Supplementary Materials for

Chinas hydrofluorocarbon challenge

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Table 1: Main HFCs produced in China [1]

Substance	100-year GWP	ODSs Replaced
HFC-32 [2]	675	HCFC-22
HFC-125 [2]	3,500	HCFC-22
HFC-134a [3]	1,430	CFC-12, HCFC-22
HFC-143a [4]	4,470	R502
HFC-152a [5]	124	CFC-12
HFC-227ea [6]	3,220	CFC-12, Halon 1301
HFC-236fa [6]	9,810	Halon 1211
HFC-245fa [6]	1,030	HCFC-141b

[1] Sources: GWP is adapted from the 2013 North American HFC amendment proposal.

[2] HFC-32 and HFC-125 are components for mixed refrigerant such as R407, R410, R504, and R404. Mixed refrigerant are widely used in domestic refrigeration, central air conditioning, industrial refrigeration, transport refrigeration, and cold storage. Compared with HFC-125, the production and consumption of HFC-32 varied widely, partly attributed to the demand shock caused by the 2008 global financial crisis.

[3] HFC-134a is primarily used for automobile air conditioners, which accounts for about 80% of all consumption. Other main usage includes domestic, industrial and commercial refrigeration (15%), plastic insulation foams, and medical aerosols. HFC-134a has the largest share in all HFCs and it has been increasing steadily.

[4] HFC-143a is used to make blend refrigerant R404a, which is used in commercial refrigeration (eg. freezers in supermarket and cold storage), transport refrigeration, and vessel refrigeration.

[5] HFC-152a is the second largest HFC widely used as refrigerant, aerosol propellant, foam expansion agent. It can also be used as a feedstock for manufacturing HFC-143a. Because HFC-152a has both low ODP and low GWP, its use is expected to increase dramatically.

[6] HFC-227ea is commonly used as a gaseous fire suppression agent, medical aerosol propellant, and refrigerant. HFC-236fa is mainly used as a fire extinguishing agent and HFC-245fa is used as a foam blowing agent.

Table 2: China's HFC production and consumption (2005-2009) [1]

	2005	2006	2007	2008	2009
Panel A: HFC Production (metric tons)					
HFC-32	6,197	10,515	19,083	18,733	18,378
HFC-125	3,588	9,540	12,488	15,264	17,734
HFC-134a	14,604	24,922	46,505	47,777	57,423
HFC-143a	1,181	1,503	5,167	6,827	7,592
HFC-152a	33,030	43,201	51,877	53,896	52,527
HFC-227ea	1,928	3,363	5,800	5,321	4,564
HFC-236fa	245	233	349	401	187
HFC-245fa	253	293	0	323	714
Total	61,026	93,570	141,269	148,542	159,119
Panel B: HFC Consumption (metric tons)					
HFC-32	1,357	4,988	22,197	9,573	10,395
HFC-125	1,088	4,335	6,363	8,194	9,520
HFC-134a	13,210	16,946	21,116	21,870	29,799
HFC-143a	104	721	3,317	1,968	3,993
HFC-152a	6,189	15,908	22,607	13,480	10,229
HFC-227ea	1,125	1,786	2,090	2,289	2,527
HFC-236fa	26	5	16	41	86
HFC-245fa	0	90	264	300	795
Total	23,099	44,779	77,970	57,715	67,343

[1] Sources: Survey of China's HFC industry.

Table 3: 100-year GWP for HCFCs [1]

Substance	100-year GWP
HCFC-21	151
HCFC-22	1,810
HCFC-123	77
HCFC-124	609
HCFC-141b	725
HCFC-142b	2,310
HCFC-225ca	122
HCFC-225cb	595

[1] Sources: The 2013 North American HFC amendment proposal.

Table 4: China's HCFC production and consumption in the base years (2008-2010) [1,2]

	2008		2009		2010	
	Metric tons	CO_2eq tons	Metric tons	CO_2eq tons	Metric tons	CO_2eq tons
Panel A: HCFC Production						
HCFC-22	287,159	519,757,790	312,045	564,801,450	310,000	561,100,000
HCFC-123	2,558	196,966	2,238	172,326	2,819	217,063
HCFC-124	365	222,285	474	288,666	401	244,209
HCFC-141b	81,298	58,941,050	91,880	66,613,000	98,711	71,565,475
HCFC-142b	22,724	52,492,440	29,125	67,278,750	33,957	78,440,670
HCFC-225	0	0	0	0	0	0
Total	394,104	631,610,531	435,762	699,154,192	445,888	711,567,417
Panel B: HCFC Consumption						
HCFC-22	173,811	314,597,910	200,559	363,011,790	220,985	399,982,669
HCFC-123	367	28,259	298	22,946	748	57,596
HCFC-124	0	0	279	169,911	-14	-8,648
HCFC-141b	40,139	29,100,775	50,323	36,484,175	56,688	41,098,583
HCFC-142b	16,862	38,951,220	21,811	50,383,410	23,531	54,355,455
HCFC-225ca	0	0	42	5,124	56	6,808
Total	231,179	382,678,164	273,312	450,077,356	301,993	495,492,462

[1] Sources: The 2008-2009 data are from the Sector Plan for HCFC Phase-out in the Industrial and Commercial Refrigeration and Air Conditioning (ICR) Sector in China http://www.undp.org/content/dam/undp/documents/projects/CHN/00063099/PRODOC.pdf; The 2010 production data are from http://www.multilateralfund.org/Our\%20Work/webhelp/index.html#!hcfcProdPhasOutManaPlanForChin; The 2010 consumption data are from UNEP/OzL.Pro/ExCom/71/30 http://www.multilateralfund.org/71/English/1/7130.pdf. The GWP data are from Table 3.

[2] The data set only includes the part that will be eventually emitted into the atmosphere, so it does not include the production for feedstock use.

Table 5: China's HFC baseline (metric tons CO_2eq) [1]

	2008-2010 HCFC Average [2]	HFC Baseline
Production	680,777,380	612,699,642
Consumption	442,749,327	398,474,395

[1] The 2013 North American HFC amendment proposal suggests the HFC baseline for Article 5 parties is 90% of the average HCFC production and consumption over 2008-2010. Article 5 parties are defined in the Montreal Protocol as those with per capita consumption and production of ODSs less than 0.3 kg/year.

[2] The HCFC production and consumption data are from Table 4.

Table 6: China's registered HFC-23 CDM projects [1]

ID	Province	1st period ktCO_2eq/yr	Credit start	Total issuance (kCERs)
CDM00473	Jiangsu	8,411.43	12/1/2006	51,463.55
CDM00294	Zhejiang	5,789.68	8/1/2006	37,955.13
CDM00356	Shandong	10,110.12	1/1/2007	59,508.85
CDM00472	Jiangsu	10,437.25	12/22/2006	63,011.17
CDM00672	Zhejiang	3,656.60	11/1/2006	26,231.66
CDM00673	Zhejiang	4,783.75	1/1/2007	33,509.81
CDM00741	Sichuan	2,065.53	5/1/2007	13,193.01
CDM01000	Zhejiang	4,809.63	4/6/2007	28,231.66
CDM01578	Jiangsu	3,473.39	5/1/2008	12,927.61
CDM01678	Shandong	4,248.09	9/14/2007	21,780.17
CDM01848	Zhejiang	7,865.28	4/20/2009	29,450.57

[1] Sources: UNEP Risoe CDM/JI Pipeline Analysis and Database: `http://www.cdmpipeline.org`. The approved GWP for HFC-23 CDM projects is 11,700 for the first commitment period under the Kyoto Protocol. CER: certified emission reduction, 1 CER = 1 ton carbon dioxide equivalent. All registered projects receive carbon credits for 7 years.