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Executive Committee of the
Interim Multilateral Fund for the
Implementation of the Montreal Protocol

Eighth Meeting
Montreal, 19-21 October 1992

PROJECT PROPOSAL: CHINA

This document consists of:

- a) Letter from the Government of China;
- b) Nanjing Refrigerator General Works Conversion to HCFC-22 Compressors
Financial Appraisal Summary;
- c) Feasibility Report on Substitution Project and Technical Reform of Small
Semi-hermetic Refrigerator Compressors;
- d) Project Pre-Appraisal Document (prepared by the World Bank).

NOTE FROM THE FUND SECRETARIAT

This project proposal was sent directly by the Government of China for consideration by the Executive Committee at its eighth meeting.

The Government of China requested that the World Bank be the implementing agency for the project. This request was communicated to the World Bank along with copies of the documents submitted to the Fund Secretariat by the Government of China.

The World Bank responded positively to the decision of the Government of China and subsequently submitted a project pre-appraisal report to the Secretariat which is included in this document.

Consequently, the document being submitted consists of:

- Letter from the Government of China
- Nanjing Refrigerator General Works Conversion to HCFC-22 Compressors Financial Appraisal Summary, prepared by the Government of China
- Feasibility Report on Substitution Project and Technical Reform of Small Semi-hermetic Refrigerator Compressors, prepared by the Government of China
- Project Pre-Appraisal Document, prepared by the World Bank.

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NATIONAL ENVIRONMENTAL PROTECTION AGENCY

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Dr. Omar E. El-Arini
Chief Officer
Interim Multilateral Fund
For the Implementation of the Montreal Protocol

Aug. 31, 1992

Dear Dr. Omar E. El-Arini:

We have completed the Feasibility Study and Appraisal Reports of Nanjing HCFC-22 Project which is identified by foreign expert and in compliance with Chinese Country Program. But the World Bank has deferred this project from the first batch of investment projects. Mr. Brown from World Bank explained the impossibility to include this project in the first batch of the projects from the Bank aspect.

As you may know that the refrigeration sector in China is growing very fast now. We do think that the HCFC-22 project is a very important transitional substitution in this area. It could reduce a large amount of CFC-12 substantially in the near future in China refrigeration sector.

Enclosed please find the Feasibility Study Report and Appraisal Report of Nanjing HCFC-22 Project. Please submit it to MPEC for consideration and approval. We hope you could help us to arrange this project to be included into the first investment projects of World Bank.

Thank you very much for your attention.

Best regards.

Sincerely,



Wang Yangzu
Deputy Administrator
NEPA

**NANJING REFRIGERATOR GENERAL WORKS
CONVERSION TO HCFC-22 COMPRESSORS
FINANCIAL APPRAISAL SUMMARY**

CHINA INVESTMENT BANK
JIANGSU BRANCH, NANJING BRANCH
JUL. 1992.

1. **COUNTRY:**
P.R. CHINA
2. **PROJECT TITLE:**
NANJING CONVERSION TO HCFC-22 COMPRESSORS
3. **SECTOR COVERED:**
REFRIGERATION FREEZING INSTALLATION
4. **ODS CONSUMPTION IN SECTOR:**
4,000 TONS CFC-12 IN 1991

5. **PROJECT IMPACT:**

Nanjing Refrigerator General works released 200 tons of CFC-12 in CFC compressor production in 1991. According to the annual production increase rate of 25%, the output of CFC refrigerating compressor will be 12,000 by the end of 1995, under the production without the project. The CFC-12 released will be 300 tons. The construction duration of the project will be 3 years. The output of production in the fourth year will reach its full capacity of 12,000 compressors, phasing out 300 tons of CFC-12, ODP phased out will be 300 tons, after the factory use HCFC-22 instead of CFC-12.

6. **PROJECT DURATION:** 3 years
7. **PROJECT ECONOMIC LIFE:** 10 years
8. **TOTAL PROJECT COST:** 21,666.3 thousand yuan R.M.B.

	INVESTMENT COST		INCREMENTAL OPERATING COST	
	LOCAL (THOUSAND R.M.B)	FOREIGN THOUSAND U.S.D.	LOCAL (THOUSAND U.S.D.)	FOREIGN COST THOUSAND U.S.D.
INCREMENTAL COST	-	1695.1	301.7	-
OTHERS	9256.7	259.5	-	-

9. **TOTAL PROPOSED OTS FUNDING** 1,996.8 thousand U.S.D.
10. **IMPLEMENTING ENTERPRISE:**
The Nanjing Refrigerator General works.
CO-OPERATOR: The Hefei General Machinery Research Institute of MMEI.

11. CO-ORDINATING MINISTRY:

The third Equipment Bureau. Ministry of Machinery and Electronics Industry (MMEI).

12. PROJECT SUMMARY:

The project will phase out the compressors which use CFC-12 as refrigerant in small semi-hermetic compressor production in Nanjing Refrigerator General Works. Instead of using HCFC-22 in new compressor production. The project also includes a CFC compressor processing line modification. When the annual output of compressor reaches 12,000 300 tons of CFC-12 will be reduced, i.e., the ODP value is 300 tons.

Nanjing Conversion to HCFC-22 compressors is the first project in MMEI, and listed as one of the priority projects under the support of UNDP (project no:R3).

13. PROJECT OBJECTIVES

(1) To import and master the advanced commercially certified compressor production technology, and phase-out CFC-12 consumption in production of small semi-hermetic compressors at the Nanjing Refrigerator General Works by converting the production line to HCFC-22 compressors. The Nanjing Factory will work with the HeFei Institute to redesign its small CFC-12 compressors to use HCFC-22.

(2) To modify existing processing line and testing line and increase output of production to 12,000 per year, under the financial support of WB. The factory will phase out 300 tons of CFC-12 every year since the fourth year under the full capacity of production. (ODP value 300 tons.)

(3) To popularize the substitute technology to other enterprises (including Commercial Ministry's enterprise).

14. SECTOR BACKGROUND

There are more than 100 enterprises producing 1-5 KW small refrigerating compressor in P.R. China. The production capacity is more than 250,000, actual production more than 100,000 per year. The total CFC-12 released in 1991 was more than 4,000 tons, it's equivalence ODP is also 4,000 tons and it will reach 11,660 tons in 1995 (estimated).

15. ENTERPRISE BACKGROUND

Nanjing Refrigerator General works is one of the biggest enterprises which produce semi-hermetic refrigerate compressor in MMEI, it's production capacity is 18,000 per year, including 5,000 sets of 1-5 KW compressor which occupy 5-10% of the domestic market. Nanjing conversion to HCFC-22 compressors is recommended by UNDP. The project technology is widely used in advanced countries. Nanjing Factory will seek technology sources abroad for its new small HCFC-22 compressors. For this project the Nanjing factory will work with the Hefei Institute to redesign its small semi-hermetic CFC-12 compressor to use with HCFC-22.

All the HCFC-22 compressors are for local market.

16. PROJECT IMPLEMENT PLAN

To finalize the HCFC-22 compressor design in the first year of the project implementation, Nanjing factory will import technology from abroad for its new small HCFC-22 compressors, meanwhile modify the existing production line and finish its modification in the third year and increase its output to full production in the fourth year.

17. CONVERSION TECHNOLOGY

To use HFC-134a instead of CFC-12 as refrigerant have been succeeded in domestic refrigerator compressor production, but it has not yet used in 1-5KW low temp. small compressor production. There are still a lot of difficulties in 1-5KW compressor production which use R717 as refrigerant.

HCFC-22 used in 1-5KW compressor production is widely used in advanced countries, its technology has been already commercially certified, in addition, it should be pointed out that China CP already spend 9,150,000 dollars to modify a CFC-12 production line, make it produce HCFC-22, it will produce 5,000 tons of HCFC-22 per year. The line is in Jinang, the project of HCFC-22 is approved by UNDP working group in 1991 and 1992. So the Nanjing conversion to HCFC-22 compressors is the most feasible one.

18. PROJECT COST

The total project investment is 22,715.6 thousand R.M.B. yuan. under the condition that all the WB fundings are loan, including 2,139.1 thousand U.S. dollars, and 10,950.8 thousand R.M.B. yuan.

Of total project cost, fixed assets is 21,021.6 thousand R.M.B. yuan, net working capital requirement is 1,694 thousand R.M.B. yuan.

In fixed assets in investment WB provides Foreign Exchange of 1,695.1 thousand U.S. dollars, domestic bank 8,400 thousand yuan, factory self-raised 444 thousand U.S. dollars, and 856.7 thousand R.M.B. yuan so the total non-WB investment should be 11,698.5 thousand R.M.B. yuan and 444 thousand U.S. dollars. According to WB pre-appraisal mission, 1,694 thousand R.M.B. yuan, the net working capital requirement based on annual net operating cost, which are discounted at 12% in project duration, also provided by WB.

From above mentioned, WB total investment should be 1,695.1 thousand U.S. dollars and 1,694 thousand R.M.B. yuan calculating on the official exchange rate 1 dollar for 5.5 R.M.B., it should be 11,017.05 thousand yuan R.M.B. which takes 48.5% of total project investment.

19. FINANCIAL RATE OF RETURN (FRR)

According to the calculation, the Financial rate of return of the project is 2.20% and is much lower than the standard FRR of 12% proposed by the WB.

20. PROJECT ECONOMIC RATE OF RETURN

According to the calculation and comparison, the project economic rate of return is 3.44%, and is a little bit higher than FRR.

This is because CFC-12 have been obsoleted abroad gradually, while HCFC-22 products

are in popular, so the economic price of former is much lower than that of latter, moreover, in economic analysis, taking no account of sales tax is another factor.

ERR is higher than FRR which accounts for the social benefit is much higher than the factory's benefit, it has little financial advantage for factory to use HCFC-22 instead of CFC-12 as refrigerant in compressor production, therefore WB provides financial aid for the project is necessary.

21. ENTERPRISE FINANCE CONDITION:

In 1991, the factory's net profit is 1,581 thousand R.M.B. yuan. but the factor has to repay 12,000 thousand loan in coming years. So if WB loan portion is higher, it will affect the factory's ability to repay the loan.

The project FRR will be 11.96% if the proportion of grant and loan is 75:25, there will be no problem for factory to repay the loan within the project duration.

22. FINANCING PLAN:

WB's proportion of financial support should be 75:25, in order to keep the project FRR at 12%, then the interest of project investment channelled by WB reduced, which will affect the factory fixed assets value and net operating cost and amount of working capital.

The total project investment cost is 21,666.3 thousand R.M.B. yuan, of which, the project fixed assets investment is 20,006.9 thousand R.M.B., net working capital is 1,659.4 thousand R.M.B. WB provides 1,695.1 thousand U.S. dollars for appropriate expense of fixed assets, 1,659.4 thousand R.M.B. yuan for the project net working capital.

The amount of loan by domestic bank will remain as 8,400 thousand R.M.B., factory self-raised fund will be 259.5 thousand dollars and 856.7 thousand R.M.B.

WB's amounts of grant and non-grant are as follows:

	FIXED ASSETS thousand U.S.D.	NET WORKING CAPITAL thousand R.M.B.
Total	1,695.1	1,659.4
Grant	1,271.3	1,244.55
Loan	423.8	414.9

Foreign exchange rate:

1 dollar = 5.5 R.M.B. yuan

WB total investment should be 1,996.9 thousand U.S. dollars (including: 1,497.6 thousand dollars grant, 499.2 thousand dollars loan).

23. UNIT ABATEMENT COST

(1) The project total investment loaned fully by WB will be 22,715.6 thousand R.M.B., calculating on the investment recovery factory of 10%. The project economic life of 10 years.

$$C(F) = 3,696.86 \text{ thousand R.M.B. yuan}$$

$$OC = 2,474.19 \text{ thousand R.M.B. yuan}$$

$$OS = 4,864.8 \text{ thousand R.M.B. yuan}$$

$$UAC = \frac{C(F) + (OC - OS)}{ODS}$$
$$= \frac{3,696.86 + 2,474.19 - 4,864.8}{300}$$

$$= 4.354 \text{ RMB yuan/kg} = 0.792 \text{ Dollar/kg}$$

(2) When proportion of grant and non-grant is provided by WB at 75%:25%, the project total investment will be 21,666.3 thousand R.M.B. yuan, calculating on the investment recovery factor of 10% and the project economic life of 10 years.

$$C(F) = 3,526.09 \text{ thousand R.M.B. yuan}$$

$$OC = 2,425.49 \text{ thousand R.M.B. yuan}$$

$$OS = 4,864.8 \text{ thousand R.M.B. yuan}$$

$$UAC = \frac{3,526.09 + 2,425.49 - 4,864.8}{300}$$

$$= 3.623 \text{ RMB yuan/kg}$$

$$= 0.658 \text{ Dollar/kg}$$

The unit abatement cost is lower, it accounts for the project is feasible.

NJW2.DAT

Feasibility Report on substitution project and
technical reform of small semi--hermetic refrige-
rate compressor

Nanjing Refrigerator General works, China

April, 1992

XJW1.DAT

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1. Executive Summary

1.1 Project name: Ozone layer protection project

1.2 Engineering name: Substitution project and technical reform of small semi-hermetic refrigerate compressor production line

1.3 Operator in chief: NRGW

Project Manager: Jiang hong—da

Technical Manager: Wang zhen—hong

1.4 Cooperator: General Machinery Research Institute
Ministry of Machinery and Electronics Industry.

Manager: Wang chan—qin

Technical Manager: Wang de—kui

1.5 Superior Organization: 3th Branch of M.M.E.I

Supervisor: Zhao yu—xia

1.6 Editor: Yu huo—yun. Ju jia—zheng. Zhang zhao—hui

1.7 Brief Introduction

Ozone layer protection is one of the important environmental works of the world. Organized by UNEP, Montreal and Vienna protocols were signed internationally. China Government also signed the protocols in 1989 and

1991. According to the protocols, the countries who signed the protocols should reduce and finally stop ozone consumption material usage. CFC—12 refrigerant used in refrigerate equipment is O.D.S material, its ODP is 1.0. The protocol says the developing countries should stop CDS usage by the end of 2010. The protocol executive committee's decision in Feb 27, 1992 is that NRCW's small semi—hermetic refrigerate compressor production line reform and technical substitution project is the first one in MMEL.

China is the most population country in the world. Refrigerate equipments are abundantly used in different lines of life with developing of the economic reform and production increasing, People's life level raising, especially for Industry, Agriculture, transport, scientific research, commercial services. Market demand more and more small refrigerate equipment for food, fish the compressor of it use CFC—12 as refrigerant. It is a main serious leakage. According to the statistic, more than 110 factories produce 1—5Kw compressor within China, the production capacity is more than 25 million sets. Actual production is put at 10 million per year. (Semi—hermetic type in 30% . Open type in 70%). The CFC—12 refrigerant discharged amount is 46

hundred tones the amount of CFCs will be increasing rapidly in near future if no close control action was taken on. So substitution work must be speed up in order to reduce CFCs increase in the atmosphere.

At present, HCF—134a already replace CFC—12 as refrigerant in domestic-made refrigerator car air-conditioners, but it is not a practical way to use it in 1 to 5Kw small semi-hermetic compressor production and it is also a technical problem to use R717 instead of CFC—12.

HCFC—22 used as refrigerant for 1 to 5Kw compressor technique is already abundantly used in the advanced countries, it is identified a practicable and acceptable in technique and commercial way. So the aim of the substitution project is that to use HCFC—22 instead of CFC—12 used in 1 to 5Kw compressors.

75% of the factories which produce 1 to 5Kw compressor are under the leadership of MMEI. 25% of it under MMC. MMEI and MMC agreed to take NRGW as a demonstrator in CFC—12 substitution project. NRGW will share the technique with other factories within China. When the project complete.

1.7.1 Import the commercial identified technique from

advanced countries and apply it in domestic compressor production, redesign the compressor which use CFC—12 as refrigerant, use HCFC—22 instead.

1.7.2 Technically reform the existing production lines and test devices with the financial support from the World Bank, Establish 12000 production capacity assembly and processing line. Reduce CFC—12 300 tones per year.

1.7.3 Share the substitution technique with other factories within China train the experts and workers for small semi—hermetic refrigerate compressor's design, manufacture and maintenance.

1.7.4

Total invest

Incremental cost

Multilateral Fund: 1944000 U.S.D

Counterpart loan: 9110600 R.M.P

2. Zero—state of NRGW

2.1 Factory present condition.

Nanjing Refrigerator General Works is one of 14 important refrigerating factories in China. It is under the leadership of MMEL, It is a pointed factory to produce semi—hermetice refrigerating compressor. It's location is

in wasteast industry area of Nanjing. Area ocupation is 10.3 million m², building area is 6.99 million m² capital assets 3361 million yuan I.M.P. nute present value is 2654 million yuan. There are 17 series of products, more than 160 kinds of it some of them won many times state silver medals and spanish quality medal. The 3, 5, 7 million Kcal / h capacity cabinet refrigerating equipments was a pointed product to replace import one. NRGW also export products to more than 24 countries. Its got good reputation within China and abroad.

In the period of sixth—five year plan, NRGW imponted a facial—heat exchanger production line from OAK, U.S.A. heat—exchange rate increase 20%. Tube—shell heat—exchanger use newly developed technique DAE, DAC. heat—exchange rate increase about 15 to 30%. The product resulted in good quality and reliable performance.

2.2.1 Manufactured product construction.

NRGW major products is semi—hermetic compressor air—condition equipments, refrigerate units, chillers and condensing units also the dehumidifier. The Semi—hermetic refrigerating compressor can be devided into two parts, one

is domestic developed 1 to 5Kw series.(for small refrigerate storage use,the purpose of the substitute projet is to modify this part),the other is D / B mestic and Big—4 series (licenced technique from Dunham—Bush U.S.A). The substitution project is mainly for domestic part.

Air—condition products is in 11 series, total 60 kinds of it, they are air and water cool refrigerating units and can be matched with H , M , L temp. condition, refrigerating units. Dehumidifier can be devided into normal type and tempering —up and down type. Advcenced CT dehumidifier can auto tempering—up and down controlled by set—point by different degree of humid and desired moist. NRGW cooperated with Canatal company produce "Special air—conditioner for computer room " in 1991.

2.2.2 Factory production capacity.

The production capacity of small semi—hermetic refrigerating compressor in NRGW is 18000 per year. (include 1 to 5 Kw series 7000 sets, D / B 11000 sets)

The factory has 3 production line, one assembly line, one washing line and a paint line, 426 machineries in total, 19 big machines. One CMM and so on.

2.3 Organization state of production.

2.3.1 Mechanism of organization and production.

NRGW has two son branches one air—conditioner department, one institute. One refrigerate technical school, ten workshops workers are 2141 in total, engineers 286, it is 13.3% of total workers.

Relationship between NRGW executive organization and
it's department.

Factory Director

1. Technical Director	2. Production Director	3. Executive Director	4. Director's office
Chief engineer office	Production plan office	Labour office	5. Sales office
Research institute	Supply office	Education office	6. Financial office
Quality inspect center	Maintenance office	Security office	7. Executive control and TQC office
Process Art office	Security and environ—	Build office	
Inspection office	ment office		
Devices office	Compressor Branch		
	Second Branch		
	Workshops		
	Labour service office		

2.3.2 Labour—force construction.

There are 2141 workers in NRGW, Factory manager followed by 3 vice—managers and 2 manager 's advisers. Technician 286. Senior engineers 10, Engineers 50, lecturers 5. Doctors 7. Accountants 3.

2.4 Current State of NRGW.

Main manufactured products are 1903 sets in 1991 include 773 air—condition units. Dehumifier 233 sets refrigerating units 899 sets. manufactured products value is 37843 million yuan R.M.B. Saling profit 4204 million yuan.

2.5 Finaneral state of NRGW.

2.5.1 Financial control mechnism.

Chief accountant is the factory manager 's assistant and adviser. Who is charge of financial income and expansion make financial,saling and expansion, repost everyday and give suggestions,too.

2.5.2 Content of finaacial control.

1. In charge of production cost,invest fund and expansion.
2. Reasonably arrange and supervise the usage of invest fund assets and production cost.
3. Regulate cash expansion and dispatch.

NRGW have rich experience in semi—hermetic refrigerator compressor production as above mentioned NRGW is able to undertake the project with the financial support from the World Bank. It will share the technique with other factories within China when the project complete.

3. Market forecast & production design.

3.1 Market demand.

100 million small semi—hermetic compressor will be need every year, mainly used in small refrigerating equipments and storage house, advanced with development of economic reform and people ' s life level raise, refrigerating equipt are abundantly used in different lines of life according to the market investigation and MMEI statistic, market demand 10 million sets per year, By the end of 2000, it will be increased to 16 million sets.

3.2 Production design.

The purpose of MMEI and MMC to choose NRGW as a demonstrator in substitution project is to reduce invest risks and result in good environmental effective. According to CFC 5 reducing plan of Montreal Protocol and Vienna

Protocol and the present condition of NRGW, it is a clever Decision to choose NRGW as a demonstrator. When the project complete, NRGW's production capacity will be 12000 sets per year in that case, it can reducing CFC's serious leakage, manufactured products will occupy 10% of the market demand. NRGW takes 2FL5B44A—3.0 semi—hermetic as representative product redesign it, make it suitable HCFC—22.

Type	output per year	each set			Whole year		
		Refrigerate capacity	Net weight	price RMB	Refrigerate Capacity	Total weight	Output value
		(KW)	(Kg)		(10 ⁻³ Kw)	(T)	10 ⁻³ RMB
2FL5B 44A—3.0	12000	8.32	78	2100	9.98	936	2520

4. Main material supply and Power facilities.

4.1 Main material supply.

Some of the material are from Government ,include steel,wood, coal, others from supplier, compressor spare—p-arts from supplier are motor, piston, pin, push, crankshaft and connecting rod.

4.2 Power facilities.

4.2.1 Water—inlet

Water—supply source from city water—plant, inlet water—pipe diameter 150mm. Water—outlet no problem.

4.2.2 Boiler room.

Newly built boiler room has two 4 t/h boilers. Which supply steam for production, bathroom and kitchen.

4.2.3 Power supply.

Newly built transformer room has one SL7—630 / 10 transformer. Power inlet cbble is 10 KVA, power consumption is 1500 Kw.

4.2.5 House modification.

Only small parts of the house need modified,most of them are ready for new machineries.

5. Equipment selection.

One of the important taske of the sabstitution project is undertake technical reform of the existing production and assembly line, apply advanced technique in production.

5.1 Compressor house processing.

Buy 4 machinery centers, 1 vertical grinding machine only 7 new devices are needed.

5.2 Valve plate, cylinder cover and terminal cover processing.

Technically reform 19 machineries in order to increase processing effect.

5.3 Compressor Spare—parts and its painting.

Increase compressor painting devices, press machines 18 sets are domestic made, import 6 sets from America, England, Japan.

6. Environmental and Social effect.

6.1 Brief:

Environment protection will be better after the project complete, NRGW will reduce serious CFC_s leakage and finally stop CFC_s usage.

6.2 Environmental effect.

Current product of NRGW 2FL5B44A—2.2 semi—hermetic refrigerate compressor use CFC—12 as refrigerant, It's ODP value is 1.0. It's a material should be reduced and finally fully stopped, according to Montreal Protocol, The project is for this purpose. HFC—134a ODP is 0, but it can't

to be used in practical commercial way, due to different difficulties. HCFC—22's ODP is 0.05 use it instead of CFC—12 is acceptable and practical in technique and commercial way. Redesign compressor is necessary in substitution project due to different physical character of HCFC—22 and CFC—12.

NRGW will cooperate with Hefei General Mechanical Institute in compressor design with financial support from World Bank, use HCFC—22 instead of CFC—12 and reform the existing production lines and inspection devices, form 12000 new type small semi—hermetic refrigerating compressor production line, reduce CFC—12 300 tones per year.

6.3 Economic effect.

Due to HCFC—22 selling price is much higher than CFC—12 and compressor redesign need advanced technique and need much more expensive material, together with depreciation of the machineries, all these will increase production cost, the factory's profit will be influenced as undertake the substitution project. Financial support from World Bank is necessary.

The loan for technical reform during seventh five year plan is not yet paid, together with counterpart loan for this project. It become a heavy burden for NRGW.

All in all, financial support is necessary for substitution project undertaken by NRGW. If NRGW gets financial support from the World Bank it can reduce CFC—12 300 tones per year.

7. Schedule of the project

Project undertaker is NRGW.

NRGW cooperated with Hefei General Mechanical institute in small semi—hermetic refrigerating compressor redesign.

After the project approved by UNDP and NRGW receive the money.

First year:

A: 8 experts will be sent to Dutch, America and English on the purpose of on—the—spot investigation.

B: Invites specialists from U.S.A. Copeland Co. and Purdue University to give us lectures on CFC_s substitution technology.

C. Complete the work of import technology and absorb it and try the new type compressors production

D. Design the process art for new type compressor, undertake the technical reform of the production line, Device selection and order them

Second year: A: Sending persons who in charge of process art, managing and equipment testing to U.S.A and Dutch to receive technical training for CFC_s substitution work.

B: Invite specialists from Dutch, Copeland Co. to give us lectures on CFC_s substitution and CFC_s recovery in China.

C: Complete technical reform for production and equipments improt and begin the installation and adjust production line.

D. Complete trial production and performace test, try our best to produce 1—5Kw compressor 500 to 1200 sets.

Third year: A: Complete installation and adjustment of production line and increase production capacity to 4800 compressors.

B: complete substitution training.

Fourth year: Increase the production Capacity to 12000 annually.

7.3 Engineering contract and Devices buying

Engineering devided into two parts. One domestic part, other is abroad parts domestic part include home—made equipment buying, Abroad part is important machine and

software imports, on-the-spot investigation. Foreign experts giving lectures and equipment installation and adjustment.

7.4 Training and production.

7.4.1 Production Organization.

Present NRGW production Organization and control system is enough, no more workers are needed.

7.4.2 Training.

NRGW need training some workers and experts for substitution project.

8. Invest General Estimate.

The investment of the project is about 194.4 million U.S. Dollars and 911.06 million R.M.B. Total in RMB 1953.06 million yuan for details reference to "Invest cost and expansion".

9. Economic analysis.

9.1 Forecast

The product cost is based on worker wage controlling expansion, depreciation of the machine and capital assets, include base depreciation rate 9.6% & repairing cost, R.M.B. loan interests 8.46% per year.

9.1.2 Selling profit and tax.

2FL5b44A—3.0 (R22) selling price is 2100 per set.

9.1.3 Financial cash flow analysis.

When $i=10\%$ (NPV) is 22.09 million yuan internal rate is 10.4% invest period is 10 years.

9.1.3 Invest profit rate.

$$\begin{aligned}\text{Invest profit} &= \frac{\text{Total profit}}{\text{Total invest}} \times 100\% \\ &= \frac{103.49}{1953.06} \times 100\% = 5.3\%\end{aligned}$$

9.1.3.3 Invest tax rate.

$$\begin{aligned}\text{Invest tax rate} &= \frac{\text{Total profit} + \text{Total tax}}{\text{Total invest}} \times 100\% \\ &= \frac{103.49 + 190.51}{1953.06} \times 100\% = 15.05\%\end{aligned}$$

Summing-up

For this subproject the Nanjing factory will work with the Hefei Institute to redesign its small semi-hermetic CFC-compressor for use with HCFC-22 and convert its production line.

The technology which will be imported from abroad is ready commercial certified, likewise the technology sources have been identified as Copeland Co. U.S.A. It is a popular technology in advanced country, it is a practical way at present.

From the view of the project effect, UNDP stresses environmental effect, so HCFC-22 product is less competitive than CFC-12. If WB proportions its grant and non-grant will better the result. When $i = 12\%$, Foreign exchange loan is 100%, $NPV = -78.47$ thousand yuan R.M.B. Internal financial rate of return is 10.08%, repayment will be 9 years.

PROJECT COVER SHEET

COUNTRY: China

PROJECT TITLE: Nanjing Conversion to HCFC-22 Compressors

SECTOR COVERED: Commercial Refrigeration

ODS CONSUMPTION IN SECTOR: 9,135 tons CFC-12 in 1991 (9135 tons ODP)

PROJECT DURATION: 3 years

PROJECT IMPACT: Phase out 300 tons CFC-12 (300 tons ODP)

TOTAL PROJECT COST: \$4,212,000

PROPOSED OTF GRANT: \$2,183,000

LOCAL AGENCIES: Nanjing Refrigerator General Works
Ministry of Machines and Electronic Industry

IMPLEMENTING AGENCY: WORLD BANK

PROJECT APPRAISAL DOCUMENT

GRANTEE: China

COST: \$ 4,212,000

FINANCING: \$ 2,183,000 OTF grant
1,965,000 local loan
213,000 enterprise funds

APPRAISAL DATE:

GRANT APPROVAL DATE:

PEER REVIEWERS:

TECHNICAL REVIEW:

Project Summary:

This subproject will phase out CFC-12 consumption in production of small semi-hermetic compressors at the Nanjing Refrigerator General Works (the Enterprise) by converting the production line to HCFC-22 compressors. The Enterprise will work with the Hefei Institute to redesign its small CFC-12 compressors for use with HCFC-22. Foreign experts will be brought to China to give technical advice on the compressor conversion. After the HCFC-22 compressor design is finalized, the Enterprise will convert its small semi-hermetic compressor production line to its production. This subproject will result in a reduction of 300 tons of CFC-12 annually when the project is in full operation.

Project Objectives:

The project objectives are to: (i) redesign the small semi-hermetic compressor produced by the Enterprise for use with HCFC-22; and (ii) convert the Enterprise's small semi-hermetic compressor line to production of HCFC-22 units.

Sector Background:

China's commercial refrigeration industries consumed about 9,135 tons of CFC-12 in 1991. This amount will continue to grow unless new equipment is built for use with CFC substitutes. In 1996 CFC-12 consumption is expected to reach 11,660 tons for commercial refrigeration applications.

Project Description:

The Enterprise will work with the Hebei Institute to redesign its small semi-hermetic CFC-12 compressor for use with HCFC-22 and convert its production line. The Enterprise currently produces both CFC-12 and HCFC-22 semi-hermetic compressors. CFC-12 compressors are used in both high and low temperature applications. The HCFC-22 compressors are used exclusively for high temperature applications. Half of the compressors made at the plant are assembled into condensing units, water chillers and other devices. The remaining half are sold to other concerns. The Enterprise has an agreement with Dunham Bush (US). Foreign experts will be invited to participate in the design project. Following completion of design and successful testing of HCFC-22 prototypes, the Enterprise's small semi-hermetic compressor line will be converted to commercial production.

Project Costs: (The figures below are taken from the CIB appraisal report, corrected for the current policy decision that the OTF financing is limited to the incremental costs as calculated according to the June 1992 MPEC decision. Costs estimates are based on current Enterprise estimates as supplied by CIB and the enterprise and need to be updated based on actual information from technology and equipment suppliers, as well confirmation on cost details such as interest during construction and contingencies. The cost estimates and analysis will be updated during the Bank's appraisal of the project.)

Incremental Costs	Project Costs		
	Local	Foreign	Total
\$2.183 million	2.167 million	\$1.955 million	\$4.122 million

Financial and Economic Analysis (The following analysis is based on the CIB appraisal report):

The company is reported to be heavily in debt including capital loans for its previous investments and for working capital loans both of which are being repaid at seven percent annually and represent over four percent of gross turnover, based on early 1992 data. The Enterprise ability to repay existing loans and new debt including the foreign debt to be incurred will need to be confirmed, included confirmation of satisfactory debt service coverage and cash flow projections for the Enterprise.

FRR of project before consideration of Grant -1% (ERR to be confirmed)
The low FRR is due to the assumption that the revenue will be the same (compressors will be sold at same price and that operating cost will go up due to the higher cost of HCFC 22 compared to CFC12. These assumptions will need to be assessed during appraisal. The market for the new compressors also needs to be confirmed.

Incremental cost based on the Enterprise obtaining a 12% FRR on the project after the incremental cost (the proposed OTF grant) portion is subtracted: \$2.183 million

(The above analysis is based on figures recalculated by CIB with the assistance of the Bank

mission. The revised numbers are slightly different from the document submitted to the MPEC. The differences appear to be due to changes in methodology only.)

Unit statement cost: \$0.792/kg ODF (reference CIB appraisal report page 5)

Financing Plan (to be confirmed during appraisal):

OTF grant	\$2.183 million
Enterprise funds	0.213
Local loan	1.963
Other loan	0.000
total	\$4.122 million

"Other loan" would be equivalent to the difference between the total foreign costs of the project and the amount of the OTF grant, but in this case no foreign exchange loan appears to be required. The financing plan and loan arrangements will need to be confirmed during appraisal as well as impact on enterprise financial viability.

Project Implementation and Schedule:

The Ministry of Machines and Electronic Industry (MMEI) will oversee the successful implementation of this subproject. The subproject will be carried out by the technical staff of the Enterprise. The Hefei Institute will provide technical assistance to the Enterprise during project execution. The technology acquisition arrangements for the project will be confirmed during appraisal. Project implementation and disbursement schedules will be confirmed during appraisal. Procurement arrangements will follow standard Bank guidelines as agreed with CIB for OTF subprojects. Assuming satisfactory appraisal, the subproject would be added to the first ODS Project for China and would be processed on the same schedule as those subprojects. A detailed subproject implementation schedule will be prepared during appraisal.

Environmental Considerations:

An Environmental Assessment according to Chinese national regulations will need to be prepared and available for review during appraisal.

Technical Assessment:

The project will be submitted to the Bank's OORG technical panel for review during a meeting scheduled for September 28. The technical panel's recommendations will be taken into consideration in regard to final project design and appraisal.

CHINA - OZONE DEPLETING SUBSTANCES (ODS) PHASE OUT PROJECT
Calculation of Grant Amount
Nanjing Refrigerator General Works

Annex 1

Without Grant Financing

US\$ '000

Year	Investment	Grant	Revenue	Incremental Tax	Operating Cost	Total Incremental Oper benefits	Net Cash Flow
1	3,298					0	(3,298)
2	824					0	(824)
3			354	22	180	152	152
4			885	55	450	379	379
5			885	55	450	379	379
6			885	55	450	379	379
7			885	55	450	379	379
8			885	55	450	379	379
9			885	55	450	379	379
10			885	55	450	379	379
11			885	55	450	379	379
12	(300)		885	55	450	379	679
NPV at 12%						1,939	(1,979)
FIRR							-1%

With Grant Financing

Year	Investment	Grant	Revenue	Incremental Tax	Operating Cost	Total Incremental Oper benefits	Net Cash Flow
1	3,298	1,772				1,772	(1,526)
2	824	443				443	(381)
3			354	22	180	152	152
4			885	55	450	379	379
5			885	55	450	379	379
6			885	55	450	379	379
7			885	55	450	379	379
8			885	55	450	379	379
9			885	55	450	379	379
10			885	55	450	379	379
11			885	55	450	379	379
12	(300)		885	55	450	379	679

NPV at 12%	1,935	1,939	(44)
FIRR			12%

Note:
ODS Reduction investment cost \$4,122

Proposed OTE financing for:	
Investment cost	\$4,122
Add/less incremental operating losses/benefits	\$1,939
Total ODS reduction project cost (or incremental cost)	\$2,183
Funds needed to be raised by enterprise for the project	\$2,183
Loans	\$1,945
Self financing	\$218

File name: Nanjing
Date created: 17-Sep-92
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Need to check on whether the total cost include IDC, and physical and price contingencies, and whether permanent working capital is needed for the project