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United Nations Industrial Development Organization

Energy Conservation and GHG Emissions Reduction in Chinese TVEs – Phase II

Metal Casting Replication Projects for Energy Efficiency (Nanjing)

Final Report

Contract No.: 16001007
Project No.: EG/CPR/99/G31

Submitted by:

Jiangsu Province Metallurgical Design Institute Co. Ltd.

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18 June 2007

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I Introduction

1. Foreword

This report is the final report submitted to the United Nations Industrial Development Organization (UNIDO) by Jiangsu province Metallurgical Design Institute Company Limited (JSMDI), the contractor of Foundry Sector Replication Projects for Energy Efficiency (with contract No. 16001007).

The sub-contractor has successfully accomplished the Replication Project for Energy Efficiency in Foundry Sub-sector in Nanjing.

2. Project Background

Township and village enterprises (TVEs) constitute a significant share of Chinese economic production and social welfare. TVEs also contribute significantly to local and global environmental problems. The aim of this project, Energy Conservation And Greenhouse Gas Emissions Reduction In Chinese Township And Village Enterprises—Phase II, which is funded by the Global Environmental Fund (GEF), is to reduce greenhouse gas emissions in China from the TVE sector by increasing the utilization of energy efficient technologies and products in the brick, cement, metal-casting, and coking sub-sectors. The project intends to overcome key policy, market, technological, and financial barriers to the production, marketing, and utilization of energy efficient technologies and products in these industries.

This subcontract, Foundry Sector Replication Projects for Energy Efficiency, is intended to replicate the successful experiences and best practices of the demonstration foundry plants by implementing technology upgrading to improve energy efficiency and product quality. For project replication in the foundry sector, UNIDO and the Project Management Office (PMO) of the Ministry of Agriculture have identified 6 foundry enterprises.

II Introduction to Nanjing casting foundries and the 6 participating TVEs

1. Introduction to Nanjing casting foundries

The annual output of TVEs in Nanjing metal casting sector ranks the top ten in China. There are more than 40 foundries with annual output of over 2000 T registering a total output of 0.2 million tons annually, including 0.18million tons of ferrous castings, 0.02million tons of nonferrous castings. The products both supply domestic market and overseas market, among which 40% export abroad. The castings consist of valves, pipe fittings, couplings, machines, automobile parts, machinery fittings, weighing products etc. that made of graphite pig iron, malleable iron and as-cast steel.

Most foundries in Nanjing are established and developed by themselves, of which characterized by poor production conditions, outdated equipment, backward production process, rough management, low product quality, high consumption and

severe contamination. Therefore, it is inevitable and urgent for them to conduct technological renovation. The 6 potential foundries are representative in terms of scale, production process, equipment and management. If they are successfully renovated, other foundries are encouraged to follow their steps accordingly. Therefore, the whole metal casting industries will be pushed forward to a high degree in terms of energy management, environmental protection and economic profit. We have invited the CEOs and technical staff from the 6 potential foundries to hold a forum in early 2005 and have gained detailed information of the each enterprise, such as existing production conditions, production process, management system and environmental protection, etc. Besides, they are well informed of the subcontract background, objectives, tasks and significance of project accomplishment. Based on our understanding, all the potential foundries have strong desire and economic power to conduct technical renovation in terms of energy-efficiency, management upgrading, quality inspection and production process improvement, etc and most of them have already been under way to a certain degree. We will provide economic consultation, engineering design, personnel training to the enterprise regarding project feasibility; help them to improve management for final realization of energy conservation and greenhouse gas emission reduction.

2. Introduction to the 6 participating TVEs

The 6 participating TVEs are typical private owned township and village enterprises located in Nanjing, Jiangsu Province. The foundries mainly produce casting each at annual output of 5000t. Main export markets include Europe, America, Korea and Japan etc. The 6 participating TVEs are followings:

1. Nanjing Jiali Metal Co., Ltd.,
2. Nanjing Shuanglong Abrasion Resistant Alloy Co., Ltd.,
3. Nanjing Lishui Zhongshan Foundry Co., Ltd.,
4. Nanjing Huafeng Oil Pump Co., Ltd.,
5. Nanjng Xusheng Casting Co., Ltd.,
6. Nanjing Dongjun Machinery Co. Ltd. Etc.

3. Accomplished effective measures

Effective measures adopted: 1. Made use of remaining heat and wasting heat of cupola to preheat blast air. 2. Revamped the cupola to intermediate frequency furnace or adopt mixed smelting process of cupola with intermediate frequency furnace. 3. Changed non-ferrous metal pot furnace to frequency conversion furnace. Developed casting furnace towards frequency conversion and vacuum smelting. 4. Developed and popularized ductile iron technique as cast condition. 5. Developed and popularized vacuum and sealed model v-casting technique. 6. Developed and popularized vanish model casting technique. 7. Adopted modern casting mould sand process.

III Project summary

1. Project review

(1) Since the project kick-off on March 8, 2006, the contractor has provided the 6 foundry plants with all consulting and engineering services required by the contract. The services include:

Task I: Consulting services

Activity 1: Project start-up meeting, Summary of the best practices and experiences of the pilot foundries, and demonstrate and replicate it in the 6 replication foundries through training activities.

Activity 2: Enterprises evaluation

Activity 3: Propose renovation measures and investment plan to the TVEs' management to upgrade their existing production technologies and equipment.

Activity 4: Develop project plan and feasibility study report.

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

Activity 6: management system

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

Task II: Engineering services

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

Activity 9: Equipment procurement, installation and commissioning, trial tests.

(2) During consulting services and engineering services, the contractor submitted 1st Progress Report, 2nd Progress Report and the Final Report.

(3) By now, the contractor has finished all the consulting and engineering services required in the contract. The contractor organized 6 plants to visit the replication enterprise to learn its advanced experiences on energy saving technology renovation and improving the production and management system. The contractor helped the plants complete the technology renovation design, construction and equipments purchase, installation and test. Now, the new energy saving equipments run well and ensure the normal production. The contractor assisted the plants in setting up the production and energy management system. Furthermore, the contractor conducted the training on energy saving technology and policy for the managers and technicians of 6 plants.

(4) During the implementation of the project, the plants actualized the co-financing ratios they promised. The ratios are all higher than the lowest ratio requirement (4:1) and the highest reached 13:1, the lowest reached 8.8:1.

2. Project outcome

(1) Promotion of energy conservation and technical renovation in the 6 plants

The current situation of 6 participating foundries is that most foundries are holding low-level production process, lacking in technicians and operating the business out of order. These led to the unstable product quality and high production cost. Moreover, due to the high energy consumption and large effluent, the pollution is very severe. The 6 plants have the common problems including the high energy consumption due to the out of date equipments, unstable product quality due to the lack of advanced equipments and management measures, severe environmental pollution and a large waste of resources without the recycling of pig iron and scrap steel.

Although the entrepreneurs realized the importance to adopt energy saving technology, they delayed the technical renovation with the consideration of the capital, technology and equipments. This project provided an opportunity for 6 plants to conduct technical renovation. Besides financial support, it helped all plants to find out the existing problems in producing process and energy consumption, and proposed feasible scheme about renovation and equipment purchase. All the project activities made the entrepreneurs decide to implement the technical renovation.

Through the technical renovation, the production capacities of 6 plants increased by 20% with outputs from 20,500 to 25,500 ton castings per year. The total energy consumption of the 6 foundries will reduce by 1587 tce per year. Among which, the highest reduction was 540 tce. The total CO_2 emission reduction was 3957 tons per year. The comparison of the energy consumption before and after the technical renovation is shown in Annex 2 and the table below.

Table: Comparison of Energy Consumption before and After Technical Renovations in the 6 Foundries

No	Item		Unit	Average of six Foundries	The most in six Foundries	The least in six Foundries
1	Energy consumption per unit product	Before I renovation	tce/t	0.2497	0.341	0.190
2		After renovation	tce/t	0.2029	0.249	0.170
3		Comparison	%	−23.06	−37	−11.76
4	CO_2 emission per unit product	Before I renovation	t/t	0.6226	0.8501	0.4736
5		After renovation	t/t	0.5058	0.6207	0.4238
6		Comparison	%	−23	−37	−11.76

(2) Improvement of economic benefits and energy/production management of the 6 plants

The average energy saving reached 264.5 tce per year and the outputs increased over 20 percent after technical renovation, which brought high economic benefit. The awareness of 6 plants on safe production, product quality, energy management and environmental protection was enhanced through the training and perfecting production management. The related systems are established and the level of integrated management is improved.

(3) Promotion of energy conservation and technical renovation in other plants

The plants selected in this project are located in Nanjing City and its six counties. The great achievements of energy saving effects and economic benefit after the technical renovation in the 6 extension plants have encouraged the other plants to conduct technical renovation, which is very helpful for the further replication of the project, such as Nanjing Yongda Mechanical Casting Company. Other enterprises have much interest in the energy saving foundry equipments and discussed with the technician of equipments plan in the training course. Some enterprises prepared to purchase the energy saving equipments such as front iron liquid quality apparatus to improve the production level and reduce the energy consumption.

(4) Great benefits from the technical training for the foundry enterprise

The technical training is a good chance for local foundry enterprises to communicate with famous experts and learn the developing trend of foundry industry and the updated foundry technology. It is important and helpful for the enterprises to establish the development strategy.

Subcontractor actively cooperated with the local governments to organize most local foundry enterprises to participate in the training. Other enterprises were provided the opportunity to understand the background and outcome of this project, and the information of the equipment providers. All the activities are helpful to technical renovation.

(5) Local governments pay more attention to popularize the technical renovation in other plants.

(6) Nanjing Foundry Association plans to disseminate the technical renovation practices and make full use of the network system generated by the project in other foundry TVEs.

3. Project Experience

(1) Timely communication with local governments and TVEs to help them understand the project completely

Since it was the first time for many government officials and entrepreneurs to participate in the international project, it indicated that the biggest obstacle for the smooth implementation of the project lied in the inadequate understanding of the project objective, requirements and implementation process. The contractor has actively disseminated the project on many aspects, such as training, field visits and

the participation of the activities conducted by other contractors, and communicated with replication TVEs and local governments to help them understand the project deeply.

(2) Adequate surveys during the project implementation

Surveys should be conducted during the project implementation to find existing problems in production process, technology, equipments and management because of the large varieties among the local foundry enterprises. According to the survey results, together with the project requirements and needs of the plants, the practical technical renovation scheme is formulated. The first-hand materials on energy consumption should be gathered to ensure the veracity of calculation about the energy savings and emission reduction after technical renovation.

(3) Enhancement of the active participation of the local governments

During project implementation, subcontractors coordinated with local governments and enhanced their active participation. Local governments provided subcontractor with much help to promote the project implementation. SME bureau supported the coordination with local enterprises and surveys in-site and organization of the training workshop.

(4) Development of technical training for the enterprises with flexible form

Subcontractor organized the site visiting for some famous foundry experts and compiled the training materials to satisfy the strong requirements of enterprises. The training form included lecture, case analysis, and discussion. The rich training content included development prospect and production process of foundry industry, and usage of energy saving equipment, and advanced management and operation system. It is a fruitful training. Many enterprises gave good feedback.

(5) Enhancement of the active participation of equipment plant and replication enterprise

Subcontractor chose the appropriate production equipments for the replication enterprises according to the actual condition of enterprises and the best process for the technical renovation. During the technical communicating meeting between research department, design institutes and TVEs, subcontractor arranged the equipment demonstration to enhance the active participation of the equipment plants.

4. Suggestions

(1) Promotion of technical renovation in more plants through the radiant role of 6 replication TVEs

LPIC should carry out the preferential policies for replication TVEs to play their radiant role and attract more TVEs to adopt energy saving technologies. Thereafter, the energy efficiency of local industry will increase and the GHG emission will be reduced.

(2) Offer of further technical services and guidance

The contractor should set up long-term relationship with replication TVEs and provide them with technical services and guidance when they adopt further energy saving technologies and develop new products. It will ensure a sustainable project with regard to the promotion of local energy conservation.

(3) Offer of erecting technical renovation network and sale network for Nanjing Foundry Association

(4) Facilitate TVEs to enjoy favorable policy.

IV Activities conducted

From the project kick-off on March 8, 2006 to December 30, 2006, the contractor conducted the activities as following:

Activity 1: Project start-up, Summary of the best practices and experiences of the pilot foundries, and demonstrate and replicate it in the 6 replication foundries through training activities.

Task members: Song Wenzhong, Yu Hongpeng, Wei Chundan, Meng Qinggui

Output: Specified work plan

The project briefing meeting was held on March 8, 2006. The contractor reported the approaches, work plan and personnel arrangement, implementation methodology, and control measures to implement the contract. The briefing of this project is March 8, 2006 determined at this meeting. The contractor promised that they would implement this project on time and contract price would not change. The work plan was specified at the meeting.

Activity 2: Enterprises evaluation

Task members: Song Wenzhong, Yu Hongpeng, Wei Chundan, Meng Qinggui, Zhang Zhiping, Xu Ningfeng

Output: Detailed work plan for phase I

From March 8 to April 30, the contractor listed the detail responsibilities for each expert and team member and set up a sound operation and communication process to ensure the high work efficiency. Additionally, the contractor finished the work plan in details for phase I.

Activity 3: Propose renovation measures and investment plan to the TVEs' management to upgrade their existing production technologies and equipment.

Task members: Song Wenzhong, Wei Chundan, Meng Qinggui, Xu Ningfeng

Output: Primary renovation plan and project estimate

From April 13 to 30, the contractor conducted a survey on the replication enterprise, then produced primary renovation plan and project estimate based on the actual

conditions.

Activity 4: Develop project plan and feasibility study report.

Task members: Song Wenzhong, Wei Chundan, Meng Qinggui, Xu Ningfeng, Zhang Zhiping

Output: Feasibility study report

Before May 31, 2006, the contractor visited the 6 foundry plants selected in this project to know the conditions of technology and products, and analyzed the status of production, emission, technology and market then produced feasibility study report including renovation process, equipments table, financing estimate etc.

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

Task members: Song Wenzhong, Wei Chundan, Meng Qinggui, Xu Ningfeng, Wang Weiming

Output: Devise technical renovation plan

From June 1 to September 30, the contractor carried out directions for the 6 plants to implement the plan-level assessment. The main contents included production processes, production technology and equipments, raw materials, consumption status of energy, products, outputs and marketing, financial status and management system. Furthermore the contractor confirmed the investment estimate and financing condition.

Activity 6: Management system

Task members: Song Wenzhong, Wei Chundan, Meng Qinggui, Xu Ningfeng, Zhang Zhiping

Output: Improvement of TVEs internal management system

From June 1 to October 30, the contractor organized experts to review and appraise the renovation scheme on the production progress, raw materials and energy saving, environmental impact and safety appraisal, etc. Meanwhile, the contractor solicited comments from 6 plants and output comments on TVEs internal management system.

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

Task members: Song Wenzhong, Wei Chundan, Meng Qinggui

Output: Training teaching material and training team

On Oct. 15, 2006, the contractor emphasized the importance of technical renovation for Energy Conservation and GHG Emissions Reduction, introduced popular Energy Conservation and environment protection consciousness.

On Dec. 22 to 24, 2006, the contractor published training teaching material, which contents including local energy policy, environment protection policy, dirty discharge standard and design specification, etc. Then in JSMDI, twenty three people from Nanjing SME bureau, Nanjing Foundry Association and six foundries' managers all accepted the training supplied by the contractor.

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

Task members: Song Wenzhong, Wei Chundan, Meng Qinggui, Chen Shaoyan, Yang Xihong, Xu Liren

Output: Engineering design

The contractor started six foundries' feasibility study report from June 1, 2006 to Sep. 30, 2006, due to six foundries' actual condition.

According to the renovated plan, the contractor offered appropriate detailed design of plant process, general drawing layout, water supply and discharge, ventilation etc.

Activity 9: Equipment procurement, installation and commissioning, trial tests.

Task members: Song Wenzhong, Yu Hongpeng, Wei Chundan, Meng Qinggui, Chen Shaoyan, Yang Xihong

Output: Offer of production line installation, testing and running

Considered fabrication period, equipments stock began in 2005, while installation, test and run began from June 31, 2006 to Dec. 30, 2006.

Accomplishment condition of technical renovation for six Foundries in following table:

No	Name of renovation project	Installation & Commissioning	Trial running	Normal Operation
1	In Nanjing Dongjun Machinery Co. Ltd. resin sand production line and 5T cupola hot blast supply device	In Sep. 2006	In Oct. 2006	Since Nov. 2006
2	In Nanjing Huafeng Oil Pump Co., Ltd, MF furnace production line	In Mar. 2006	In May, 2006	Since Jul. 2006
3	In Nanjing Jiali Metal Co., Ltd, Mechanical facing cut production line	In Jun. 2006	In Aug. 2006	Since Oct. 2006
4	In Nanjing Shuanglong Abrasion Resistant Alloy Co., Ltd , lost foam production line	In Oct. 2006	In Oct. 2006	Since March 2007
5	In Nanjng Xusheng Casting Co., Ltd., resin sand production line and 5T cupola hot blast supply device	In Aug. 2006	In Sep. 2006	Since Nov. 2006

6	In Nanjing Lishui Zhongshan Foundry Co., Ltd., cupola hot blast supply device	In Jun. 2006	In Jul. 2006	Since Aug. 2006

V Annex

1. Table of newly added equipments for six foundries' technical renovation.
2. List of drawings
3. M & E Form for six foundries for energy efficiency
4. Certificate of Acceptance for technical renovations by each of the six foundries.

Annex1. Main new added equipments table for six foundries' technical renovation

（1）Nanjing Dongjun Machinery Co. Ltd.

No	Equipments	Type	Unit	Q'ty	Supplier	Price	
						RMB(￥)	U.S. $
1	Resin sand production line	HYH-15A	set	1	Hangzhou Red Sun Company	480000	58536
2	5T cupola hot blast supply device	Self-made	set	1		38000	4634

Notes: 1.Exchange rate of U.S. $ to RMB(￥) adopted at 1:8.2 (but now 1:7.72).

2. Other renovated facilities such as building, power, crane etc. not listed. So do following tables.

（2）Nanjing Huafeng Oil Pump Co., Ltd.

No	Equipments	Type	Unit	Q'ty	Supplier	Price	
						RMB(￥)	U.S. $
1	Resistor furnace	1.5t/h	set	2	Taixing Kexing Furnace Factory	52000	6341
2	Core shooter		set	2	Qingdao machine casting Factory, Jiangyin machine casting Factory	225000	27439
3	Muller		set	2			
4	Facing cut		set	3			

5	Aluminium melt furnace		set	1		40000	4878
6	Core shooter with hot core box		set	1			
7	MF furnace		set	2		160000	19512
8	Surface scallop instrument		set	3		33750	4116
9	Crane feeder	10t/1.0t	set	1		125000	15244

（3）Nanjing Jiali Metal Co., Ltd

No	Equipments	Type	Unit	Q'ty	Supplier	Price	
						RMB(Y)	U.S. $
1	Core shooter	E863	set	4	Qingdao machine casting Factory, Jiangyin machine casting Factory	80000	9756
2	Mechanical facing cut	E145、E124	set	6、2	Qingdao machine casting Factory, Jiangyin machine casting Factory	168000	20487
3	Muller	S118	set	2	Qingdao machine casting Factory	62000	7561
4	Powdered coal machine		set	2		26000	3170
5	Deduster of Cupola	Self made	set	1	Self made	30000	3658
6	Annealing oven	4m3	set	2		45000	5487

7	Shot cleaning room	Q3710 II	set	1	Qingdao machine casting Factory	41000	5000
8	Vertical lathe	C518-2	set	3	Nanjing Machine Tool Foundry Factory	67000	8170
9	Quick analysis instrument		set	3		11000	1341

（4）Nanjing Shuanglong Abrasion Resistant Alloy Co., Ltd.

No	Equipments	Type	Unit	Q'ty	Price	
					RMB(￥)	U.S. $
1	Pre-foaming machine	SJ-KF-450	set	2	248000	30243
2	Semi-auto vertical molding machine		set	1	35000	4268
3	Vacuum and negative pressure system	SK-20	set	1	47000	5731
4	Water deduster and cold water separator	Non-standard	set	1	42000	5122
5	Shower sand feeder & Mold facing agitator	1000 × 1000	set	1	30000	3658
6	Three dimensional variable frequency vibration table	Non-standard	set	1	29000	3536

（5）Nanjng Xusheng Casting Co., Ltd.

No	Equipments	Type	Unit	Q'ty	Price	
					RMB(￥)	U.S. $
1	Resin sand production line	S258-SM	set	1	480000	58536

2	5T cupola hot blast supply device	Non-standard	set	1	40000	4878
3	Facilities of resin sand production line		set	1	295000	35975
4	MF furnace	KGPS-1/450	set	1	62000	7560

（6）Nanjing Lishui Zhongshan Foundry Co., Ltd.

No	Equipments	Type	Unit	Q'ty	Supplier	Price	
						RMB(￥)	U.S. $
1	Resin sand production line	HYH-15A	set	1	Hangzhou Red Sun Company	480000	58536
2	Muller	S118	set	3	Qingdao machine casting Factory	92000	11220
3	MF furnace	KGPS-1/450	set	1	Wuxi Furnace Factory	62000	7560
4	Shot cleaning room	Q3710 II	set	3	Qingdao machine casting Factory	48000	5853
5	Barrel type shot blasting machine	Q3110B	set	4	Qingdao machine casting Factory	40000	4878

, Annex2. List of drawings

Item	Name of Foundries	Technical Renovation	Outcomes		
			Plan Drawing	Process Layout drawing	Equipments installation drawing
1	Nanjing Dongjun Machinery Co. Ltd.	One is to build a new resin sand production line; The other is to modify the cupola, change its profile and apply hot blast operation	2	2	7
2	Nanjing Huafeng Oil Pump Co., Ltd.	Build one medium frequency furnace production line of 3000t/a nodular cast iron capacity	1	1	3
3	Nanjing Jiali Metal Co., Ltd.	1.Replacement of hand molding by machine molding; 2.Replacement of green core by precoated dry sand core; etc.	2	3	4
4	Nanjing Shuanglong Abrasion Resistant Alloy Co.	Build a new lost foam casting process line	3	3	6
5	Nanjing Xusheng foundry Co., Ltd.	One is to build a new resin sand production line; The other is to modify the cupola.	1	1	2
6	Nanjing Lishui Zhongshan Foundry Co., Ltd.	One is to build a new resin sand production line; The other is to modify the cupola.	2	2	5
	Total		11	12	27

M & E Form: Foundry Sebsector Replication Project

No.	TYEs	Business Profile	Major Energy-use Equipments	E E Baseline										Proposed Technical Renovation	Project Investment				Project Status	Anticipated Results								Remarks [1]
				Energy Type	Energy consumption (physical quantity)	Conversion Factor	Energy use (tce)	Energy Use/Unit Product		Output Before Renovation	Total energy use (tce)	CO_2 Coefficient	CO_2 Emissions (t/a.)		Total (RMB ¥10,000)	GEF support (US$)	Others (RMB¥10,000)			Start-end date	Financial Evaluation			Production after renovation		Energy Use/Unit Product		Energy Savings (tce/a.)	CO_2 emission Reduction (t/a.)	
1	Nanjing Dongjun Machinery Co. Ltd.	mainly produces gray iron casting and nodular iron casting at annual output of 5000t, annual output value of 40 million yuan, approximately US$5 million	uses clay sand casting process, with equipments of 5t/h cupola and MF furnace	Coal (t)	352.000	1.000	352.00	0.333	tce/t castings	3,200 tce/t castings (a.)	1,066.95	2.493	2,659.91	one is to build a new resin sand production line to reduce hot metal single consumption and coke consumption, the other is to modify the cupola, change its profile and apply hot blast operation	201.6	15,000	Commercial loan	81.00	finished	2005.10-2006.12	Payback period	4.44	year	5,000 t castings/a.		0.23 tce/t castings	540.00	1,346.22	
				Coke(t)	736	0.971	714.95										Entrustment Loan	0			IRR	27.00	%						
				Power/MWh		0.383	0.00										Self-Funding	108.60			NPV	141.00	¥10,000						
				Produced oil t)		1.471											Financial Assistance	0			Cost of energy saving[a]	232.60	¥1/tce						
				Sum total			1,066.95																						
Total															201.6	15000												
2	Nanjing Huafeng Oil Pump Co., Ltd.	mainly produces gray iron casting and nodular iron casting at annual output of 8000~10000t, annual output value of 40~55 million yuan, approximately US$7 million	The cupola uses coke as fuel for smelting and pouring of normal castings	Coal (t)	700.700	1.000	700.70	0.238	tce/t castings	3,000 tce/t castings (a.)	713.19	2.493	1,777.98	build one medium frequency furnace production line of 3000t/a nodular cast iron capacity	158	15,000	Commercial loan		finished	2005.10-2006.12	Payback period	6.64	year	3,000 t castings/a.		0.184 tce/t castings	162.00	403.87	
				Coke(t)		0.971	0.00										Entrustment Loan				IRR	13.52	%						
				Power/MWh	32.61	0.383	12.49										Self-Funding	146			NPV	22.00	¥10,000						
				Produced oil t)		1.471											Financial Assistance				Cost of energy saving[a]	379.80	¥1/tce						
				Sum total			713.19																						
Total															158	15000												
3	Nanjing Jiali Metal Co., Ltd.	mainly produces gray iron casting and nodular iron casting at annual output of 5000t, annual output value of 40~45 million yuan, approximately US$5 million	uses sand casting process, with molds and cores made by manual operation	Coal (t)			0.00	0.274	tce/t castings	2,500 tce/t castings (a.)	685.00	2.493	1,707.71	1. Replacement of hand molding by machine molding; 2. Replacement of green core by precoated dry sand core;etc.	132	15,000	Commercial loan		finished	2005.10—2006.12	Payback period	3.76	year	5,000 t castings/a.		0.21 tce/t castings	312.00	777.82	
				Coke(t)	705.20	0.971	685.00										Entrustment Loan				IRR	34.90	%						
				Power/MWh		0.383	0.00										Self-Funding	120			NPV	137.00	¥10,000						
				Produced oil t)		1.471											Financial Assistance				Cost of energy saving[a]	166.80	¥1/tce						
				Sum total			685.00																						
Total															132	15000												
4	Nanjing Shuanglong Abrasion Resistant Alloy Co.	specialized in production of abrasive products,occupies a land of 22 mu, approximating 14652m2. The annual output capacity is 4000t/a.	wet casting process	Coal (t)			0.00	0.341	tce/t castings	1,800 tce/t castings (a.)	614.33	2.493	1,531.53	build a new lost foam casting process line	165	15,000	Commercial loan		finished	2005.10-2006.12	Payback period	4.52	year	2,500 t castings/a.		0.249 tce/t castings	230.00	573.39	
				Coke(t)		0.971	0.00										Entrustment Loan	65			IRR	26.29	%						
				Power/MWh	1,604.00	0.383	614.33										Self-Funding	68			NPV	111.00	¥10,000						
				Produced oil t)		1.471											Financial Assistance	20			Cost of energy saving[a]	350.30	¥1/tce						
				Sum total			614.33																						
Total															165	15000												
5	Nanjing Xusheng foundry Co., Ltd.	mainly produces gray iron casting and nodular iron casting at annual output of 5500t, annual output value of 20~30 million yuan, approximately US$3 million.	uses clay sand casting process	Coal (t)			0.00	0.218	tce/t castings	5,000 tce/t castings (a.)	1,089.91	2.493	2,717.15	one is to build a new resin sand production line to reduce hot metal single consumption and coke consumption; the other is to modify the cupola, change its profile and apply hot blast operation	200	15,000	Commercial loan		finished	2005.10—2006.12	Payback period	6.71	year	5,000 t castings/a.		0.19 tce/t castings	141.20	352.01	
				Coke(t)	1,122.00	0.971	1,089.91										Entrustment Loan				IRR	13.24	%						
				Power/MWh		0.383	0.00										Self-Funding	188			NPV	26.00	¥10,000						
				Produced oil t)		1.471											Financial Assistance				Cost of energy saving[a]	279.40	¥1/tce						
				Sum total			1,089.91																						
Total															200	15000												
6	Nanjing Lishui Zhongshan Foundry Co., Ltd.	gray iron casting and nodular iron casting at annual output of 10000t, annual output value of 60~65 million yuan, 315 persons of labour force	uses clay sand casting process, with equipments of 7t/h cupola and MF furnace	Coal (t)			0.00	0.190	tce/t castings	5,000 tce/t castings (a.)	950.13	2.493	2,368.66	one is to build a new resin sand production line to reduce hot metal single consumption and coke consumption; the other is to modify the cupola, change its profile and apply hot blast operation	196	15,000	Commercial loan		finished	2005.10-2006.12	Payback period	7.05	year	5,000 t castings/a.		0.17 tce/t castings	100.00	249.30	
				Coke(t)	978.10	0.971	950.13										Entrustment Loan				IRR	11.94	%						
				Power/MWh		0.383	0.00										Self-Funding	184			NPV	15.00	¥10,000						
				Produced oil t)		1.471											Financial Assistance				Cost of energy saving[a]	306.00	¥1/tce						
				Sum total			950.13																						
Total															196	15000												