility located in Tanggu district.

B. Additional Monitoring

1. Water and Wastewater

39. Water used for the project construction was supplied by a local water supply company. Ground water has not been extracted during the project construction.

40. As mentioned in the implementation status of the EMP, septic wastewater from the temporary office building and construction workers’ camps was collected and disposed properly to the onsite septic seepage disposal system throughout the project construction period. Treated wastewater is sent to the Harbor Industrial Park Wastewater Treatment Plant. Regular inspection confirmed that there was no direct discharge of residential wastewater to surface water. In addition, all equipment wash-down areas were equipped with oil separators. The construction wastewater generated was very small amount and the wastewater was properly treated before discharge to the Harbor Industrial Park Wastewater Treatment Plant.

2. Dust

41. Mitigation measures to control dust during the project construction were properly implemented. Regular inspections confirmed that no serious dust issue occurred during the project construction.
3. Noise

42. Noise impacts were additionally tested. On February 2012, noise monitoring was conducted and the monitoring results are shown in Table 8. The monitoring results show that the noise level during the construction phase was lower than the Emission Standard of Environmental Noise for Boundary of Construction Site (GB12523-2011).

Table 8: Noise Monitoring Results

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>Monitoring Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC tower</td>
<td>40.9</td>
</tr>
<tr>
<td>IG tower</td>
<td>41</td>
</tr>
<tr>
<td>Air separation workshop</td>
<td>45</td>
</tr>
<tr>
<td>Daytime Noise emission standard</td>
<td>70</td>
</tr>
<tr>
<td>Nighttime Noise emission standard</td>
<td>50</td>
</tr>
</tbody>
</table>

Note: CC tower is the power generation cooling tower and IG tower is cooling tower of coal gasification island.
Source: Huaneng GreenGen Co.

4. Soil loss

43. The affected area for soil loss was estimated around 38.36 hectares (ha). During the project construction, the actual disturbed land area was 35.18 ha. Soil loss monitoring has been focusing on the implementation of soil loss control measures at the project site. Regular inspections for soil loss confirmed that all the construction companies strictly followed the construction standards, and actively carried out soil prevention measures following the designed construction arrangements. The soil prevention measures were implemented along with the construction of main components. The project construction strictly followed the “Implementation Options for Soil Erosion Control for the Tianjin IGCC Project” Site inspections by supervision companies and the CHRI confirmed the full compliance of implementing soil erosion control measures.

44. The results of soil loss monitoring show that the amount of soil loss was 3,533 tons in 2009; 1,480 tons in 2010; and 691 tons in 2011. As for site treatment, re-vegetation was implemented during October 2010 and December 2011. Trees and grass were planted over an area of 7.72 ha. By February 2012, the disturbed land area had been effectively treated and soil loss was successfully controlled.

V. CONCLUSIONS AND RECOMMENDATIONS

45. During the period of this report, all civil works and equipment installation were completed. During the project construction, the contractors fulfilled their contractual obligations to protect the environment by fully implementing the mitigation measures; and minimizing the environmental impact during the project implementation.

46. Proper institutional arrangements to implement the EMP and EMP monitoring plan were established. The IA established the EMU and has assigned three staff including one deputy general manager in charge of the implementation of the EMP.

47. Environmental provisions have been included into all the construction contracts. Field check by engineers from two supervision companies and project owner were conducted on a

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1 Under the PRC laws, this report has to be prepared and approved by the Tianjin Water Resource Bureau.
regular basis. Project and contact information has been posted in the bulletin boards at all construction sites. Monitoring results and site inspection confirmed that the contractors have complied with the EMP requirements. Daily environmental records confirmed that no serious environmental issues have occurred during the project construction.

48. HGC established the environmental monitoring facility as a part of their environmental management capacity building activities. The EMP monitoring and the compliance monitoring have been conducted by the GreenGen monitoring facility, the Tanggu EMS, CHRI, and the HIPMC. Environmental monitoring during the project construction phase has been properly conducted in accordance with the EMP monitoring plan.

49. By the end of February 2012, the project followed the EMP and its monitoring plan. No violation and noncompliance with the PRC environmental laws and regulations were found during the project construction. No environmental complaints were received during the project construction phase.

50. Currently, the project is conducting individual and combined equipment testing. After completion of systems testing, the project will perform trial operation until the end of 2012. It is recommended that the project should continue implementing the EMP and EMP monitoring plan throughout the entire testing and trial operation periods.
APPENDIX: Photos of the Project Site

Figure A-1: Re-vegetation of project site  (8 December 2011)

Figure A-2: Treated construction site at power generation island (8 December 2011)
Figure A-3: Cooling tower of power generation island (8 December 2011)

Figure A-4: Slag bin for coal gasification system (8 December 2011)
Figure A-5: Coal gasification system (8 December 2011)

Figure A-6: Buildings for wastewater treatment system (8 December 2011)
Figure A-7: Pool for wastewater treatment system (8 December 2011)

Figure A-8: Main road of Tianjin IGCC project site (17 January 2012)
Figure A-9: Syngas desulfurization system (8 December 2011)

Figure A-10: Boiler water desalting system (17 January 2012)
Figure A-11: Coal bins for feed coal supply to coal gasification island (17 January 2012)

Figure A-12: Waste heat boiler at gas-steam combined cycle island (17 January 2012)
Figure A-13: Environmental monitoring lab (22 February 2012)

Figure A-14: Sign for work safety (22 February 2012)
Figure A-15: Bulletin at construction site of coal gasification island (22 February 2012)