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PROJECT DOCUMENT
People's Republic of China

Project Title: Sector plan for Phase-out of HCFCs in the Solvent Sector in China (Stage-II, for 2020 and 2025 compliance)

Project Number: Award ID 00087758, Output ID: 00094679

Implementing Partner: Ministry of Environmental Protection/Foreign Economic Cooperation Office (MEP/FECO)

Start Date: 1 April, 2017

End Date: 31 March 2026

PAC Meeting date: 27 March 2017

Brief Description

At the 77th ExCom meeting held November 2016 in Montreal, Canada, decision was taken to approve, in principle, US \$ 47,262,566 for stages II of HPMP in the solvent sector in China. The Stage II Solvent Sector Plan will contribute to China's overall HCFCs Phase-out Management Plan (HPMP) to achieve the 35% HCFCs consumption reductions by 2020. From the perspective of the sector, the Solvent Sector Plan proposes to phase out a total of 1,214.56 metric tonnes (MT) HCFCs by 2020 which is about 27.1% of the baseline level, and achieve the complete phase-out of HCFCs in the solvent sector by the end of 2025. To achieve the targets, investment in production/manufacturing line conversions will be carried out in large-consumption enterprises. More than 80% of the HCFCs used in the solvent sector will be replaced by low GWP alternatives including hydrocarbon and HFOs. Manufacturing line conversions will be supported by a series of technical assistance and capacity building activities as well as policy and regulatory interventions to ensure permanent and sustainable phase-out. Upon successful implementation, the stage II Solvent Sector Plan will result in a reduction of 455.2 ODP tons of HCFCs consumption in the solvent sector and will reduce green-house gas emissions of 11.30 million CO₂-equivalent tonnes. The stage II Solvent Sector Plan originally requested a funding level of US \$57.5 million, the sector plan was approved at the 76th and 77th ExCom meetings with a total funding level of US \$ 47,262,566.

Contributing Outcome (UNDAF/CPD, RPD or GPD):

2. More people enjoy a cleaner, healthier environment as a result of improved environmental protection and sustainable green growth.

Indicative Output(s):

Output 1.3: Solutions developed at national and sub-national levels for sustainable management of natural resources, ecosystem services, chemicals and waste.

Output 1.4: Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented.

Total resources required (USD):	47,262,566	
Total resources allocated (USD):	MP Multilateral Fund:	47,262,566
	Company In-kind	

Agreed by (signatures):

UNDP	Implementing Partner
 UNDP	 FECO/MEP
Print Name: <i>Mr. Patrick Hovnanian</i> Date: <i>16 May 2017</i> <i>Deputy Country Director</i>	Print Name: _____ Date: <i>2017.4.19</i>

LIST OF ABBREVIATIONS

CP	Country Programme
SGD	Sustainable Development Goals
ICR	Industrial and Commercial Refrigeration and Air-conditioning Sector
SESP	Social and Environmental Screening Procedure
QA	Quality Assurance
ExCom	Executive Committee of the Multilateral Fund
FECO	Foreign Economic Cooperation Office
GWP	Global Warming Potential
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
HPMP	HCFCs Phase out Management Plan
IA	Implementing Agency
MEP	Ministry of Environmental Protection
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MOP	Meeting of Parties to the Montreal Protocol
MP	Montreal Protocol
MT	Metric Tonnes
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substances
PBP	Performance Based Payment
SBAA	Standard Basic Assistance Agreement
UNDP	United Nations Development Programme

I. DEVELOPMENT CHALLENGE

In order to protect the ozone layer, the international community signed The Vienna Convention for the Protection of the Ozone Layer in 1985 and The Montreal Protocol on Substances that Deplete the Ozone Layer (hereinafter referred to as the Montreal Protocol) in 1987. The Montreal Protocol and the following amendments called on developed and developing countries to join efforts to phase out ozone depleting substances (ODS) in production and consumption sectors.

The Government of China signed The Vienna Convention for the Protection of the Ozone Layer in September 1989, and the Montreal Protocol and its London Amendment in 1991, and became a Party complying with Article V of the Montreal Protocol. In April 2003, China signed the Copenhagen Amendment to Montreal Protocol. In May 2010, China officially signed the Montreal Amendment to Montreal Protocol and the Beijing Amendment to Montreal Protocol.

In order to fulfill the Montreal Protocol, the Government of China organized an investigation and assessment into the feasibility of hydrochlorofluorocarbons (HCFCs) phase-out in 2004, and began to discuss with the international community the opportunities and challenges of accelerating HCFCs phase-out and the corresponding conditions and objectives in 2005. In September 2007, all Parties to the Montreal Protocol agreed to adjust the HCFCs phase-out schedule at the 19th Meeting of the Parties to the Montreal Protocol.

According to the new schedule, China, as one of the Article 5 countries of the Montreal Protocol, should freeze the production and consumption of HCFCs at the average level of 2009 and 2010 (baseline) by 2013 and have completed the accelerated phase-out in 2030, on the basis of the following reduction steps:

By 2015 of 10 percent;

By 2020 of 35 percent;

By 2025 of 67.5 percent;

While allowing for servicing an annual average of 2.5% during the period 2030-2040.

The solvent sector is one of the seven identified HCFC consuming and producing sectors in China. There are over 400 enterprises using HCFCs in this sector which involves many industrial sectors, spread predominantly in 21 provinces in China. The sector is characterized by emissive uses of HCFCs for degreasing and other applications in four main sub-sectors with their respective contribution to HCFC consumption: Disposable Medical Devices (DMD) (40%), Metal Degreasing (MD) (20%), Electronics Degreasing (ED) (20%) and Solvent Formulation (SF) (20%).

Degreasing is widely used in the DMD, industrial machinery, instruments, electronics, telecommunications, metal processing, textile, fine chemicals and optical products sectors. Survey shows that more than 400 enterprises consume HCFCs, most of which are HCFC-141b. HCFC-225 only accounts for a very small portion. These enterprises mainly produce disposable medical devices, electronics and metal processing. HCFCs consumption as solvent is geographically concentrated in Jiangxi, Jiangsu, Zhejiang, Shanghai, Beijing, Guangdong, Fujian and Sichuan, etc. Different enterprises have significantly different consumption scales; generally speaking, HCFCs consumption of these enterprises is small.

For the convenience of HCFCs phase-out management, the solvent sector can be further divided into four major subsectors: DMD, metal degreasing, electronics degreasing and solvent formulation, according to the service conditions and consumption fields of HCFCs in solvent sector in China.

- a) DMD subsector: in this subsector, HCFCs are used, firstly as a degreaser to clean needle-making tools and; secondly as a thinner to silicone oil for deposit silicone coating on both the needle tip and the inwall of outer syringe barrel.
- b) Metal degreasing subsector: this subsector mainly uses HCFC and its compound solvent to remove the cutting oil, punching oil, lubricating grease, metal dust, dirt, grease or other pollutants formed on the surface of metal components and parts during the surface processing and storage processes. The scope of servicing objects is extensive, mainly including compressor parts, electrical machinery parts, valves, textile spinnerets, and micro temperature control parts.

- c) Electronics degreasing subsector: this subsector uses HCFCs or its compound solvent for degreasing. The scope of servicing objects is extensive, mainly including precise electronic components (such as relays, integrated circuits, piezoresistors, semi-conductors, micro switches), LCD and its components, and optical glass similar to LCD (such as contact lenses), integrated circuit boards and their assembly parts.
- d) Solvent formulation subsector: strictly speaking, most of the enterprises in this subsector are not the final consumers of HCFCs. On one hand, they consume HCFCs to provide degreasing engineering services; on the other hand, they usually produce and provide HCFC-containing degreasers, medical thinners of silicone oil and other products for downstream users.

The two main HCFCs used in the solvent sector are HCFC-141b and HCFC-225. The consumption amounts of HCFC-141b are 4,351.54 metric tonnes (478.67 ODP tons) and 4,612 metric tonnes (507.32 ODP tons) in 2009 and 2010, all of which are produced domestically. The consumption amounts of HCFC-225 are much smaller, i.e. 41.92 metric tonnes (1.05 ODP tons) and 55.80 metric tonnes (1.39 ODP tons) in 2009 and 2010 and all consumption are imported from other countries. That is to say, in 2009 and 2010, 4,393.46 metric tonnes (479.72 ODP tons) and 4,667.8 metric tonnes (508.71 ODP tons) of HCFCs with a baseline (average of 2009 and 2010 consumption levels) of 4,530.63 metric tonnes (equal to 494.22 ODP tons) are consumed in the solvent sector.

China's Stage I of HPMP Solvent Sector Plan was approved at the 65th Meeting of the Executive Committee in November 2011 to support the reduction of a total of 599.45 metric tonnes (MT) of HCFC-141b consumption in the solvent sector for the duration of 2012 and 2016.

Nine conversion projects were financed by the Stage I Solvent Sector Plan. The actual ODS that were phased out was 638.112 MT of HCFC-141b. Project activities for all 9 conversion projects have been completed and have passed evaluation and national acceptance.

Based on the A7 data submitted to the Multilateral Fund Secretariat in 2016, the 2015 HCFCs consumption in the solvent sector of 3,815.40 MT, or 418.51 ODP tonnes, is below the maximum allowable consumption of 455.2 ODP tonnes.

Phase-out Targets for stage II of HPMP

The solvent sector faces enormous challenges in HCFCs phase-out. For example, the HCFCs-consuming enterprises are in diverse industrial sectors and have generally low level of individual consumption; alternative technologies in the solvent sector are often customer-dependent with diversified and complex requirements. However, data survey indicated that the accelerated phase-out of HCFCs in the solvent sector is possible due to the participation enthusiasm of the whole sector and the good timing to phase out HCFCs completely in the DMD subsector.

In consideration of the domestic and international requirements for accelerated phase-out of HCFC-141b with high ODP, and in view of the fact that the accelerated phase-out of HCFCs in the solvent sector can be achieved in spite of many difficulties, and in light of the Overarching HPMP formulated by the Government of China to phase-out HCFCs, the Stage II of HPMP in the Solvent Sector will not be limited to the phase-out target in 2020, but will focus on the complete phase-out of HCFCs in the solvent sector by 2026. Phase-out target in the Stage II HPMP in the Solvent Sector Plan is developed and classified into four stages, i.e. 20% reduction of the baseline consumption by 2018, 35% reduction by 2020, 70% reduction by 2023 and 100% reduction by 2026, with the reserve of 500 MT of HCFC-141b consumption in 2025 for the transitional needs of SMEs and those ineligible enterprises. These targets are higher than targets specified in Decision XIX/6, if applicable for the solvent sector.

Considering that HCFC-225 consumption in the solvent sector is small and all HCFC-225 are imported, the Government of China will reduce HCFC-225 consumption until its final phase-out mainly by import control on HCFC-225. Phase-out projects will be conducted if necessary.

Therefore, 1,214.56 MT (133.60 ODP tons) of HCFC-141b and 13.24 MT (0.33 ODP tons) of HCFC-225 will be reduced in 2016-2020, to achieve the target of phasing-out 1,227.80 MT (133.93 ODP tons) of HCFCs; and reduction of 2,913.15 MT (320.45 ODP tons) of HCFC-141b and 31.76 MT (0.80 ODP tons) of HCFC-225 in 2021-2025 to achieve the target of phasing-out 2,944.91 MT (321.24 ODP tons) of HCFCs.

In summary, the sector plan stage II is planned to be implemented during 2016—2026, and is expected to phase out all the consumptions of HCFCs in the solvent by the end of 2026, with 4173 MT (455.17 ODP tonnes) of HCFCs to be phased out in about 10 year. The phases out schedules are as following:

Year		2009	2010	2015	2018	2020	2023	2025	2026
<i>Maximum allowable consumption</i>	HCFC-141b (MT)	4,351.54	4,612.00	4,127.71	3,585.42	2,913.15	1,344.53	500.00	0.00
	ODP (T)	478.67	507.32	454.05	394.40	320.45	147.90	55.00	0.00
	HCFC-225 (MT)	41.92	55.80	45.00	39.09	31.76	14.66	0.00	0.00
	ODP (T)	1.05	1.39	1.12	0.98	0.79	0.37	0.00	0.00
	HCFC in total (MT)	4,393.46	4,667.80	4,173.00	3,624.51	2,944.91	1,359.19	500.00	0.00
	Total ODP (T)	479.72	508.71	455.17	395.38	321.24	148.27	55.00	0.00
<i>Baseline consumption</i>	HCFC-141b (MT)	4,481.77							
	ODP (T)	492.99							
	HCFC-225 (MT)	48.86							
	ODP (T)	1.22							
	Total ODP (T)	494.22							
<i>Staged reduction targets</i>	HCFC-141b (MT)				542.29	672.27	1,568.62	844.53	500.00
	ODP (T)				59.65	73.95	172.55	92.90	55.00
	HCFC-225 (MT)				5.91	7.33	17.10	14.66	0.00
	ODP (T)				0.15	0.18	0.42	0.37	0.00
	Total HCFC (MT)				548.20	679.60	1,585.72	859.19	500.00
	ODP in total (T)				59.80	74.13	172.97	93.27	55.00

Notes:

- 1) Due to the lack of HCFCs consumption statistics of 2015 before submission of this report, both HCFC-141b and HCFC-225 consumption in 2015 are maximum allowable consumption after reducing 7.9% (the reduction target for the Stage I Solvent Sector Plan) of baseline consumption;
- 2) Similarly, the consumption in 2018, 2020, and 2023 is the maximum allowable consumption in the year after reducing 20%, 35% and 70% of baseline consumption, respectively.
- 3) 500 MT of HCFC-141b consumption in 2025 will be reserved to meet the transitional needs of SMEs and ineligible enterprises. HCFC-141b will be completely phased out by 2026.

II. STRATEGY

Necessity to phase out HCFCs in the solvent sector

Degreasing is an essential procedure of production for enterprises of many sectors. China is experiencing rapid economic development. HCFCs phase-out in the solvent sector certainly will affect the development of some related sectors, including the DMD, air conditioning compressor, electronics and communications sectors, which are closely related to human health, national economy and the people's livelihood. This requires timely measures and promotion of sectoral HCFC phase-out activities in a progressive manner, in order to minimize the negative impact of phase-out activities.

Survey conducted indicated that the DMD subsector has grown rapidly at an annual growth of 10% and above in recent years due to the steadily increased health demands at home and abroad. In contrast, the metal and the electronics subsectors have shrunk in production in recent years due to worldwide economic slump, and the consumption of HCFCs in these two subsectors and their associated subsector of solvent formulation decreased year by year. The overall consumption of HCFCs in the solvent sector also decreased year after year. However, the HCFC-141b consumption in the solvent sector could expand quickly, as the consumption of HCFCs in the metal and electronics subsectors and the associated solvent formulation rebound in response to economic recovery and the consumption of HCFCs in the DMD subsector continues to increase greatly if

the sector plan is not implemented continuously. In that case, not only all efforts made during Stage I might end up in vain, but also the future compliance of the Montreal Protocol might be extremely difficult for the sector, which would bring risks to the country's achievement of long-term HCFCs phase-out target.

The solvent sector consumes mainly HCFC-141b with the highest ODP value. The Solvent Sector Plan is an indispensable part of China's HCFCs overall phase-out management plan, the success or failure of this Plan would have a significant bearing on China's compliance of the Montreal Protocol.

More importantly, in each HCFC-consuming sector, especially the solvent sector, there is a large number of small enterprises. How to encourage and enable these enterprises to join the overall phase-out action in order to ensure the achievement of China's long-term HCFCs phase-out target will become a challenge for each sector and the country. It is a good opportunity to establish effective implementation mechanism, especially for small enterprises, and make a significant contribution to the sustainability of the country's phase-out action.

In addition, besides the reduction of ODS, implementation of the sector plan will result in tremendous benefits of greenhouse gas emission reduction due to the use of alternatives with low GWP.

Requirements for alternatives

The alternatives of HCFC-141b should meet the following requirements in principle.

- a) Be harmless to both the ozone layer and the environment;
- b) Have no influence on the workers' safety and health;
- c) Use of zero ODP and low GWP alternatives;
- d) No worse than the existing process in terms of the production capacity and technical level;
- e) Must be cost effective.

Because HCFCs are widely used in different subsectors of the solvent sector for diverse purposes, the specific requirements for alternatives should not be the same due to the differences of subsector, purpose and service objects.

In the DMD subsector, HCFC-141b could be used as a degreaser and/or a silicone oil thinner respectively. When it used as a degreaser, there is no special requirements for the alternatives/alternatives, except for that the quality of the medical devices does not change with the replacement of HCFC-141b and meets relevant national and industrial standards. When it is used as a silicone oil thinner, the alternatives should be good solvent to silicone oil, suitable for the production of medical materials with excellent biocompatibility, suitable for use in purification workshops with the highest possible flash-point and the lowest possible inflammability, and harmless to workers' health with low toxicity.

In both the metal and the electronics degreasing subsectors, HCFC-141b is used only as a degreaser. The specific requirements for the alternatives vary widely depending on different service objects. For instance, for simply-structured parts like the temperature controller parts and the valve parts in the metal degreasing subsector, there should be more choices for the alternatives; while for the compressor and its parts, due to the involvement of compressor rotor and stator coils, it is required that the alternatives should have excellent electric insulation and high volatility, so that there is no residual degreaser inside the coils after degreasing; for other objects like the spinneret, due to special structure, small and deep holes and high degreasing quality requirements, the alternatives should have lower surface tension and high volatility, so that the alternatives can easily diffuse into valid area at the deep holes for effective degreasing, and are unlikely to have influences on production quality due to residual solvent inside the deep holes. However, for the optical glass products in the electronics subsector, like various LCD products and contact lenses, it is required that the alternatives must be free of water and had better be free of chlorine and bromine.

In the solvent formulation subsector, by mixing with other solvents, HCFC-141b is often used to produce various degreasing products supplied for metal, electronics and other degreasing purposes. The survey indicated that these products are supplied for the strong and weak electricity fields besides the metal and electronics subsectors, for the purpose of charged degreasing. When the alternatives are used on these occasions, it is specially and clearly required that they should be nonflammable, be resistant to voltage impact (with a static volume resistivity up to $10^{12}\Omega\cdot\text{cm}$, and a dynamic insulation resistance up to $10^{11}\Omega$), be free of icing after continuous 10 seconds of spraying at the same position of a circuit board, had better

have a KB value varying within 50 and 60, have the residual ions less than one third of the initial ion concentration for off-line degreasing and less than three fifths of the initial ion concentration for on-line degreasing, be free of the accumulation of static electricity, and have no such corrosion effects as white spots and cracking on plexiglass. On the other hand, HCFC-141b is also used as a thinner of silicone oil to produce mixed silicone liquid for the deposit silicone coating on needle tip or inwall of outer syringe barrel. On these occasions, the requirements for the alternatives are similar to those requirements for the alternatives used in the process of deposit silicone coating.

Main Alternatives and Characteristics

At present, the alternatives in the solvent sector could be classified into three categories, i.e. non-ODS organic solvent degreasing technologies, water-based and semi-aqueous degreasing technology and degreasing-free technologies.

Along with the development and deepening of ODS phase-out, both domestic and foreign institutions have conducted numerous researches on the alternatives for ODS, and many non-ODS alternatives and degreasers have been introduced into the solvent sector. Due to excellent degreasing performance and relatively simple degreasing process, these technologies and products have been widely accepted by enterprises. Some alternatives and alternatives have been widely used for the phase-out of ODS degreasers abroad, for the phase-out of CTC, TCA and CFC-113 in the solvent sector in China during early stage, and for the phase-out of HCFC-141b during Stage I, with proven effectiveness.

At present, the non-ODS alternatives/alternatives available for the solvent sector are listed in Table 2-1 below.

Water based/semi-aqueous degreasing technologies have been widely used in each subsector of the solvent sector, to replace CTC, CFC-113 and TCA during early stage and HCFC-141b at present. For example, some enterprises in the DMD subsector have already adopted the phosphoric acid inactivation and high pressure jet technology to clean needle tube; some enterprises in the metal sub-sector have already adopted domestic water-based degreaser to clean metal parts; and some enterprises in the electronics subsector have already adopted the water-based/semi-aqueous degreasing technologies to clean high-end LCD products.

These types of technologies with zero ODP and low GWP are ideal solutions. But they have disadvantages in complexity and long process flow, high capital investment, high cost of water purification via filtration, distillation, deionization or reverse osmosis, high energy consumption and cost, potential residual contamination when surfactants and / or detergents are required, high disposal cost of waste liquid, and difficult to dry after degreasing. These disadvantages are also one of the main reasons why most enterprises rejected this type of technologies during the early stage of ODS phase-out and the Stage I of HCFC-141b phase-out. In addition, due to the limits of these technologies themselves, as mentioned above, they are not suitable for degreasing some water-sensitive objects.

Degreasing-free technology is mainly used in the electronics subsector to serve various electronic circuit boards and electronic components; it often uses the non-clean flux or solder-paste with low solid content for welding under the shield of inert gas to avoid successive degreasing procedure. This technology has the potential of leaving residues that could be detrimental to the reliability of the final assembly.

Table 2-1: Non-ODS alternatives/alternatives available for the Solvent Sector

Name	GWP	Characteristics	Typical product	Application scope
Hydrocarbon solvents	<20	Low GWP; good material compatibility, strong degreasing ability; low toxicity; flammable and explosive; high boiling point; moderate cost; not suitable for manual operation; complex process and high investment in equipment. Can leave film of high boiling deposits and potential contamination build up after repeated use.	KC-6; various high-performance hydrocarbon solvent	Thinner of silicone oil degreaser used in DMD, metal and electronics subsectors
HFEs	43~320	Moderate GWP; low toxicity; non-combustible; good material compatibility; moderate degreasing ability; stiff price; simple degreasing process; suitable for both manual and mechanical operations; moderate investment in equipment for mechanical operation.	HFE7100 and HFE7200, and their azeotropic solvents	Thinner of silicone oil; degreaser used in each subsector
Chlorinated solvents	0	Low GWP; strong degreasing ability; no corrosion effect to most metals; non-combustible and non-explosive; cheap and easy to get; high toxicity; not suitable for manual operation; complex process and relatively high investment in equipment. Can cause stress cracking/crazing on plastic surfaces. Potential compatibility issues.	Dichloromethane, trichloroethylene, tetrachloroethylene	Thinner of silicone oil; degreaser used in each subsector
HFCs	170~1700	Moderate GWP; low toxicity; low surface tension; good material compatibility; some have weak degreasing ability while others have strong ability; liquid non-flammable, but certain flammability for some products vapors; relatively expensive price; flexible process; suitable for manual and mechanical operations; moderate investment in equipment for mechanical operation.	HFC-4310mee HFC-365mfc HFC-C447ef HFC-245fa Heptafluorocyclopentane	Thinner of silicone oil; degreaser used in each subsector
HFOs	1	Low GWP, good material compatibility; strong degreasing ability; very low and moderate boiling point; moderate to high volatility; high price; not suitable for manual operation; standard to relatively complex process; moderate investment in equipment. SOLSTICE 0 ow boiling point.	Trans-1-chloro-3,3,3-trifluoropropane	Degreaser used in metal and electronics subsectors
Alcohol soluble silicone	0	Zero ODP and low GWP. Alcohol is flammable.	/	For deposit coating on needle tip and on inwall of outer syringe barrel
Solvent-free silicone	0	Zero ODP and low GWP	/	For deposit coating on inwall of outer syringe barrel

In the electronics subsector, these technologies have been used for the phase-out of TCA, CFC-113 and other ODS degreasers during early stage. However, it has some unacceptable shortcomings, such as cleaning quality, high investment cost or complex process. With gradual phase-out of ODS solvents, degreasing-free technology were widely and fully applied in suitable subsectors and enterprises to replace CFC-113, TCA and CTC. Only in limited fields, could it be applied as alternatives of HCFC-141b in the future. That is to say, for the solvent sector, even in the electronics subsector, degreasing-free could only be a secondary technology for HCFC-141b phasing out in Stage II in China.

Selection of Alternative Technology and Challenges

Based on the current situation and development trend of the alternatives/alternatives for the solvent sector, non-ODS solvent technologies would be preferred to replace HCFC-141b, and occasionally supplemented by water based, semi-aqueous and degreasing-free technologies.

In light of the physical and chemical properties, cost and safety requirements, degreasing needs and acceptance of enterprises, several options are recommended to different subsectors. Information is listed in Table 2-2.

Table 2-2: List of available alternatives recommended for each subsector

Subsector	Recommended alternative	Purposes	Reasons and advantages	Disadvantages and improvement measures
DMD	KC-6	Thinner of silicone oil and degreaser	①Modified hydrocarbon solvent, composing mainly of isoparaffin and siloxane; having zero ODP. ②Moderate price, and GWP<20, having the advantages of competitive price and greenhouse gas emission reduction among various non-ODS solvent alternatives. ③Actual effect as silicon oil thinner and degreaser was identified in the DEMO project and HCFC-141b phasing out projects in stage I.	①Compared to HCFC-141b, it's flammable in special conditions, need to improve safety grades and add fire-fighting measures. ②Boiling point is higher than that of HCFC-141b, need to adjust deposit coating process and add dry procedure. ③Needs special incineration disposal with after burning to prevent POPs formation
	HFEs/HFCs	Thinner of silicone	①Low toxicity, no flammability, no safe and health danger; ②Similar to HCFC-141b, could be directly applied to original deposit coating process; ③Applied in Europe and US successfully.	①Weak solvent solubility with low KB value and higher GWP, could be blended with IPA, alcohol, trans-1,2-dichloroethylene to improve KB indicator and lower GWP; ②Although operational fee would be much higher than before due to expensive unit price, it could be reduced by high quality, properly designed cleaning machine.
	Alcohol soluble silicone oil	Deposit coating	①Medium price, lower GWP, with advantage of price and greenhouse gas reduction; ②No need much conversion to existing deposit coating process and equipment.	①Still not industrialized, no mature industry application case, could be applied in DEMO project and spread after it is identified by enterprise; ②Alcohol thinners are often flammable, need to promote safety grade and strengthen fire-fighting measures.
	Solvent-free silicone oil	Deposit coating	①No safety and explosion problems due to no use of solvent ②Low total cost due to the use of only low viscosity silicon oil but no extra solvent; ③Massive greenhouse gas reduction.	①Still not industrialized, no mature industry application case, could be applied in DEMO project and spread after it is identified by enterprise; ②Only applied to the deposit coating on inwall of outer syringe barrel, with high quality requirement to silicon oil spray gun, conversion cost is acceptable.

Metal and electronics	High-performance hydrocarbon solvents	Degreasing	<p>①Easily obtainable and low price and lower GWP, with the advantage of price and greenhouse gas reduction;</p> <p>②There are successful application cases in Metal and Electronics areas at home and abroad;</p> <p>③Degreasing process has been identified, with all types of degreasing machines;</p> <p>④HC solvent recovery system could be helpful to reduce solvent cost</p>	<p>①Possible flammable and explosive, must promote safety grade and use totally sealed system;</p> <p>②Hard to dry due to high boiling point, need complex vacuum dry system and equipment with high price;</p> <p>③For lower HCFC-141b consumption enterprise, compare to the grant they could apply for, incremental investment cost is much higher.</p>
	HFES/HFCs	Degreasing	<p>①Low toxicity and no flammability, no safe and health risk;</p> <p>②Similar to HCFC-141b, need no much adjustments to existing process;</p> <p>③Suitable for different process and workplaces, especially for those enterprises with lower HCFC-141b consumption and manual-cleaning;</p> <p>④Applied widely in Europe and US successfully.</p>	<p>①Weak solvent solubility with low KB value and higher GWP, could be blended with IPA, alcohol, trans-1,2-dichloroethylene to improve KB indicator and lower GWP;</p> <p>②Although operational fee could be much higher than before due to expensive unit price, it could be reduced by properly designed high quality cleaning machine, or by the co-solvent system blended with lower cost and high cleaning ability solvents.</p>
	Trans-1,2-dichloro-ethylene	Degreasing	<p>①Easily obtainable and low price and lower GWP, with the advantage of price and greenhouse gas reduction;</p> <p>②Strong cleaning ability, good compatibility with other materials, no corrosion to most of metals, which meet the requirements of different scales and objects in Metal and Electronics subsectors</p> <p>③Suitable for immersion degreasing, ultrasonic degreasing and manual degreasing.</p>	<p>①Little flammable and explosive risk, could be avoided by blended with HFES and HFCs;</p> <p>②Need to note that the blended solvents will have much higher price to reduce the cost effectiveness. Can be offset with properly designed low-emission machines</p> <p>③“Trans” presence can cause cracking and crazing in some plastics. Recommend compatibility tests.</p>
	HFOs	Degreasing	<p>①Lowest GWP in existing non-ODS alternative;</p> <p>②No flammability, no safe risk;</p> <p>③Applied in HCFC-141b phasing out in stage I.</p>	<p>①Some with lower boiling point, easily volatile, possible high loss of solvent during cleaning process. Theoretically could be improved by proper equipment design, but no suitable cleaning machine for HFO in marketing for the low boiling HFO. The higher boiling HFO can be used in some existing equipment;</p> <p>②Due to expensive price, operational fee will be increased if not used in proper equipment;</p> <p>③Not suitable for manual cleaning for easily volatile.</p>

Solvent formulation	HFEs	Degreaser formulation	<ul style="list-style-type: none"> ① Besides front advantages, HFEs has good chemical inertness and electric insulativity, suitable for power cleaning; ② Good compatibility with HC, Alcohols, alcohol ether, organic silicon solvent; ③ Ever successful application in domestic solvent formulation enterprises 	① Expensive price, hard to accept for enterprises. Could reduce the cost by optimized formula.
	HFCs	Degreaser formulation	<ul style="list-style-type: none"> ① Similar to HFEs, suitable Metal, Electronics and Power Degreasing; ② Successful cases in domestic solvent formulation sub sector. 	<ul style="list-style-type: none"> ① Expensive price, hard to accept for enterprises. Could reduce the cost by optimized formula. ② High GWP. Although their GWP could be reduced by optimized formula, still need discreet to choose, consider them as supplemented technologies.
	HFOs	Degreaser formulation	① Low boiling point (Solstice) and easily volatile, suitable speedy dry areas, such as aerosol cans. Good for contact cleaner sprays.	<ul style="list-style-type: none"> ① Expensive price, hard to accept for enterprises. ② No existing successful case. Need to have commercial application examples.
	Chlorinated solvents	Degreaser formulation	<ul style="list-style-type: none"> ① Lower price and easily obtainable, strong cleaning ability, no flammable. ② Good compatibility with most solvents; ③ Lower GWP, with the advantage of obvious greenhouse reduction. 	① High toxicity. Could reduce health risk by optimized formula and more prevention measures in occupational health. Disposal must be correct to prevent environmental issues.

Notes: When HCFC-141b is totally phased out in the DMD subsector, the solvent formulation enterprises serving this subsector will transfer to other directions or disappear, and in the Solvent Sector Plan, the HCFC-141b consumed by solvent formulation subsector is only for degreasing use, its silicone oil thinner use had been offset by the medical enterprises. The alternative technology and cost calculation is also based on this premise.

It should be noted that the alternatives listed in above table are just for reference in the HCFC-141b phase-out. In this Solvent Sector Plan, different alternatives will be identified for different subsectors for cost estimation (see Table 5-1 in Chapter V for details) based on comprehensive comparison of their physical and chemical properties, if successfully applied, cost-effectiveness of conversion, safety risk and acceptability by the enterprises etc.

As the solvent sector involves quite different industrial fields, the enterprises in each subsector certainly have distinct degreasing requirements for alternative technology; even in the same subsector, the enterprises may need totally different alternatives due to different objects needed to be cleaned and the difference in degreasing requirements, the alternatives/alternatives for the solvent sector are characterized by complexity and diversification, and often demand customized design according to sector characteristics and enterprises' actual needs. Although existing experiences could be learned, many alternatives being used well abroad might not be suitable in the next stage because the enterprise's technical ability, scale and profitability were totally different, especially for SMEs, which will face much bigger challenges in HCFC-141b phase-out.

In consideration of the current situation of the solvent sector and the characters of existing alternatives, this sector will face two main challenges in HCFC-141b phase-out and alternatives selection: Firstly, the demand for alternatives is always diversified, different enterprises probably have totally different choices, lacking of a special super-alternative to replace HCFC-141b completely for all purposes. Most of time, the alternative technology needs to be designed and formulated one by one; Secondly, any feasible and suitable alternative will need a lot of money to realize the target of HCFC-141b phase-out, making the phase-out work much harder. Why and how so many funds are required? One side is the expensive alternative, their operational cost is more than 15 times of HCFC-141b; the other side is the cheap but not safe alternative, that will require the expensive cleaning machine and safety measures to be assembled to reduce their flammability and toxicity.

III. RESULTS AND PARTNERSHIPS

On the premise of ensuring each eligible enterprise having a fair chance to participate in phase-out activities, the phase-out strategy should be developed by adhering to the principle of "efficiency first" and exploit diverse ways and models to guarantee the achievement of HCFC-141b phase-out targets for the sector. The strategy consists of four main components, i.e. HCFC-141b phase-out activity, alternative technology research and development, technical assistance and policy support.

Implement HCFC-141b phase-out activities at subsector and enterprise levels.

- a) Give priority to large enterprises, and adopt flexible and diverse phase-out models. Regarding the enterprises with advanced technical capacity, relative mature alternatives and high consumption volume of HCFC-141b, it is planned to phase out their HCFC-141b consumption by individual phase-out projects, as was done in Stage I. However, for those enterprises with low consumption of HCFC-141b and insufficient technical and financial capacity but clear willingness for conversions, the "centralized phase-out" mode could be considered in accordance with the geographic distribution, sector distribution and technical needs of those enterprises.
- b) Demonstration phase-out. For those special subsectors and enterprises which will have crucial influence on the achievement of HCFCs phase-out targets, especially those enterprises providing power degreasing solvent and services to the customers, their HCFC-141b consumption is relatively high in solvent formulation subsector even in the whole solvent sector. It is very hard to identify the alternatives for charged degreasing because of strict requirement. So far, no cost-effective solution could be applied. Before 2020, some demonstration projects with different alternatives might be developed, with the intent to provide demonstration and experience for HCFC-141b phase-out in this field, and make contribution to the phase-out target of the whole solvent sector.

Promote the development of suitable alternatives for HCFC-141b to provide support for sustainable HCFC phase-out.

- a) To encourage the research and development of alternatives, and conduct demonstration projects timely for those suitable alternatives in different industrial fields.

- b) To revise/formulate technical standards and guidance for alternatives, technologies, equipment and production processes, with aims to help enterprises handle new alternatives, improve their knowledge on the know-how of operational process, as well as to facilitate the penetration of alternatives in the market.
- c) To provide sustainable and adequate technical support and services to SMEs, help them phase out HCFC-141b smoothly and successfully.

Provide policy support and publicity in a timely manner.

- a) Timely summarize and promote the experience of implemented projects in the solvent sector, carry out trainings and publicity activities, improve the understanding of enterprises on HCFC-141b phase-out, and encourage enterprises to participate in early HCFC-141b phase-out.
- b) Improve and enhance the monitoring and implementation system established during early phase-out of other ODS and recent phase-out of HCFCs in the solvent sector, and make further efforts to develop and promulgate policies and regulations to ensure sustainable HCFC-141b phase-out.
- c) Urge those enterprises not eligible for funding to phase out HCFC-141b consumption according to the schedule set in the Solvent Sector Plan, with technical support when needed, and implementation of policies on HCFCs management.

Although HCFC-225 consumption in the solvent sector is limited, individual HCFC-225 phase-out contracts with grant fund may also be considered for those eligible enterprises.

Project output

Output 1: The solvent sector will reduce 1,214.56 MT (133.60 ODP tons) of HCFC-141b and 13.24 MT (0.33 ODP tonnes) of HCFC-225 in 2016-2020. In this regards, investment projects will be arranged to achieve the target of phasing out a total of 1,227.80 MT (133.93 ODP tons) of HCFCs.

Output 2: Additional 2,913.15 MT (320.45 ODP tons) of HCFC-141b and 31.76 MT (0.80 ODP tons) of HCFC-225 will be phased out in the period of 2021-2025 to achieve the target of phasing out the additional quantity of 2,944.91 MT (321.24 ODP tons) of HCFCs.

In order to ensure the reduction of 1,214.56 tonnes (133.60 ODP tons) of HCFC-141b consumption by 2020, and complete phase-out of HCFCs in the solvent sector by 2026, all eligible enterprises will be considered under the sector plan. With the modes of “individual phase-out project” or “package phase-out project”, the HCFC-based production lines and equipment of eligible enterprises will be converted with preferred cost-effective alternatives. At the same time, the fire safety measures and air cleanliness of the workshops will also be retrofitted depending on the requirements of the alternatives on fire safety, health protection and air cleanliness. Project investment will be mainly distributed to these selected technology conversions and related supporting activities, such as training, test and detection, transfer of intellectual property rights, environmental and safety assessments.

Output 3: Before 2020, some demonstration projects with different alternatives might be developed, with the intent to provide demonstration and experience for HCFC-141b phase-out in this field, and make contribution to the phase-out target of the whole solvent

Output 4: Policies: In order to ensuring sustainability of the applications of the new non ODS technologies, policy measures and technical assistance activities will be conducted to assist the phase out those HCFCs consumption enterprises that are not eligible for MLF funding due to not meeting ExCom eligibility criteria.

The policy design for HCFC-141b phase-out management plan of the solvent sector is based on:

- a) Legal basis: the *Law of the Peoples Republic of China on the Prevention and Control of Atmospheric Pollution* revised and promulgated in August, 2015 and the *Regulation on the Management of Ozone Depleting Substances* promulgated in March, 2010;
- b) Policy framework for ODS phase-out stipulated in the National Programme;
- c) Current status of the solvent sector in China, such as low consumption level, large number of SMEs, and decentralized industrial sectors;
- d) Make full use of existing policy and regulatory framework to maintain continuity and

- consistency of policies, laws and regulations;
- e) Ensure that policies are enforceable and operational to facilitate supervision and management;
 - f) Give full consideration to policies' economic efficiency and fairness.
 - g) Research and development: policy and financial support will be provided for the research and development of alternatives to ensure normal development of the solvent sector.

It is expected that during the stage II, the following policies will be issued:

- a) Ban on HCFCs consumption in the Solvent Sector
- b) Annual amend of the import quotas for HCFC-225
- c) Rules and recommendations for new alternative technologies and their utilization of new technologies such as the safety requirement for hydrocarbon solvents, etc.

Output 5: Technical Assistance

The technical assistance activities will not only support the achievement of interim phase-out targets of Stage II, but also give consideration to the requirements for sustainable implementation of follow-up phase-out activities. Technical assistance activities under Stage II for the Solvent Sector Plan shall focus on 1) improvement of the ability of the authorities on managing HCFC-141b phase-out in the solvent sector; 2) research and development of new implementation mechanisms; 3) promotion of available alternatives; 4) exchange and dissemination of information concerning HCFC phase-out; 5) supervision and evaluation of the technology conversions in beneficiary enterprises; and 6) encouraging and promoting HCFC phase-out in SMEs and those enterprises not eligible for funding.

Technical assistance activities are critical to the sector's HCFC-141b phase-out and include the following contents:

- a) Training workshops and meetings. Training workshops will be organized to inform solvent enterprises of the staged targets and phase-out schedule for Stage II Solvent Sector Plan. Participants will be informed of the available alternatives, the application and implementation procedures of phase-out project, and the relevant laws, regulations and rules on HCFCs phase-out. All beneficiaries of the Solvent Sector Plan will be required to follow proper procedures for procurement of goods and services, and to report such affairs as grant management and disbursement, and environmental and social safeguards. In the meantime, the experience exchange meetings on the implementation of HCFC-141b phase-out projects will be organized to provide the candidate enterprises with experiences and references in the selection of alternatives, the organization and implementation of HCFC phase-out projects and the financial management.
- b) Strengthening Management of HCFCs phase-out. Improve the capacity of authorities on the management and monitoring of HCFC phase-out; strengthen the management functions of local environmental departments and relevant industrial associations. At the same time, project meetings and other education will be provided to help these management authorities and relevant experts improve their abilities to the identification, organization, supervision and evaluation of HCFCs phase-out activities in the solvent sector.
- c) Consultancy service. an expert team will be established by FECO/MEP to support the implementation of the Stage II Sector Plan with various consultancy services. The expert team will 1) provide the implementation of the Stage II Sector Plan with such technical assistances as the screening and evaluation of alternatives, the research on implementation mechanism, and the development of overall phase-out strategy and implementation plan for each subsector; 2) provide technical assistance for solvent enterprises to prepare project proposals, equipment procurement documents, etc., and provide technical support to enterprises throughout the project implementation period on a "when needed" basis; 3) provide technical support for SMEs and those enterprises not eligible for funding to help them select and apply suitable alternatives to replace HCFC-141b; 4) provide technical support for FECO/MEP on the aspects of project review, supervision, verification and commissioning, etc.

- d) Research and development of new implementation mechanisms. As one of the priority technical assistance activities, evaluation and assessment on implementation mechanism will be conducted, with the involvement of local environmental departments, relevant industrial associations, experts and enterprises' representatives to discuss the feasibility of adopting various new implementation mechanisms and the associated measures for supervision and management, to ensure the HCFC-141b phase-out in SMEs.
- e) Screening and optimization of alternatives. Select and optimize the available alternatives and carry out industrial application demonstration for the alternative technology with high promotion potential and cost effectiveness.
- f) Technology exchange and learning. Organize relevant project management personnel, representatives from local environmental departments, associations, scientific research institutions and industry experts to go to advanced institutions at home and abroad for information and technical exchange, in order to introduce and learn the advanced alternatives of HCFC-141b and their experiences in the selection of alternatives and the organization and management of phase-out activities.
- g) Public awareness. Conduct extensive publicity by means of radio, television, newspapers and other media, to improve the HCFC-141b phase-out awareness of enterprises in the solvent sector and enhance their awareness to participate in phase-out activities, as well as to deepen the understanding of the public and stakeholders on HCFC-141b phase-out. At the same time, experience and lessons learned from previous phase-out activities will be summarized and promoted timely and introduced to potential beneficiaries in the solvent sector.

IV. PROJECT MANAGEMENT

The project will be implemented under the National Execution (NIM) modality in line with the Standard Basic Assistance Agreement between UNDP. The Ministry of Environmental Protection (MEP) is the government institution responsible for the daily execution and coordination of the project and will serve as the government Executing Agency (EA). MEP has designated the Foreign Economic Cooperation Office (FECO) as the Project Management Office (PMO, or National Ozone Unit) in the implementation of activities relating to fulfilling China's obligations under the multilateral environmental conventions.

Government-Private Collaboration will be the main approach for the project to achieve the objective. The private sector will be closely involved in the project and will be supported by national and local governments in the implementation of the project. The private sector will also support the government in participating in assessment of the new policy impacts and standards. Hands-on experience from the private sector will be taken up to facilitate effective technology transfer and experience exchange, ensuring sustainability of project

Collaboration between the industrial associations in this case is also important for the implementation of the sector plan, the associations will help FECO and the enterprises in the implementation of the sector plan, provide technical assistance to the enterprises and PMO. In this regards, the relevant association will act as the implementation partner, and will sign cooperation agreement or contract with FECO regarding the assistance to FECO in the implementation of the stage II sector plan. This will define the responsibilities of both parties.

The enterprises or companies who participate in the HCFC phase out programme will commit to phase out the consumption of HCFCs after conversion of the production or manufacturing lines. They will organize a working group, consisting of technical experts and managerial personnel for the implementation of the project.

V. RESULTS FRAMEWORK

Table 5-1 Results Framework

Intended Outcome as stated in the UNDAF/Country [or Global/Regional] Programme Results and Resource Framework: 2. More people enjoy a cleaner, healthier environment as a result of improved environmental protection and sustainable green growth.											
Outcome indicators as stated in the Country Programme [or Global/Regional] Results and Resources Framework, including baseline and targets: (SP) Indicator 2.1.2: Total ODP tonnes of hydrochlorofluorocarbons (HCFC) consumption that companies committed to reduce by signing the UNDP project agreements											
Applicable Output(s) from the UNDP Strategic Plan: Output 1.3: Solutions developed at national and sub-national levels for sustainable management of natural resources, ecosystem services, chemicals and waste. Output 1.4: Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented.											
Project title and Atlas Project Number: Sector plan for Phase-out of HCFCs in the Solvent Sector in China (Stage-II, for 2020 and 2025 compliance) Award ID 00087758, Output ID: 00094679											
EXPECTED OUTPUTS	OUTPUT INDICATORS	DATA SOURCE	BASELINE		TARGETS (by frequency of data collection)						DATA COLLECTION METHODS & RISKS
			Value	Year	Year 1	Year 2	Year 3	Year 4	Year 5	FINAL	
Output 1 Consumption reduction of HCFCs by 2020	1.1 The solvent sector will reduce 1,214.56 MT (133.60 ODP tons) of HCFC-141b and 13.24 MT (0.33 ODP tonnes) of HCFC-225 in 2016-2020. The total HCFCs to be phased out by the end of 2020 is 1,227.8 MT. Non-eligible consumption are planned to be achieved by TA activities such as policies, quotas, management of import and exports, enforcement of regulations, etc.	Annual progress report		2015	N/A	N/A	548.20 MT (59.8 ODP T)	N/A	1,227.8 MT (133.93 ODP T)		Verifications and article 7 data submitted to the ExCom every year
Output 2 Consumption reduction of HCFCs by 2025	1.2 Additional 2,913.15 MT (320.45 ODP tons) of HCFC-141b and 31.76 MT (0.80 ODP tons) of HCFC-225 to be reduced in the period of 2021-2025	Annual progress report	1,227.8 MT (133.93 ODP T)	2021	N/A	N/A	2,813.5 MT	N/A	3,672.7 MT		Verifications and article 7 data submitted to the ExCom every year

VI. MONITORING AND EVALUATION

In accordance with UNDP's programming policies and procedures, the project will be monitored through the following monitoring and evaluation plans:

Table 6-1 Monitoring Plan

Monitoring Activity	Purpose	Frequency	Expected Action	Partners (if joint)	Cost (if any)
Track results progress	Progress data against the results indicators in the RRF will be collected and analysed to assess the progress of the project in achieving the agreed outputs.	Quarterly, or in the frequency required for each indicator.	Slower than expected progress will be addressed by project management.		
Monitor and Manage Risk	Identify specific risks that may threaten achievement of intended results. Identify and monitor risk management actions using a risk log. This includes monitoring measures and plans that may have been required as per UNDP's Social and Environmental Standards. Audits will be conducted in accordance with UNDP's audit policy to manage financial risk.	Quarterly	Risks are identified by project management and actions are taken to manage risk. The risk log is actively maintained to keep track of identified risks and actions taken.		
Learn	Knowledge, good practices and lessons will be captured regularly, as well as actively sourced from other projects and partners and integrated back into the project.	At least annually	Relevant lessons are captured by the project team and used to inform management decisions.		
Annual Project Quality Assurance	The quality of the project will be assessed against UNDP's quality standards to identify project strengths and weaknesses and to inform management decision making to improve the project.	Annually	Areas of strength and weakness will be reviewed by project management and used to inform decisions to improve project performance.		
Review and Make Course Corrections	Internal review of data and evidence from all monitoring actions to inform decision making.	At least annually	Performance data, risks, lessons and quality will be discussed by the project board and used to make course corrections.		
Project Report	A progress report will be presented to the Project Board and key stakeholders, consisting of progress data showing the results achieved	Annually, and at the end of the project (final report)			

	against pre-defined annual targets at the output level, the annual project quality rating summary, an updated risk long with mitigation measures, and any evaluation or review reports prepared over the period.				
Project Review (Project Board)	The project’s governance mechanism (i.e., project board) will hold regular project reviews to assess the performance of the project and review the Multi-Year Work Plan to ensure realistic budgeting over the life of the project. In the project’s final year, the Project Board shall hold an end-of project review to capture lessons learned and discuss opportunities for scaling up and to socialize project results and lessons learned with relevant audiences.	Specify frequency (i.e., at least annually)	Any quality concerns or slower than expected progress should be discussed by the project board and management actions agreed to address the issues identified.		

VII. MULTI-YEAR WORK PLAN

TIME FRAME/MONITORING MILESTONES:

Table 7-1 Project Implementation Timeframe

ACTIVITIES	2016				2017				2018				2019				2020			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Signing phase-out contracts</i>					√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<i>Completion of phase-out contracts</i>											√	√	√	√	√	√	√	√	√	√
<i>Training for solvent enterprises</i>					√		√		√		√		√		√		√		√	
<i>Enforcement of management abilities to HCFC phase-out</i>					√	√	√	√	√	√	√	√								
<i>Consultancy services</i>					√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<i>Development and practice of implementation mechanisms</i>					√		√		√		√		√		√		√		√	
<i>Screening and optimization of available alternatives</i>						√		√		√		√		√		√		√		√
<i>Public Awareness</i>						√				√				√				√		
<i>Consumption control (record management on solvent enterprises by Local EPBs)</i>				√																
<i>HCFC alternative management (recommended list, safety requirements and operation specifications)</i>		√				√														

ACTIVITIES	2021				2022				2023				2024				2025				2026
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
<i>Signing phase-out contracts</i>	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√					
<i>Completion of phase-out contracts</i>	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<i>Training on solvent enterprises</i>	√		√		√		√		√		√		√		√						
<i>Consultancy services</i>	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
<i>Public Awareness</i>		√				√				√		√		√		√	√	√	√		
<i>Consumption control (consumption ban and supply control for HCFC)</i>																				√	
<i>Regular project management</i>	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<i>Verification of HCFC-141b consumption</i>	√												√								√

Table 7-2 Fund Allocation for solvent Sector Plan (Stage II)

Category	Brief Description	US \$
Investment	Conversion cost for enterprises in the solvent sector	42,612,641
Technical assistance	Training workshops, meetings and public awareness	2,187,359
	Strengthening Management of HCFCs phase-out	
	Review and development of policies and regulations, Research and development of new implementation mechanism	
	Consultancy services	
	Study on alternative technology	
	Knowledge and experience sharing and exchange	
Project management for FECO		2,462,566
Grand total		47,262,566

The Agreement between China and the ExCom is expected to be finalized in an ExCom meeting in 2017. Annual tranche allocation will be decided according with the work plan of the Stage II Solvent Sector Plan. The tranche allocation and annual work plan will be reflected upon finalization of the Agreement.

Table 7-3 below presents the budgets for the **2016 tranche** released by the ExCom. Subsequent annual tranches under the project will be added with budget revision upon release of each tranche by the ExCom. Total fund approved in principle by the ExCom for Stage II HPMP Solvent Sector Plan is US \$ 47,262,566 for period 2016 – 2026.

AWARD ID	00087758									
PROJECT ID	00094679									
Project Title	Sector plan for Phase-out of HCFCs in the Solvent Sector in China (Stage-II, for 2020 and 2025 compliance)									
Executing Agency	Foreign Economic Cooperation Office, Ministry of Environmental Protection (FECO/MEP)									
ATLAS Activity	Responsible Party	Source of funds	ATLAS Code	ATLAS Budget Description	2017	2018	2019	2020	2021	Total
Activity 1: Investment Projects	FECO/MEP	63080	72100	Contractual services – companies	2,035,950	508,987				2,544,937
	Sub-Total				2,035,950	508,987				2,544,937
Activity 2: Technical Assistance	FECO/MEP	63080	71300	Local consultants	8,000	2,000				10,000
	FECO/MEP	63080	71600	Travel	4,000	1,000				5,000
	FECO/MEP	63080	72100	Contractual services – companies	72,000	18,000				90,000
	FECO/MEP	63080	75700	Training, workshop and meeting	8,000	2,000				10,000
	UNDP	63080	71300	International consultants	8,000	2,000				10,000
	UNDP	63080	71600	Travel	8,000	2,000				10,000
	UNDP	63080	72100	Contractual services – companies	-	5,000				5,000
Sub-Total				108,000	32,000				140,000	
Activity 3: Project Management	FECO/MEP	63080	71800	Contractual services – Implementing partner	109,600	27,400				137,000
	Sub-Total				109,600	27,400				137,000
Grand Total					2,253,550	568,387				2,821,937

Note: During project implementation, subsequent (2017 - 2025) tranches released by the ExCom will be added to the project budget with budget revisions, to the total approved sector plan project funding of US\$ 47,262,566. The budget listed above could be adjusted between budget lines under each activity and/or new budget line could be added while keeping the same subtotal for each activity, if deemed necessary; the budget among the activities under each year could be adjusted through the budget revision to be agreed between UNDP and FECO/MEP.

USD 16,000 in 2017 allocation of tranche 2016, and USD 9,000 in 2018 of tranche 2016 will, in agreement between parties, be kept in UNDP for relevant activities.

Based on the Agreement between China and ExCom that will be finalized at an ExCom meeting in 2017, the annual tranche will be decided. Tranche will be released annually after UNDP submits, on behalf of China, the annual Tranche Implementation Report, the annual Tranche Implementation Plan and a Tranche Release Request that are reviewed and approved by the ExCom. The format of the Tranche Implementation Report and Tranche Implementation Plan are set out under the agreement. Any amendment of format will be stated by the decisions of the ExCom.

In principle, disbursement of each tranche from UNDP to FECO/MEP will be divided into three payment instalments. Each payment instalment will be disbursed based on achieving the indicators/milestones.

Payment Schedule and Indicators

Table 7-4: Tranche 2016 (USD 2,821,937)

Payment Schedule	Disbursement (US\$)	Indicators/Milestones
- First disbursement	- 1,410,970 (50%) ¹	<ul style="list-style-type: none"> - The annual funding tranche upon Executive Committee's approval of the annual Tranche Implementation Plan; - Receipt by UNDP of fund transfer from the MLF Treasury; - ProDoc signed between FECO/MEP and UNDP. - 2017 implementation work program submitted and agreed with UNDP.
- Second disbursement	- 846,580 (30%)	<ul style="list-style-type: none"> - 50% of the First disbursement has been committed in the phase-out activities. - Signed conversion contract with HCFCs to be phased out not less than 300 metric tonnes (33 ODP tonnes) in 2017.
- Third disbursement	- 564,387 (20%) ²	<ul style="list-style-type: none"> - Total 80% of the Tranche 2016 has been committed in the phase-out activities. - More than 20% of Tranche 2016 has been disbursed from FECO/MEP to the final beneficiaries. - Tranche Implementation Report and Tranche Implementation Plan for 2018 prepared and is satisfactory to UNDP for submission to the ExCom

VIII. GOVERNANCE AND MANAGEMENT ARRANGEMENTS

The project will be managed in accordance with National Execution (NIM) modality. The Government of China through its Foreign Economic Cooperation Office, Ministry of Environmental Protection (FECO/MEP) will be implementing the project with support from UNDP. The MoU between UNDP and FECO/MEP which was signed on 8 January 2011 will serve as the guideline for the overall management on the project implementation. The Performance Based Payment (PBP) mechanism will be applied for the implementation of the solvent sector plan project as discussed this project document.

The project will be technically and managerially implemented in accordance with the framework of the project proposal submitted and approved by the 76th and 77th ExCom meetings as included in Annex III, and as revised to reflect the updated baseline conditions and final ExCom approved fund.

Roles and responsibilities of UNDP and FECO/MEP

¹ USD 16,000 of which will, in agreement between parties, be kept in UNDP for relevant activities.

² USD 9,000 of which ,will, in agreement between parties, be kept in UNDP for relevant activities, and US\$2,656 will be deducted from this payment based on decision 77/23(b)

UNDP is serving as the implementing agency to supervise the implementation of the sector plan, specifically including the following responsibilities:

- Providing assistance for policy development, planning and management of sector programming as set out in the e sector when required;
- Enduring verification of performance and progress of the disbursement in accordance with the agreement between the Government of China and the ExCom and with its specific internal procedures and requirements as set out in the sector and assisting FECO/MEP in the implementation and assessment of the activities;
- Assisting FECO/MEP in the preparation of the solvent sector annual Tranche Implementation Plan/biennial work programme and Tranche Implementation Report as per Appendix 4-A in the agreement between the Government of China and the ExCom;
- Enduring financial verification of the activities implemented;
- Reviewing and clearing all TORs for TA activities and provide advice and assistance as needed;
- Monitoring the progress and carrying out supervision missions;
- Ensuring fund disbursement in accordance with the guidelines of the ExCom;
- Reporting the progress of the Tranche Implementation Plan and submitting requests to the ExCom for future tranches;

FECO/MEP will be responsible for the overall implementation, coordination and management of the solvent sector plan, specifically including the following responsibilities:

- Preparing and implementing annual Tranche Implementation Pan/biennial work programme;
- Implementing, supervising and monitoring the conversion activities;
- Developing policy framework, implementing regulatory actions, and conducting technical assistance activities during the implementation as planned. All technical assistance activities will be further defined through development of specific TOR to be reviewed and agreed between UNDP and FECO/MEP;
- Executing performance-based contracts with enterprises participating in stage II for technology conversions, and ensuring disbursement to the enterprises based on agreed performance targets;
- Preparing the annual Tranche Implementation Plan/biennial work program and annual Tranche Implementation Report as per provision of the agreement between the Government of China and the ExCom; and the reports as required by UNDP.
- Facilitating performance verification and financial audit as required;
- Coordinating between various HCFCs consumption sectors at national level in such a way as to facilitate establishment of reliable sector level HCFC consumption data;
- Ensuring coordination between all related stakeholders in the sector;
- Carrying out commission procedure for establishing completion of enterprise level conversions.

IX. LEGAL CONTEXT AND RISK MANAGEMENT

This document together with the CPAP signed by the Government and UNDP which is incorporated herein by reference, constitute together a Project Document as referred to in the Standard Basic Assistance Agreement (SBAA); as such all provisions of the CPAP apply to this document. All references in the SBAA to “Executing Agency” shall be deemed to refer to “Implementing Partner”, as such term is defined and used in the CPAP and this document.

Consistent with the Article III of the Standard Basic Assistance Agreement (SBAA), the responsibility for the safety and security of the Implementing Partner and its personnel and property, and of UNDP’s property in the Implementing Partner’s custody, rests with the Implementing Partner. To this end, the Implementing Partner shall:

- (a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- (b) assume all risks and liabilities related to the implementing partner’s security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of the Implementing Partner’s obligations under this Project Document.

The Implementing Partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/sc/committees/1267/aq_sanctions_list.shtml. This provision must be included in all sub-contracts or sub-agreements entered into under/further to this Project Document”.

Any designations on maps or other references employed in this project document do not imply the expression of any opinion whatsoever on the part of UNDP concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

Select the relevant one from each drop down below for the relevant standard legal text:

1. Legal Context:

- Country has signed the Standard Basic Assistance Agreement (SBAA)
- Country has not signed the Standard Basic Assistance Agreement (SBAA)
- Regional or Global project

2. Implementing Partner:

- Government Entity (NIM)
- UNDP (DIM)
- CSO/NGO/IGO
- UN Agency (other than UNDP)
- Global and regional projects

Or [click here for the MS Word version of the standard legal and risk management clauses.](#)

X. ANNEXES

1. Project Quality Assurance Report

2. **Social and Environmental Screening Template** [English][French][Spanish], including additional Social and Environmental Assessments or Management Plans as relevant. (*NOTE: The SES Screening is not required for projects in which UNDP is Administrative Agent only and/or projects*

comprised solely of reports, coordination of events, trainings, workshops, meetings, conferences, preparation of communication materials, strengthening capacities of partners to participate in international negotiations and conferences, partnership coordination and management of networks, or global/regional projects with no country level activities).

3. **Risk Analysis.** Use the standard [Risk Log template](#). Please refer to the [Deliverable Description of the Risk Log](#) for instructions
4. **Capacity Assessment:** Results of capacity assessments of Implementing Partner (including HACT Micro Assessment)
5. **Project proposal** as originally submitted to the 76th ExCom, and revised to reflect on ExCom approval at the 76th and 77th ExCom meetings.