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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Seventy-fifth Meeting
Montreal, 16-20 November 2015

PROJECT PROPOSALS: CHINA

This document consists of the comments and recommendations of the Fund Secretariat on the following project proposals:

Phase-out

• HCFC phase-out management plan (stage I)	UNDP, UNEP, UNIDO, World Bank, Germany, and Japan

Refrigeration

• Demonstration project for ammonia/carbon dioxide (NH_3/CO_2) refrigeration system using semi-hermetic frequency convertible screw refrigeration compressor units in the industrial and commercial refrigeration industry at Fujian Snowman Co., Ltd.	UNDP

China: HCFC phase-out management plan (stage I) (UNDP, UNEP, UNIDO, World Bank, Germany, and Japan)

Note by the Secretariat

Background

1. At its 64th meeting, the Executive Committee approved, in principle, stage I of the HPMP for China for the period 2011 to 2015 at the amount of US $265 million (excluding agency support costs), associated with extruded polystyrene (XPS) foam, polyurethane (PU) foam, industrial and commercial refrigeration and air-conditioning (ICR), room air-conditioning manufacturing (RAC) and refrigeration servicing sector plans, the national enabling programme and the national co-ordination plan. The Committee also decided that the solvent sector, at a maximum level of funding of up to US $5,000,000, (excluding support costs), could be considered at the 65th meeting (decision 64/49). With the approval of the solvent sector plan at the 65th meeting (decision 65/36), the overall funding for stage I of the HPMP for China amounted to US $270,000,000.

2. The Agreement between the Government of China and the Executive Committee for the phase-out of HCFCs was first approved at the 66th meeting, and updated at the 67th meeting, reflecting the newly established HCFC baseline for compliance in China, the change in responsibility of co-operating agencies, and the established agency support costs (decision 67/20).

3. To ensure compliance with the Montreal Protocol by China, the 2013 and 2015 HCFC consumption control targets in the six sector plans are shown in Table 1.

Table 1. HCFC consumption limits and targeted phase-out amount in consumption sectors for stage I of the HPMP for China

National/Sectoral level	2013 (ODP tonnes)		2015 (ODP tonnes)	
	Max. allowable consumption	Phase-out amount	Max. allowable consumption	Phase-out amount
National	18,865	n/a	16,979	n/a
Sector plans				
XPS	2,540	338	2,286	254
PU	5,392	673	4,450	942
ICR	2,403	224	2,163	240
RAC	4,109	176	3,698	411
Solvent	494	30	455	39
Servicing	n/a	50	n/a	
Total	**n/a**	**1,490**	**n/a**	**1,886**

4. Since the approval of the HPMP for China, the Executive Committee has approved several tranches associated with the sector plans as listed in Table 2.

Table 2. Dates of approvals of sector plans of the HPMP for China

Sector plan	Meeting of the Executive Committee								
	64th	65th	68th	69th	71st	72nd	73rd	74th	75th**
XPS	First			Second	Third		Fourth		Fifth
PU	First		Second		Third*		Fourth		Fifth
ICR	First		Second		Third		Fourth		Fifth
RAC	First		Second		Third		Fourth		Fifth
Solvent		First			Second				Third
Servicing	First		Second			Third		Fourth	Fifth

* Approved on an exceptional basis on the understanding that funding would be disbursed by the Treasurer to the World Bank only after the Secretariat had accepted as sufficient information provided by the World Bank to the effect that disbursement of 20 per cent or more of the second tranche to final beneficiaries had been achieved. Funds were transferred from the Treasurer to the Wold Bank in January 2014.
** Requested.

Submission to the 75th meeting

5. On behalf of the Government of China UNDP, UNEP, UNIDO, the World Bank and the Governments of Germany and Japan submitted tranche requests for the sector plans associated with stage I of the HPMP for China as shown in Table 3, together with an independent verification of HCFC production and consumption in 2014 (World Bank), annual implementation reports covering the activities undertaken so far, and annual implementation plans for the activities to be implemented in 2016.

Table 3. Tranche requests of sector plans submitted to the 75th meeting

Sector plan (lead and co-operating agency)	Overall funding approved in principle (US $)	Previously approved funding (US $)	Previously approved funding as share of overall approved in principle (%)	Funding requested at 75th meeting (US $)	Share of funding approved and requested of total approved in principle (%)
XPS (UNIDO, Germany)	50,000,000	42,767,000	86.0	7,233,000	100.0
PU (World Bank)	73,000,000	62,050,000	85.0	10,950,000	100.0
ICR (UNDP)	61,000,000	51,850,000	85.0	9,150,000	100.0
RAC (UNIDO)	75,000,000	63,750,000	85.0	11,250,000	100.0
Solvent (UNDP)	5,000,000	4,500,000	90.0	500,000	100.0
Servicing (UNEP, Japan)	5,640,000	4,774,000	85.0	866,000	100.0
Total	**269,640,000**	**229,691,000**	**85.0**	**39,949,000**	**100.0**

6. After reviewing the project proposals, the Secretariat concluded that all of the sector plans had merits to warrant their submission to the 75th meeting.

HCFC consumption

7. The Government of China has reported consumption of HCFC under Article 7 of the Montreal Protocol and has also provided country programme data as shown in Table 4.

Table 4. HCFC consumption in China (2010 to 2014)

Year	2010	2011	2012	2013	2014*	Baseline
Metric tonnes						
HCFC-22	220,984.9	213,809.0	237,459.7	195,009.29	190,322.43	215,260.7
HCFC-123	748.0	772.0	778.4	1,010.97	1,005.78	528.3
HCFC-124	-14.2	16.8	-5.7	119.89	96.23	135.2
HCFC-141b	56,687.7	68,332.2	63,863.9	51,010.33	51,847.78	54,011.8
HCFC-142b	23,530.5	22,241.3	15,274.3	12,855.04	9,918.41	22,670.7
HCFC-225ca	55.8	59.5	16.2	28.73	33.23	49.0
Total	**301,992.7**	**305,230.8**	**317,386.8**	**260,034.25**	**253,223.86**	**292,655.7**
ODP tonnes						
HCFC-22	12,154.17	11,759.49	13,060.28	10,725.51	10,467.73	11,839.34
HCFC-123	14.96	15.44	15.57	20.22	20.12	10.57
HCFC-124	-0.31	0.37	-0.13	2.64	2.12	2.98
HCFC-141b	6,235.64	7,516.55	7,025.03	5,611.14	5,703.26	5,941.30
HCFC-142b	1,529.49	1,445.69	992.83	835.58	644.70	1,473.60
HCFC-225ca	1.40	1.49	0.41	0.72	0.83	1.23
Total	**19,935.4**	**20,739.0**	**21,094.0**	**17,195.80**	**16,838.75**	**19,269.02**
Change to previous year	7.2%	4.0%	1.7%	-18.5%	-2.1%	n/a

* Source: country programme implementation report

8. The consumption of China continues to be dominated by three substances, HCFC-22, HCFC-141b and HCFC-142b, which collectively account for 99.8 per cent of the country's consumption. Overall HCFC consumption in 2014 was the lowest in the last six years due to reductions of 357 ODP tonnes in HCFC-22, HCFC-123, HCFC-124 and HCFC-142b consumption. Consumption of all substances is expected to continue decreasing as additional enterprises complete their conversions to alternative technologies in all manufacturing sectors.

9. Table 5 presents HCFC consumption per sector for 2014 which demonstrates compliance with the manufacturing sector consumption limits set out in rows 1.3.1, 1.3.2, 1.3.3, 1.3.4 and 1.3.5 of Appendix 2-A of the Agreement between the Government of China and the Executive Committee.

Table 5. Consumption of HCFC (in ODP tonnes) per sector in China in 2014*

Substance	XPS foam	PU foam	ICR	RAC	Solvent	Servicing
HCFC-22	1,644.5		2,200.00	3,547.50		3,118.80
HCFC-141b		5,155.00			484.00	
HCFC-142b	604.5		6.50			32.70
HCFC-123			12.98			7.10
HCFC-124						2.10
HCFC-225ca/cb					0.83	
Total	**2,249.00**	**5,155.00**	**2,219.48**	**3,547.50**	**484.83**	**3,160.70**
Maximum allowable consumption	2,540.00	5,392.20	2,402.80	4,108.50	494.20	n/a

*Aerosol sector not included as it is not part of stage I of the HPMP.

10. The Government of China continued to monitor the consumption in the different sectors, to ensure compliance with the targets. Each year, the Foreign Economic Cooperation Office (FECO) collects data from different sources including beneficiary enterprises, verification report of the production sector, the license system and industrial associations. Data is cross verified with the actual consumption in the enterprises only for some sectors and substances, such as the RAC sector (with limited consuming enterprises) and HCFC-123. For sectors with large number of small and medium-sized enterprises (SMEs) (i.e., XPS foam, PU foam, ICR, and servicing sector) consumption is monitored through the national system of licensing and quotas for HCFC imports, exports, production and consumption. The domestic production quotas control HCFC sold in the local market and subsequent consumption in SMEs. Quotas are also issued to enterprises with an annual consumption of HCFCs over 100 mt.

11. In addition, FECO is cooperating with the local Environmental Protection Bureaus (EPBs) to strengthen policies that can support the reduction of HCFC consumption, including the ban for the new HCFC-based manufacturing facilities and controls on the growth of HCFC consumption.

Verification of production and consumption of HCFCs in China

12. The World Bank commissioned an independent verification of 2014 HCFC production and consumption in China. The verification confirmed that the production of HCFC in 2014 is within the limits established by the Agreement for the production sector. The verification team also verified HCFC consumption data for the various HCFCs.

13. The Secretariat noted a difference of 645.87 ODP tonnes between the consumption reported under the Article 7 (16,838.53 ODP tonnes) and that reported in the verification report (17,484.40 ODP tonnes). The World Bank informed that China has always used (and will continue using) the customs data to report its consumption and production under Article 7. The estimate of HCFC use per sector reported in the country programme implementation report uses information obtained from the verification report. During the verification process to determine the export amount of HCFCs, the producers must provide completed supporting documents for each export (both direct by producer and indirect through dealers). For any exports that producers have no completed supporting documents, the verification team considered

those corresponding quantities as domestic sales. Therefore, consumption from the verification report will, in general, be higher than the actual consumption.

Verification of manufacturing sector conversions

14. UNDP, UNIDO and the World Bank submitted technical verification reports to verify the completed conversions in 2014 in the PU foam, ICR, RAC and solvents sectors, in line with paragraph 5(b)(i) of the Agreement. The verifications reports confirmed the completion of these projects, ODP tonnes of HCFC phased out and provided reassurance on the commitment from converted enterprises to not to revert to the use of HCFCs. An overview of the sector verifications undertaken so far is shown in Table 6.

Table 6. Overview of sector verifications as per paragraph 5(b)(i) of the Agreement

Sector	Number of enterprises	HCFC phase-out verified (mt)	Percentage of HCFC phase-out in 2014 verified	Remarks/issued identified
XPS	n/a	n/a	n/a	No enterprise received national acceptance in 2014
PU	7	921.46	75	None
ICR	1	172.31	30	None
RAC	4	2,357.77	33	None
Solvent	1	50.97	12	None

Overview of progress

15. An overview of the main achievements in the implementation of stage I of the HPMP include:

(a) Compliance with all the manufacturing sector consumption limits during the years of implementation and establishment of licensing and quota system to control the overall compliance in each one of the manufacturing sectors;

(b) Two XPS foam enterprise converted (612.78 mt of HCFC-22 and HCFC-142b) and substantial progress in the conversion of additional 23 enterprises being assisted to phase out a total of 9,590 mt of HCFC-22 and HCFC-142b;

(c) Eleven PU foam enterprises converted (1,229.41 mt of HCFC-141b) and progress in the conversion of the remaining 43 enterprises being assisted to phase out a total of 12,762.95 mt of HCFC-141b;

(d) Eleven RAC manufacturing enterprises converted (6,115 mt of HCFC-22), and substantial progress in the conversion of the remaining 13 enterprises being assisted to phase out a total of 9,966 mt of HCFC-22;

(e) A solvent demonstration project completed (27.82 mt of HCFC-141b), five solvent enterprises converted (413.21 mt) and substantial progress in the conversion of the remaining four being assisted to phase out a total of 638.11 mt of HCFC-141b;

(f) Eight production lines in the ICR sector converted (1,044.6 mt of HCFC-22) and substantial progress in the conversion of the remaining production lines included in stage I. Assisted enterprises are no longer using HCFC 22 resulting in the phase-out of an additional 7,082 mt of HCFC-22;

(g) Technical assistance and support activities implemented to facilitate smooth implementation of the conversions and adoption of alternative technologies in all manufacturing sectors, including *inter-alia* standard revisions, research and development on applicability of low global warming potential technologies, training, awareness raising, technology promotion and dissemination; and

(h) Refrigeration servicing sector: completed the drafting of three standards covering the use of flammable refrigerants in household appliances; requirements for the transport, installation and servicing of room air conditioning equipment using flammable refrigerants were defined; six national and regional training centres established, 29 training courses completed; feasibility study to support the certification of service technicians was completed; purchased and distributed 30 sets of portable refrigerant identifiers; continued outreach and communication activities focusing on the use of HC-290 equipment.

16. The date of completion of stage I as specified in paragraph 13 of the Agreement is 31 December 2016. In view of the fact that there are still enterprises conversions ongoing in most of the manufacturing sectors, the Secretariat discussed with the implementing agencies estimated dates of completion for each one of the sectors and with UNDP (as the lead implementing agency) the estimated completion of the overall stage I of the HPMP. UNDP indicated that the revised date of completion of stage I is December 2019 as additional time will be required to disburse incremental operating cost to converted enterprises and to complete administrative closure of contracts established under stage I. However, it is noted that most of the activities in each sector are expected to be completed during 2017.

17. In accordance to decision 74/19, the Government of China and the bilateral and implementing agencies are requested to submit progress reports on a yearly basis on the implementation of the work programme associated with the final tranches of each sector plan, and verification reports until the approval of stage II. A paragraph reflecting this request is included in the Secretariat's recommendation for each sector.

Disbursement of funds and interest accrued

18. Based on decision 69/24, each of the sector plans submitted included detailed information on funds disbursed and interest accrued, as shown in in the respective sector plans of this document. Table 7 summarizes the level of funds disbursed by the implementing agencies as of September 2015.

Table 7. Level of disbursement per sector

XPS foam sector plan (UNIDO/Germany)		**Tranche 1**	**Tranche 2**	**Tranche 3**	**Tranche 4**	**Total**
Funds approved		21,831,023	10,607,977	3,998,000	6,330,000	42,767,000
Disbursements from implementing agencies to FECO	Amount (US $)	19,693,823	9,586,277	1,199,400	1,899,000	32,378,500
	Disbursement ratio	90.2%	90.4%	30.0%	30.0%	75.7%
Disbursements from FECO to beneficiaries	Amount (US $)	12,693,506	5,720,438	1,199,400	1,899,000	21,512,344
	Disbursement ratio	58.1%	53.9%	30.0%	30.0%	50.3%
PU foam sector plan (World Bank)						
Funds approved		38,859,000	5,520,000	13,592,000	4,079,000	62,050,000
Disbursement from the World Bank to FECO	Amount (US $)	31,087,200	4,416,000	6,796,000	2,039,500	44,338,700
	Disbursement ratio	80.0%	80.0%	50.0%	50.0%	71.5%
Disbursement from FECO to beneficiaries	Amount (US $)	17,706,932	3,660,567	4,532,936	1,179,517	27,079,952
	Disbursement ratio	45.6%	66.3%	33.4%	28.9%	43.6%

ICR sector plan (UNDP)		Tranche 1	Tranche 2	Tranche 3	Tranche 4	Total
Funds approved		25,380,000	6,900,000	8,495,000	11,075,000	51,850,000
Disbursements from UNDP to FECO	Amount (US $)	25,380,000	6,900,000	8,495,000	3,282,872	44,057,872
	Disbursement ratio	100.0%	100.0%	100.0%	29.6%	85.0%
Disbursements from FECO to beneficiaries	Amount (US $)	9,975,216	3,148,500	2,929,694	2465581	18,518,991
	Disbursement ratio	39.3%	45.6%	34.5%	22.3%	35.7%
RAC sector plan (UNIDO)						
Funds approved		36,430,000	9,200,000	8,495,000	9,625,000	63,750,000
Disbursement from UNIDO to FECO	Amount (US $)	32,786,917	4,600,000	4,235,300	2,887,500	44,509,717
	Disbursement ratio	90.0%	50.0%	49.9%	30.0%	69.8%
Disbursement from FECO to beneficiaries	Amount (US $)	15,361,821	3,848,378	2,650,373	2,013,940	23,874,512
	Disbursement ratio	42.2%	41.8%	31.2%	20.9%	37.5%
Solvent (UNDP)						
Funds approved		2,500,000*			2,000,000	4,500,000
Disbursement from UNDP to FECO	Amount (US $)	2,500,000			1,600,000	4,100,000
	Disbursement ratio	100.0%			80.0%	91.1%
Disbursement from FECO to beneficiaries	Amount (US $)	2,195,543			979,224	3,174,767
	Disbursement ratio	87.8%			49.0%	70.6%
Servicing (UNEP/Japan)						
Funds approved		1,659,000	678,000	1,184,000	1,253,000	4,774,000**
Disbursement from UNEP to FECO	Amount (US $)	1,302,000	385,000	650,000	500,000	2,837,000
	Disbursement ratio	78.5%	56.8%	54.9%	39.9%	59.4%
Disbursement by FECO	Amount (US $)	1,114,264	288244	588,163	255,103	2,245,774
	Disbursement ratio	67.2%	42.5%	49.7%	20.4%	47.0%
Total all sectors						
Funds approved by the Executive Committee		126,659,023	32,905,977	35,764,000	34,362,000	229,691,000
Disbursements to FECO	Amount (US $)	112,749,940	25,887,277	21,375,700	12,208,872	172,221,789
	Disbursement ratio	89.0%	78.7%	59.8%	35.5%	75.0%
Disbursements from FECO to beneficiaries	Amount (US $)	59,047,282	16,666,127	11,900,566	8,792,365	96,406,340
	Disbursement ratio	46.6%	50.6%	33.3%	25.6%	42.0%

*Approved at the 65th meeting.

**Of this amount, US $308,500 has been allocated for procurement of equipment and meeting resource persons, and will be disbursed through a Small Scale Funding Agreement (SSFA) directly to FECO.

19. The rate of disbursement of funding available from the previously approved tranche is above 20 per cent in all sectors included in Table 7. Seventy-five per cent of the funds approved for the implementation of stage I have been disbursed to FECO, and 42 per cent have been disbursed to final beneficiaries.

20. The implementing agencies provided the information on interest accrued as of the end of 2014 as shown in Table 8. The information on interest is supported by an audit report submitted by the World Bank on the disbursement for stage I of the HPMP sector plans of 2014.

Table 8. Information provided by implementing agencies on interest accrued

Sector plan	Interest accrued (US $)			
	As of 31 December 2012	As of 31 December 2013	As of 31 December 2014	Total
XPS (UNIDO, Germany)	12,583	43,153	62,905	118,641
PU (World Bank)	0.00	5,195	6,431	11,626
ICR (UNDP)	70,628	87,093	33,650	191,371
RAC (UNIDO)	10,016	66,791	94,424	171,231
Solvent (UNDP)	2,289	5,293	7,091	14,673
Servicing (UNEP, Japan)	642	1,427	1,079	3,148
Total	**96,158**	**208,952**	**205,580**	**510,690**

21. The recommendation for approval for each sector plan by the Executive Committee includes a request to the Treasurer to offset future transfers to the implementing agencies by the amount of interest accrued by the Government of China up to 31 December 2014.

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

China

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase out plan (stage I) XPS foam	Germany, UNIDO (lead)	64th	10% by 2015

(II) LATEST ARTICLE 7 DATA (Annex C Group l)	Year: 2013	15,761.32 (ODP tonnes)

(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)									Year: 2014
Chemical	Aerosol	Foam	Fire fighting	Refrigeration		Solvent	Process agent	Lab use	Total sector consumption
				Manufacturing	Servicing				
HCFC-123				12.9	7.1				20
HCFC-124					2.1				2.1
HCFC-141b	64.3	5,155				484			5,703.3
HCFC-142b		604.5		6.5	33.7				644.7
HCFC-22	121.9	1,644.5		5,582.5	3,118.8				10,467.7
HCFC-225ca						0.8			0.8

(IV) CONSUMPTION DATA (ODP tonnes)			
2009 - 2010 baseline:	19,269.0	Starting point for sustained aggregate reductions:	18,865.44
CONSUMPTION ELIGIBLE FOR FUNDING (ODP tonnes)			
Already approved:	3,445.19	Remaining:	15,420.25

(V) BUSINESS PLAN		2015	2016	Total
UNIDO	ODS phase-out (ODP tonnes)	85.9	0.0	85.9
	Funding (US $)	7,204,310	0	7,204,310
Germany	ODS phase-out (ODP tonnes)	0.0	6.4	6.4
	Funding (US $)	0	560,181	560,181

(VI) PROJECT DATA			2011	2012	2013	2014	2015	Total
Montreal Protocol consumption limits			n/a	n/a	19,269.0	19,269.0	17,342.1	n/a
Maximum allowable consumption (ODP tonnes)			n/a	n/a	19,269.0	18,865.4	16,978.9	n/a
Agreed funding (US $)	Germany	Project costs	459,023	390,977	0	0	500,000	1,350,000
		Support costs	51,260	47,059	0	0	60,181	158,500
	UNIDO	Project costs	21,372,000	10,217,000	3,998,000	6,330,000	6,733,000	48,650,000
		Support costs	1,602,900	715,190	279,860	443,100	471,310	3,512,360
Funds approved by ExCom (US $)		Project costs	21,831,023	10,607,977	3,998,000	6,330,000	0.0	42,767,000
		Support costs	1,654,160	762,249	279,860	443,100	0.0	3,139,369
Total funds requested for approval at this meeting (US $)		Project costs	0	0	0	0	7,233,000	7,233,000
		Support costs	0	0	0	0	531,491	531,491

Secretariat's recommendation:	For individual consideration

PROJECT DESCRIPTION

22. On behalf of the Government of China, UNIDO as the lead implementing agency, has submitted to the 75th meeting a request for funding for the fifth and final tranche of the extruded polystyrene (XPS) foam sector plan of stage I of the HCFC phase-out management plan (HPMP), at a total cost of US $7,764,491, consisting of US $6,733,000, plus agency support costs of US $471,310 for UNIDO, and US $500,000, plus agency support costs of US $60,181 for the Government of Germany. The submission includes a progress report on the implementation of the fourth tranche of the XPS foam sector plan together with the tranche implementation plan for 2015 to 2016.

Progress report on the implementation of the fourth tranche

23. The Government of China continued implementing the ODS regulations and policies established in previous tranches, including the quota permits to XPS foam enterprises consuming more than 100 metric tonnes (mt) of HCFCs per year. Conversion of the 25 XPS foam enterprises covered under stage I is summarized below:

(a) Of the 19 XPS foam enterprises funded with the first three tranches (6,879.5 mt), two have completed their conversions, eight have completed the trial running, five have completed the installation of the equipment, and three have completed the procurement process and signed contracts with suppliers of equipment, with full conversion expected by 2016. One enterprise, Zhejian Yuegong (128.21 mt), decided to withdraw from the project as it will stop its production of XPS foam panels based on its development strategy and financial constraints. The funds allocated to this enterprise (US $769,260) were reallocated to new enterprises identified during the fourth tranche; and

(b) Seven enterprises (2,838.7 mt) were selected for assistance with funds from the fourth and fifth tranches. Five of them have completed the procurement process and signed contracts with suppliers of equipment and two are currently conducting the procurement process. Conversions are expected to be completed during 2016.

24. Progress in the implementation of the XPS foam sector plan in China is presented in Table 1:

Table 1. Progress in the implementation of the XPS foam sector plan in China

Status of implementation	Number of enterprises	HCFC consumption (mt)	Expected date of completion	Share of stage I target (%)
Enterprises conversions				
Project completed	2	612.78	2015	6.1
Trial running completed	8	3,450.97	2015-2016	34.4
Equipment delivered and installed	5	1686.32	2016	16.8
Procurement contracts with suppliers signed	8	3452.04	2016-2017	34.4
Procurement process ongoing	2	387.87	2016-2017	3.9
Subtotal	**25**	**9,589.98**		**95.6**
Additional reductions through regulations	n/a	441.02		
Stage I HCFC reduction target	n/a	**10,031.00**		

25. Additional technical assistance activities implemented include:

(a) Completion of standards for panels used in cold storage, civil engineering[1] and board for thermal insulation;

(b) Verification of financial reports prior to payments to enterprises that had achieved project milestones, project supervision and day-to-day operational management;

(c) Workshop on procedures for performance verification and resolution of technical issues arising from the conversions; and

(d) Research on optimization of CO_2 technology and production of a book on good practices for safe production of XPS foam using CO_2 technology in cooperation with the Beijing University of Chemical Technology (BUCT).

Level of fund disbursement

26. As of September 2015, of the US $6,330,000 approved for the fourth tranche, US $1,899,000 had been disbursed from UNIDO to FECO, and US $1,899,000 (30 per cent) had been disbursed by FECO to beneficiaries. Table 2 presents the status of total disbursement.

Table 2. Status of disbursements for the XPS foam sector plan as of September 2015

XPS foam sector plan	Agency	Tranche 1 (US $)	Tranche 2 (US $)	Tranche 3 (US $)	Tranche 4 (US $)	Total
Funds approved by the Executive Committee	UNIDO	21,372,000	10,217,000	3,998,000	6,330,000	41,917,000
	Germany	459,023	390,977	-	-	850,000
	Total	**21,831,023**	**10,607,977**	**3,998,000**	**6,330,000**	**42,767,700**
Disbursements from implementing agencies to FECO	UNIDO	19,234,800	9,195,300	1,199,400	1,899,000	31,528,500
	Germany	459,023	390,977	-	-	850,000
	Total	**19,693,823**	**9,586,277**	**1,199,400**	**1,899,000**	**32,378,500**
	Disbursement ratio	90.2%	90.4%	30.0%	30.0%	75.7%
Disbursements from FECO to beneficiaries*	UNIDO	12,400,033	5,424,506	1,199,400	1,899,000	20,922,939
	Germany	293,473	295,932	-	-	589,405
	Total	**12,693,506**	**5,720,438**	**1,199,400**	**1,899,000**	**21,512,344**
	Disbursement ratio	58.1%	53.9%	30.0%	30.0%	50.3%

*This figure also includes disbursements related to technical assistance and PMU.

Implementation plan for the fifth tranche of the XPS foam sector plan

27. Of the 23 XPS foam enterprises with ongoing projects, an estimated of 16 enterprises will complete their conversions in 2016, while the remaining enterprises being funded from the fourth and fifth tranches will complete their conversions in 2017. Proposed technical assistance activities will continue supporting the conversions through verification and commissioning of projects; training workshops on policy development; assessment on development and application of alternative technologies; and public awareness raising. Research activities will continue on: improving thermal conductivity of XPS foam using CO_2 as blowing agent; the flame retardant used in XPS foam production; additives and polystyrene to improve stability and cell size; and manufacturing of high-performance XPS foam.

[1] XPS foam panels used for civil engineering applications (highways, railways, airports and canals) require higher compressive strength and better freeze-thaw resistance. The standard will play an important role in promoting access of new XPS foam to the market and broadening the application of XPS foam.

28. Table 3 presents the budget of the activities to be implemented during the implementation of the fifth tranche.

Table 3. Budget for the fifth tranche of the XPS foam sector plan in China

Activity	Budget (US $)
Conversion of XPS foam enterprises to non-HCFC technology	6,295,355
Technical assistance activities	475,000
Project monitoring	462,645
Total fifth tranche	**7,233,000**

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

HCFC consumption

29. Consumption of HCFCs in the XPS foam manufacturing sector in 2014 was 39,200 mt (2,249 ODP tonnes), which is lower than the 43,051 mt (2,540 ODP tonnes) allowable consumption in the Agreement between the Government of China and the Executive Committee (Table 4). The reduction in HCFC consumption has been achieved initially through the application of the HCFC production quota and domestic sale quota issued for each producer, as well as HCFC consumption quotas for manufacturing enterprises using more than 100 mt. The completion of the XPS foam enterprise conversions will make these reductions sustainable.

Table 4. Consumption of HCFCs in the XPS foam sector

XPS foam sector		2009	2010	2011	2012	2013	2014	2015
Consumption*	metric tonnes (mt)	41,000	45,100	43,905	44,200	41,164	39,200	n/a
	ODP tonnes	2,419	2,661	2,583	2,529	2,377	2,249	n/a
Maximum allowable consumption **	Mt	n/a	n/a	n/a	n/a	43,051	43,051	38,746
	ODP tonnes	n/a	n/a	n/a	n/a	2,540	2,540	2,286
Phase-out target**	Mt	n/a	n/a	n/a	n/a	5,726	n/a.	4,305
	ODP tonnes	n/a	n/a	n/a	n/a	338	n/a.	254

** As per the country programme implementation report.
*** As per Agreement signed at the 67th meeting of the Executive Committee.

Status of implementation

30. The Secretariat requested information on three specific enterprises where implementation was progressing at a slower pace. UNIDO explained that in one enterprise (Shanghai Xinzhao) approval from the local fire-fighting bureau was taking longer as the selected technology was hydrocarbon (HC)-based; another enterprise (Chengdu Kewen) changed its selection of alternative from HC to CO_2 and had to resubmit its project implementation plan to FECO for re-evaluation; and the third enterprise (Xinxiang Yingzi) relocated its factory to meet the conversion requirements. The three enterprises have already signed procurement contracts with suppliers of equipment and have been urged to complete conversions before the end of 2016.

31. UNIDO indicated that while the majority of conversions will be completed in 2016, it is highly unlikely that all activities could be finalized at the end of December 2016, in particular the conversions of enterprises funded by the last tranche. The final date of completion would be decided with the other implementing agencies and a common date would be agreed if date of completion is to be later than 2016.

Technical issues

32. The Secretariat followed up on the results of the optimization of the CO_2 and ethanol technology in order to share those results with other Article 5 countries. UNIDO explained that some of the subjects being analyzed are CO_2 as main blowing agent, the effect of the nucleating agent, processing agent, composite blowing agent, flame retardant, infrared ray attenuator and processing process on the cell size, cell size distribution, and the surface quality, density, compression strength, and thermal conductivity of the XPS foam board. The results will only be available by December 2016, when the technical assistance project is completed.

33. On the national standard of XPS foam board for thermal insulation, UNIDO explained that it is being revised in terms of the requirements for thermal conductivity and to incorporate a more restricted definition of flame retardancy. The revised standard is aimed at promoting the adoption of CO_2 technology by enterprises to replace HCFCs, and facilitating the market acceptance of CO_2-based XPS foam products. Some of the challenges found in the conversion of XPS foam enterprises have been the need to provide more technical assistance on the proper operation of new production lines, the need to improve the production process with CO_2-based technology and the need to enhance training on the new alternative technology and on safety issues.

Interest

34. In line with decision 69/24(b)(ii) that requests implementing agencies to report, in the tranche implementation reports, on interest accrued by China on funds transferred for the HPMP, UNIDO informed the Secretariat that in 2014 FECO has earned a cumulative interest of US $62,904.94 for the XPS foam sector plan[2].

Conclusion

35. The Secretariat noted that the XPS foam sector plan continues to progress, with two conversions completed and an additional 23 enterprises currently working on their conversions to phase out a consumption of 9,590 mt of HCFC-22 and HCFC-142b, which represents around 95.6 per cent of the HCFC reduction target for stage I of the XPS foam sector. The remaining reductions of 441 mt to complete the target of 10,031 mt will be achieved by the enterprise that did not receive funding (128 mt) and through the application of the licensing system by FECO. The majority of the enterprise conversions will be completed before the end of 2016. However, a few conversions involving a change in the technology selected or relocation of the plants may extend beyond that date. The overall level of disbursement is 50.3 per cent. In view of the progress taking place the Secretariat recommends approval of the fifth tranche.

RECOMMENDATION

36. The Executive Committee may wish to consider:

(a) Noting the progress report on the implementation of the fourth tranche of the extruded polystyrene (XPS) foam sector plan of stage I of the HCFC phase-out management plan (HPMP) for China;

(b) Requesting the Government of China and UNIDO to submit progress reports on a yearly basis on the implementation of the work programme associated with the final tranche until the completion of the project, verification reports until approval of stage II, and the project completion report to the first meeting of the Executive Committee in 2018;

[2] These figures are supported by an independent audit covering all sectors submitted by the World Bank.

(c) Approving the fifth and final tranche of the XPS foam sector plan of stage I of the HPMP for China, and the corresponding 2015-2016 tranche implementation plan, at the amount of US $7,764,491 consisting of US $6,733,000, plus agency support costs of US $471,310 for UNIDO; and US $500,000, plus agency support costs of US $60,181 for the Government of Germany; and

(d) Requesting the Treasurer, in line with decision 69/24, to offset future transfers to UNIDO by US $62,904.94 representing additional interest accrued by the Government of China up to 31 December 2014 from funds previously transferred for the implementation of the XPS foam sector plan for China, as per decision 69/24.

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS
China

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase out plan (stage I) PU foam	World Bank	64th	10% by 2015

(II) LATEST ARTICLE 7 DATA (Annex C Group l)	Year: 2013	15,761.32 (ODP tonnes

(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)									Year: 2014
Chemical	Aerosol	Foam	Fire fighting	Refrigeration		Solvent	Process agent	Lab use	Total sector consumption
				Manufacturing	Servicing				
HCFC-123				12.9	7.1				20
HCFC-124					2.1				2.1
HCFC-141b	64.3	5,155				484.0			5,703.3
HCFC-142b		604.5		6.5	33.7				644.7
HCFC-22	121.9	1,644.5		5,582.5	3,118.8				10,467.7
HCFC-225ca						0.8			0.8

(IV) CONSUMPTION DATA (ODP tonnes)			
2009 - 2010 baseline:	19,269.0	Starting point for sustained aggregate reductions:	18,865.44
CONSUMPTION ELIGIBLE FOR FUNDING (ODP tonnes)			
Already approved:	3,445.19	Remaining:	15,420.25

(V) BUSINESS PLAN		2015	Total
World Bank	ODS phase-out (ODP tonnes)	139.7	139.7
	Funding (US $)	11,716,500	11,716,500

(VI) PROJECT DATA			2011	2012	2013	2014	2015	Total
Montreal Protocol consumption limits			n/a	n/a	19,269.0	19,269.0	17,342.1	n/a
Maximum allowable consumption (ODP tonnes)			n/a	n/a	19,269.0	18,865.4	16,978.9	n/a
Agreed funding (US $)	World Bank	Project costs	38,859,000	5,520,000	13,592,000	4,079,000	10,950,000	73,000,000
		Support costs	2,914,000	386,400	951,440	285,530	766,500	5,303,870
Funds approved by ExCom (US $)		Project costs	38,859,000	5,520,000	13,592,000	4,079,000	0	62,050,000
		Support costs	2,914,000	386,400	951,440	285,530	0	4,537,370
Total funds requested for approval at this meeting (US $)		Project costs	0	0	0	0	10,950,000	10,950,000
		Support costs	0	0	0	0	766,500	766,500

Secretariat's recommendation:	For individual consideration

PROJECT DESCRIPTION

37. On behalf of the Government of China, the World Bank as the designated implementing agency, has submitted to the 75th meeting a request for funding for the fifth and final tranche of the polyurethane rigid (PU) foam sector plan of stage I of the HCFC phase-out management plan (HPMP), at the amount of US $10,950,000 plus agency support costs of US $766,500. The submission includes a progress report on the implementation of the fourth tranche of the PU foam sector plan together with the tranche implementation plan for 2016, and verification reports of a sample of manufacturing lines converted.

Progress report on the implementation of the fourth tranche

38. The Government of China continued implementing the ODS regulations and policies established in previous tranches, including the quota permits to PU foam enterprises consuming more than 100 metric tonnes (mt) of HCFCs per year. The ban on using HCFC-141b as blowing agent in the sub-sectors of reefer containers, refrigerators and freezers, and small household appliances is being prepared by the China Household Electrical Appliance Association (CHEAA), and is expected to be issued in 2015.

39. Between December 2014 and January 2015 a group of seven PU foam enterprises signed subcontracts with FECO to start project implementation in 2015. With the addition of these enterprises, a total of 54 PU foam enterprises with a consumption of 12,762.95 mt (1,403.92 ODP tonnes) of HCFC-141b participated in stage I of the HPMP.

40. Eleven enterprises (1,229.41 mt or 135.23 ODP tonnes of HCFC-141b) completed their conversion and introduced water-blown technology in 2014. Project completion was verified and certificate of national commissioning was provided in 2015. Six additional enterprises (518.20 mt or 57 ODP tonnes) where conversion is ongoing have stopped purchasing HCFC and conversion is expected by the end of 2015. The remaining 37 are at different stages of conversion (i.e. procurement of equipment, delivery of equipment, installation and trials). Overall progress in the implementation of the PU foam sector plan in China is presented in Table 1.

Table 1. Progress in the implementation of the PU foam sector plan in China

Status of implementation	Number of enterprises	HCFC consumption (mt)	Expected date of completion	Share of stage I target (%)
Enterprise conversions				
Project completed	11	1,229.41	2014	8.37
Stopped HCFC purchase/use	6	518.20	2015	3.53
Trial running completed	16	3,777.85	2015-2016	25.73
Equipment delivered	8	3,895.50	2015-2016	26.53
Procurement contracts with suppliers signed (equipment delivery ongoing)	3	277.18	2016	1.89
Procurement process ongoing	6	1,880.74	2016	12.81
Preparing procurement	4	1,184.07	2017	8.06
Subtotal	**54**	**12,762.95**		**86.91**
Additional reductions through regulations	n/a	2,000.00		13.62
Total reductions stage I		**14,762.95**		**100.53**
Stage I HCFC reduction target	n/a	**14,685.00**		

41. FECO also signed contracts with six systems houses for technical assistance to supply foam manufacturers with hydrocarbon (HC)-based pre-blended polyols. They are presently preparing and conducting equipment procurement. The implementation of this component is based on the results obtained from the demonstration project on cyclopentane-based pre-blended polyols in the manufacture of rigid PU foam in China approved at the 59th meeting.

42. Additional technical assistance activities implemented include:

(a) Workshops for beneficiary enterprises on safety issues related to PU foam manufacturing with cyclopentane and a workshop on alternative blowing agents for small and medium-sized enterprises (SMEs) using HCFC-141b in pre-blended polyols as possible options for future conversions;

(b) Preparation of terms of reference for a study on alternative technologies in the spray foam sub-sector, including water, liquid carbon dioxide and HFOs;

(c) Preparation of terms of reference for a guideline/standard on the safe design and operation of PU foam plants using cyclopentane pure or in pre-blended polyols, taking into account existing relevant standards in China;

(d) Development of a management information system to track HCFC phase-out and provide project data and progress reports;

(e) Preparation of terms of reference for technical support systems for SMEs on a regional basis to identify and test potential substitutes and provide training for their adoption;

(f) Verification of financial reports prior to payments to enterprises that had achieved project milestones, project completion verifications, project supervision and day-to-day operational management provided by the China Plastic Processing Industry Association (CPPIA), the implementation supporting agency to FECO; and

(g) Technical assistance and monitoring support at the provincial level to ensure the sustainable phase-out of HCFC-141b.

Level of fund disbursement

43. As of September 2015, of the US $4,079,000 approved for the fourth tranche, US $2,039,500 had been disbursed from the World Bank to FECO, and US $1,179,517 (28.9 per cent) had been disbursed by FECO to beneficiaries. Table 2 presents the status of total disbursements.

Table 2. Status of disbursements of the PU foam sector plan as of September 2015

PU foam sector plan		**Tranche 1 (US $)**	**Tranche 2 (US $)**	**Tranche 3 (US $)**	**Tranche 4 (US $)**	**Total (US $)**
Funds approved by the Executive Committee		38,859,000	5,520,000	13,592,000	4,079,000	62,050,000
Disbursement from the World Bank to FECO	Amount	31,087,200	4,416,000	6,796,000	2,039,500	44,338,700
	Disbursement ratio	80.0%	80.0%	50.0%	50.0%	71.5%
Disbursement from FECO to beneficiaries*	Amount	17,706,932	3,660,567	4,532,936	1,179,517	27,079,951
	Disbursement ratio	45.6%	66.3%	33.4%	28.9%	43.6%

*This figure also includes disbursements related to technical assistance and PMU.

Sector verification

44. By the end of 2014, eleven enterprises had completed their conversions, thus phasing out 1,229.41 mt (135.23 ODP tonnes) of HCFC-141b. As required by paragraph 5 (b)(i) of the Agreement, the World Bank commissioned independent verification reports on the completion of the conversion of seven enterprises using 921.46 mt of HCFC-141b. This represents more than 10 per cent of the consumption phased out in 2014.

45. The verification reports confirmed that the seven enterprises stopped manufacturing PU foam using HCFC-141b and started manufacturing with water-based technology, achieving an overall phase-out of 921.46 mt of HCFC-141b. The verifications reviewed procurement records for raw materials, pipe specifications, production records, stock management records, invoices, production processes and related documents. They also included physical inspection of raw materials and warehouses. The reports confirmed that given the technology selected, these conversions did not require the replacement of the baseline foam dispensers, so there was no destruction of baseline equipment. The reports also concluded that the conversions were completed between 2013 and 2014, and that all the enterprises received the full amount of the Multilateral Fund grant in accordance with their conversion subcontracts with FECO. No evidence suggested that any of these enterprises had reverted to the use of HCFC-141b.

Implementation plan for the fifth tranche

46. The funds requested under the fifth tranche will be used to complete the conversion of the remaining PU foam enterprises and the introduction of HC-based pre-blended polyols in six systems houses. FECO will continue monitoring the implementation of the conversions and enforcing the relevant ODS management policies to ensure compliance of the consumption targets. In addition to the ongoing technical assistance activities, FECO will undertake safety training workshops, organize a study tour to exchange information on the development of low-GWP alternative technologies, conduct research on cyclopentane technology in panel production, and organize a final meeting with all relevant stakeholders to assess the implementation of the PU foam sector plan. The budget for activities in the fifth tranche is shown in Table 3 below.

Table 3. Budget for the fifth tranche of the PU foam sector plan in China

Activity	Budget (US $)
Complete the conversion of the remaining PU foam enterprises and development of HC-based pre-blended polyols by six systems houses	9,449,850
Technical assistance activities	952,650
Project monitoring	547,500
Total	**10,950,000**

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

HCFC consumption

47. Consumption of HCFC-141b in the PU foam manufacturing sector in 2014 was 46,864 mt (5,155 ODP tonnes), which is lower than the maximum allowable consumption established for the same year in the Agreement between the Government of China and the Executive Committee (Table 4). The reduction in consumption has been initially achieved through the application of the HCFC production quota and domestic sale quota issued for each producer; the HCFC consumption quotas issued to manufacturing enterprises using more than 100 mt per year; and followed by the phase-out of HCFC-141b in foam enterprises so far converted. These reductions will become sustained as more enterprises complete their conversions and phase out HCFC-141b.

Table 4. HCFC-141b consumption and targets for the PU foam sector

PU foam sector		2009	2010	2011	2012	2013	2014	2015
Consumption*	metric tonnes (mt)	45,971	52,069	63,570	59,109	46,338	46,864	n/a
	ODP tonnes	5,056.8	5,727.5	6,992.7	6,501.9	5,097.2	5,155.0	n/a
Maximum allowable consumption*	mt	n/a	n/a	n/a	n/a	49,018	49,018	40,451
	ODP tonnes	n/a	n/a	n/a	n/a	5,392.2	5,392.2	4,449.6
Phase-out target**	mt	n/a	n/a	n/a	n/a	6,116	n/a	8,569
	ODP tonnes	n/a	n/a	n/a	n/a	672.8	n/a	942.6

* As per the country programme implementation report.
** As per Agreement signed at the 67th meeting of the Executive Committee.

48. A total of 12,762.95 mt of HCFC-141b will be phased out through the conversions of PU foam enterprises. The remaining HCFC-141b phase-out required to achieve the stage I reduction target (14,685 mt) will be achieved through policy measures, including the quota system and the ban on the use of HCFC-141b for manufacturing of refrigerators, freezers, reefers and containers, and small household appliances, expected to enter into force in 2015. The World Bank explained that these measures are needed, as not all enterprises will receive financial assistance due to eligibility constraints or reluctance to participate in the sector plan.

Status of implementation

49. Upon request of additional information on five enterprises where implementation is progressing at a slower pace, the World Bank clarified that in one enterprise the delay was due to an internal restructuring; in the other four enterprises the delays were due to slower pace of implementation. However, the five enterprises will stop using HCFC-141b upon completion of their conversions by the end of 2015 or early 2016.

50. The World Bank indicated that while the majority of conversions will be completed in 2016, the completion of activities in the PU foam sector plan will be June 2017. The World Bank indicated that the final date of completion would be decided with the other implementing agencies and a common date would be agreed if date of completion is to be later than 2016.

Technical issues

51. Upon request, the World Bank explained that the main challenges for the introduction of pre-blended HC polyol systems are related to the higher transport cost required to comply with appropriate safety measures, in particular when there are long distances and multiple actors in the supply chain. Thicker drums and special vehicles are required for transportation of HC pre-blended polyols. The systems houses will provide the end-users with safety training and instructions for the application of pre-blended HC polyols.

52. With regard to the study on comparisons of alternatives for the spray foam sector, at the Secretariat's request, the World Bank confirmed that it should be possible to produce a report that can be shared with other Article 5 countries once the study is completed.

Interest

53. In line with decision 69/24(b)(ii) that requests implementing agencies to report, in the tranche implementation reports, on interest accrued by China on funds transferred for the HPMP, the World Bank informed the Secretariat that in 2014 FECO has earned a cumulative interest of US $6,431.38 for the PU foam sector plan[3].

Conclusion

54. The PU foam sector plan continues to progress as planned. The conversion of 54 eligible enterprises assisted under stage I will result in the phase-out of 12,762.95 mt (1,403.92 ODP tonnes) of HCFC-141b, representing 87.0 per cent of the HCFC reduction target for stage I of the PU foam sector plan. The remaining reductions to achieve the target of 14,685 mt (1,615.35 ODP tonnes) will be achieved through the application of regulations, including the quota system and the ban on the use of HCFC-141b for manufacturing of refrigerators, freezers, reefers and containers, and small household appliances, to enter into force this year. The overall level of disbursement has increased to 43.6 per cent; 87.0 per cent of the overall funding approved is already committed in ongoing implementation contracts with PU foam enterprises and systems houses. In view of the progress taking place, the Secretariat recommends approval of the fifth tranche.

RECOMMENDATION

55. The Executive Committee may wish to consider:

(a) Noting the progress report on the implementation of the fourth tranche of the polyurethane rigid (PU) foam sector plan of stage I of the HCFC phase-out management plan (HPMP) in China;

(b) Requesting the Government of China and the World Bank to submit progress reports on a yearly basis on the implementation of the work programme associated with the final tranche until the completion of the project, verification reports until approval of stage II, and the project completion report to the first meeting of the Executive Committee in 2018;

(c) Approving the fifth and final tranche of the PU foam sector plan of stage I of the HPMP for China, and the corresponding 2016 tranche implementation plan, at the amount of US $10,950,000, plus agency support costs of US $766,500 for the World Bank; and

(d) Requesting the Treasurer to offset future transfers to the World Bank by US $6,431.38, representing interest accrued by the Government of China up to 31 December 2014 from funds previously transferred for the implementation of the PU foam sector plan for China, as per decision 69/24.

[3]These figures are supported by an independent audit covering all sectors, submitted by the World Bank.

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS
China

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase out plan (stage I) industrial, commercial and air conditioning (ICR)	UNDP (lead)	64th	10% by 2015

(II) LATEST ARTICLE 7 DATA (Annex C Group l)	Year: 2013	15,761.32 (ODP tonnes)

(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)									Year: 2014
Chemical	Aerosol	Foam	Fire fighting	Refrigeration		Solvent	Process agent	Lab use	Total sector consumption
				Manufacturing	Servicing				
HCFC-123				12.9	7.1				20
HCFC-124					2.1				2.1
HCFC-141b	64.3	5,155				484			5,703.3
HCFC-142b		604.5		6.5	33.7				644.7
HCFC-22	121.9	1,644.5		5,582.5	3,118.8				10,467.7
HCFC-225ca						0.8			0.8

(IV) CONSUMPTION DATA (ODP tonnes)			
2009 - 2010 baseline:	19,269.0	Starting point for sustained aggregate reductions:	18,865.44
CONSUMPTION ELIGIBLE FOR FUNDING (ODP tonnes)			
Already approved:	3,445.19	Remaining:	15,420.25

(V) BUSINESS PLAN		2015	Total
UNDP	ODS phase-out (ODP tonnes)	116.8	116.8
	Funding (US $)	9,790,500	9,790,500

(VI) PROJECT DATA			2011	2012	2013	2014	2015	Total
Montreal Protocol consumption limits			n/a	n/a	19,269.0	19,269.0	17,342.1	n/a
Maximum allowable consumption (ODP tonnes)			n/a	n/a	18,865.4	18,865.4	16,978.9	n/a
Agreed funding (US $)	UNDP	Project costs	25,380,000	6,900,000	8,495,000	11,075,000	9,150,000	61,000,000
		Support costs	1,903,500	483,000	594,650	775,250	640,500	4,396,900
Funds approved by ExCom (US $)		Project costs	25,380,000	6,900,000	8,495,000	11,075,000	0	51,850,000
		Support costs	1,903,500	483,000	594,650	775,250	0	3,756,400
Total funds requested for approval at this meeting (US $)		Project costs	0	0	0	0	9,150,000	9,150,000
		Support costs	0	0	0	0	640,500	640,500

Secretariat's recommendation:	For individual consideration

PROJECT DESCRIPTION

56. On behalf of the Government of China, UNDP as the designated implementing agency, has submitted to the 75th meeting a request for funding for the fifth and final tranche of the industrial and commercial refrigeration and air-conditioning (ICR) sector plan of stage I of the HCFC phase-out management plan (HPMP), at the amount of US $9,150,000 plus agency support costs of US $640,500. The submission includes the progress report on the implementation of the fourth tranche, the tranche implementation plan for 2016, and a verification report of a sample of manufacturing lines converted.

Progress report on the implementation of the fourth tranche

57. The reduction in HCFC consumption was mainly achieved through the conversion of 32 production lines in 17 enterprises that consume HCFC-22, and through a quota control. The conversion projects have been progressing well. During the implementation of the fourth tranche, conversions of eight productions lines were completed and 565.43 metric tonnes (mt) (31.1 ODP tonnes) were phased out. The conversions of 17 production lines with a total consumption of 6,180.14 mt are in progress: eight out of 17 lines are expected to be completed in 2015; the remaining nine lines are planned to be completed in 2016. In 2015, seven new lines were identified for conversion, with a total consumption of 901.85 mt. Contracts were signed in August and October 2015. The work plans are being developed and product design will start soon. The overall progress of implementation is shown in Table 1.

Table 1. Overview of the phase-out projects in the ICR sector in China

No.	Phase-out project	Phase-out of HCFC-22 (mt)	Status	Share in phase-out (%)
1	Enterprises owned by non-Article 5 countries	167.27	Controlled by quota	2
2	Demonstration projects at Qinghua Tongfang and Yantai Moon	311.9	Completed	4
3	Conversions of 8 productions lines in 4 enterprises	565.43	Completed	7
4	Ongoing conversion of 17 production lines in 7 enterprises	6,180.14	Conversions are at different stages of the process and expected to be completed in 2015 and 2016. HCFC has been phased out in all enterprises	73
5	Conversions of 7 production lines in 6 enterprises identified in 2015	901.85	Contracts signed in August and October 2015. Conversion is to be started, HCFCs will be phased out by 2016	11
6	Remaining tonnage to be identified in 2015	323.41	Enterprise to be identified with the funding from the fifth tranche	4
Total planned phase-out in ICR sector in stage I		**8,450.60**		**100**

Alternative technologies used in conversion projects

58. A number of alternative technologies were used in different applications in the ICR sector as shown in Table 2. The main alternative technology selected so far has been HFC-32, accounting for 54 per cent of the total consumption. The use of HFC-410 (representing 28 per cent) was due to lack of a suitable low-GWP technology for the manufacture of unitary and multi-connected air-conditioning

systems and the compelling need to comply with the reduction target. The Government of China is exploring more options for conversion to non-HFC-based technologies through technology promotion and enabling activities. It is expected that more enterprises will choose HFC-32, CO_2 and NH_3 for conversions during the fifth tranche.

Table 2. Alternative technology used in conversion projects*

Sub-sector	R-32	R-410A	NH_3/ CO_2	CO_2/ HFC-134a	HFC-134a	NH_3	CO_2	HFO/ HFC-134a	Total
HCFC-22 consumption converted to different technologies (mt)									
Unitary air-conditioning	2,517.90	1,345.97							3,863.87
Multi-connected air-conditioning		814.83							814.83
Freezers, cold storage and condensing unit			753.57	65.75	31.77				851.09
Industrial and commercial water chiller (heat pump)	1,293.84				396.84	95.30			1,785.97
Small-sized water chiller (heat pump)	331.66								331.66
Compressors	0.00						0.00	0.00	0.00
Total consumption (mt)	**4,143.40**	**2,160.80**	**753.57**	**65.75**	**428.60**	**95.30**	**0.00**	**0.00**	**7,647.43**
Percentage (%)	54	28	10	1	6	1	0	0	100
Number of manufacturing lines converted to different technologies									
Unitary air-conditioning	5	3							8
Multi-connected air-conditioning		2							2
Freezers, cold storage and condensing unit			3	1	1				5
Industrial and commercial water chiller (heat pump)	7				4	1			12
Small-sized water chiller (heat pump)	1								1
Compressors	2						1	1	4
Total number of lines	**15**	**5**	**3**	**1**	**5**	**1**	**1**	**1**	**32**
Percentage (%)	47	16	9	3	16	3	3	3	100

*Based on all the conversion projects for which technologies have been selected, excluding the demonstration projects.

Technical assistance activities

59. The following technical assistance activities were undertaken to enable the smooth conversion of enterprises:

Revision of standards

60. Revision of the National Safety Standard (GB9237) is progressing. The Standardization Administration of China (SAC) has approved the revision, and a draft standard has been formulated and comments have been integrated into the revised draft which has been submitted to the SAC for final approval. With the new safety standard in place, equipment based on flammable alternative refrigerants including R-32 will be allowed to enter into the market.

61. Revision of product standards to include flammable refrigerants is also progressing. The final drafts for three standards, unitary air-conditioners, water chilling packages for household, and ducted air-conditioning units, have been reviewed and accepted by the Standard Specific Committee and submitted to the National Standard Committee for approval.

62. The Government of China has released national standard GB/T 29030-2012 for CO_2 compressors. However, the related safety and construction standards have not been revised. A technical assistance activity has been initiated to develop specifications for CO_2 refrigeration systems. The project will be undertaken by three enterprises/agencies: Yantai Moon, China Institute of Refrigeration and the Internal Trade Engineering Design and Research Institute.

Studies on the applicability of HFC-32 and natural refrigerants in ICR sector

63. The project team has carried out information collection, conducted experiments, reviewed technical standards, visited enterprises, and prepared a report which was discussed in March 2015. Based on the discussion, the team formed a work plan for additional work in order to finalize the study.

Study on applicability of natural refrigerants in the ICR sector

64. The project team has collected information on four natural refrigerants: CO_2, NH_3, HC-290 and water, reviewed the technical standards, visited enterprises, and prepared a report which was discussed in March 2015. Based on the discussion, the team formed a new work plan for further study.

Survey on the cold chain sub-sector

65. FECO planned a technical assistance to gain a better understanding on the situation of the cold chain industry and to analyse the strategy and technology roadmap to phase out HCFC in this sub-sector. The activities of the survey would involve collecting information on cold storage, refrigerated transport and refrigerated products for storage and sale; and assessing technologies being used, consumption of HCFCs, and alternatives and technology options. The contract has been signed with the Internal Trade Engineering Design and Research Institute in August 2015.

Technology promotion

66. In order to promote zero-ODP and low-GWP refrigerants, a demonstration project on heat pumps in room heating was launched in 2014. The indirect impact of the piloted technologies is expected to avoid installation of about 37,750 units of HCFC-22-based heat pumps and to achieve a potential reduction of 37.75 mt of HCFC-22. The project included ten pilot sub-projects with total costs of US $1.37 million for different refrigerants and applications including CO_2, NH_3, HFC-32 and HFC-134a. The contracts were signed in October 2014. Equipment installation will be completed by October 2015 and all sub-projects will start operation in late December 2015 and be completed by May 2016.

67. A technology development project, initiated in July 2015, aims at promoting low-GWP alternatives through research, development and demonstrations to remove the barriers for using alternatives in various applications. It will focus on several key sub-sectors, including cold chain, transport refrigeration (ships, subway, train, and trucks), heat pumps and large-sized commercial chillers. The project will include up to ten sub-projects using alternatives with GWP values below 750.

Level of fund disbursement

68. As of September 2015, of the US $51,850,000 approved so far, US $44,057,872 had been disbursed from UNDP to FECO, and US $18,518,991 (35.72 per cent) had been disbursed by FECO to beneficiaries. Table 3 presents the status of total disbursement.

Table 3. Status of disbursement of the ICR sector plan as of September 2015 (US $)

ICR sector plan		Tranche 1	Tranche 2	Tranche 3	Tranche 4	Total
Funds approved by the Executive Committee		25,380,000	6,900,000	8,495,000	11,075,000	51,850,000
Disbursement from UNDP to FECO	Amount	25,380,000	6,900,000	8,424,373	3,282,872	44,057,872
	Disbursement ratio	100.0%	100.0%	99.2%	29.6%	85.0%
Disbursement from FECO to beneficiaries	Amount	9,975,216	3,148,500	2,929,694	2,465,581	18,518,991
	Disbursement ratio	39.3%	45.6%	34.5%	22.3%	35.7%

Sector verification

69. The completion of conversion at eight manufacturing lines has permanently eliminated the HCFC consumption of 565.4 mt. In accordance with paragraph 5(b)(i) of the Agreement, the verification of the converted lines was conducted at Nanjing Tianjia, which covers two production lines and 172.3 mt of HCFC-22 consumption. The verification covers 30.5 per cent of total phase-out and 25.0 per cent of the total number of lines converted in 2014. The verification confirmed that two production lines using HCFC-22 have been converted and using HFC-410A and HFC-32; the old equipment has been destroyed; and the enterprise is committed to not using HCFC-22 in the converted lines.

Tranche implementation plan form 2015-2016

70. The total budget for the implementation of the fifth tranche of the ICR sector plan in China amounts to US $9,150,000, with a breakdown as follows:

(a) Continuing the conversions in enterprises that have signed contracts in previous tranches and conversion of additional enterprises to alternatives with a minimum phase-out of 324 mt of HCFC-22 (US $6,300,000);

(b) Training workshop on project implementation mechanism for personnel involved in conversion projects (US $100,000);

(c) Establishment of a training centre for NH_3 and CO_2 technology (US $280,000);

(d) Revision and formulation of technical standards for the use of zero-ODP low-GWP alternatives in the ICR sector (US $160,000);

(e) Workshops for the review and dissemination of environmental-friendly technologies in the ICR sector (US $120,000);

(f) Demonstration of CO_2 technology in the super-market sector (US $300,000);

(g) Technology promotion for demonstrating CO_2 heat pump (US $1,000,000);

(h) Support to China Refrigeration and Air-conditioning Industry Association (US $170,000); and

(i) Monitoring and management of project activities in the ICR sector (US $720,000).

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

HCFC consumption

71. The consumption of HCFCs in the ICR sector in 2014 was 40,749 mt (2,219.48 ODP tonnes), which is lower than the maximum allowable consumption established in the Agreement between the Government of China and the Executive Committee as shown in Table 4. The reduction is achieved through a combination of the conversion projects which permanently eliminate the consumption and the effective monitoring and quota control on other consumers in the ICR sector. Although a number of conversion projects will only be completed in 2016, all of the enterprises phased out HCFCs at the time when the contracts for conversions were signed. The phase-out of HCFCs in enterprises owned by non-Article 5 countries is controlled through a quota system.

Table 4. Reduction in HCFC consumption in the ICR sector

	2011	2012	2013	2014	2015
Maximum allowable consumption(ODP tonnes)	n/a	n/a	2,402.80	2,402.80	2,162.50
Maximum allowable consumption (mt)	n/a	n/a	43,925	43,925	39,320
Actual consumption in ICR sector (ODP tonnes)*	2,651.72	2,610.47	2,224.80	2,219.48	
Actual consumption in ICR sector (mt)*	48,213	47,463	40,805	40,749	
Reduction target set in HPMP (ODP tonnes)	n/a	n/a	224.50	0	240.30
Reduction target set in HPMP (mt)	n/a	n/a	4,080	0	4,370
Actual reduction achieved (ODP tonnes)**			385.67	5.32	
Actual reduction achieved (mt)			6,658	56	

*The consumption in the ICR sector is based on estimated amount as actual amounts cannot be accurately verified.
**This data shows the difference between the consumption in current year and previous year.

Level of implementation of activities achieved

72. The Secretariat noted that the projects in Zhuhai Gree, with a contract signed in December 2012, to convert five lines with a consumption of 2,607.13 mt of HCFC-22 and Guandong Midea, with a contract signed in July 2013, to convert four lines with a consumption of 2,229.09 mt of HCFC-22 have not been completed yet. UNDP clarified that several production lines are being converted in both enterprises. The conversion entails change to plant layouts and will impact on the operation of other production. Therefore the conversion is being planned and coordinated with the overall production plan at the enterprises. In addition, the current safety standard at the enterprises does not allow the usage of HFC-32, which is a flammable refrigerant. Since there is yet no market for the products, as standards and regulations need to be developed, manufacturers are not motivated to expedite the conversion.

73. The Secretariat sought clarification on the technology promotion activities and whether a tonnage phase-out would be associated with these activities. UNDP clarified that the projects are designed to promote the use of alternatives in heat pumps in order to avoid the increase in the use of HCFC-22 as the heat pump sub-sector is rapidly growing and the potential increase of HCFC-22 consumption may offset the phase-out so far achieved in the ICR sector. The impact of the projects would be more indirect, therefore there is no tonnage phase-out associated with these activities.

74. The Secretariat further noted that the 2015 tranche included a group of demonstration projects for heat pumps with a total cost of US $1 million, and queried why this was needed as ten sub-projects to demonstrate the heat pump technology has already been launched and are still in progress. UNDP clarified that these projects are designed to promote low-GWP alternatives in heat pumps that are HCFC-free in the local market. The HCFC-22 consumption in the heat pump manufacturing sector is rapidly increasing due to the Government's efforts to replace coal boilers. The demonstration projects will assist in the introduction of low-GWP technologies in this sector and potentially avoiding the introduction

of HFC refrigerants. Without the market promotion, the manufacturers and the consumers would most probably choose HFCs (HFC-407C or HFC-410A) as these are technically mature, economically favourable and easy to maintain. The Government of China is trying to replicate the success use of HC during CFC phase-out in the heat pump sector to curb the growth of HCFC consumption hence to save the future efforts for second conversion.

Interest

75. In line with decision 69/24(b)(ii)[4], UNDP reported that as of 31 December 2014 FECO has earned an interest of US $33,650 in 2014 for the ICR sector plan[5].

Conclusion

76. A licensing and quota system has been implemented to control the overall compliance in the ICR sector. HCFCs are no longer used in enterprises that signed contracts for conversion. The total consumption of 8,126.6 mt has been phased out and 323.4 mt is to be phased out in 2016. The HCFC consumption in the ICR sector has met the control target set in the Agreement.

77. The implementation of the ICR sector plan is progressing. The conversions of eight production lines have been completed and verified in accordance with paragraph 5(b)(i) of the Agreement. The total consumption of 1044.6 mt has been permanently eliminated. The conversion at the remaining production lines will be gradually completed, in 2015 and 2016, however all enterprises are no longer using HCFC-22 resulting in the phase-out of an additional 7,082 mt. Technical assistance and support activities including standard revisions, research and development on applicability of low-GWP technologies, training, awareness raising, technology promotion and dissemination have been and will continue to be implemented to facilitate smooth implementation of the conversion of manufacturing capacity and assist in the adaption, successive marketing and commercialization of converted equipment in China and the global market.

78. In view of the progress made and the overall disbursement rate of 36 per cent, the Secretariat recommends approval of the fifth and final tranche.

RECOMMENDATION

79. The Executive Committee may wish to consider:

(a) Noting the progress report on the implementation of the fourth tranche of stage I of the industrial and commercial refrigeration and air-conditioning (ICR) sector plan for China;

(b) Requesting the Government of China and UNDP to submit progress reports on a yearly basis on the implementation of the work programme associated with the final tranche until the completion of the project, verification reports until approval of stage II, and the project completion report to the first meeting of the Executive Committee in 2018;

(c) Approving the fifth and final tranche of stage I of the ICR sector plan for China, and the corresponding 2016 tranche implementation plan, at the amount of US $9,150,000 plus agency support costs of US $640,500 for UNDP; and

[4] That requests implementing agencies to report on interest accrued by China on funds transferred for the HPMP in the tranche implementation reports.

[5] These figures are supported by an independent audit covering all sectors submitted by the World Bank.

(d) Requesting the Treasurer to offset future transfers to UNDP by US $33,650 representing interest accrued by the Government of China up to 31 December 2014 from funds previously transferred for the implementation of the ICR sector plan as per decision 69/24.

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

China

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase out plan (stage I) room air-conditioning (RAC)	UNIDO	64th	10% by 2015

(II) LATEST ARTICLE 7 DATA (Annex C Group l)	Year: 2013	15,761.32 (ODP tonnes)

(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)								Year: 2014	
Chemical	Aerosol	Foam	Fire fighting	Refrigeration		Solvent	Process agent	Lab use	Total sector consumption
				Manufacturing	Servicing				
HCFC-123				13.0	7.1				20.1
HCFC-124					2.1				2.1
HCFC-141b	64.3	5,155.0				484.0			5,703.3
HCFC-142b		604.5		6.5	33.7				644.7
HCFC-22	121.9	1,644.5		5,582.5	3,118.8				10,467.7
HCFC-225ca						0.8			0.8

(IV) CONSUMPTION DATA (ODP tonnes)			
2009 - 2010 baseline:	19,269.0	Starting point for sustained aggregate reductions:	18,865.44
CONSUMPTION ELIGIBLE FOR FUNDING (ODP tonnes)			
Already approved:	3,445.19	Remaining:	15,420.25

(V) BUSINESS PLAN		2015	Total
UNIDO	ODS phase-out (ODP tonnes)	143.6	143.6
	Funding (US $)	12,037,500	12,037,500

(VI) PROJECT DATA			2011	2012	2013	2014	2015	Total
Montreal Protocol consumption limits			n/a	n/a	19,269.0	19,269.0	17,342.1	n/a
Maximum allowable consumption (ODP tonnes)			n/a	n/a	4,108.5	4,108.5	3,697.5	n/a
Agreed funding (US $)	UNIDO	Project costs	36,430,000	9,200,000	8,495,000	9,625,000	11,250,000	75,000,000
		Support costs	2,732,250	644,000	594,650	673,750	787,500	5,432,150
Funds approved by ExCom (US $)		Project costs	36,430,000	9,200,000	8,495,000	9,625,000	0	63,750,000
		Support costs	2,732,250	644,000	594,650	673,750	0	4,644,650
Total funds requested for approval at this meeting (US $)		Project costs	0	0	0	0	11,250,000	11,250,000
		Support costs	0	0	0	0	787,500	787,500

Secretariat's recommendation:	For individual consideration

PROJECT DESCRIPTION

80. On behalf of the Government of China, UNIDO as the designated implementing agency, has submitted to the 75th meeting a request for funding for the fifth and final tranche of the room air-conditioning manufacturing (RAC) sector plan of stage I of the HCFC phase-out management plan (HPMP) for China, at the amount of US $11,250,000, plus agency support costs of US $787,500. The submission includes a progress report on the implementation of the fourth tranche of the RAC sector plan, the tranche implementation plan for 2015-2016, and a verification report of a sample of manufacturing lines converted.

Progress report on the implementation of the fourth tranche

Policy development

81. The Government of China continued implementing the ODS regulations and policies established in previous tranches, including the issuance of quota permits to enterprises consuming more than 100 metric tonnes (mt) of HCFCs per year for all applications, including room air-conditioning.

Implementation of investment projects

82. A total of 24 RAC enterprises with an overall consumption of 9,966 mt (548 ODP tonnes) of HCFCs including three compressor manufacturers, have been supported to convert to non-HCFC alternative technologies, with the funding provided from the previous four tranches of the RAC sector plan under the HPMP.

83. The overall progress in the conversion of these enterprises is summarized in the table below.

Table 1. Status of conversions of RAC enterprises currently assisted

Status of implementation	Enterprises	HCFC consumption (mt)	Date of completion
Enterprises converted	11 enterprises 13 lines*	6,115	3 in October 2013 4 in October 2014 3 in December 2014 2 in April 2015 1 compressor line in 2015
Equipment partially or totally delivered	4	1,246	December 2014
Procurement plan completed and bidding completed	3	719	July 2015
Contract signed	4	1,886	December 2016
Total	**24**	**9,966****	

*Including 1 compressor production line
**Including over 300 mt of HCFC attributed to non-Article 5 share in the enterprises

84. These include four additional enterprises converting to HC-290, which have been identified and signed contracts as part of the fourth tranche.

Technical assistance

85. The following technical assistance activities have been implemented:

(a) Continued research into technology required for HC-290 air-conditioners, assessing performance improvements, refrigerant distribution properties, safety measures, compressor properties, and charge optimization. All major manufacturers in the RAC

sector in China were involved in this research. Preliminary results from the research suggest the risk associated with the use of HC-290 air-conditioners is manageable. The research will be completed in 2016;

(b) In cooperation with China Household Electric Appliances Association (CHEAA), three standards to ensure the safe use of HC-290 in the RAC sector, including technical safety codes for using flammable refrigerants in the household and in the air-conditioners manufacturing industry; requirements for transportation of room air-conditioners charged with flammable refrigerants; and technical safety codes for servicing equipment using flammable refrigerants, were drafted. The standard for safety codes for servicing had been approved and adoption envisaged for adoption in 2016; while the two other standards are targeted for approval by 2016;

(c) Set up a training centre in Guangdong and conducted a pilot training programme on servicing HC-290 air-conditioners, with the participation of over 40 technicians and trainers from manufacturers and vocational schools; and

(d) Completed public awareness activities aimed at promoting HC-290 air-conditioners through launching an HC-290 logo; two side-events at the Open-ended Working Group meeting of the Montreal Protocol; HC-290 market outreach activities in Shanghai, Guangdong and Shenzhen; initiated the first public procurement and installation of 243 sets of HC-290 air-conditioners for Shenzhen University; and organized an alternatives workshop in Zhejiang province.

Technical verification

86. UNIDO submitted a technical verification report to verify the completed conversions of three production lines to R-410A technology in two enterprises (Gree Chongqing and Midea); one line to HC-290 in Chunlan Nanjing; and one compressor conversion to HC-290 technology in Haili Nanchang, in line with paragraph 5(b)(i) of the Agreement between the Government of China and the Executive Committee.

87. The verification reports confirmed that the enterprises mentioned above have started production of air-conditioning equipment using R-410A and HC-290, resulting in a phase-out of 2,357.77 mt of HCFC-22. One of the enterprises (Gree Chongqing) had converted additional lines at their own cost, with a production of over 2 million air-conditioners. The report included lists of equipment replaced and destroyed and new equipment installed; written confirmation on the destruction of the equipment, the final conversion completed, and a commitment from the enterprises that these conversions were sustainable. The reports concluded that the conversions were completed between 2013 and 2014, and that all the enterprises received funding in accordance with their conversion subcontracts with FECO.

Tranche implementation plan for 2016

88. The 2016 annual implementation plan foresees a continuation of the technical assistance activities undertaken in previous tranches, with focus on ensuring that the HCFC quota management system for RAC manufacturers is strictly implemented. Technical assistance activities will continue to support the market penetration of HC-290 air-conditioners; ensure that the incremental operation cost (IOC) system put in place in the last year will provide further incentive for a broader acceptance of HC-290 technology; continue to support the development of substitutes and research for non-HCFC alternative technology for air-conditioning and refrigeration equipment manufacturing, and its efforts to improve knowledge and capabilities of equipment manufacturers in the understanding and use of these substitute technologies.

89. For activities at the enterprise level, the plan foresees to replace the conversion of the 18th line for production of RAC equipment to HC-290 technology committed under the HPMP, with the conversion of an enterprise manufacturing heat pump water heaters or compressors to HC-290 or CO_2 technologies. This change was justified to facilitate China's actions towards compliance with the 2020 target, considering that market penetration of HC-290-based air-conditioning systems not only in China but also in many countries is still low, while the HC-290 heat pump might be introduced at a faster pace.

90. The activities and budget for the fifth and final tranche of the RAC sector plan are presented in Table 2.

Table 2. Budget for the fifth tranche of the RAC sector plan in China

Activity	Budget (US $)
Conversion to non-HCFC RAC production and payment of IOC	10,193,752
Technical assistance activities, research and development	30,000
Project implementation and management	956,250
Contingencies	69,998
Total	**11,250,000**

91. Approved funds are already committed in the contracts between FECO and the enterprises, and payments will be released upon completion of implementation milestones. As the conversions are progressing and a large number of enterprises are expected to complete their projects in 2015, the level of disbursement from FECO to final beneficiaries will be higher by the end of 2015.

SECRETARIAT'S COMMENT AND RECOMMENDATION

COMMENTS

HCFC consumption and reductions in consumption

92. Table 3 presents HCFC-22 consumption in the RAC sector[6]. The estimated consumption in 2014 of 64,500 mt (3,547.5 ODP tonnes), was lower than the maximum allowable consumption of 74,700 mt (4,108.5 ODP tonnes) for the RAC sector. This reduction is attributed to the conversions of six enterprises with an associated phase-out of 1,886.2 mt (103.7 ODP tonnes) of HCFC-22, and the regulatory and technical assistance activities implemented by the Government of China.

Table 3. Consumption of HCFC in the RAC sector

RAC sector		2009	2010	2011	2012	2013	2014***	2015
Actual consumption*	mt	71,500	77,900	74,700	72,600	68,900	64,500	n/a
	ODP tonnes	3,932.5	4,284.5	4,108.5	3,993.0	3,789.5	3,547.5	n/a
Maximum allowable consumption**	mt	n/a	n/a	n/a	n/a	74,700	74,700	67,230
	ODP tonnes	n/a	n/a	n/a	n/a	4,108.5	4,108.5	3,697.7
Phase-out target	mt	n/a	n/a	n/a	n/a	3,200	0	7,470**
	ODP tonnes					176	0	410.9**
Actual reduction achieved	mt	n/a	n/a	n/a	n/a	2,074.6	1,803.7	2,236.9
	ODP tonnes	n/a	n/a	n/a	n/a	114.1	99.2	123

* As per the country programme implementation report.
** As per Agreement with the Executive Committee.
*** Estimated consumption was submitted by UNIDO, China had not submitted Article 7 data for 2014

[6] These figures are estimates since the distribution of HCFC-22 to different sectors cannot be monitored with accuracy.

Level of implementation of activities achieved

93. The Secretariat noted that the current contracts for the conversion of production lines (17 lines to HC-290 and 8 lines to R-410), will result in the HCFC phase-out of over 9,900 mt (i.e., 9,600 mt of eligible consumption plus 324 mt of related consumption of the share of non-Article 5 ownership of the enterprises). This amount is higher than the 9,454 mt agreed in the RAC sector plan.

94. In responding to the issue of slow market uptake of HC-290 RAC equipment and the current research ongoing to optimize the performance of HC-290 compressors to be used in these systems, UNIDO explained that the results of the research and technical assistance activities do not impact on the conversion of the production lines as these focus on general issues, which are expected to help the manufactures to optimize their design of the units. Two meetings were organized to share the results with the manufacturers so that they can take immediate actions on the product design. Any improvement in the product design can be implemented by the manufacturers before large scale production. It is expected that reduction of risk levels and charge size will further facilitate market acceptance.

95. With regard to the IOC payments for enterprises that had converted to HC-290 technology, and how this has been implemented as in incentive programme to facilitate the acceptance of HC-290 air-conditioning equipment, UNIDO explained that so far no payment has been made yet. The amount of IOC will be paid based on actual sales, to be verified by a third party, (i.e., financial accounting firm) as set in the contracts between FECO and the enterprises. Due to this verification process, IOCs due in 2015 will only be paid in 2016.

Level of fund disbursement

96. As of September 2015, of the US $9,625,000 approved for the fourth tranche, US $2,887,500 had been disbursed from UNIDO to FECO, and US $2,013,940 (21 per cent) had been disbursed by FECO to beneficiaries. Table 4 shows the status of disbursement.

Table 4. Status of disbursements (US $)

RAC sector	Tranche 1	Tranche 2	Tranche 3	Tranche 4	Total
Funds approved by the Executive Committee	36,430,000	9,200,000	8,495,000	9,625,000	63,750,000
Disbursement from UNIDO to FECO	32,786,917	4,600,000	4,235,300	2,887,500	44,509,717
Disbursement ratio (%)	90	50	50	30	70
Disbursement from FECO to beneficiaries	15,361,821	3,848,378	2,650,373	2,013,940	23,874,512
Disbursement ratio (%)	42	42	31	21	37

Work plan for 2016

97. The Secretariat noted that the fifth tranche included the proposal of using funds for the remaining 18th line of an air-conditioning manufacturing enterprise committed under the HPMP to convert a manufacturing enterprise for heat pump water heaters or compressors to HC-290 or CO_2, and indicated that such a change was not consistent with the Agreement of the RAC sector plan, and will include a sub-sector that had not yet been considered with regard to activities and potential incremental costs. In addition, a project preparation request for a demonstration project for heat pumps with the same approach to what had been included, was submitted to the 74th meeting but did not receive the Executive Committee's approval. The request did not provide enterprise information or consumption for the review by the Secretariat with regard to this proposal, but noted that this will follow the approach taken by UNIDO and FECO for identifying eligible enterprises, according to established guidelines.

98. UNIDO explained that as the enterprises and lines identified in the RAC sector would have already reached the tonnage required for reduction, and that currently the market uptake of HC-290 air-conditioning equipment was rather limited, FECO felt that this would be an opportunity to start work on this sub-sector that has a high growth potential in China which will be included in stage II of the HPMP.

99. However, noting the Secretariat's concerns and the lack of supporting information, FECO, with the assistance of UNIDO, will revert back to the original Agreement for the RAC sector, and select suitable companies for the remaining 18th line for conversion to complete the target enterprises for the first stage of the RAC sector.

100. In noting the budget for the tranche and the fact that there is only one line remaining to be identified for HC-290 conversion, UNIDO explained to the Secretariat that some IOC payments would be made from this budget. In addition, UNIDO, FECO's agreement would do its utmost to possibly identify other enterprises with under this tranche. Any remaining funds would have to be considered according to the Agreement between China and the Executive Committee on stage I of the HPMP.

101. The Secretariat also noted that there were some activities planned as part of the fifth tranche that would be completed after December 2016, the effective date of completion of stage I of the HPMP as specified in paragraph 13 of the Agreement. UNIDO indicated that the final date of completion would be decided with the other implementing agencies and a common date would be agreed if date of completion is to be later than 2016.

Interest

102. UNIDO informed the Secretariat that FECO has earned a total of US $94,424 in interest from funds transferred to FECO by UNIDO for the RAC sector plan.

Conclusion

103. The Secretariat noted that the implementation of the RAC sector plan continue to progress, with 24 enterprises currently undergoing their conversion to non-HCFC technology to phase out a consumption of 9,966 mt (548 ODP tonnes) of HCFC-22. Eleven enterprises with 13 lines have already completed their conversion resulting in a phase-out of 6,115 mt (336 ODP tonnes), and the rest will be completed no later than December 2016. The overall level of disbursement for UNIDO to FECO is 70 per cent and from FECO to 20 enterprises is 37 per cent; most of the funds are already committed in ongoing contracts with enterprises; and it is expected that FECO will undertake additional payments to enterprises upon their completion of implementation milestones. In view of the progress taking place and the newly identified enterprises, the Secretariat recommends approval of the fifth and final tranche.

RECOMMENDATION

104. The Executive Committee may wish to consider:

(a) Noting the progress report on the implementation of the fourth tranche of the room air-conditioning manufacturing (RAC) sector plan of stage I of the HCFC phase-out management plan (HPMP) for China;

(b) Requesting the Government of China and UNIDO to submit progress reports on a yearly basis on the implementation of the work programme associated with the final tranche until the completion of the project, verification reports until approval of stage II, and the project completion report to the first meeting of the Executive Committee in 2018;

(c) Approving the fifth and final tranche of the RAC sector plan of stage I of the HPMP for China, and the corresponding 2016 tranche implementation plan, at the amount of US $11,250,000, plus agency support costs of US $787,500 for UNIDO; and

(d) Requesting the Treasurer to offset future transfers to UNIDO by US $94,424 representing interest accrued by the Government of China up to 31 December 2014 from funds previously transferred for the implementation of the RAC sector plan as per decision 69/24.

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

China

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase out plan (stage I) solvent	UNDP (lead)	65th	10% by 2015

(II) LATEST ARTICLE 7 DATA (Annex C Group l)	Year: 2013	15,761.32 (ODP tonnes)

(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)									Year: 2014
Chemical	Aerosol	Foam	Fire fighting	Refrigeration		Solvent	Process agent	Lab use	Total sector consumption
				Manufacturing	Servicing				
HCFC-123				12.9	7.1				20
HCFC-124					2.1				2.1
HCFC-141b	64.3	5,155				484			5,703.3
HCFC-142b		604.5		6.5	33.7				644.7
HCFC-22	121.9	1,644.5		5,582.5	3,118.8				10,467.7
HCFC-225ca						0.8			0.8

(IV) CONSUMPTION DATA (ODP tonnes)			
2009 - 2010 baseline:	19,269.0	Starting point for sustained aggregate reductions:	18,865.44
CONSUMPTION ELIGIBLE FOR FUNDING (ODP tonnes)			
Already approved:	3,445.19	Remaining:	15,420.25

(V) BUSINESS PLAN		2015	Total
UNDP	ODS phase-out (ODP tonnes)	6.4	6.4
	Funding (US $)	535,000	535,000

(VI) PROJECT DATA			2011	2012	2013	2014	2015	Total
Montreal Protocol consumption limits			n/a	n/a	19,269.0	19,269.0	17,342.1	n/a
Maximum allowable consumption (ODP tonnes)			n/a	n/a	18,865.4	18,865.4	16,978.9	n/a
Agreed funding (US $)	UNDP	Project costs	2,500,000	0	2,000,000	0	500,000	5,000,000
		Support costs	187,500	0	140,000	0	35,000	362,500
Funds approved by ExCom (US $)		Project costs	2,500,000	0	2,000,000	0	0	4,500,000
		Support costs	187,500	0	140,000	0	0	327,500
Total funds requested for approval at this meeting (US $)		Project costs	0	0	0	0	500,000	500,000
		Support costs	0	0	0	0	35,000	35,000

Secretariat's recommendation:	For blanket approval

PROJECT DESCRIPTION

105. On behalf of the Government of China, UNDP as the designated implementing agency has submitted to the 75th meeting a request for funding for the third and final tranche of the solvent sector plan of stage I of the HCFC phase-out management plan (HPMP), at the amount of US $500,000 plus agency support costs of US $35,000. The submission includes the progress report on the implementation of the second tranche, the tranche implementation plan for 2015-2016, and a verification report of a sample of manufacturing lines converted.

Progress report on the implementation of the second tranche

106. A total of nine enterprises consuming 610.2 metric tonnes (mt) (67.12 ODP tonnes) of HCFC-141b were included in stage I.

107. In March 2013 a first group of four enterprises signed implementation contracts with FECO to phase out 353.3 mt (38.86 ODP tonnes) of HCFC-141b used as a solvent in the manufacturing of medical devices. All four enterprises selected KC-6 (siloxane) as the replacement technology.

108. Between November and December 2013, an additional five enterprises signed implementation contracts with FECO to phase out 256.9 mt (28.26 ODP tonnes) of HCFC-141b as a solvent in medical devices (two enterprises), metal cleaning (two enterprises) and electronics cleaning (one enterprise). The replacement technologies selected were KC-6 for medical devices, isopropanol/alcohol for electronics cleaning and HC/trans-1-chloro-3,3,3-trifluoropropene for metal cleaning.

109. Out of the nine enterprises assisted, five (413.2 mt) completed their conversions and received national acceptance between January and July 2015. Conversion at the remaining four enterprises (197.1 mt) will be completed by end of 2015.

110. Additional technical assistance activities implemented included:

(a) Training workshops to guide the beneficiary enterprises on the project requirements and procedures of implementation, as well as financial and procurement regulations;

(b) Implementation review meetings with technical and safety experts to discuss and approve enterprises' implementation plans, performance audits, and on-site disbursement verifications;

(c) On site verification of the project to demonstrate KC-6 in medical devices in order to collect experiences and lessons learned to reduce technical, financial and safety risks of the conversions; and

(d) Development of a management information system to track HCFC phase-out and provide project data and progress reports.

Level of fund disbursement

111. As of September 2015, of the US $2,000,000 approved for the second tranche, US $1,600,000 had been disbursed from UNDP to FECO, and US $979,224 (48.76 per cent) had been disbursed by FECO to beneficiaries. Table 1 presents the status of total disbursement.

Table 1. Status of disbursements of the solvent sector plan as of September 2015

Solvent sector plan		Tranche 1	Tranche 2	Total
Funds approved		2,500,000	2,000,000	4,500,000
Disbursement from UNDP to FECO*	Amount (US $)	2,500,000	1,600,000	4,100,000
	Percentage	100.0%	80.0%	91.1%
Disbursement from FECO to beneficiaries	Amount (US $)	2,195,543	979,224	3,174,767
	Percentage	87.8%	49.0%	70.6%

*This figure also includes disbursements related to technical assistance and PMU.

Sector verification

112. By mid-2015 five enterprises had completed the conversion of 137 manufacturing lines, phasing out 413.2 mt of HCFC-141b. As required by paragraph 5 (b)(i) of the Agreement, UNDP commissioned an independent verification on the completion of the conversion of the enterprise Shandong Wego Group Medical Polymer (Wego), which used HCFC-141b in the manufacturing of medical devices, and represents more than 10 per cent of the consumption phased out so far in 2015.

113. The verification confirmed the conversion of 51 assembly lines (49 to KC-6 and two to silicon oil) with an associated phase out of 50.97 mt of HCFC-141b. Appropriate ventilation systems were installed for the spraying systems, baseline equipment for the use of HCFC-141b in all converted lines was disposed of with involvement of the Local Notary Public Office. The independent consultant also verified the use of new equipment (spraying and ventilation) for the use of KC-6 in all production lines and verified associated documentation demonstrating purchase of the alternative. The report concluded that FECO could consider taking a commitment from Wego that the enterprise will no longer use HCFC-141b for the converted lines.

Tranche implementation plan for 2015-2016

114. The remaining four enterprises will complete their conversions and obtain national acceptance. UNDP and FECO will continue monitoring implementation and undertaking visits by technical experts, performance verifications and disbursements. In addition, FECO will undertake a study on the possibility of phasing out HCFC in the medical devices' sub-sector based on the successful experience, organize several meetings for stakeholders to promote knowledge sharing and lessons learned, organize a study tour to gain experience on alternative technologies and policy enforcement measures, and prepare a project completion report. Table 2 presents the budget for the final tranche.

Table 2. Budget for the final tranche of the solvent sector plan in China

Activity	Budget (US $)
Conversion of solvent enterprises to non-HCFC technology	200,000
Technical assistance activities and project monitoring	300,000
Total final tranche	**500,000**

SECRETARIAT`S COMMENTS AND RECOMMENDATION

COMMENTS

HCFC consumption

115. Consumption of HCFCs in the solvent sector in 2014 was 4,433.2 mt (484.83 ODP tonnes), which is lower than the maximum allowable consumption established for the same year in the Agreement between the Government of China and the Executive Committee (Table 3). The reduction in HCFC consumption has been initially achieved through the application of the HCFC production quota and domestic sale quota issued for each producer, as well as HCFC consumption quotas to manufacturing

enterprises using more than 100 mt. The conversion of the nine enterprises included in stage I will make these reductions sustainable.

Table 3. Consumption of HCFCs in the solvent sector

Solvent sector		2009	2010	2011	2012	2013	2014	2015
Consumption*	Mt	4,352.0	4,612.0	4,660.0	4,755.0	4,258.7	4,433.2	n/a
	ODP t	478.72	507.32	512.60	523.05	466.25	484.83	n/a
Maximum allowable consumption **	Mt	n/a	n/a	n/a	n/a	4,492.7	4,492.7	4,138.2
	ODP t	n/a	n/a	n/a	n/a	494.20	494.20	455.20
Phase-out target**	Mt	n/a	n/a	n/a	n/a	272.7	0.0	354.5
	ODP t	n/a	n/a	n/a	n/a	29.00	0.00	39.00

* As per the country programme implementation report.
** As per Agreement signed at the 67th meeting.

Status of implementation

116. The Secretariat followed up on the status of implementation of the four enterprises with ongoing projects. It was confirmed that the conversions are now completed and the enterprises are currently obtaining several certifications such as environment and safety assessments from relevant local authorities, conducting destruction of HCFC-based equipment and undertaking training of their workers on the use of new solvent before the national acceptance process. Two enterprises are expected to complete national acceptance by the end of 2015 and complete fund disbursement in early 2016. Based on the information received, no activities under the solvent sector plan will extend beyond 2016.

117. The conversion of the nine enterprises included in the plan corresponds to a phase-out of 610.2 mt of HCFC-141b by the end of 2015. In addition, 27.82 mt of HCFC-141b were phased out by the solvent demonstration project at Zhejiang Medical Devices Co. Ltd., also included in stage I. As a result, the total of 638.11 mt phased out under stage I is larger than the HCFC reduction target of 627.2 mt established for the sector.

Interest

118. In line with decision 69/24(b)(ii)[7], UNDP reported that in 2013 and 2014 FECO has earned a cumulative interest of US $12,384 for the solvent sector plan, (i.e., US $5,293 in 2013 and US $7,091 in 2014)[8].

Conclusion

119. The Secretariat noted that the solvent plan is well in advance of implementation with five out of nine enterprises having completed their conversions and the remaining four expected to complete theirs by the end of 2015 or early 2016. The conversion of these nine enterprises and the demonstration project at Zhejiang Medical Devices Co. Ltd., represents 101.7 per cent of the HCFC reduction target for stage I of the solvent sector. The overall level of disbursement is 70.55 per cent. In view of the progress taking place the Secretariat recommends approval of the third and final tranche of the solvent sector plan.

[7] That requests implementing agencies to report on interest accrued by China on funds transferred for the HPMP in the tranche implementation reports.
[8] These figures are supported by an independent audit covering all sectors submitted by the World Bank.

RECOMMENDATION

120. The Fund Secretariat recommends that the Executive Committee:

(a) Takes note of the progress report on the implementation of the second tranche of stage I of the solvent sector plan for China;

(b) Requests the Government of China and UNDP to submit progress reports on a yearly basis on the implementation of the work programme associated with the final tranche until the completion of the project, verification reports until approval of stage II, and the project completion report to the first meeting of the Executive Committee in 2018; and

(c) Requests the Treasurer to offset future transfers to UNDP by US $12,384, representing interest accrued by the Government of China in 2013 and 2014 from funds previously transferred for the implementation of the solvent sector plan for China as per decision 69/24; and

121. The Fund Secretariat further recommends blanket approval of the third and final tranche of stage I of the solvent sector plan for China, and the corresponding 2016 tranche implementation plan, at the funding level shown in the table below:

	Project title	Project funding (US $)	Support cost (US $)	Implementing agency
(a)	Sector plan for phase-out of HCFCs in the solvent sector (stage I, third tranche)	500,000	35,000	UNDP

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

China

(I) PROJECT TITLE	AGENCY	MEETING APPROVED	CONTROL MEASURE
HCFC phase out plan (stage I) servicing sector, including enabling	Japan, UNEP (lead)	64th	10% by 2015

(II) LATEST ARTICLE 7 DATA (Annex C Group l)	Year: 2013	15,761.32 (ODP tonnes)

(III) LATEST COUNTRY PROGRAMME SECTORAL DATA (ODP tonnes)									Year: 2014
Chemical	Aerosol	Foam	Fire fighting	Refrigeration		Solvent	Process agent	Lab use	Total sector consumption
				Manufacturing	Servicing				
HCFC-123				12.9	7.1				20
HCFC-124					2.1				2.1
HCFC-141b	64.3	5,155				484			5,703.3
HCFC-142b		604.5		6.5	33.7				644.7
HCFC-22	121.9	1,644.5		5,582.5	3,118.8				10,467.7
HCFC-225ca						0.8			0.8

(IV) CONSUMPTION DATA (ODP tonnes)			
2009 - 2010 baseline:	19,269.0	Starting point for sustained aggregate reductions:	18,865.44
CONSUMPTION ELIGIBLE FOR FUNDING (ODP tonnes)			
Already approved:	3,445.19	Remaining:	15,420.25

(V) BUSINESS PLAN		2015	Total
Japan	ODS phase-out (ODP tonnes)	1.0	3.0
	Funding (US $)	90,400	271,200
UNEP	ODS phase-out (ODP tonnes)	9.9	38.5
	Funding (US $)	873,960	3,405,774

(VI) PROJECT DATA			2011	2012	2013	2014	2015	Total
Montreal Protocol consumption limits			n/a	n/a	19,269.0	19,269.0	17,342.1	n/a
Maximum allowable consumption (ODP tonnes)			n/a	n/a	18,865.4	18,865.4	16,978.9	n/a
Agreed funding (US $)	Japan	Project costs	80,000	80,000	80,000	80,000	80,000	400,000
		Support costs	10,400	10,400	10,400	10,400	10,400	52,000
	UNEP	Project costs	1,579,000	598,000	1,104,000	1,173,000	786,000	5,240,000
		Support costs	176,703	66,921	123,547	131,269	87,960	586,400
Funds approved by ExCom (US $)		Project costs	1,659,000	678,000	1,184,000	1,253,000	0	4,774,000
		Support costs	187,103	77,321	133,947	141,669	0	540,040
Total funds requested for approval at this meeting (US $)		Project costs	0	0	0	0	866,000	866,000
		Support costs	0	0	0	0	98,360	98,360

Secretariat's recommendation:	For blanket approval

PROJECT DESCRIPTION

122. On behalf of the Government of China, UNEP as the lead implementing agency, has submitted to the 75th meeting a request for funding for the fifth and final tranche of the refrigeration servicing sector plan and the national enabling programme of stage I of the HCFC phase-out management plan (HPMP), at a total cost of US $964,360, consisting of US $786,000, plus agency support costs of US $87,960 for UNEP, and US $80,000, plus agency support costs of US $10,400 for the Government of Japan. The submission includes a progress report on the implementation of the fourth tranche and the tranche implementation plan for 2016.

Progress report on the implementation of the fourth tranche

123. The following activities have been implemented since the approval of the previous tranche:

(a) The code on technical specifications for servicing and maintenance of refrigeration and air-conditioning (RAC) equipment was submitted for review, and is expected to be in effect by the end of 2015. Three standards were completed covering the use of flammable refrigerants in household appliances; requirements for the transport, installation and servicing of room air-conditioning equipment using flammable refrigerants were defined. These codes and standards support the implementation of the industrial and commercial refrigeration (ICR) and RAC manufacturing sector phase-out;

(b) The six national and regional training centres established in June 2014 completed 29 training courses resulting in 827 trained trainers/technicians and 312 students in early 2015. An additional eight training centres were contracted (using funds from the previous CFC phase-out plans), to operate similar to the six centres established under the HPMP. All 14 centres will support the servicing sector training activities;

(c) Consultations were held with the training centres to improve the training methodology, review the subjects covered by the programme, and to adopt course materials to the current needs of the country, particularly in the servicing of equipment using HC-290. Equipment upgrades required by the centres, as well as criteria for the standardization of trainer qualifications were identified;

(d) A feasibility study to support the certification of service technicians was completed, and emphasised the need to incorporate good practices training as a requirement to the current certification system. Moreover, an additional study was initiated to assess the specific needs of the vocational system with regard to refrigeration servicing. Based on the results of the study, the certification examination for technicians will be revised;

(e) A database containing key information on trainers, technicians, training costs, and a qualification certificate scheme for service enterprises, was developed under the training programme;

(f) Under the Shenzhen demonstration project[9], the following activities were completed:

(i) The local Government's green procurement policy was drafted and lists the requirements for RAC equipment bidding and servicing;

[9] The purpose of the demonstration projects is to test the feasibility and validity of policy measures, technical approaches, and management modality, and identify the cost effectiveness of related activities. The experiences and lessons obtained from the demonstration project are expected to be a reference to formulate the detailed rules corresponding to the ODS management regulation. If the demonstration project is successful, Shenzhen would also play a role of leadership in encouraging other cities to take similar actions as soon as possible.

(ii) The guidelines for the management and phase-out of HCFCs in the RAC servicing sector in Shenzhen were endorsed in July 2015;

(iii) Outreach activities to promote the use of HC-290 based room air-conditioning equipment were initiated;

(iv) An online database with information on the refrigeration servicing workshops and enterprises to support the monitoring and supervision of the servicing sector in the municipality was established;

(g) The contract between the General Administration of China Customs (GACC) and the FECO/MEP for training and capacity building activities was signed in June 2015. The activities are to be implemented from 2015-2017 resulting in 1,250 trained enforcement officers;

(h) The updated national online ODS import and export management system (in place since 1 January 2014) enabled the processing of 2,194 export applications from January to August 2015;

(i) Thirty sets of portable refrigerant identifiers were distributed to 10 customs offices; training on the use and maintenance of these identifiers is on-going; and

(j) Outreach and communication activities supporting the launch of environmentally-friendly and low-carbon label for room air-conditioners and heat pumps continued. A seminar on green cooling and heating was held on Ozone Day.

Level of fund disbursement

124. As of September 2015, of the US $4,774,000 approved so far, US $2,837,000 has been disbursed by UNEP to FECO/MEP under the Project Cooperation Agreement (PCA), as shown in Table 1.

Table 1. Status of disbursements for the servicing sector and enabling activities component as of September 2015

Description		**Tranche 1**	**Tranche 2**	**Tranche 3**	**Tranche 4**	**Total**
Funds approved (US $)		1,659,000	678,000	1,184,000	1,253,000	4,774,000*
Disbursement by UNEP to FECO	Amount (US $)	1,302,000	385,000	650,000	500,000	2,837,000
	Disbursement ratio	78%	57%	55%	40%	59%
Disbursement by FECO	Amount (US $)	1,114,264	288,244	588,163	255,103	2,245,774
	Disbursement ratio	67%	42%	50%	20%	47%

*Of this amount, US $308,500 has been allocated for procurement of equipment and meeting resource persons, and will be disbursed through a Small Scale Funding Agreement (SSFA) directly to FECO.

Implementation plan for the fifth and final tranche

125. The requested funding for the fifth and final tranche will be used to:

(a) Review and renew the contracts of the first batch of regional training centres to continue implementing training activities: updating training equipment, supporting the promotion of HC-290 based air-conditioners, and conducting an assessment of the technician training programme under stage I to make recommendations for improvements (US $563,500);

(b) Continue the capacity building policy training activities for ozone officers at the provincial, municipal, city and county levels; and continue coordination with MEP and other related Ministries on activities for the servicing sector (US $90,000);

(c) Provide training on the operation of an electronic system for Customs, the Commerce Department, importers and exporters; and develop training material for training of customs officers with updated information on new standards (US $35,000);

(d) Continue the operation of the ozone protection website and use of social media to outreach information on the phase-out of HCFCs in China; organise meetings with stakeholders to develop a strategy to support the outreach activities; hold activities for Ozone Day; and develop and print publicity materials (US $77,500);

(e) Support the operation of the working group overseeing the implementation of the servicing sector plan (US $80,000); and

(f) Provide technical assistance to MEP/FECO on implementation of the sector plan (US $20,000).

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

Level of implementation of activities achieved

126. A significant progress in the implementation of activities associated with the fourth tranche of the servicing sector and enabling activities component has been achieved. The Secretariat sought clarification on: how the finalization of the codes and standards (complemented activities under the ICR and RAC manufacturing sectors) had progressed; whether additional training centres for servicing technicians would be identified during stage II of the HPMP; the current status of implementation of the certification of technicians; and how the results of the Shenzhen demonstration project will be replicated in other provinces.

127. UNEP explained that the work being done, with regard to the codes and standards, is critical for market penetration of RAC systems converted to alternative technologies, in particular HC-290 air conditioners). These standards have been approved and will be implemented on 1 February 2016. UNIDO provided guidance and advice during the process of standards development, and both implementing agencies were involved in the consultation and finalisation of these standards.

128. UNEP explained that the identification of training centres, in addition to the 11 centres identified in stage I, may be required in stage II due to the size of the country. UNEP will ensure the sustainability of the training programmes for technicians and will assist with the implementation of the certification programme expected to be operational during stage II.

129. UNEP also explained that under the Shenzhen demonstration project, a workshop will be held in 2015 or 2016 to share the experiences and lessons learned, and the ideas that facilitated the development of policies and regulations that built ODS phase-out into the daily responsibilities of many government departments. After this workshop, other provinces may implement the approach taken by Shenzhen.

130. The UNEP indicated that while the majority of the activities for the RAC servicing sector will be completed in 2016, the completion date of the sector plan will be June 2017. For the discussion on the date of completion on the overall stage I of the HPMP in China, refer to paragraph 16 in the consolidated overview of China's tranche request.

Interest

131. In line with decision 69/24(b)(ii) that requests implementing agencies to report, in the tranche implementation reports, on interest accrued by China on funds transferred for the HPMP, UNEP informed the Secretariat that in 2012, 2013 and 2014 FECO has earned a cumulative interest of US $3,148 for the refrigeration servicing sector plan and the national enabling programme[10] (i.e. US $642 in 2012, US $1,427 in 2013[11] and US $1,079 in 2014).

Conclusion

132. The Secretariat noted that sufficient progress had been demonstrated in the implementation of the planned activities for the servicing and enabling component of the HPMP for China. Several agreements were reached, meetings held and training programmes completed, with various stakeholders building capacity for the efficient implementation of the activities. The national ODS import and export management system was upgraded, enabling the processing of approximately 2,200 export applications since 1 January 2015. Additional institutes were identified for training of service technicians; progress had been made in the technician certification programme; and a two-year agreement between the GACC and FECO/MEP will result in the training of 1,250 enforcement officers.

133. Over US $2.8 million, representing 59 per cent of the funds so far approved have been disbursed from UNEP to FECO/MEP. Of this amount, approximately US $2.5 million has been disbursed by FECO/MEP to key stakeholders, including the training institutes.

134. The Secretariat further noted that the current request meets the required pre-conditions for the release of the fifth and final tranche of the HPMP.

RECOMMENDATION

135. The Fund Secretariat recommends that the Executive Committee:

(a) Takes note of the progress report on the implementation of the fourth tranche of stage I of the refrigeration servicing sector plan and the national enabling programme in China;

(b) Requests the Government of China and UNEP to submit progress reports on a yearly basis on the implementation of the work programme associated with the final tranche until the completion of the project, and the project completion report to the first meeting of the Executive Committee in 2018; and

(c) Requesting the Treasurer to offset future transfers to UNEP by US $3,148, representing interest accrued by the Government of China in 2012, 2013 and 2014 from funds previously transferred for the implementation of the refrigeration servicing sector plan and the national enabling programme for China, as per decision 69/24.

[10]These figures are supported by an independent audit covering all sectors, submitted by the World Bank.

[11] Interest accrued in 2012 and 2013 for the refrigeration servicing sector plan were not offset from the approval of the previous tranches.

136. The Fund Secretariat further recommends blanket approval of the fifth and final tranche of the refrigeration servicing sector plan and national enabling programme for China and the corresponding 2016 tranche implementation plan, with associated support costs at the funding levels shown in the table below:

	Project Title	Project Funding (US $)	Support Cost (US $)	Implementing Agency
(a)	HCFC phase-out management plan (stage I, fifth and final tranche) (refrigeration servicing sector and the national enabling programme)	786,000	87,960	UNEP
(b)	HCFC phase-out management plan (stage I, fifth and final tranche) (refrigeration servicing sector and the national enabling programme)	80,000	10,400	Japan

PROJECT EVALUATION SHEET – NON-MULTI-YEAR PROJECT

CHINA

PROJECT TITLE(S)	BILATERAL/IMPLEMENTING AGENCY
(a) Demonstration project for ammonia/carbon dioxide (NH_3/CO_2) refrigeration system using semi-hermetic frequency convertible screw refrigeration compressor units in the industrial and commercial refrigeration industry at Fujian Snowman Co., Ltd.	UNDP

NATIONAL CO-ORDINATING AGENCY	MEP/FECO

LATEST REPORTED CONSUMPTION DATA FOR ODS ADDRESSED IN PROJECT

A: ARTICLE-7 DATA (ODP TONNES, 2014, AS OF OCTOBER 2015)

HCFCs	15,761.32

B: COUNTRY PROGRAMME SECTOR DATA (ODP TONNES, 2014, AS OF OCTOBER 2015)

HCFC-22	10,467.7
HCFC-123	20.0
HCFC-124	2.1
HCFC-141b	5,703.3
HCFC-142b	644.7
HCFC-225a	0.8

HCFC consumption remaining eligible for funding (ODP tonnes)	15,420.25

CURRENT YEAR BUSINESS PLAN ALLOCATIONS		Funding US $	Phase-out ODP tonnes
	(a)	n/a	n/a

PROJECT TITLE:	
ODS use at enterprise (ODP tonnes):	n/a
ODS to be phased out (ODP tonnes):	n/a
ODS to be phased in (ODP tonnes):	n/a
Project duration (months):	18
Initial amount requested (US $):	2,412,263
Final project costs (US $):	
Incremental capital cost:	3,261,988
Contingency (10 %):	
Incremental operating cost:	0
Co-funding	849,725
Total project cost:	3,261,988
Local ownership (%):	100
Export component (%):	0
Requested grant (US $):	2,412,263
Cost-effectiveness (US $/kg):	n/a
Implementing agency support cost (US $):	168,858
Total cost of project to Multilateral Fund (US $):	2,581,121
Status of counterpart funding (Y/N):	Y
Project monitoring milestones included (Y/N):	Y

SECRETARIAT'S RECOMMENDATION	Individual consideration

PROJECT DESCRIPTION

137. On behalf of the Government of China, UNDP as the designated implementing agency has submitted to the 75th meeting a request for funding for a demonstration project for NH_3/CO_2 refrigeration system using semi-hermetic frequency convertible screw refrigeration compressor units in the industrial and commercial refrigeration (ICR) industry at Fujian Snowman Co., Ltd., at the amount of US $2,412,263 plus agency support costs of US $168,858.

138. In line with decision 72/40[12], the Executive Committee approved funding for the preparation of this project in the amount of US $24,000, plus agency support costs of US $1,680 for UNDP, on the understanding that its approval did not denote approval of the project or its level of funding when submitted (decision 74/26). The proposal submitted is contained as Annex I to the present document.

Objective

139. The objective is to establish the suitability of NH_3/CO_2 refrigeration system using semi-hermetic frequency convertible screw refrigeration compressor units for small- and medium-sized ICR systems (e.g. freezers and cold storage used in supermarkets and food processing) as a replacement for HCFC-22-based compressors.

Sector and enterprise background

140. The consumption of HCFC-22 in the ICR sector amounts to approximately 40,805 metric tonnes[13] (mt) annually in China; however in recent years, the ICR refrigeration equipment has grown at more than 10 per cent annually, with an associated increase in demand for HCFC-22. The demonstration targets a sub-sector of small- and medium-sized ICR equipment which consumes approximately 4,000 mt annually in China.

141. Fujian Snowman Co., Ltd., established in March 2000, manufactures compressors, ice-making equipment, cooling water equipment, ice storage and cooling systems, and has research and development capacity. The production lines for ice makers and ice storage equipment will be modified and used to conduct the demonstration project.

Rationale

142. HCFC-22 is used in refrigeration equipment placed in densely populated areas; as the charge of NH_3-based refrigeration equipment is more than 100 kg, its location is required to be placed away from populated areas according to safety regulations. Most large-scale, low-temperature refrigeration systems use open-type compressors and open-system design with a significant amount of leakage and low recovery rate of refrigerant during maintenance; therefore, consumption in servicing such systems is usually high. The development of NH_3 semi-hermetic screw refrigeration compressors with refrigerant charge of less than 50 kg and demonstration of its use in NH_3/CO_2 refrigeration system will allow for the use of NH_3 in small- and medium-sized ICR equipment in densely-populated area and reduce refrigerant leakage.

[12] The Executive Committee decided *inter alia* to consider at its 75th and 76th meetings proposals for demonstration projects for low global-warming potential (GWP) alternatives to HCFCs within the framework established, and provided criteria for such projects.
[13] Estimated 2014 consumption.

143. The use of NH_3/CO_2 refrigeration system with semi-hermetic frequency convertible screw refrigeration compressors has not been tested in China[14]. Therefore through the demonstration project the technology will be tested and standardized in a factory-controlled environment.

Project description

144. The NH_3/CO_2 refrigeration system will be designed using NH_3 as the refrigerant and CO_2 as the heat transfer fluid. The NH_3/CO_2 technology will be demonstrated in three compressor modules with different refrigerant charge and volumetric displacement, as show in Table 1.

Table 1. Specifications of NH_3/CO_2 refrigeration system

Model	Theoretical volumetric displacement (m^3/hr)	NH_3 charge (kg)	CO_2 charge	HCFC-22 charge replaced (kg)
SSSCA50 (SRS-12L)	262	17	30	75
SSSCA60 (SRS-1008L)	221	22	35	90
SSSCA210 (SRS-1612LM)	652	48	60	194

145. The project consists of process and product design; construction of NH_3 pressure vessels; modification of the heat exchanger production line; construction of test device; manufacture of compressor prototypes; testing and performance evaluation; training; and technology dissemination. The three models will be tested in laboratory only (end-user testing is not included in the project).

146. Testing of two models with similar theoretical displacement is proposed as they have different structures and different applications. The compressor with 221 m^3/hr theoretical displacement will be applied in applications in the below -35 degrees low-temperature field, while the one with 262 m^3/hr theoretical displacement will be applied in applications in the above -35 degrees field.

Project budget

147. The total project cost has been estimated at US $3,261,988; of which US $2,412,263 is being requested from the Multilateral Fund and the remaining US $849,725 will be shared by the enterprise (Table 2). A letter of commitment to implement the project has been received from Fujian Snowman Co., Ltd.

Table 2. Project cost by activity (US $)

Activity	Description	Budget	Counterpart funding	MLF funding
Product and process design	Design of compressor, motor, pressure vessels, electrical control system; manufacturing process; electrical control and software	426,791	0	426,791
Modification of production line for compressors	Modification of a production line for NH_3 compressors	568,859	0	568,859
Modification of production line for compression units	Modification of existing lines into a production line for NH_3 compression units	156,454	156,454	0

[14] Technical expert confirmed that such technology is used in Sweden.

Activity	Description	Budget	Counterpart funding	MLF funding
Test device construction	Electrical leakage detector, detectors for vibration, noise and temperature; helium leakage detector; performance test equipment for compressors and compression units; pressure vessel strength test	1,213,012	438,184	774,828
Manufacturing of prototype	Costs of materials for manufacturing nine prototype units and labour	686,778	162,755	524,023
Training of personnel	Training and materials	133,412	15,650	117,762
Market promotion	Promote technology adoption on the market	76,682	76,682	0
Total		3,261,988	849,725	2,412,263

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

148. During the review of the demonstration project, the Secretariat consulted a refrigeration expert on various aspects of the demonstration project including the innovation of the technology, requirements for conducting the demonstration, design of process and the proposed cost schedule. The discussion is summarized as follow.

Technology innovation and added value

149. The Secretariat noted UNDP's efforts to formulate a demonstration project for the introduction of NH_3/CO_2 refrigeration system in line with decision 72/40. The project has been closely linked with the phase-out activities in the HCFC phase-out management plan (HPMP) for China, it will design, manufacture, test and optimize the NH_3/CO_2 refrigeration system including NH_3 semi-hermetic compressors for easy adoption by the market and subsequent servicing, and will also lower the manufacturing cost of the system. If proven successful the project will provide a technology solution to replace HCFC in small- and medium-sized ICR equipment with charge below 200 mt. Therefore the demonstration will provide added value to HCFC phase-out.

Replicability

150. The review of the project by a technical expert confirmed that the system can be used in many small and medium-sized ICR refrigeration applications (e.g. cold storage, food processing and cold display in supermarkets, where mostly HCFC-22 is consumed[15]).

Technical issues

151. Clarifications were sought on whether the production line will be converted to produce 3,000 units of the NH_3/CO_2 refrigeration system. UNDP explained that within this demonstration project, the enterprise will be retrofitting an open compressor line to produce a few prototypes of semi-hermetic compressors for testing and technology validation. If the prototypes prove successful and the testing results are satisfactory, the enterprise will retrofit an old production line by adding production operations equipment and testing equipment into a new line to produce 3,000 units per year of NH_3/CO_2 refrigeration systems.

[15] The total remaining eligible consumption in the ICR sector in all Article 5 countries is estimated at 12,403 mt in Table 2 of document UNEP/OzL.Pro/ExCom/74/49 noted by the Executive Committee at the 74th meeting.

152. In responding to a question about why a new performance-testing device was required, as the factory has already produced open-type compressors and the existing testing laboratory for open-type compressors could be modified to test the semi-hermetic compressor, UNDP explained that the existing laboratory is for testing compressors with theoretical displacement above 300 m^3/hr. The two new models to be developed have theoretical displacement below 300 m^3/hr (the pipes and test equipment are designed for large theoretical displacement); modifying the existing laboratory would cost even more than constructing a new one. The Secretariat noted that 36 per cent of this cost has been co-funded by the enterprise.

153. The Secretariat noted that the enterprise holds two patents for the accessories in the system – the oil separator and the fin tube of the heat exchanger, and queried how this would hinder the transfer of NH_3/CO_2 technology being developed. UNDP explained that the oil separator and the fin tube of the heat exchanger are core accessories for NH_3/CO_2 refrigeration systems. The enterprise holds the design technology for these parts and will use them in product prototype units. This will not prevent other enterprises from constructing their own units using their own technology. Fujian Snowman will provide an integrated refrigeration system including NH_3 compression unit, the heat exchanger and CO_2 circuit in its product with the control system.

Impact of the project

154. The Secretariat inquired about the impact of the project in terms of HCFC-22 phase-out. UNDP advised that this project does not result in direct HCFC phase-out. However, if the NH_3/CO_2 refrigeration system with NH_3 semi-hermetic compressor proves successful it can be used in ICR equipment such as ice makers and refrigeration systems in supermarkets, thus it has a great potential for replacing HCFCs.

155. For indirect impact, Snowman could convert its ice-maker production line into a production line with an annual capacity of 3,000 units of NH_3/CO_2 refrigeration system to avoid 359 mt of HCFC-22 consumption per year if the demonstration is successful.

Potential risk for adoption of the technology

156. It is expected that the cost of the new NH_3/CO_2 refrigeration systems will be higher than the HCFC-22-based systems although the exact cost of the new system will not be known until a production line is set up, which pose a potential barrier to market adoption. UNDP advised that at this moment almost all alternative technologies are more expensive than HCFC-22 systems. The cost of the new NH_3/CO_2 technology will be high at the beginning, but is expected to decrease if mass production takes place. It should also be noted that the HCFC production in China is decreasing, as it is controlled by quota. The supply shortage will increase the price of HCFC-22 and the competitiveness of HCFC-22 is disappearing gradually. Moreover, although the cost of the NH_3/CO_2 system is high, it may have improved energy efficiency. With technology promotion and dissemination, as well as the increasing desire for low-GWP and energy-efficiency alternatives, the new product will eventually be accepted by the market.

Project cost

157. As explained by UNDP the reasons for the high cost of the demonstration project are:

(a) As the product is new in China, major development work and testing will be involved;

(b) From a technical point of view, the hermetic system is more costly than open-type systems; and

(c) The high-pressure of CO_2 requires more costly materials.

158. With regard to costs of the testing laboratory, questions were asked about the helium leakage detector (US $266,041) as a similar product approved for the demonstration of HC-290 air-conditioner (AC) was only US $32,000. UNDP explained that the current system is much larger than the HC-290 domestic AC, and the specifications of the equipment are different from each other. Enquiries on price of equipment suitable for the project made before project preparation were approximately US $250,000 to US $280,000.

159. With regard to the high cost of CO_2 used for prototyping, UNDP explained that the CO_2 is a secondary refrigerant of the NH_3 semi-hermetic screw compression refrigeration system. The charge of CO_2 is between 30-60 kg in one unit. During the research and development process, repetitive test will be conducted for the prototypes of new products. The quantity of CO_2 required is estimated at approximately 6,000 kg (at US $9.40/kg). The Secretariat noted that the amount of CO_2 requested is sufficient for testing each module for five times.

160. Based on the information in the project document and responses from UNDP, the Secretariat's technical expert confirmed that the costs for product and process design, modification of production line and training of personnel were at a reasonable level.

Conclusion

161. The Secretariat considers that this project complies with the guidelines for low-GWP alternative demonstration projects as established by decision 72/40. The project targets a priority area where significant eligible consumption exists in Article 5 countries. The technology has never been tested in an Article 5 country and will provide a viable alternative with zero ODP, low-GWP and improved energy efficiency for small- and medium-sized refrigeration applications, including supermarket and cold-chain stores. The Executive Committee may wish to consider approval of this project in light of the guidelines and other projects being considered under the allocated window of US $10 million for this purpose.

RECOMMENDATION

162. The Executive Committee may wish to consider:

(a) The demonstration project for ammonia/carbon dioxide (NH_3/CO_2) refrigeration system using semi-hermetic frequency convertible screw refrigeration compressor units in the industrial and commercial refrigeration industry at Fujian Snowman Co., Ltd. in the context of its discussion on proposals for demonstration projects for low-GWP alternatives to HCFCs as described in the document on the overview of issues identified during project review (UNEP/OzL.Pro/ExCom/75/27); and

(b) Approving the demonstration project for ammonia/carbon dioxide (NH_3/CO_2) refrigeration system using semi-hermetic frequency convertible screw refrigeration compressor units in the industrial and commercial refrigeration industry at Fujian Snowman Co., Ltd. in the amount of US $2,412,263, plus agency support costs of US $168,858 for UNDP in line with decision 72/40.

Annex I

75th Meeting of the Executive Committee for the Implementation of the Montreal Protocol

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET - NON-MULTI-YEAR INVESTMENT PROJECTS

COUNTRY: CHINA

PROJECT TITLE:

Demonstration project for ammonia/carbon dioxide (NH_3/CO_2) refrigeration system using semi-hermetic frequency convertible screw refrigeration compressor units in the industrial and commercial refrigeration industry at Fujian Snowman Co., Ltd.

IMPLEMENTING AGENCY:

UNDP

PROJECT DATA			
Sector:	Industrial and Commercial Refrigeration and Air Conditioning (ICR)		
Sub-sector:	Commercial and Industrial Refrigeration and Freezing Equipment		
ODS use in sector (2013* metric tonnes):			**40,805**
Project impact (metric tonnes):			**382**
Project duration:			18 months
Project Costs:	Incremental Capital Costs(including contingencies):	US$	**3,261,988**
	Incremental Operating Costs:	US$	0
	Total Costs:	US$	**3,261,988**
Local ownership:			100%
Exports to non-A5 countries:			0%
Request grant		**US$**	**2,412,263**
Counterpart fund		**US$**	**849,725**
Cost-effectiveness (US$/kg-ODS):			
Implementing agency support costs:		**US$**	**168,858**
Total Cost to Multilateral Fund:		**US$**	**2,581,121**
Status of counterpart funding (Yes/No):			Yes
Project monitoring milestones included (Yes/No):			Yes

***Preliminary data based on ongoing surveys*

PROJECT SUMMARY

This demonstration project, upon successful completion, will establish the suitability of ammonia semi-hermetic frequency convertible screw refrigeration compressor unit as a viable replacement for HCFC-22 technology in the manufacture of integrated coolant refrigeration systems for commercial and industrial applications at Fujian Snowman Co., Ltd.

The project will cover product redesign and development, production of ammonia semi-hermetic frequency convertible screw refrigeration compressor, process tooling modifications and construction, testing and performance evaluation, product trials, prototype testing, production line conversion, technical assistance and training, to convert one production line of capacity 3,000 units annually.

If successful, the demonstration project will contribute towards promotion of this technology for replacing HCFC-22 based refrigeration systems in cold storage and freezing applications and enable cost-effective conversions at other similar manufacturers in this sub-sector.

Prepared by: UNDP in consultation with FECO and industry **Date:** September 2015

PROJECT OF THE GOVERNMENT OF PEOPLES REPUBLIC OF CHINA

Demonstration Project for Ammonia Semi-hermetic Frequency Convertible Screw Refrigeration Compressor Unit in the Industrial and Commercial Refrigeration Industry at Fujian Snowman Co., Ltd.

Objective

The objective of this proposed demonstration project is to establish the suitability of ammonia semi-hermetic frequency convertible screw refrigeration compressor unit as a viable replacement for HCFC-22 technology in the manufacture of systems for commercial and industrial applications at Fujian Snowman Co. Ltd.

Sector Background

The Industrial and Commercial Refrigeration and Air Conditioning (ICR) Sector in China has experienced remarkable growth in the past two decades, averaging at about 12% annually, due to the steep growth in the demand for consumer, commercial and industrial products, resulting from rapid overall economic development. This sector is categorized into several sub-sectors, namely: compressors, condensing units, small-sized air-source chillers/heat pumps, commercial and industrial chillers/heat pumps, heat pump water heaters, unitary commercial air conditioners, multi-connected commercial air conditioners, commercial and industrial refrigeration and freezing equipment, mobile refrigeration and air conditioning equipment and refrigeration and air conditioning components and parts. The 2014 estimated HCFC consumption in the sector based on ongoing surveys was about 40,805 metric tons, 98% of that HCFC is HCFC-22.

With the recent changes in Chinese people's lifestyle, the market of frozen food and cool processing is growing very rapidly. Furthermore, with the development of national economy, the petrochemical industry, energy development and other fields are also developing rapidly, bringing more market demand. Bio-pharmaceuticals, mine freezing, hydropower dams, etc. in the field of CBM liquefaction industry refrigerated equipment are also expanding. In recent years, the refrigerated equipment is increasing at the average speed of more than 10%. The majority of refrigeration equipment manufacturing enterprises are small and medium enterprises. According to survey by the industrial association, HCFC-22 refrigerant consumption for refrigeration equipment (including condensing units) level is about 4,000 metric tons annually.

Refrigeration equipment is regarded as one important end-user as stated in Sector Plan for Phase-out of HCFCs in the Industrial and Commercial Refrigeration and Air conditioning Sector in China and it includes food display case, transport refrigeration, icemaker, quick freezers, cold store, refrigerated warehouse, beverage cooling equipment, etc. The main end users are supermarkets, shops, air conditioned refrigeration warehouses, restaurants, food distributors, kitchens of hotel, food process plants, etc. These systems are all medium and small industrial and commercial system which use HCFC-22 as one important refrigerant. The amount of HCFC consumption is above 25% of ODS consumption. The refrigerant substitute is important for these field products. So the new core technology developed for medium and small industrial and commercial refrigeration is useful for ODS substitute.

Alternative Technology

The following factors need to be considered for selection of the alternative technology:

Technical factors

- Processing characteristics
- Functionality in end-product
- Proven and mature technology
- Energy efficiency

Commercial factors

- Cost-effectiveness
- Reliable availability

Health and safety factors
- Low risk for occupational health
- Low risk for physical safety (flammability, etc.)

Environmental factors
- Direct ozone impacts
- Direct and indirect climate impacts

Some of the zero-ODP alternatives to HCFC-22 currently available for this application are listed below:

Substance	GWP	Application	Remark
Ammonia	0	Industrial refrigeration and process chillers	Flammability and toxicity issues. Material compatibility issues. Regulatory issues.
CO_2	1	Refrigeration in a secondary loop and in stationary and mobile air conditioning systems	Major redesign of system components needed. Investment costs are prohibitive
R-404A	3,260	Low temperature applications	High GWP, less efficient at medium temperatures, synthetic lubricants needed

R-404A has high GWP and requires synthetic lubricants, although its thermodynamic properties is suitable for low-temperature applications. Its long-term sustainability from an environmental perspective is considered doubtful.

Ammonia is a traditional natural refrigerant with good environment properties as well as favorable thermodynamic properties. The operating pressures are low, it has low flow resistance and it has excellent heat transfer characteristics. Being a single substance, it is chemically stable. It has high refrigeration capacity. It is widely available at affordable prices. However, ammonia is quite reactive; it is toxic and moderately flammable. It is also not compatible with non-ferrous materials.

CO_2 was a commonly used refrigerant in the late 19th and early 20th centuries, however, its use gradually faded out. CO_2 has many favorable characteristics. It has no ODP and GWP of 1; it is inert, non-toxic and chemically stable, is compatible with almost all materials and available widely at affordable prices. For a given refrigeration capacity, the system components with CO_2 are much smaller compared to other refrigerants. However, the main disadvantage with CO_2 is its high operating pressures, which requires special designs for the system and components. CO_2 is also not very efficient at high ambient temperatures.

Fujian Snowman Co. Ltd. has selected ammonia semi-hermetic frequency convertible screw refrigeration compressor unit with CO_2 in its design as the technology of choice for its low-temperature coolant integrated refrigeration systems, considering the favorable environmental and thermodynamic properties of these two refrigerant alternatives.

Enterprise Background

Fujian Snowman Co., Ltd. was established in March 2000, with a registered capital of RMB 160 million. The headquarter is located in MinJiang Industrial Zone, Fuzhou, Fujian Province, and the company covers an area of 300 acres in Binhai and Liren new industrial park of Changle City. The company has developed into the largest professional manufacturer of ice-making system, and it became a professional high-tech enterprise integrated with R&D, designing, manufacturing, sales and engineering unit installation of compressors, ice-making equipment, cooling water equipment, ice storage system and cooling system. The products are widely used in cold-chain logistics, food processing, ice storage cooling, mine cooling, nuclear power plant construction, water conservancy and hydropower and other fields.

***Ice making machine*：** Fujian Snowman owns more than 100 exclusive patents with proprietary intellectual property rights. It has developed more than 40 types of products, especially the ice making machine sales ranks at top in China.

Screw refrigeration compressor units: The Company has developed dozens of new type of high efficiency and energy saving screw refrigeration compressor, its technology has reached the international advanced level. This technology will fill in the gaps and promote the compressor industry development.

Compressor manufacture: Packaged systems with open (NH_3), semi-hermetic (HCFC-22) and hermetic screw compressors (HCFC-22) and also reciprocating compressors (HCFC-22). The enterprise has two famous brands of compressor, which are SRM and RefComp. The screw compressor production is about 4000 in 2012, 3500 in 2013, and 1000 in 2014. The average of production quantity is about 3000 annually.

Industrial refrigeration systems: Fujian Snowman Co., Ltd. is one of the largest manufacturers of integrated industrial refrigeration systems, such as large capacity brine chillers, ice makers, etc. based on screw compressors, with a 40-60% market share.

Fujian Snowman Co., Ltd. is committed to technology innovation, focusing on environment protection, energy efficiency and safety. Over 30-40% of its refrigeration products use natural refrigerants.

In 2015 Fujian Snowman Co. Ltd. manufactured the following HCFC-22 based integrated refrigeration systems:

No	Product Line	Evaporating temperature (^oC)	Quantity (Nos.)	HCFC consumption (metric tons)
1	Water Chillers	-5 to +3	50	N/A
2	Ice maker	-30 to -15	400	23
3	Brine Chillers	-40 to 3	11	N/A
4	Ice storage system	-18 to -5	20	1

Of the above the list, namely, ice maker and ice storage refrigeration systems, each with an average HCFC-22 charge quantity of about 50kg, is the target for conversion in the current project. These products can use ammonia semi-hermetic screw compressor, which can result in change of the refrigerant from HCFC-22 to natural refrigerant, especially the ammonia charge is less than 50kg.

Rationale for Technology Demonstration

In China, presently, the refrigerated equipment of large quantity of ammonia (usually more than hundreds of MTs) is used far away from more densely populated areas. According Chinese law and regulations, large ammonia based systems (more than 100 kg) are not allowed in the densely populated areas. Therefore, the refrigeration equipment that is used in densely populated sized is mainly used HCFC-22 as a refrigerant. For example, each of the quick freezers, cold stores, refrigerated warehouses in the sub-sector uses up to dozens to hundred kilogram HCFCs; this can be substituted with less than 50kg ammonia in the new refrigeration system. Food display case, cold store, beverage cooling equipment, etc.in the supermarket is one main target of the demonstration project.

The development of NH_3 semi-hermetic screw refrigeration compressors with less than 50kg ammonia will make it possible for medium and small sized refrigerated equipment based on ammonia to be used in the densely-populated area, which will gradually reduce the use of HCFC-22.

As stated earlier, future market demand in China for food processing and related technologies and for industrial refrigeration is promising. The best operating evaporation temperature bracket for NH_3 refrigeration system is above -35, and this is the normal range for medium and small-scale low-temperature industrial refrigeration applications. Especially, these refrigeration applications use not large units. The investment of cascade has not been high in the country. Thus, one stage NH_3 system that use CO_2 as coolant, can replace HCFC-22 in many applications, which have significant growth potential in the future.

Furthermore, most of the large-scale low-temperature refrigeration systems use open-type compressors and open system design, with a significant amount of leakage and low recovery rate of refrigerant during maintenance, thus

annual consumption of HCFCs in servicing for such systems is very high. Thus, replacing HCFCs in such applications gains high priority from an environmental standpoint.

While NH_3 semi-hermetic frequency convertible screw refrigeration compressor unit has been implemented elsewhere, its application has been sporadic and mainly focused on site-assembled custom-built legacy systems and not on a commercial production scale. China, in general and Fujian Snowman Co. Ltd. in particular, offers an opportunity for standardizing this technology on a commercial scale. This is because Fujian Snowman Co., Ltd. manufactures integrated low-temperature refrigeration systems. Standardizing this technology in a factory-controlled environment will favor its widespread adoption considering the future growth prospects for its application. Thus, demonstration of this technology is considered critical for its early adoption and consequent dissemination of its technical performance. This will contribute to sustainable reductions in HCFC consumption as well as to contribute to protecting the climate system.

Project Description

Fujian Snowman Co., Ltd. specializes in the manufacture of integrated packaged refrigeration systems incorporating twin-screw refrigeration compressors, of open (NH3) and semi-hermetic (HCFC-22) designs. Nowadays, the charge of NH_3 open twin-screw compressor integrated package refrigeration system is more than 100kg, which are forbidden to use in more densely populated areas by the government. So the production line will be redesigned and constructed to fit the small discharge semi-hermetic frequency convertible screw refrigeration compressor. In order to expand the application of NH_3 in small and medium industrial and commercial refrigeration field, the type of NH_3 compressor will be changed to semi-hermetic. So, the present demonstration project will cover low-temperature (evaporating temperature above -35) applications, where the current HCFC-22 based designs will be replaced by NH_3 refrigeration system technology, using ammonia semi-hermetic frequency convertible screw refrigeration compressor.

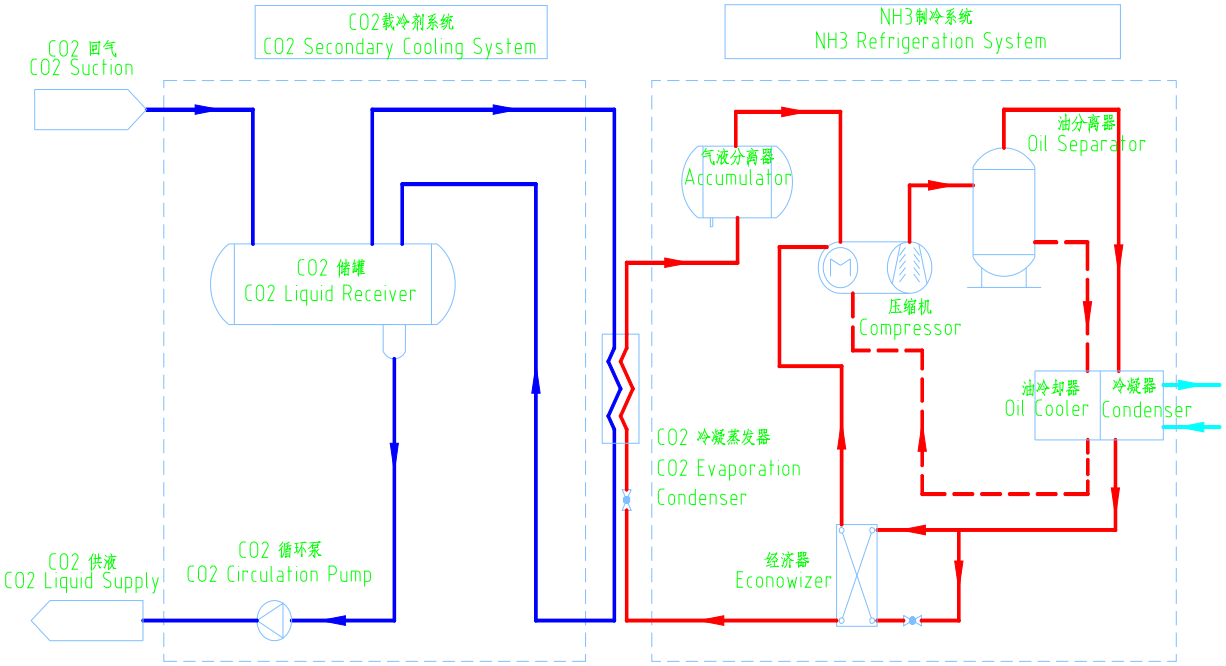
Introduction

The cold storages in China are mostly designed as Direct Expansion coil units where refrigerant is directly circulated in evaporator coil(s) which evaporates and absorbs heat in the fan coil unit. This type of units require large quantity of charge in the system

In order to reduce the quantity of charge in the integrated refrigeration system which can be allowed to be used in cold storage just like supermarket etc., the first step is redesigning and modifying the production line with some appropriate mechanical processing cutting tool to product the ammonia semi-hermetic frequency convertible screw refrigeration compressor. Then, the refrigeration system would be designed and developed as following type unit: NH_3 as the refrigerant, and CO_2 as heat transfer fluid (which means coolant) to be the alternative solution of HCFC-22 refrigerant in the medium and small freezing and cooling storages. The charge of refrigeration system is less than 50kg, which is safe for some applications. Units of three different sizes will be developed in this project.

Under this demonstration project, in order to produce the new type of compressor that is ammonia semi-hermetic frequency convertible screw refrigeration compressor with ammonia charge less than 50kg, the key components are as following: new compressors design, modification of the existed compressor production line, modification of heat exchanger product line, construction of compression unit production line, Manufacturing of prototypes, construction of test device.

As the new production of NH_3 refrigeration system, the relevant schematic diagram is as below:



This system through the development of ammonia semi-hermetic frequency convertible screw compressor unit which suits for medium and small freezing and cooling storages, using NH_3 as the refrigerant and CO_2 as coolant (heat transfer fluid), would not only would phase-out HCFC-22 refrigerant and reduce NH_3 charge volume (much less than 50kg) in refrigeration system, but would also eliminate presence NH_3 in the cold storage side by using CO_2 as carrier (heat transfer fluid) and guarantee the safety of cold storage operation.

Current status of technology development

Fujian Snowman Co., Ltd. has carried out initial development of NH_3 refrigeration systems with semi-hermetic frequency convertible screw compressor for medium and small commercial refrigeration and medium industrial refrigeration applications (the refrigerant quantity is less than 50kg.), with a view to offer factory-manufactured integrated systems. The current status is as below:

- The semi-hermetic frequency convertible screw compressors are specially designed with the advantages of small size, light weight, smooth and safe operation at high speed. It can obtain high volumetric efficiency, low noise and little vibration. The capacity control from 15% to 100% of the capacity can be achieved.
- Oil separator with indigenous patent is adopted. The separator has the advantage of efficient separation, which reduces oil content within the coolant refrigeration system. This gives full play to heat exchanger efficiency to ensure highly efficient operation of the refrigeration system.
- Fin-tube design for the system condenser is selected. The heat exchanger tube design is patented. This design has the advantage of high heat transfer efficiency.
- Liquid refrigerant pump enhances the heat exchange intensity of evaporator inner surface and raises heat transfer coefficient of the evaporator.
- Hot gas defrosting is utilized. Electronic expansion valve is used to control liquid flow, which can accurately regulate superheat to obtain good heat exchange.
- Intelligent and automatic controls have been adopted for the coolant (heat transfer fluid) refrigeration system, which can respond automatically to load changes and external conditions. Remote computerized monitoring system is employed. The refrigeration system has complete security protection devices and functions.

In October 2014, the design of NH_3 refrigeration system with semi-hermetic frequency convertible screw compressor undertaken by Fujian Snowman Co., Ltd. passed technical appraisal by Fujian Science and

Technology Agency. The appraisal group agreed that the project filled a technology gap, and that the product performance can achieve advanced levels and could be commercialized.

Feasibility

While the design of the NH_3 refrigeration system is based on conventional principles, the key elements in its operationalization and commercialization are the innovations needed to make the systems efficient, as well as to make them reliable by integrating system components optimally and manufacturing the integrated system in a factory-controlled environment. The present demonstration project will enable wider adoption of standardized, efficient and reliable factory-manufactured integrated medium and small NH_3 refrigeration systems.

Project activities

For the demonstration project, the existing product lines of compressor and pressure vessels will be modified to meet the industrial production capacity of three typical specifications of NH_3 refrigeration systems. To achieve this goal, the following activities will be carried out: Product and process redesign, Modification and construction of production lines, construction of test devices for product performance, Manufacturing of prototypes and Personnel training. After the modification, technology dissemination and documentation of the results would be carried out.

Product and process design

At present, the main product of the enterprise is the conventional refrigeration system with HCFC-22 as the refrigerant. There is large difference in product design and production process between NH_3 refrigeration systems with semi-hermetic frequency convertible screw compressor and HCFC-22 based refrigeration systems. To meet this need, the following design will be needed based on production process: three specifications of NH_3 screw compressor unit, The main design works as follows: profile design of screw rotor, electrical motor design, compressor design, working drawings and related design assessment and review; The design of ammonia semi-hermetic frequency convertible screw compressor，and the design of special motor for the ammonia semi-hermetic frequency convertible screw compressors，construction of the product lines of compressor and pressure vessels, design of test devices for NH_3 refrigeration system, design of user demonstrations for the early users of NH_3 refrigeration systems.

The three specifications of NH_3/CO_2 screw compressors units for the project are as below:

Model	**Theoretical displacement (m^3/hr)**	**NH_3 charge** (kg)	**CO_2 charge**	**HCFC-22 substitute**(kg)	**Status**
SSSCA50 (SRS-12L)	262	17	30	75	To be developed
SSSCA210 (SRS-1612LM)	652	48	60	194	To be developed
SSSCA60 (SRS-1008L)	221	22	35	90	To be developed

** Please note that Ammonia charge in the system is less than 50 kg.*

All of the above would be covered in the current project. The design elements would comprise of the following

- The design of ammonia semi-hermetic frequency convertible screw compressor;
- The design of special motor for the ammonia semi-hermetic frequency convertible screw compressors;
- The design of NH_3 related pressure vessel screw frequency convertible compressors;
- The design of NH_3 system of screw frequency convertible compressors unit;
- Electrical control;
- The applied controlling software design.

The process design would comprise of the following:

- Pressure Vessel Manufacturing Process Design
- Forming of pressure vessels, welding process design
- Reconstruction design of container strength test device
- Compressor Unit Assembly Manufacturing Process Design
- Compressor unit production process design
- Forming, welding process design
- Forming, welding and other process equipment design
- Assembly process, tooling design
- Electrical Control System Manufacturing Process Design
- Electrical control system production process design

Construction of production device

The low temperature and small refrigerant charge NH_3 refrigeration system is the new product of Fujian Snowman Co., Ltd. The existing product lines cannot all be used for producing NH_3 system components such as semi-hermetic frequency convertible screw compressor, pressure vessel and heat exchanger.

1. Modification of compressor production line
   - Modification and construction of the existing manufacturing lines of the NH_3 compressors including rough castings production, rotor machining, housing processing, house strength test, the compressor assembly for the semi-hermetic screw compressor.
   - The investment on special process equipment is made for the three specifications NH_3 semi-hermetic screw compressor, including compressor model, fixture and special inspection gauge of the rotor profiles.
   - The operating pressure of the existing compressor product line is below 20 kg. The design pressure of NH_3 semi-hermetic screw compressor is 20 kg in the NH_3 refrigeration system. The existing NH_3 open compressor does not need to be modified.
   - High-strength processing tool is needed because NH_3 compressor housing material, rotor profiles and material, and all components materials are different from conventional products.
   - The airtight device are need to test the compressor in order to decrease the leakage.
2. Modification of compression unit production line
   - Pipe processing equipment, welding tool and grinding tool is needed because NH_3 compression unit is different from the conventional products.
3. Modification of pressure vessel production line

   The modification and construction of product line for pressure vessels will include the following:
   - Modification and construction of the existing manufacturing lines of the pressure vessels below the pressure of 20kg, including production process link of the added high-pressure low-temperature CO_2 pressure vessel, tube processing and welding for tube expander, welding and assembly for CO_2 evaporator, because CO_2 is as coolant;
   - The materials for the CO_2 pressure vessels of high-pressure low-temperature are different from the conventional components materials. Therefore, the corresponding process equipment and control need to be added during production and test process, such as welding, expanding joint and inspection.
   - The strength test and air tightness test are needed for the high-pressure low-temperature pressure vessel. Welding equipment of stainless steel container and high-pressure low-temperature vessel will be added, as well as welding test plate and assessment method of high-pressure low-temperature vessel.

4. Modification of heat exchanger production line

- Modification and construction of manufacturing line for the existing 14kg fan heat exchanger, including processing of CO_2 fin heat exchanger, shell sheet metal processing, expansion joint, welding, strength and air tightness testing;
- Added unit assembly of NH_3 refrigeration system with twin screw compressors, including the assembly of NH_3 refrigeration system and test of the air load factory;

Construction of test devices for product performance

As a new refrigeration system, the NH_3 system cannot be tested in the existing performance test laboratory after product commercialization. Further, the product test device of the medium and small NH_3 refrigeration system requires new facility construction. The test devices of NH_3 semi-hermetic compressor housing strength and air load are to be added. In addition the following additions need to be done:

- Compressor testing device
- Pressure vessel strength testing device
- NH_3/CO_2 compression unit performance test equipment
- Assessment of the test device by national professional agency

Manufacturing of prototypes

According to the industrialization requirement of the NH_3 refrigeration system, three specifications of refrigeration systems need to be developed. Before commercialization, the prototype of refrigeration system needs to be manufactured and tested before mass production. As processing parts are numerous and processing precision is strict, the waste rate from casting to completion is very high. Hence, three sets of rough parts need to be produced for each compressor size. One set of rough parts need to be manufactured for other auxiliary equipment. The prototype manufacturing will cover the following:

- Manufacture nine sets of NH_3 semi-hermetic screw compressor prototypes for each specification of SSSCA50(NH_3 17kg) SSSCA210 ($NH_3$48kg) and SSSCA60 (NH_3 22kg)
- Manufacture one set of component matching with the coolant system for each specification.
- Refrigeration system prototype assembly.
- Experimental test on refrigeration system prototypes.

Personnel Training

The design, production, marketing and debugging of the new product are different from those of the conventional refrigeration system. Therefore, business unit training is needed for all sections of the project. The following personnel will be included in the training:

- Related designers, technicians.
- Production management persons, manufacturing workers.
- Product application engineer.
- Technician for installation and debugging, equipment maintenance personnel.
- Related user operators, equipment administrative personnel.

Technology Dissemination

According to user's requirements, design of the first demonstration application engineering for NH_3 refrigeration system with ammonia semi-hermetic frequency convertible screw refrigeration compressor will include scheme compilation, construction drawing design, details compilation of construction materials, instructions of installation and construction, instructions of debug operation.

Market promotion is needed for new technology entry in the market. A detailed work plan is needed in the market promotion as NH_3 refrigeration system with ammonia semi-hermetic frequency convertible screw refrigeration compressor is new to domestic refrigeration industry. The following methods will be used to promote the technology:

- Technical communication with engineering design companies, introduction of product, and promotion and recommendation plan.

- Technical communication with construction companies, product promotion and recommendation, and application technology.
- Application promotion in relevant industry associations.
- Organize product release conference, and display product and application technology.
- Communicate with government environmental protection departments to enhance publicity campaign.
- Advertisement and promotional brochures.
- Participate in exhibitions, such as International Refrigeration Exhibition in China, Chinese Fisheries Exposition, and Chinese Food Processing Exposition; display the product and application technology.
- Provide free technology, debug and maintenance to users of the demonstration project.

Summary

The conversion will be carried out in close consultation with FECO/MEP, industry associations, scientific and technical institutions and the special working group for the ICR sector.

Project Costs

Incremental Capital Costs
The total incremental capital costs amount to US$3,261,988. Details are provided in Annex-I.

Incremental Operating Costs
Since the fund for demonstration projects is not enough, so Chinese company would like to bear the IOC themselves

Total Project Costs
The agreed total project costs amounts to US$ 3,261,988. Considering ExCom decision 72/40(b), decision 73/27 and other related decisions, the MLF support for the demonstration projects is not enough. Therefore, the enterprise component would be added to bear the remaining cost for the demonstration project as the counterpart fund. This would amount to US$ 845,993.

Financing

The requested MLF grant is US$ 2,415,995, which represents eligible incremental costs, not including agency support costs.

Implementation

Project Monitoring Milestones

The project milestones and timelines from the date of receipt of funds is given in the table below.

MILESTONE/MONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Start-up of project activities	X																	
Submission of project document for signature	X	X																
Project document signature		X	X															
Preparation and request for bids			X	X														
Award of contracts				X	X	X												
System design and compressor design	X	X	X	X	X	X	X	X										
Stainless vessel processing equipment	X	X	X	X														
Design of testing lab and procurement of material	X	X	X	X														
Processing of casting model and boxes for compressor parts					X	X	X	X										
Installation of testing equipment					X	X	X	X										
Processing of vessel parts for testing equipment					X	X	X	X										
Prototype manufacturing of compressors					X	X	X	X										
System drawings									X	X	X	X						
Fixtures and cutters for NH_3 compressor									X	X	X	X						
Conversion for Fin-tube processing									X	X	X	X						
Installation and tuning of testing equipment									X	X	X	X						
Assembly of compressors									X	X	X	X						
Retrofitting of testing device for NH_3 compressor													X	X	X	X		
Modification and construction of production line													X	X	X	X		
Verification of testing lab													X	X	X	X		
Completing the prototype system													X	X	X	X		
Market survey and obtaining the certificates																	X	X
Installing air load testing equipment																	X	X
Training and technical assistance																	X	X
Verification																	X	X

Payment Schedule

The following table presents the proposed performance based payment schedule including the counterpart contribution for the project.

Schedule (Predicted date)	Payment Conditions	Amount (US$)	Accumulated Amount (US$)
1st Payment (January 31 2016)	Upon signing of the contract	724,800	724,800
2nd Payment (August 31 2016)	Completion of compressor test equipment for NH_3 system	724,800	1,449,600
3rd Payment (Mar 31 2017)	Completion of prototype building, and completion of testing equipment	483,200	1,932,800
4th Payment (June 30 2017)	Completion of training, technology dissemination, and verification of project	483,195	2,415,995

Management

The project will be under the overall management and coordination of the Foreign Economic Cooperation Office, Ministry of Environmental Protection of China. UNDP will be the implementing agency for the project, which will provide international coordination and technical assistance as needed.

The project employs the Performance-based Payment (PBP) mechanism in its implementation. Under the PBP mechanism, the enterprise tasked to carry out the conversion would play the role as a key executer, which is responsible for all the activities related to the conversion (with supervision of the technical expertise team hired by FECO and/or UNDP), including but not limited to: product redesign, procurement of raw material, components, equipment and consulting services as per the budget allocation table, modification and construction of production lines and product testing devices, etc., trial operation of production lines, and project technical commissioning. The procurement shall be organized fully in line with the marketing principle, so that the goods and services procured are high quality, most reasonable price and suitable for product line conversion to make sure the new alternative technology applied feasibly and successfully. The detailed arrangement on procurement will be defined in the contract between FECO/MEP and the Executor (enterprises).

FECO and UNDP will not be involved in the procurement activities of the enterprise by any means other than make payment to the enterprise in tranches for the costs of procurement and conversion, at agreed payment dates given in the payment schedule, and when milestones prerequisite for the tranche have all been achieved on time.

Verification

1) **Periodical Performance Verification.** Before each payment, FECO will invite independent experts to verify whether the performance for each milestone that the payment depends on have been satisfying. The verification reports will be submitted and accepted by UNDP as the main supporting documents for requesting the installment of payment.

2) **Technical Assessment.** Before the last installment of payment, FECO and UNDP will invite independent experts to verify whether the selection and application of alternatives in practice are suitable and feasible. The assessment report will be submitted to FECO and UNDP.

M&E

1) FECO and UNDP will organize a joint Monitoring and Evaluation mission to the Project executer during this project operation. The mission can be combined with the verification mission accordingly. The M&E schedule will basically follow the timeline of payment schedule.

2) NEX Audit will be organized by UNDP during the project implementation upon UNDP's audit arrangement in the project years. For any issue identified during the auditing process, FECO shall take corresponding correction/improvement measures as per the audit findings and recommendation. Meanwhile, the payment may be suspended depending on the nature of the issues concerned until the acceptable/satisfactory results are worked out.

3) Quarterly Review and Annual Review Meeting will be organized by FECO; Semi-annual Project Review Reports and a final Project Report will be submitted to UNDP at least 10 days before the review meetings and by the end of project operation in 2016.

Impact

The successful implementation of this demonstration project will provide an environmentally safe and cost-effective alternative for enabling replication of this technology in similar applications in this sector in China and facilitate HCFC reductions for compliance with the future HCFC control targets.

The project will result in production of new technology based products at production capacity of 3,000 unit annually and thus will result in indirect reductions of 359 metric tons of HCFC-22 usage at Fujian Snowman Co. Ltd. Over a 15-year life-span of the refrigeration systems manufactured by the enterprise. Further, the consumption of HCFCs for servicing of those systems are expected to be 226.16 metric tons in the cycle life of those equipment. The total indirect GHG emission reductions will amount to about 1,041,602.60 CO2-eq tones will be achieved, thus contributing to protection of both the ozone layer and the climate system.

The project also can reduce consumption in the ice-maker based on HCFC-22 made by the company directly if the ice maker production line will be converted to NH_3 based. The production of ice maker is about 400 units annually, with about 23 metric tons HCFCs-22 consumption in a year.

ANNEX-I

Incremental Cost Calculations

Incremental Capital Costs

No	Cost Head		Amount (US$)
1	**Product and process design**		
	System	System design (US$ 147,730)	
	Process	Process design (US$ 44,319)	**426,791**
	Compressor	Compressor design (US$ 156,495)	
	Software	Heat exchange analysis software (US$ 78,247)	
2	Modification of production lines		
	Compressor (US$ 568,859)	Mechanical processing cutting tool (US$ 62,598)	
		Shockproof boring bar (US$ 62,598)	
		High-precision hydraulic chuck (US$ 62,598)	
		Another cutting tool (US$ 31,299)	
		Machining tooling (US$ 93,897)	
		Rotor milling cutter (US$ 70,423)	**725,313**
		Ammonia Motor mould (US$ 70,423)	
		Vacuum equipment (US$ 28,951)	
		Airtight device (US$ 86,072)	
	Compression Unit (US$ 156,454)	Pipe processing equipment and grinding tool (US$ 78,247)	
		Auxiliary fixture tool(US$ 23,474)	
		Welding equipment (US$ 54,733)	
3	**Test device construction**		
	Compressor and compression unit performance test(US$ 1,213,012)	Electric leakage detector (US$ 3,130)	
		Detector (US$ 4,695)	
		Helium detector (US$ 266,041)	**1,213,012**
		Compressor performance test equipment (US$ 312,989)	
		Compression unit performance test equipment (US$ 438,184)	
		Pressure vessel strength test device (US$ 187,973)	
4	**Manufacturing of prototype**		
	Material for the prototype production (US$ 580,361)	NH_3 compressor (US$ 295,775)	
		NH_3 oil separator (US$ 28,169)	
		CO_2 liquid-storage tank (US$ 56,338)	
		Heat exchanger (US$ 21,127)	
		Starting cabinet（inverter）(US$ 42,254)	
		Electric control cabinet (US$ 4,695)	
		Valve parts, pipe, flanges (US$ 31,299)	
		Metal hose（testing）(US$ 9,390)	**686,778**
		CO_2 Pump (US$ 28,169)	
		CO_2(0.9999)(US$56,338)	
		NH_3(US$ 2,034)	
		Frozen Oil (US$ 1,095)	
		Helium (US$ 3,443)	
		nitrogen (US$ 235)	
	Test labor fee and some test cost (US$ 106,417)	Installation and test labor fee(US$ 70,423)	
		Safety protection articles (US$ 28,169)	
		NDT testing costs (US$ 7,825)	
5	**Personnel training**		
	Training (US$ 117,762)	Training (US$ 117,762)	
	Welder training and material fee (US$ 15,650)	Welder training (US$ 7,825)	**133,412**
		Material fee(US$ 7,825)	
6	**Market Promotion**		76,682
	Market Promotion	Market Promotion (US$ 76,682)	
Total			**3,261,988**
Among which paid by counterpart funding by the enterprise(see ANNEX-Ⅱ)			**849,725**
Total by MLF funding (see ANNEX-Ⅲ)			**2,412,263**

ANNEX-□
Counterpart funds

No	Cost Head		Amount (US$)
1	**Modification of production lines**		**156,454**
	Compression Unit (US$ 156,454)	Pipe processing equipment and grinding tool (US$ 78,247)	
		Auxiliary fixture tool(US$ 23,474)	
		Welding equipment (US$ 54,733)	
2	**Test device construction**		**438,184**
	Compression unit performance test equipment (US$ 438,184)	Compression unit performance test equipment (US$ 438,184)	
3	**Manufacturing of prototype**		**162,755**
	Test labor fee and some test cost (US$ 162,755)	CO_2 liquid-storage tank (US$ 56,338)	
		Installation and test labor fee(US$ 70,423)	
		Safety protection articles (US$ 28,169)	
		NDT testing costs (US$ 7,825)	
4	**Personnel training**		**15,650**
	Welder training and material fee (US$ 15,650)	Welder training (US$ 7,825)	
		Material fee(US$ 7,825)	
5	**Market Promotion**		**76,682**
	Market Promotion	Market Promotion (US$ 76,682)	
Total			**849,725**

ANNEX-□
Grant applied from MLF

No	Cost Head		Amount (US$)
1	**Product and process design**		
	System	System design (US$ 147,730)	
	Process	Process design (US$ 44,319)	**426,791**
	Compressor	Compressor design (US$ 156,495)	
	Software	Heat exchange analysis software (US$ 78,247)	
2	Modification of production lines		
	Compressor (US$ 568,859)	Mechanical processing cutting tool (US$ 62,598)	
		Shockproof boring bar (US$ 62,598)	
		High-precision hydraulic chuck (US$ 62,598)	
		Another cutting tool (US$ 31,299)	**568,859**
		Machining tooling (US$ 93,897)	
		Rotor milling cutter (US$ 70,423)	
		Ammonia Motor mould (US$ 70,423)	
		Vacuum equipment (US$ 28,951)	
		Airtight device (US$ 86,072)	
3	**Test device construction**		
	Compressor performance test(US$ 774,828)	Electric leakage detector (US$ 3,130)	
		Detector (US$ 4,695)	**774,828**
		Helium detector (US$ 266,041)	
		Compressor performance test equipment (US$ 312,989)	
		Pressure vessel strength test device (US$ 187,973)	
4	**Manufacturing of prototype**		
	Material for the prototype production (US$ 524,023)	NH_3 compressor (US$ 295,775)	
		NH_3 oil separator (US$ 28,169)	
		Heat exchanger (US$ 21,127)	
		Starting cabinet（inverter）(US$ 42,254)	
		Electric control cabinet (US$ 4,695)	
		Valve parts, pipe, flanges (US$ 31,299)	**524,023**
		Metal hose（testing）(US$ 9,390)	
		CO_2 Pump (US$ 28,169)	
		CO_2(0.9999)(US$56,338)	
		NH_3(US$ 2,034)	
		Frozen Oil (US$ 1,095)	
		Helium (US$ 3,443)	
		nitrogen (US$ 235)	
5	**Personnel training**		**117,762**
	Training (US$ 117,762)	Training (US$ 117,762)	
Total by MLF funding			**2,412,263**

Incremental Operating Costs[1]

N/A

Total Project Costs

Cost Head	Amount (US$)
Incremental Capital Costs (including contingencies)	**3,261,988**
Incremental Operating Costs	N/A
Total	**3,261,988**

[1] Since the fund for demonstration projects is not enough, so Chinese company would like to bear the IOC themselves