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## **The Final Report for Metal Casting Replication Projects for Energy efficiency (1) (Tianjin)**

**CONTRACT No:** 05/071

**UNIDO PROJECT NUMBER:** ED/CPR/99/G31

**REPORT PREPARED BY:**

**Agro-environmental Protection Institute of Ministry of  
Agriculture**

**REPORT DRAFT BY:** Cheng Bo

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# Catalog

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<b>1</b>	<b>PROJECT BACKGROUND</b> .....	<b>2</b>
<b>2</b>	<b>PROJECT TASKS</b> .....	<b>2</b>
<b>3</b>	<b>PROJECT PERFORMANCE AND ACHIEVEMENTS</b> .....	<b>3</b>
3.1	PROJECT TEAM.....	3
3.2	PROJECT PERFORMANCE .....	5
3.3	ENERGY CONSERVATION AND EMISSIONS REDUCTION RESULTS.....	13
3.4	CAPITAL ALLOCATION AND COST BREAKDOWN .....	16
3.5	ECONOMIC BENEFIT .....	18
3.6	ACCEPTANCE LETTERS (SEE ATTACHMENT) .....	19
<b>4</b>	<b>SOCIAL BENEFIT</b> .....	<b>19</b>
4.1	CONTRIBUTE TO FINALIZING THE CORRESPONDING POLICY, LAW AND REGULATIONS .....	19
4.2	STIMULATE THE GOVERNMENT TO ISSUE NEW ENCOURAGING POLICY AND ASSIST FOUNDRIES TO OBTAIN GOVERNMENT FINANCIAL SUPPORT.....	20
4.3	SPUR THE OTHER FOUNDRIES TO CARRY OUT TECHNOLOGICAL TRANSFORMATION .....	21
<b>5</b>	<b>PROJECT REPLICATION POTENTIALITY</b> .....	<b>21</b>
<b>6</b>	<b>EXPERIENCES AND ACHIEVEMENTS</b> .....	<b>22</b>
<b>7</b>	<b>ATTACHMENTS</b> .....	<b>23</b>

## foreword

To remove key policy, market, technology, and financial barriers to the adoption of energy-efficiency technologies in the brick, cement, metal casting and coking sectors, for better to reduce greenhouse emissions, the project funded by GEF entitled "Energy Conservation and Greenhouse Gas Emissions reduction in Chinese TVEs (II phase)" is carried out in China.

This subcontract entitled "Metal Casting Replication Projects for Energy Efficiency (4)" under the project "Energy Conservation and Greenhouse Gas Emissions reduction in Chinese TVEs" has selected 7 foundries as replication enterprises to make technological transformation in Tianjin to reduce energy consumption and greenhouse gas emissions by upgrading energy efficiency and product quality.

From the start of the subcontract (Oct. 18, 2005) to the completion, the subcontractor has fulfilled all the service tasks under the TOR of the contract. We assist the 7 foundries adopt the energy conservation technologies and realize the projected energy saving target.

This document is draft final report of the project referred to as Metal Casting Replication Projects for Energy efficiency (1) (Tianjin)(UNIDO contract No: 05/071) that shall be submitted to UNIDO and GEF by AEPI (hereinafter refer to as subcontractor)

## **1 Project Background**

Funded by UNIDO, UNDP and GEF, the project entitled "Energy Conservation and Greenhouse Gas Emissions reduction in Chinese TVEs" aims to remove key policy, market, technology, and financial barriers to the adoption of energy-efficiency technologies in the brick, cement, metal casting, and coking sectors. By utilizing and replicating of energy-efficiency technology and products in above sector to reduce greenhouse gas emissions, thereby alleviating global greenhouse effect that China and World as a whole will benefit from the better cleaning-up environment.

The project "Energy Conservation and Greenhouse Gas Emissions-reduction in Chinese TVEs" has selected pilot plants in above four sectors for technology demonstration, including the Dalian Jinmei cast Pipe Co. Ltd. in Liaoning Province and Nanjing Moling Foundry in Jiangsu Province, etc. This subcontract entitled "Metal Casting Replication Projects for Energy Efficiency (1)" has selected 7 foundries as replication enterprises in Tianjin. The project is intended to replicate the successful experiences and best practices of the pilot plants to improve energy efficiency and product quality in the selected TVEs. Furthermore, popularize the effective experiences and technology to the more foundries in metal casting sector.

For replication project in the metal casting sector, UNIDO and the Project Management Office (PMO) of the Ministry of Agriculture have identified about 7 potential foundries in Tianjin that are willing and qualified to participate in project replication.

## **2 Project tasks**

The tasks under this subcontract consist of two parts. Part One involves consulting services for 7 potential replication foundries, including carrying out a plant-level assessment, preparing a project proposal and feasibility study report, and setting up a plant-wide management system. Part Two involves engineering services to

implement the 7 replication projects, including engineering design and construction, equipment purchase and installation, and personnel training.

### 3 Project performance and achievements

#### 3.1 Project team

AEPI assigns the most efficient and qualified personnel in our institute, with rich experiences in aspects of international project management, technical renovation of energy-efficiency and GHG emission reduction, production management, environmental management as well as pollution control. The expert team involved in the engagement is composed of 11 key individuals from TVEs Energy Efficiency & Environmental Protection Center in AEPI.

Mr. Chengbo, Director of TVEs Energy Efficiency & Environmental Protection Center is appointed as the Team Leader and Mr. Pan Baojun as the Project Technical Adviser. The key individuals involved in this engagement are shown in Table 2.

Table 1 the project team

No.	Name	Professional title	Assignment
1	Cheng Bo	Senior Engineer, Registered Consultant	Team leader, in charge of project planning and execution, co-financing of the TVEs, management system and final report
2	Pan Baojun	Senior Engineer	Technical Advisor General, Responsible for general technical issues, project plan review and engineering implementation and trainings
3	ZhangZe	Engineer	Production process design, feasibility study report, interim progress report
4	Xiao Jie	Engineer	Budget analysis and equipment procurement, installation and commissioning
5	ChangYuhai	Senior Engineer	Electrical design, feasibility study, engineering design/drawings and technical training
6	Mi Changhong	Senior Engineer	Copular design, feasibility study, engineering design/drawings and project supervision

7	Li Yuming	Engineer,	Mechanical design, feasibility study, engineering design/drawings and management system development
8	Chen Ling	Engineer,	Electrical design, feasibility study and engineering design/drawings
9	Gao Hongfu	Senior Engineer	Technical plan and feasibility study reviewing, training material review and on site advisory
10	Pang fengrong	Professor	Technical plan and feasibility study reviewing, training material review and on site advisory
11	Wang shida	Senior Engineer	Technical plan and feasibility study reviewing, training material review and on site advisory

For the best of the project, a review expert team is organized to review the feasibility study and the draft renovation plan for each of the TVEs thereby achieving the project objectives required in TOR. 3 national celebrated experts in metal casting sector are invited to take part in the review team to ensure the optimized plan of reduction of energy consumption and GHG emission that is adaptive to each TVEs respectively. The experts are also in charge of reviewing the training materials and on site technical advisory. Details of the expert see Table 2 below.

**Table 2: Detail information of the experts**

Name	Information			
Gao Hongfu	Specialty	Metal Casting	Professional title	Senior Engineer
	Position	Vice-chairman, Secretary General of Tianjin Metal Casting Association		
Pang Fengrong	Specialty	Metal Casting	Professional title	Professor
	Position	Director of Mechanical Engineering Department in Tianjin Science and Engineering College		
Wang shida	Specialty	Mechanics	Professional title	Professor
	Position	Professor of Tianjin Digital Control & Transmission Technology Institute, Deputy Secretary General of Tianjin Metal Casting Association		



## **3.2 Project performance**

### **3.2.1 Project performance**

According to the contract, the project team has carried out 11 activities and successfully provided consulting and engineering services to 7 replication foundries. The following deliveries are produced in the project progress periods:

#### **The 1st progress report (September of 2006)**

Energy efficiency evaluation reports for 7 foundries  
Energy- efficiency technological transformation feasibility study reports for 7 foundries

#### **The 2nd progress report (December of 2006)**

Technical renovation plans and design drawings for 7 foundries

#### **The 3rd progress report (March of 2007)**

Training materials  
Enterprise energy efficiency management system and rules

#### **The draft final report (March of 2007)**

#### **The final report (April of 2007)**

### **3.2.2 Activities carried out**

On 10th November of 2005, Project manager Mr. Cheng Bo and technical advisor Mr. Pan Baojun Visit the PMO, Ministry of Agriculture to have a presentation, briefing the work schedule and the measures would be taken.

On 23rd November of 2005, arrange kick off meeting in Jinnan District, Tianjin, in which AEPI, the PMO, Beijing Hongyuan Co, LPIC of Jinnan (Jinnan Industrial Committee) and 7 beneficial foundries took part in, finalizing the responsibilities, work scope and division of the subcontract. The inception report is formulated accordingly.

The following is briefing the activities we have carried out.

### **Task one: consulting services**

The expert team has provided consulting services with 7 replication foundries, including carrying out a plant-level assessment, preparing a project proposal and feasibility study, and setting up an adaptable plant-wide management system. 7 key activities are conducted based on above services.

#### **Activity 1: Summarize the experiences and achievements of pilot plants and replicate to 7 foundries by means of training**

Project technical advisor Mr. Pan Baojun and team member Mr. Zhang Ze summarize the experiences and achievements of Dalian Jinmei Cast Pipe Co. Ltd. and Nanjing Moling Foundry to replicate them to the 7 foundries by promotion activities. The above work is completed on 25th November of 2005.

#### **Activity 2: Plant -level evaluations**

The team members, according to their professional backgrounds, prepare specific investigation lists considering production process, facilities and equipments, raw material consumptions, energy efficiency level, quality management and financial information, etc in advance and make concrete survey by means of data analysis and on-site investigation. On basis of that, conduct plant-level all round evaluations. The above work is finished on 6th December of 2005, and formulates 7 evaluation reports accordingly (see first progress report). We can see from the evaluation results that melting and machining requirements are differed due to their varied products in each of the 7 foundries. As a result, energy consumption per unit for each foundry has difference. Table 3 shows the energy consumption figure in each foundry before technological transformation.

**Table 3 Energy consumption statistics before technological transformation**

Foundry name	Total energy consumption t standard coal	Output before technological transformation t casting	Energy consumption per unit t standard coal/t casting	Total coke consumption proportion %
Baitangkou Foundry	446.71	3000	0.149	93
Bohai (Group) Hengtong Valve Co. Ltd	1144.0	5000	0.229	59
Dazhan Valve General Plant	1196.96	5000	0.239	58
Huiyuan Metal Products Plant	580.27	3000	0.193	81
Juyuan foundry	329.26	2500	0.132	80
Kaiyuan No.3 Valve Co. Ltd.	458.10	2800	0.164	71
Xinhai Paper-making Machinery Co. Ltd	498.39	1800	0.277	80

Generally, 7 replication foundries have common characteristics in small economic scale, low skill standard and rough management. Backward technology, unsteady product quality, high material consumption and low energy efficiency of these self-financing TVEs brought negative impact on natural environment and economic benefit. Besides, weak management mechanism and low managing standard leave wide space for energy conservation. A set of scientific management system has not been sound and perfect yet, and standardized system of energy conservation has not been set up either. The policy-maker and administrators were lack of energy saving knowledge. The specialized director who engaged in energy management and energy efficiency technology promotion was not been assigned. Insufficient equipment maintenance and weak management system caused negative results, such as unsteady product quality, irrational discharge and severe energy consumption. Apart from that, the iron, rejected steel and coke discharged in the process of production were not been collected, that brought energy consumption and environment contamination to a certain degree.

### **Activity 3: Propose renovation measures and investment plan**

Based on the information collected in the investigation and evaluations, conduct a comprehensive assessment considering upgrading product quality and economic profit while reducing energy consumption and GHG emission. Furthermore, propose a preliminary technical renovation plan for each TVEs stipulating renovation feasibility and projected data (data of energy savings and GHG emission reductions) With mutual exchanging and repeated negotiations with plant managements, provide a list of measures and investments accordingly to TVEs to upgrade the existing production technologies and equipment, which will result in improved product quality, less energy consumption, and a more profitable enterprise. The technological transformation scheme in each foundry is finalized according to the following principle:

- Considering the manufacture scale, technological base, economic power and each foundry desire, select the adaptable energy saving technologie
- Excavate energy conservation potentiality in managing aspects, set up energy efficiency management system and promote long term and institutionalized energy efficiency training

On basis of the energy efficiency evaluations and project team investigation, in fully consultation with the plant management, the technological transformation contents in the following Table 4 are finalized as well as energy efficiency management system establish. The work is finished on 20th December of 2005.

**Table 4 main technological transformation contents**

Foundry name	Technological transformation content
Baitangkou Foundry	Retrofitting the cold blast cupola into a 3t/h hot blast cupola; introducing three molding machines
Bohai (Group) Hengtong Valve Co. Ltd	Purchasing new 3t/h and 5t/h hot blast cupolas to replace the original cold cupolas; building electrical furnace cooling water waste heat retrieve system
Dazhan Valve General Plant	Retrofitting 3t/h and 5t/h cold blast cupolas into high efficient hot cupolas; purchasing one new molding machine
Huiyuan Metal Products Plant	Introducing a new 3t/h hot cupola to replace the old 5t/h cold cupola, and purchasing 2 new molding machines
Juyuan foundry	Purchasing a new 3t/h hot blast cupola to replace the one original 2t/h cold cupola
Kaiyuan No.3 Valve Co. Ltd.	Purchasing a new 5t/h hot blast cupola to replace the original cold cupola
Xinhai Paper-making Machinery Co. Ltd	Purchasing a new 7t/h hot blast cupola to replace the original two 5t/h cold cupolas

**Activity 4: Develop project proposal and feasibility study report**

Considering different situations of each foundry, make repeated assessment on the investigation data and preliminary renovation plan, draft 7 project proposals accordingly. With team preliminary proof and approval of the plant management, develop 7 feasibility study reports. Lead by Mr. Cheng Bo and Mr. Pan Baojun, other team members prepare relevant chapters according to their backgrounds and assignments. The work is completed on 10th January of 2006. Output for the activity is 7 project proposals and 7 feasibility study reports. (See first progress report)

**Activity 5: Devise Technical renovation plan for each TVE and confirmation of co-financing placement**

According to the projected energy saving data required in the TOR for Energy Conservation and Greenhouse Gas Emissions reduction in Chinese TVEs(Phase II), the expert team formed by 3 celebrated experts in metal casting industry in China is responsible to review the draft report in order to make a perfect technical plan. In combination with the expert reviewing, repeated consultation with the

plant to ensure that the proposed renovation plan is fully agreed by the plant management and that co-financing can be arranged to implement the project. The work is finished on 17th January of 2006, and the output for the activity is 7 confirmation letters. (See first progress report)

**Activity 6: Draft management system framework**

Combining modernized managing concept and measures with enterprises' practical conditions, we have proposed a framework of the management system, which content is put in such aspects as energy management, quality control, production management and personnel training especially. In the meantime of construction, we assist each enterprise to set up a set of rules and regulations, including various production standards and corresponding post responsibility. The work is completed on 27th June of 2006. The 7 management system catalogs see third progress report.

**Activity 7: Organize the replication foundries to participate in project promotion activities**

During the period, our team has organized 7 replication foundries to participate in project relevant training activities four times. The first energy efficiency training was presided over by PMO in the later half of 2005 at Tianjin Junyue Hotel. The second activity was in April of 2006 at Industrial committee in Jinnan District, which Mr. Staff as a casting expert was invited to participate in by the local government. Other two activities was held by LPIC and AEPI in June and August of 2006 at Jinnan District, in which 3 celebrated metal casting experts and the plant managements were invited to exchange energy-conservation experiences.

**Task one** has been fulfilled through the above mentioned 7 activities. According to subcontract requirement, inception and the first progress reports have been submitted to PMO while the team leader and relevant experts went to Beijing to report accordingly. Parts of Activity 6 and Activity 7 are carried out after the completion of engineering construction for better performance. As a result, the first progress report is excluded Activity 6 and Activity7.

### **Task two: engineering services**

The team has successfully provided engineering services with 7 replication foundries, including engineering design and construction, equipment purchase and installation, and personnel training. Six key activities are carried out based on above services.

#### **Activity 8: Engineering design, assistance in preparation for project implementation**

The expert team conduct engineering design for each TVEs based on the approved feasibility study and implementation plan. On 14th March of 2005, the team provided preliminary engineering design drawings, after consulting with the plant, one week later, the final designing drawings were delivered to the foundries; later the team revise production scheme in accordance with market demand to avoid construction influence on regular production and sales as less as possible; Coordinate relations among enterprises, designers, constructors and equipment suppliers, assist enterprises in preparation for relative works to make sure of smooth construction. Besides, inspect co-financing by the TVEs to make sure that it is places in line with project schedule. The 7 engineering construction design drawings see the second progress report.

#### **Activity 9: Equipment procurement, installation and commissioning, trial tests**

According to the exact requirement of each TVE, assign professional experts to the construction site to provide on-site whole process supervision. As long as the problems produce, we are able to advise and resolve immediately. We direct, supervise and facilitate TVEs to renovate or introduce the new equipment, inspecting whole process of project construction, equipment installation and commissioning as well as trial tests. The work is finished on 30th May of 2006. Equipment lists see the second progress report.

#### **Activity 10: Project coordination to ensure smooth operation**

During the engineering construction and initial operation period, we are responsible for supervising the whole process to ensure that they must be in consistence with the relevant environmental and safety standards and assisting TVEs approved by the local environmental and other relevant authorities. Besides, we assist TVEs in enacting new managing measures in terms of energy efficiency, environmental protection, safety production and quality control. The work is finished on 30th May of 2006.

The engineering services defined in TOR have been fulfilled after completion of the above three activities, and the second progress report has been submitted accordingly. As the training activity is composed of energy efficiency management and energy conservation technology, it has been provided in three phases during the performance period of energy management system establish, engineering construction & trial test and testing the result of energy-conserving transformation. The third progress report describes Activity 11, Activity 6 and Activity 7.

**Activity 11: Provide personnel training and other necessary engineering services**

The celebrated experts are selected as teachers who have been involving in scientific research for many years with rich practical experiences. The training materials draft is lead along by Prof. Pang Fengrong from Tianjin University of Technology and Senior Engineer Wang Fulai from Dazhan General Valve Plant. Personnel training are provided in three phases. On the first phase, organize the plant management to take part in the training to upgrade managing standard. Besides, provide training with the operators to gain the skills of equipment operation. Management and skill training were presided over by Mr. Pan Baojun and Prof. Pang Fengrong at Dazhan General Valve Plant. On the second phase, during construction, equipment procurement, installation and commissioning period, provide plant management and key operators on-site training, make them participating in the whole process in order to master new equipment operation procedures and production process in advance and be familiar with the quality control to ensure the future regular operation.



The training were arranged at technological transformation site in each plant, which were in charged by Mr. Pan Baojun and Mr. Zhangze. In the initial regular production period, the third phase training is combining previous training contents with practical production process and managing measures, a consultant team comprised with the training teachers give instructions on how to deal with existing problems, and furthermore, propose and finalize new managing rules and regulations etc. The training is provided at technological transformation site in each plant, which were in charged by Mr. Pan Baojun and Mr. Zhangze. Until now, we have fulfilled all the tasks we should be undertaken defined in TOR, and the third progress report has been submitted accordingly. We test energy conservation results and prove the process validity in the regular run, and obtain the projected target (energy saving and emissions reduction) by ways of solving the problems arising from the new equipments and production process. On Dec. 10, 2006, all the staff participated in the project were gathered together to hold a summarizing meeting and draft final report accordingly.

### **3.3 Energy conservation and emissions reduction results**

To accurately test the energy saving results of technology transformation, we supervise the whole process of production and finalize the practical managing regulations and rules to obtain the actual information of energy & material consumptions and products. Table 5 and Table 6 are shown the statistics data and energy conservation and emissions reduction results of technological transform.

Table 5 energy consumption and production output statistics (2006.7~2006.9)

Replication foundry	Coke t	Electricity power MWh	Coal t	Blank casting t	Finished product t
Baitangkou Foundry	78.25	74.02	12.71	927.8	900
Bohai (Group) Hengtong Valve Co. Ltd	180.27	170.53	29.27	1417.5	1375
Dazhan Valve General Plant	196.39	185.79	31.89	1447.4	1375
Huiyuan Metal Products Plant	104.17	98.55	16.92	943.3	915
Juyuan foundry	56.93	53.85	9.24	773.2	750
Kaiyuan No.3 Valve Co. Ltd.	83.92	79.39	13.63	902.1	875
Xinhai Paper-making Machinery Co. Ltd	74.18	70.17	12.04	515.5	500

**Table 6 energy conservation and emissions reduction results statistics**

Replication foundry	Energy consumption <sup>①</sup> t Tce / t casting	Energy consumption <sup>②</sup> t Tce / t casting	Energy saving t Tce/year	CO <sub>2</sub> reduction T/ per year	Energy- conserving rate %	Output <sup>①</sup> t/year	Rejection rate <sup>②</sup> %	Output <sup>③</sup> t/yea	Rejection rate <sup>②</sup> %	Output increase %
Baitangkou Foundry	0.149	0.126	82.8	206.4	15.44%	3000	5	3600	3	20
Bohai (Group) Hengtong Valve Co. Ltd	0.229	0.19	214.5	534.7	17.03%	5000	5	5500	3	10
Dazhan Valve General Plant	0.239	0.207	176	438.7	13.39%	5000	9	5500	5	10
Huiyuan Metal Products Plant	0.193	0.165	102.5	255.5	14.51%	3000	8	3660	3	22
Juyuan foundry	0.132	0.11	66	164.5	16.67%	2500	8	3000	3	20
Kaiyuan No.3 Valve Co. Ltd.	0.164	0.139	87.5	218.1	15.24%	2800	8	3500	3	25
Xinhai Paper-making Machinery Co. Ltd	0.277	0.215	124	309.1	22.38%	1800	5	2000	3	11.1
Average	0.202	0.168	853.3	2127	16.76%	23100	6.9	26760	3.4	15.8

①: before technology transformation; ②: after technology transformation

### 3.4 Capital allocation and cost breakdown

#### (1) investment source and placement

According to the contract, USD105,000 is funded by UNIDO, 30% of which (USD31,500) is involve in consulting and engineering services, and 70% of which (USD73,500) shall be placed in foundry technological transformation; financial co-placement ratio by beneficial foundries is no less than 4:1. Actually, total capital for the project is raised RMB4,983,000, of which USD105,000 is funded by UNIDO( current exchange rate is 7.8) and of which RMB4,164,000 is financed by replication foundries ( including RMB350,000 by local government). The average co-placement rate exceeds 7:1. As UNIDO fund is provided in installment, the subcontractor and beneficial foundries pay the corresponding technological transformation sum in advance and is being returned after the capital received.

#### (2) capital allocation

30% of contract fund (USD31,500) is involved in team expert charges and travel expenses, and 70% of which (USD73,500 )altogether with the capital financed by foundries and local government are placed in equipment purchase, construction charges and corresponding management and training system establish.

Following Table 7 shows the capital allocation and cost breakdown.

Table 7 capital allocation and cost breakdown (10<sup>4</sup>RMB)

Foundry name	Investment source			Cost breakdown		
	Funded by UNIDO	Provided by replication foundry	Financed by local government	Construction expenses ( old equipment back outs, new equipment installment and debugging and auxiliaries construction )	Equipment cost (cupolas, fans, heat exchangers and molding machine etc	management ( management system establish, training and corresponding facilities )
Baitangkou Foundry	8.2	39.2	5	2.4	44.0	6.0
Bohai (Group) Valve Co. Ltd	8.2	76.8	5	7.5	76.0	6.5
Dazhan Valve General Plant	8.2	42.6	5	13.8	36.0	6.0
Huiyuan Metal Products Plant	8.2	33.2	5	2.5	37.9	6.0
Juyuan foundry	8.2	34.2	5	19.9	21.5	6.0
Kaiyuan No.3 Valve Co. Ltd.	8.2	45.2	5	5.9	46.5	6.0
Xinhai Paper-making Machinery Co. Ltd	8.2	110.2	5	72.5	44.4	6.5
Total	57.4	381.4	35	124.5	306.3	43
		473.8				

### 3.5 Economic benefit

From the actual production results of July 2006 to Sept. 2006, we can see that the remarkable economic benefit is obtained besides the projected target of energy saving and emissions reduction. The economic benefit involves two aspects: one is direct energy savings through equipments renovation; the other is energy and labor cost savings gained from scrap decrease through equipment renovation and management system establish. A quarterly economic benefit statistics (See Table 8) can be obtained based on the current energy cost and labor expenses in casting trade. (Coke: 1400yuan/t, coal: 500yuan/t, electricity: 1.0yuan/kWh, labor cost: 400yuan/t). The economic benefit evaluation index (see table 9) is calculated considering lump-sum engineering investment, asset depreciation & equipment maintenance cost per year in the project lifetime and investment returns.

**Table 8 Calculation list of economic benefit (2006.7~2006.9)**

Foundries	Quarterly output t	Energy efficiency of equipment transformation	Energy efficiency of rejection rate decrease	then thousand yuan RMB	
				Labor efficiency of rejection rate decrease	Integrated economic profit
Baitangkou Foundry	900	2.3	0.3	1.2	3.8
Bohai (Group) Hengtong Valve Co. Ltd	1375	3.9	0.5	1.8	6.2
Dazhan Valve General Plant	1375	2.5	0.9	2.8	6.2
Huiyuan Metal Products Plant	915	1.8	0.9	1.9	4.6
Juyuan foundry	750	1.7	0.6	1.7	4.0
Kaiyuan No.3 Valve Co. Ltd.	875	1.3	0.6	2.0	3.9
Xinhai Paper-making Machinery Co. Ltd	500	4.1			4.1

**Table 9 economic benefit evaluating index**

Foundries	Project gross investment	Payback period of investment	Internal rate of return	Net present value	Average profit tax payments ratio of investment
Baitangkou Foundry	52.4	4.0	22.95	16.4	21.7
Bohai (Group) Hengtong Valve Co. Ltd	90.0	4.6	14.73	10.85	13.9
Dazhan Valve General Plant	55.8	3.5	31.72	25.69	25.8
Huiyuan Metal Products Plant	46.4	3.4	36.58	28.7	32.6
Juyuan foundry	47.4	4.1	19.25	9.47	15.6
Kaiyuan No.3 Valve Co. Ltd.	58.4	4.2	19.76	13.7	18.5
Xinhai Paper-making Machinery Co. Ltd	55.0	5.3	18.47	17.36	18.6

### 3.6 Acceptance letters (see attachment)

The contract aim is successfully achieved through all the services provided by the subcontractor. The 7 beneficial foundries have showed satisfaction and gratitude for all assistances and are willing to issue the service acceptance letters. (see attachment)

## 4 Social benefit

### 4.1 Contribute to finalizing the corresponding policy, law and regulations

On August 31, 2006, the State Council released a policy named "Energy Conservation Work Enforcement". The act claims that the energy problem has become a key barrier to Chinese economic and social development and great importance should be attached to energy safety from the view of strategy as a whole. It clearly states that, for ten thousands GDP (calculated by the year of 2005 price), standard coal consumption should be reduced to 0.98t by the end of the 11th five-year, 20% lower than that of the end of 10th 5-year, with 4.4% average decrease rate. In this connection, the state will issue a series of "new energy conservation policy" releasing the restraint

index and corresponding priority decisions. The state is ready to launch a social "energy saving storm ". On the one hand, the control system for high-energy consumption should be established to curb energy consumption; on the other hand, the corresponding tax priority policy should be finalized to favor the energy conservation enterprises.

To realize energy conservation target in the 11th five-year, this year reduction rate of 4%, the energy conservation is taken the same essential place as the economic rise for the first time, which is stipulated in the outline of the 11th five-year plan. Accordingly, the energy saving data is added in the economic and social development integrated evaluating and testing system by government at each level. The leaders in every sector ought to regard energy conservation as an important task to complete. But the State Statistics Bureau information shows that it is still a hard way to go for realizing energy saving target.

As a high-energy consumption trade, metal casting energy conservation target is a key to completing the 11th five -year plan. The execution of the project contributes to finalizing the state energy conservation policies and rules. It not only assists foundries to realize the apportioned target, but also helps the local government to realize energy conservation target fixed by the state.

#### **4.2 Stimulate the government to issue new encouraging policy and assist foundries to obtain government financial support**

It points out in the act of " Energy Conservation work Enforcement" that insisting on principle of "among energy exploitation and energy conservation, conservation is the first ", promoting energy consumption reduction and improving energy exploitation rate are the essential to solve the energy problems in China. The project is intended to utilize and replicate energy-efficiency technology and products to the participated foundries in metal casting sector. It is beneficial for TVEs developing and favors the government to realize the energy conservation target. Therefore, Jinnan government has provided beneficial policies from many aspects to encourage the



foundries to participate in the project. For instance, three more decrees are promulgated named "Loans of Low Interest Acts for Industrial Enterprises Renovation Project in Jinnan District" ( JG[2004] No.67) "Imported Equipment Tax-free & Domestic Equipment Income Tax Credit Act for Renovation Project in Jinnan District "(JG[2004] No.68) and " Encouraging Act for technical renovation enterprises in Metal Casting Sector" to ease enterprises' financial burden. Besides, the local government have subsidized 50,000yuan for each replication foundries. Although it is a small sum, but arouses foundries' enthusiasm to carry out technical renovation.

#### **4.3 Spur the other foundries to carry out technological transformation**

The Jinnan Government subsidizes 50,000 yuan on each of 7 replication foundries to carry out energy efficiency technological transformation, and it promises that all the technological transformation foundries as the 7-replication foundries can enjoy the same sum of allowance. The priority policy stimulates other foundries to follow their steps. The other foundries in the area have participated in the promotion activities provided with 7 replication foundries. As a result, energy efficiency consciousness and energy conservation technology are pushed forward to uphill level in the area as a whole.

### **5 Project replication potentiality**

Although the project is put into end, the production process and equipments through technical renovation can be given full play continuously to energy conservation and emissions reduction until the end of lifetime. By implementing the project, the practical and adaptable management system has been formulated and the administrators and employees in the foundries have been provided with energy management and energy conservation technology training; their energy saving consciousness and skills are up levered. All these have made great potential for long-term energy efficiency benefit.

The project urges the Jinnan government to issue the new policies to promote other foundries in the area to carry out energy-efficiency technological transformation. To encourage foundries to implement technological transformation in the area, the Jinnan local government has issued "the subsidy rule for technical renovation enterprises in Metal Casting Sector". It claimed, all the foundries follow the pilot replication foundries step to have technological transformation, they will be subsidized RMB50,000 by the local government and enjoyed zero percentage interest lending policy. Jinnan is a density area of metal casting TVEs , with over 80 foundries in large, medium and small scale. Stimulated by the above policy, a large number of foundries have registered for technical renovation. The government is scheduled to subsidize 10 foundries annually for technological transformation, and it will have the program going on in the long term.

Generally, annual output of metal casting in Tianjin takes the second place among Chinese large and medium-sized city production. There are more than 300 foundries with annual output of over 2000 T in Tianjin. Tianjin Metal Casting Trade Association is entrusted to replicate the projected results of energy efficiency technological transformation and its successful experience of Tianjin Jinnan priority policy support to other districts. We convinced, it would surely promote the whole area to adopt energy-efficiency and emissions reduction technologies.

## **6 Experiences and achievements**

The precious experience is that the project is obtained support by the local government. In the initial period of project, the team experts visit the local administrators (the leader of Jinnan Industrial Committee) many times, give detailed presentations on the project

Agro-environmental Protection Institute of Ministry of Agriculture (AEPI)  
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necessity, replication foundries information, their demands and strong desire for engagement in the project. The leader of Jinnan Industrial Committee considers the project as public benefit business and should be given great support. Later, he actively applied the local government for favoring policy on the developing of the replication foundries. Apart from the 50,000 yuan subsidy on each foundry, the government also financed the technological exchanging meetings and trainings at Jinnan District, on which the foreign and domestic celebrated casting experts were invited. The local government supporting on the project has lay a sound foundation for smooth implementation in Jinnan.

## **7 Attachments**

**Attachment 1: 7 acceptance letters**

**Attachment 2: photos**

**Attachment 1: 7 acceptance letters**

## CONFIRMATION LETTER

As a replication foundry, Tianjin Huiyuan Metal Products Plant has involved in the project Metal Casting Replication Projects for Energy efficiency (1)(Tianjin) under Energy Conservation and GHG Emissions Reduction in Chinese TVEs Phase II, which is undertaken by Agro-environmental Protection Institute of Ministry of Agriculture (hereinafter referred to subcontractor). We have made technical transformation based on the finalized technical renovation plan in the feasibility study report, of which the core content is introducing a new 3t/h hot cupola to replace the old 5t/h cold cupola, and purchasing 2 new molding machines. Besides, we have placed RMB 380,000 yuan for implementing the project (Including RMB 50,000 yuan financed by the local government). During the period, the subcontractor has fulfilled the following tasks: (1) has conducted a comprehensive assessment on our energy-efficiency standard and finalized the above technical renovation content that is fully agreed by us; (2) has provided us with engineering design schemes and drawings and assisted us with engineering construction and equipments purchasing; (3) has organized us to participate in energy-efficiency technological training instructed by metal expert, Prof. Pang Fengrong, etc. (4) has formulated a set of practical energy-efficiency system, according to the requirements, we have completed internal readjustment, arranging the special duty for energy control.

Confirmed by:

Date: Nov 15, 2006



## CONFIRMATION LETTER

As a replication foundry, Tianjin Kaiyuan No. 3 Valve Co. Ltd has involved in the project Metal Casting Replication Projects for Energy efficiency (1)(Tianjin) under Energy Conservation and GHG Emissions Reduction in Chinese TVEs Phase II, which is undertaken by Agro-environmental Protection Institute of Ministry of Agriculture (hereinafter referred to subcontractor). We have made technical transformation based on the finalized technical renovation plan in the feasibility study report, of which the core content is purchasing a new 5t/h hot blast cupola to replace the original cold cupola. Besides, we have placed RMB 500,000 yuan for implementing the project (Including RMB 50,000 yuan financed by the local government). During the period, the subcontractor has fulfilled the following tasks: (1) has conducted a comprehensive assessment on our energy-efficiency standard and finalized the above technical renovation content that is fully agreed by us; (2) has provided us with engineering design schemes and drawings and assisted us with engineering construction and equipments purchasing; (3) has organized us to participate in energy-efficiency technological training instructed by metal expert, Prof. Pang Fengrong, etc. (4) has formulated a set of practical energy-efficiency system, according to the requirements, we have completed internal readjustment, arranging the special duty for energy control.

Confirmed by: 

Date: Nov 15, 2006

## CONFIRMATION LETTER

As a replication foundry, Tianjin Dazhan Valve General Factory has involved in the project Metal Casting Replication Projects for Energy efficiency (1)(Tianjin) under Energy Conservation and GHG Emissions Reduction in Chinese TVEs Phase II, which is undertaken by Agro-environmental Protection Institute of Ministry of Agriculture (hereinafter referred to subcontractor). We have made technical transformation based on the finalized technical renovation plan in the feasibility study report, of which the core content is retrofitting 3t/h and 5t/h cold blast cupolas into high efficient hot cupolas; purchasing one new molding machine. Besides, we have placed RMB 473,800 yuan for implementing the project (Including RMB 50,000 yuan financed by the local government). During the period, the subcontractor has fulfilled the following tasks: (1) has conducted a comprehensive assessment on our energy-efficiency standard and finalized the above technical renovation content that is fully agreed by us; (2) has provided us with engineering design schemes and drawings and assisted us with engineering construction and equipments purchasing; (3) has organized us to participate in energy-efficiency technological training instructed by metal expert, Prof. Pang Fengrong, etc. (4) has formulated a set of practical energy-efficiency system, according to the requirements, we have completed internal readjustment, arranging the special duty for energy control.

Confirmed by:



Date: Nov 15, 2006

## CONFIRMATION LETTER

As a replication foundry, Tianjin Xinhai Papermaking Machinery Co. Ltd has involved in the project Metal Casting Replication Projects for Energy efficiency (1)(Tianjin) under Energy Conservation and GHG Emissions Reduction in Chinese TVEs Phase II, which is undertaken by Agro-environmental Protection Institute of Ministry of Agriculture (hereinafter referred to subcontractor). We have made technical transformation based on the finalized technical renovation plan in the feasibility study report, of which the core content is purchasing a new 7t/h hot blast cupola to replace the original two 5t/h cold cupolas. Besides, we have placed RMB 1,150,000 yuan for implementing the project (Including RMB 50,000 yuan financed by the local government). During the period, the subcontractor has fulfilled the following tasks: (1) has conducted a comprehensive assessment on our energy-efficiency standard and finalized the above technical renovation content that is fully agreed by us; (2) has provided us with engineering design schemes and drawings and assisted us with engineering construction and equipments purchasing; (3) has organized us to participate in energy-efficiency technological training instructed by metal expert, Prof. Pang Fengrong, etc. (4) has formulated a set of practical energy-efficiency system, according to the requirements, we have completed internal readjustment, arranging the special duty for energy control.

Confirmed by:



Date: Nov 15, 2006

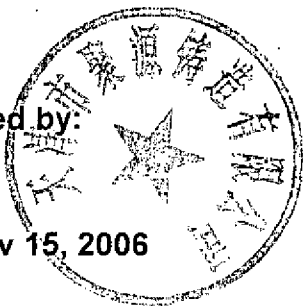


## CONFIRMATION LETTER

As a replication foundry, Tianjin Jinnan Juyuan Foundry Co. Ltd has involved in the project Metal Casting Replication Projects for Energy efficiency (1)(Tianjin) under Energy Conservation and GHG Emissions Reduction in Chinese TVEs' Phase II, which is undertaken by Agro-environmental Protection Institute of Ministry of Agriculture (hereinafter referred to subcontractor). We have made technical transformation based on the finalized technical renovation plan in the feasibility study report, of which the core content is purchasing a new 3t/h hot blast cupola to replace the one original 2t/h cold cupola. Besides, we have placed RMB 390,000 yuan for implementing the project (Including RMB 50,000 yuan financed by the local government). During the period, the subcontractor has fulfilled the following tasks: (1) has conducted a comprehensive assessment on our energy-efficiency standard and finalized the above technical renovation content that is fully agreed by us; (2) has provided us with engineering design schemes and drawings and assisted us with engineering construction and equipments purchasing; (3) has organized us to participate in energy-efficiency technological training instructed by metal expert, Prof. Pang Fengrong, etc. (4) has formulated a set of practical energy-efficiency system, according to the requirements, we have completed internal readjustment, arranging the special duty for energy control.

Confirmed by:

Date: Nov 15, 2006



## CONFIRMATION LETTER

As a replication foundry, Tianjin Bohai Valve (Group) Corporation Hengtong Valves Co. Ltd has involved in the project Metal Casting Replication Projects for Energy efficiency (1)(Tianjin) under Energy Conservation and GHG Emissions Reduction in Chinese TVEs Phase II, which is undertaken by Agro-environmental Protection Institute of Ministry of Agriculture (hereinafter referred to subcontractor). We have made technical transformation based on the finalized technical renovation plan in the feasibility study report, of which the core content is purchasing new 3t/h and 5t/h hot blast cupolas to replace the original cold cupolas; building electrical furnace cooling water waste heat retrieve system. Besides, we have placed RMB 816,000 yuan for implementing the project (Including RMB 50,000 yuan financed by the local government). During the period, the subcontractor has fulfilled the following tasks: (1) has conducted a comprehensive assessment on our energy-efficiency standard and finalized the above technical renovation content that is fully agreed by us; (2) has provided us with engineering design schemes and drawings and assisted us with engineering construction and equipments purchasing; (3) has organized us to participate in energy-efficiency technological training instructed by metal expert, Prof. Pang Fengrong, etc. (4) has formulated a set of practical energy-efficiency system, according to the requirements, we have completed internal readjustment, arranging the special duty for energy control.

Confirmed by:



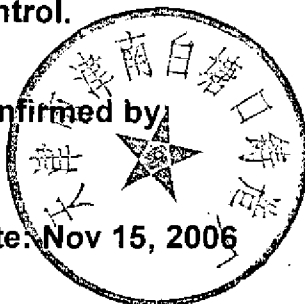
Date: Nov 15, 2006

## CONFIRMATION LETTER

As a replication foundry, Tianjin Jinnan Baitangkou Casting Plant has involved in the project Metal Casting Replication Projects for Energy efficiency (1)(Tianjin) under Energy Conservation and GHG Emissions Reduction in Chinese TVEs Phase II, which is undertaken by Agro-environmental Protection Institute of Ministry of Agriculture (hereinafter referred to subcontractor). We have made technical transformation based on the finalized technical renovation plan in the feasibility study report, of which the core content is retrofitting the cold blast cupola into a 3t/h hot blast cupola; introducing three molding machines. Besides, we have placed RMB 440,000 yuan for implementing the project (Including RMB 50,000 yuan financed by the local government). During the period, the subcontractor has fulfilled the following tasks: (1) has conducted a comprehensive assessment on our energy-efficiency standard and finalized the above technical renovation content that is fully agreed by us; (2) has provided us with engineering design schemes and drawings and assisted us with engineering construction and equipments purchasing; (3) has organized us to participate in energy-efficiency technological training instructed by metal expert, Prof. Pang Fengrong, etc. (4) has formulated a set of practical energy-efficiency system, according to the requirements, we have completed internal readjustment, arranging the special duty for energy control.

Confirmed by

Date: Nov 15, 2006



**Attachment 2: photos**



**The energy-conserving technical training of management and technical staff**



**The energy-conserving technical training of management**



**The experts guide at the scene**



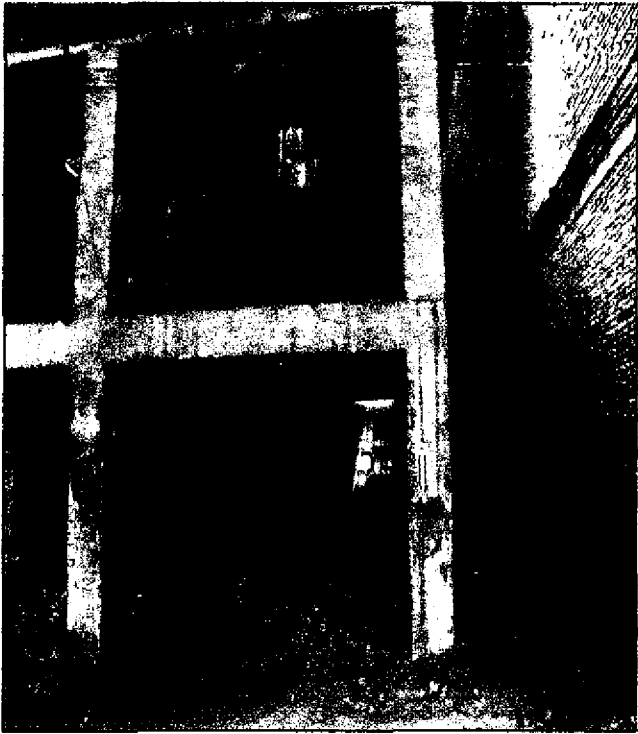
**The experts guide at the scene**



**Before transforming**



**After transforming**  
**Contrast before and after transforming of Dazhan**



**Before transforming**

**After transforming**

**Contrast before and after transforming of Xinhai**



M & E Form: Foundry Subsector Replication Project

No.	TVEs	Business Profile	Major Energy-use Equipments	E E Baseline										Project Investment			Project Status	Anticipated Results							Remarks <sup>(1)</sup>					
				Energy Type	Energy consumption (physical quantity)	Conversion Factor	Energy use (tce)	Energy Use/Unit Product		Output Before Renovation	Total energy use (tce)	CO <sub>2</sub> Coefficient	CO <sub>2</sub> Emissions (t/a.)	Proposed Technical Renovation	Total (RMB¥ 10,000)	GEF support (US\$)		Others (RMB¥10,000)	Start-and date	Financial Evaluation			Production after renovation			Energy Use/Unit Product		Energy Savings (tce/a.)	CO <sub>2</sub> emission Reduction (t/a.)	
1	Baitangkou Foundry	Main products:	Cold blast cupola (3t/h), cleaning machine, sand mixing machine	Coal (t)	0.00	0.714	0.00	0.149	tce/t castings	3,000	t castings (a.)	446.88	2.493	1,114.08	Retrofitting the cold blast cupola into high efficient hot cupola	52.4	1.05	Commercial loan	0	Finished	2005-10-20 to 2006-06-30	Payback period	4.00	year	4,250	t castings/a.	0.126	tce/t castings	97.59	243.28
				Coke(t)	428.50	0.971	416.24											Entrustment Loan	0			IRR	22.95%	%						
				Power/MWh	80.00	0.383	30.64											Self-Funding	39.2			NPV	16.40	¥10,000.00						
				Produced oil t)		1.471	0.00											Financial Assistance	5.0			Cost of energy saving	-531.90	¥1/tce						
				Sum total			446.88											Others	0											
2	Bohai (Group) Hengtong Valve Co. Ltd	Main products:	Cold blast cupola (3t/h, 5t/h), molding machine, electrical furnace, Heating boiler	Coal (t)	120.00	0.714	85.68	0.229	tce/t castings	5,000	t castings (a.)	1,143.80	2,851.50	Retrofitting two cold blast cupolas into high efficient hot cupolas, building electrical furnace	90.0	1.05	Commercial loan	0	Finished	2005-10-20 to 2006-06-30	Payback period	4.60	year	6,250	t castings/a.	0.190	tce/t castings	242.25	603.94	
				Coke(t)	695.00	0.971	675.12										Entrustment Loan	0			IRR	14.73%	%							
				Power/MWh	1,000.00	0.383	383.00										Self-Funding	76.8			NPV	10.85	¥10,000.00							
				Produced oil t)		1.471	0.00										Financial Assistance	5.0			Cost of energy saving	-395.07	¥1/tce							
				Sum total			1,143.80										Others	0												
3	Dazhan Valve General Plant	Main products:	Cold blast cupola (3t/h, 5t/h), molding machine	Coal (t)	169.00	0.714	120.67	0.239	tce/t castings	5,000	t castings (a.)	1,197.25	2,984.73	Retrofitting two cold blast cupolas into high efficient hot cupolas	55.8	1.05	Commercial loan	0	Finished	2005-10-20 to 2006-06-30	Payback period	3.50	year	5,500	t castings/a.	0.211	tce/t castings	156.47	390.08	
				Coke(t)	714.00	0.971	693.58										Entrustment Loan	0			IRR	31.72%	%							
				Power/MWh	1,000.00	0.383	383.00										Self-Funding	42.6			NPV	25.69	¥10,000.00							
				Produced oil t)		1.471	0.00										Financial Assistance	5			Cost of energy saving	-572.63	¥1/tce							
				Sum total			1,197.25										Others	0												
4	Huiyuan Metal Products Plant	Main products:	Cold blast cupola (5t/h), molding machine, sand mixing machine, shot blasting machine	Coal (t)	60.10	0.714	42.91	0.193	tce/t castings	3,000	t castings (a.)	580.47	2,447.11	A new 3t/h hot blast cupola to replace the original 5t/h cold cupola, introducing 2 molding machines	46.4	1.05	Commercial loan	0	Finished	2005-10-20 to 2006-06-30	Payback period	3.40	year	4,250	t castings/a.	0.165	tce/t castings	121.08	301.86	
				Coke(t)	500.00	0.971	485.70										Entrustment Loan	0			IRR	36.58%	%							
				Power/MWh	135.40	0.383	51.86										Self-Funding	33.2			NPV	28.7	¥10,000.00							
				Produced oil t)		1.471	0.00										Financial Assistance	5.0			Cost of energy saving	-941.73	¥1/tce							
				Sum total			580.47										Others	0												
5	Juyuan foundry	Main products:	Cold blast cupola (2t/h)	Coal (t)	65.00	0.714	46.41	0.132	tce/t castings	2,500	t castings (a.)	329.36	821.10	Retrofitting the cold blast cupola into high efficient hot cupola	47.4	1.05	Commercial loan	0	Finished	2005-10-20 to 2006-06-30	Payback period	4.10	year	3,000	t castings/a.	0.110	tce/t castings	65.24	162.63	
				Coke(t)	275.00	0.971	267.14										Entrustment Loan	0			IRR	19.25%	%							
				Power/MWh	41.30	0.383	15.82										Self-Funding	34.2			NPV	9.47	¥10,000.00							
				Produced oil t)		1.471	0.00										Financial Assistance	5.0			Cost of energy saving	-502.43	¥1/tce							
				Sum total			329.36										Others	0												
6	Kaiyuan No.3 Valve Co. Ltd.	Main products:	2 cold blast cupola (5t/h), sand mixing machine, shot blasting machine	Coal (t)	72.00	0.714	51.41	0.164	tce/t castings	2,800	t castings (a.)	458.23	1,142.36	Retrofitting two cold blast cupolas into high efficient hot cupolas	58.4	1.05	Commercial loan	0	Finished	2005-10-20 to 2006-06-30	Payback period	4.2	year	4,250	t castings/a.	0.141	tce/t castings	96.28	240.01	
				Coke(t)	336.00	0.971	326.39										Entrustment Loan	0			IRR	19.76%	%							
				Power/MWh	210.00	0.383	80.43										Self-Funding	45.2			NPV	13.7	¥10,000.00							
				Produced oil t)		1.471	0.00										Financial Assistance	5.0			Cost of energy saving	-623.03	¥1/tce							
				Sum total			458.23										Others	0												
7	Xinhai Paper-making Machinery Co. Ltd	Main products:	2 cold blast cupola (5t/h), cleaning machine	Coal (t)	120.00	0.714	85.68	0.277	tce/t castings	1,800	t castings (a.)	498.39	1,242.48	Purchasing a new 7t/h hot blast cupola to replace the original two 5t/h cold cupolas	123.4	1.05	Commercial loan	0	Finished	2005-10-20 to 2006-06-30	Payback period	5.30	year	2,000	t castings/a.	0.215	tce/t castings	123.76	308.54	
				Coke(t)	415.00	0.971	403.13										Entrustment Loan	0			IRR	18.47%	%							
				Power/MWh	25.00	0.383	9.58										Self-Funding	110.2			NPV	17.36	¥10,000.00							
				Produced oil t)		1.471	0.00										Financial Assistance	5.0			Cost of energy saving	-787.05	¥1/tce							
				Sum total			498.39										Others	0												
总计						4,654.38	0.201	tce/t castings	23,100	t castings	4,654.38	11603.37		473.8	7.35	Matching f	416.4						29,500	t castings/a.	0.144	tce/t castings	902.67	2,250.35		

The baseline date is from the 2005 statistics, and base year is 2004. The account of Financial Evaluation is after-tax statistical data of project life. i=9%. RMB exchange rate against the dollar is 7.8