Supplement to: **Projecting Future HFC-23 Emissions**

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The following tables and figures provide the additional data used in modeling the three HFC-23 emissions scenarios (Reference Case, Less Mitigation and Best Practices) discussed in the main paper.

Table S1. HFC-23 emission projections for Reference Case (RC), Less Mitigation (LM) and Best Practices (BP) scenarios. Developed countries HFC-23 emissions, and developing countries HFC-23 production from HCFC-22 production for dispersive uses and feedstock uses are common components to all three scenarios. The RC and BP scenarios assume that CDM projects are renewed whereas the LM scenario assumes that CDMs are not renewed. Further, the BP scenario assumes that additional incineration is implemented globally to reduce emissions to virtually zero by 2020. Developed countries' HFC-23 emissions, developing countries' HFC-23 production from dispersive and feedstock production of HCFC-22, and CDM "non-released" amounts of HFC-23 for 1990-2008 are tabulated in Table 4 of Miller et al. (2010). Non-released HFC-23, which essentially equals the incinerated quantity, refers to that quantity produced in a given year by the CDM projects but not released to the atmosphere that same year, as defined by Miller et al. (2010). All quantities are given in ktonnes yr^{-1}.

Year	RC Global HFC-23 emissions	LM Global HFC-23 emissions	BP Global HFC-23 emissions	Developed countries HFC-23 emissions	Developing countries HFC-23 prod. from dispersive HCFC-22 Prod.	Developing countries HFC-23 prod. from feedstock HCFC-22 Prod.	CDM "non-released" HFC-23 if renewed	CDM "non-released" HFC-23 if no renewal	Additional HFC-23 incineration req'd for zero emissions
2009	9.13	9.13	9.13	1.37	10.92	5.09	8.26	8.26	0.00
2010	11.34	11.54	11.34	2.39	12.34	4.86	8.26	8.06	0.00
2011	13.29	13.49	13.29	2.40	13.76	5.39	8.26	8.06	0.00
2012	15.24	15.44	15.24	2.41	15.17	5.91	8.26	8.06	0.00
2013	12.24	12.55	12.18	2.42	11.63	6.43	8.26	7.94	0.06
2014	12.77	16.88	12.52	2.43	11.63	6.96	8.26	4.14	0.25
2015	11.89	17.84	11.30	1.83	10.47	7.48	7.90	1.94	0.58
2016	13.26	20.08	10.95	1.85	10.47	8.14	7.20	0.38	2.31
2017	13.99	20.81	3.47	1.87	10.47	8.79	7.15	0.33	10.52
2018	14.96	21.78	2.79	1.89	10.47	9.45	6.86	0.04	12.17
2019	15.67	22.49	1.91	1.91	10.47	10.10	6.82	0.00	13.76
2020	13.05	19.87	0.00	1.55	7.56	10.76	6.82	0.00	13.05

Table S1 (Con't.)

Year	RC Global HFC-23 emissions	LM Global HFC-23 emissions	BP Global HFC-23 emissions	Developed countries HFC-23 emissions	Developing countries HFC-23 prod. from dispersive HCFC-22 Prod.	Developing countries HFC-23 prod. from feedstock HCFC-22 Prod.	CDM "non-released" HFC-23 if renewed	CDM "non-released" HFC-23 if no renewal	Additional HFC-23 incineration req'd for zero emissions
2021	13.79	20.61	0.00	1.57	7.56	11.48	6.82	0.00	13.79
2022	14.54	21.35	0.00	1.59	7.56	12.20	6.82	0.00	14.54
2023	15.28	22.10	0.00	1.61	7.56	12.93	6.82	0.00	15.28
2024	16.22	22.84	0.00	1.63	7.56	13.65	6.62	0.00	16.22
2025	13.18	19.80	0.00	1.65	3.78	14.37	6.62	0.00	13.18
2026	13.93	20.55	0.00	1.67	3.78	15.10	6.62	0.00	13.93
2027	14.80	21.30	0.00	1.69	3.78	15.83	6.50	0.00	14.80
2028	19.35	22.06	0.00	1.71	3.78	16.56	2.71	0.00	19.35
2029	21.94	22.81	0.00	1.74	3.78	17.29	0.86	0.00	21.94
2030	20.05	20.05	0.00	1.74	0.29	18.02	0.00	0.00	20.05
2031	20.80	20.80	0.00	1.76	0.29	18.75	0.00	0.00	20.80
2032	21.56	21.56	0.00	1.78	0.29	19.48	0.00	0.00	21.56
2033	22.31	22.31	0.00	1.81	0.29	20.22	0.00	0.00	22.31
2034	23.07	23.07	0.00	1.83	0.29	20.95	0.00	0.00	23.07
2035	23.82	23.82	0.00	1.85	0.29	21.68	0.00	0.00	23.82

Table S2. Comparison of assumptions regarding Ottinger Schaefer et al. (2006) and this study.

Parameter	**Ottinger Schaefer et al. (2006)**	**This Study**
Developing countries HCFC-22 dispersive production.	Follows GDP until 2015, then decline linearly to 2040	(LM,RC,BP) Follows the 2006-2007 growth rate (+48.1 ktonnes yr^{-2}) until 2013, then freeze at baseline and subsequently follow the 2007 Montreal revised phase-out.
Developing countries HCFC-22 feedstock production.	Follows GDP (EIA 2001; World Bank 2001).`	(LM,RC,BP) Follows GDP (EIA, 2010).
Developing countries HFC-23 incineration	None	(LM) CDM projects not renewed. (RC) CDM projects renewed for full 21 yrs. (BP) CDM projects renewed and extended or replaced with an equivalent through 2030.
Developing countries HFC-23/HCFC-22 co-production ratio.	Decreases from 3% in 1998 to 2% by 2020.	(LM,RC,BP) Constant at mean (2006-2009) CDM value of 2.942%
Developed countries HCFC-22 dispersive production.	Goes to zero by 2015 or 2020 (country dependent).	(LM,RC) HCFC-22 production, HFC-23/HCFC-22 co-production ratio and HFC-23 incineration assumptions combined under assumed HFC-23 emissions, which are calculated as 2008 emissions (Miller et al., 2010) scaled by the ratio of total HCFC-22 production (P_i/P_{2008}). HCFC-22 dispersive production follows the 2007 Montreal revised schedule and feedstock production follows GDP (EIA, 2010). Assumes a constant fraction of incineration. (BP) Same as LM and RC except 100% abatement phased in over ~6 yrs.
Developed countries HCFC-22 feedstock production.	2.5% annual increase.	
Developed countries HFC-23 incineration.	100% abatement by 2020.	
Developed countries HFC-23/HCFC-22 co-production ratio.	2%	

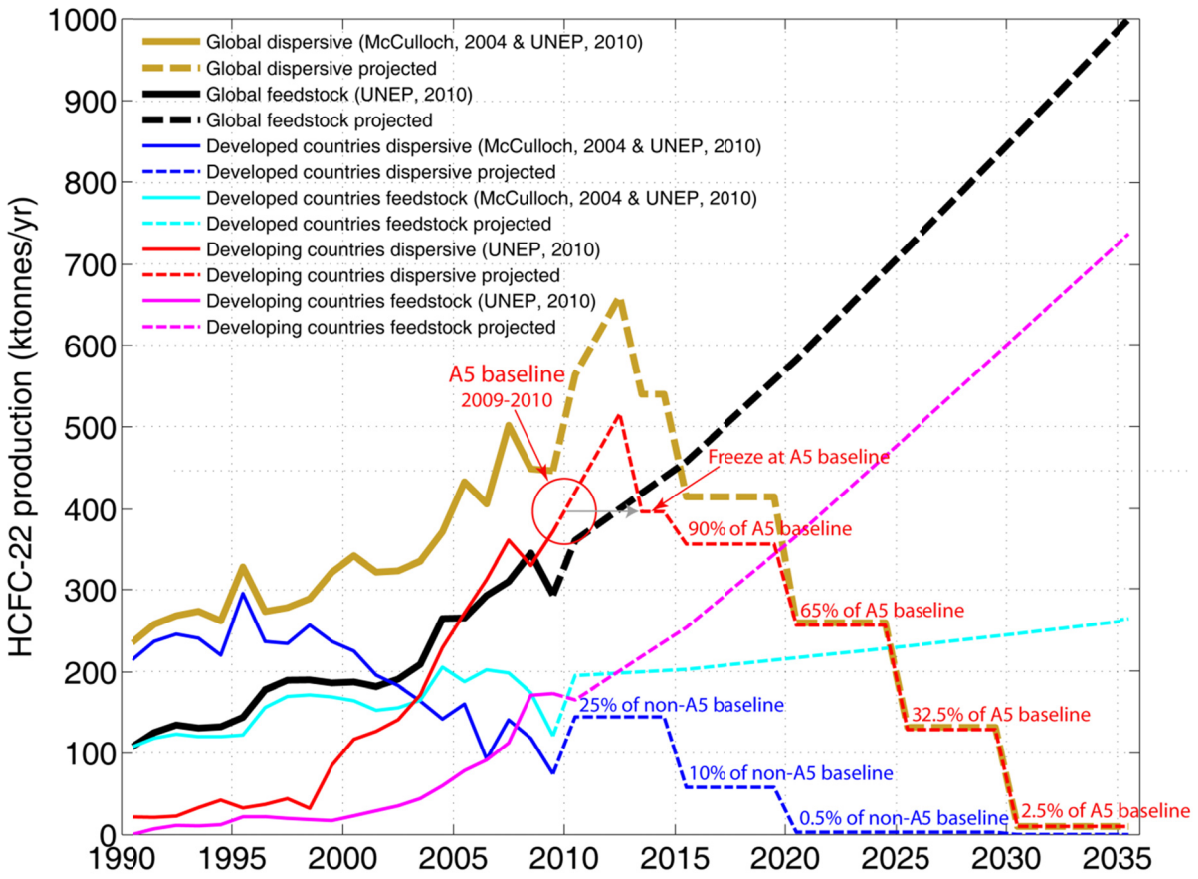

Figure S1. HCFC-22 production data of McCulloch (2004) and/or as reported to UNEP (2010) (both as tabulated in Miller et al., 2010) and the projections of HCFC-22 production used to create the Reference Case scenario in this study. Note that global feedstock production exceeds dispersive production by about 2015. The effect of the 2007 revisions to the Montreal Protocol, based on respective baselines for developed (non-A5) and developing (A5) countries, is illustrated to indicate the upper-limit of dispersive production. Developed countries baseline is defined as the 1989 ODP-weighted average production/consumption of the HCFCs plus 2.8% of the CFC production/consumption. Developing countries baseline is defined as the 2009/2010 ODP-weighted average production/consumption of the HCFCs. Note that feedstock projected growth is based on GDP projections (EIA, 2010) for developed countries and China, respectively.

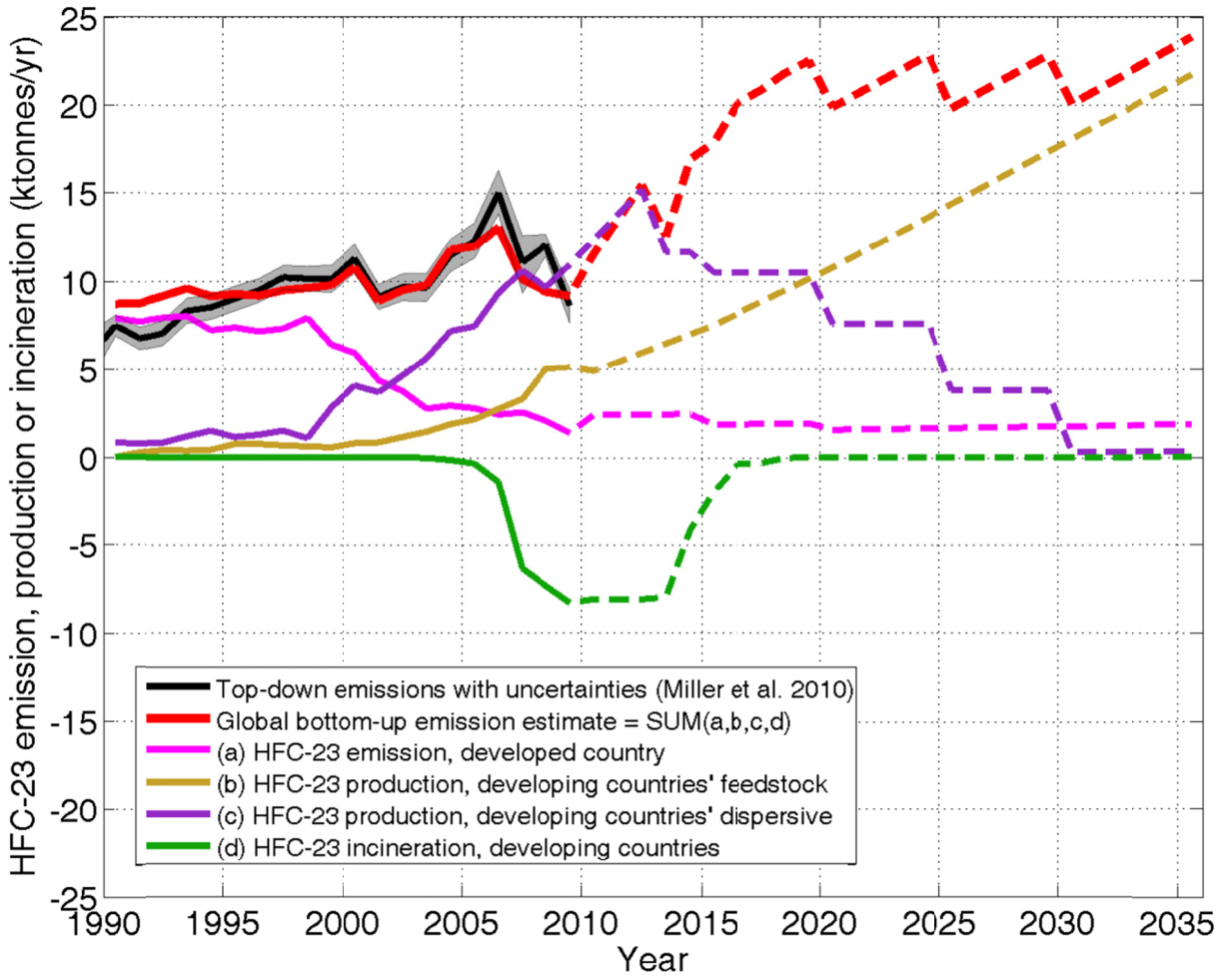

Figure S2. The Less Mitigation (LM) scenario, with the projection of global emissions shown as a thick red dashed line, and components depicted analogous to that for the Reference Case (RC) scenario in Fig. 1. Note that in the LM scenario, the 7-year accredited CDM projects are not renewed after their first period, causing global emissions to rise more quickly during 2013-2029 than in the RC scenario.

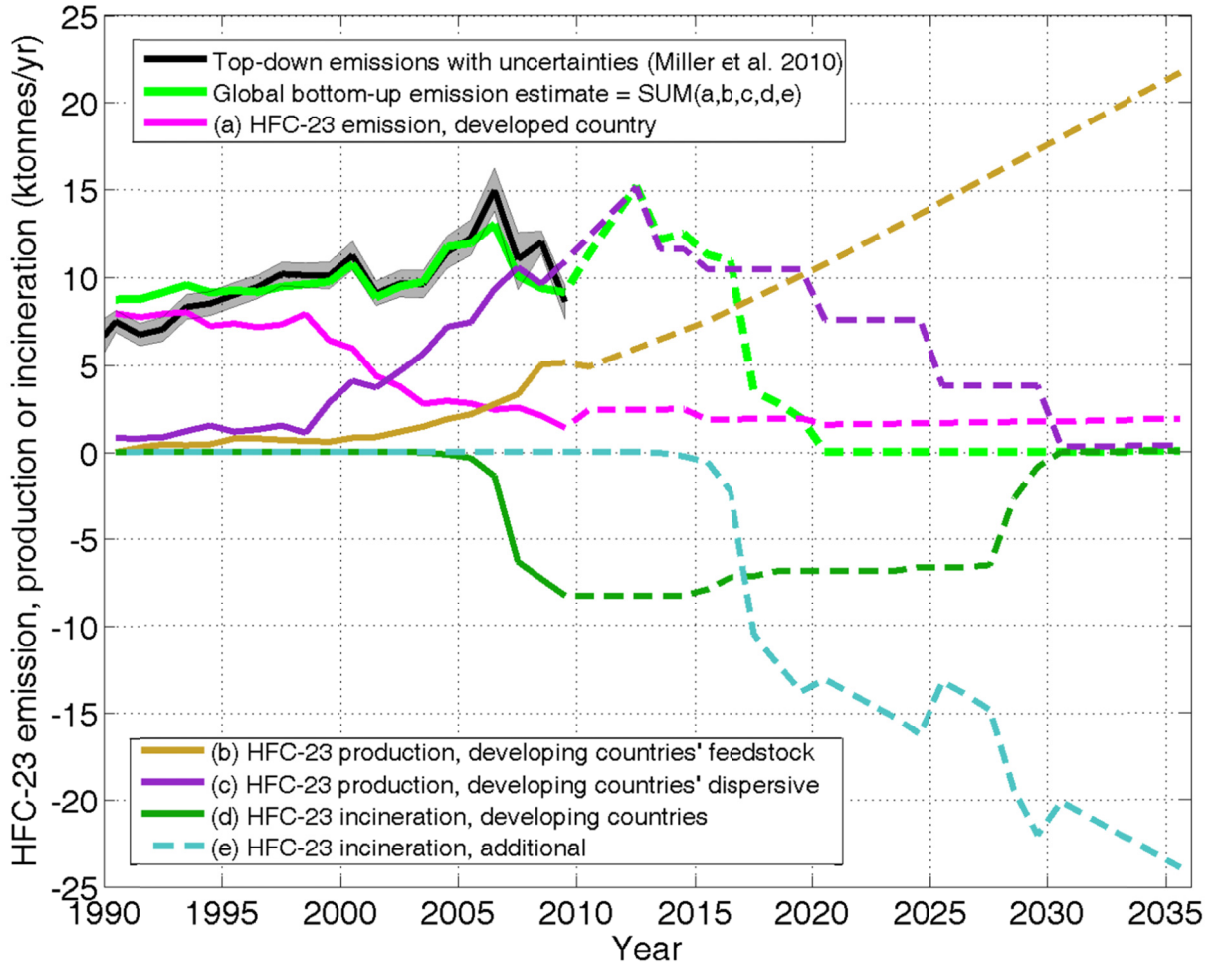

Figure S3. The Best Practices (BP) scenario, with the projection of global emissions shown as a thick light-green dashed line, and components depicted analogous to that for the Reference Case (RC) scenario in Fig. 1. Note that in the BP scenario, additional incineration capacity is implemented globally and must continue to grow at a rate sufficient to virtually eliminate all emissions from HCFC-22 production facilities as feedstock production grows. Analogous to the time lag observed in the implementation of the CDM projects, a similar time lag is assumed in implementing the additional incineration.

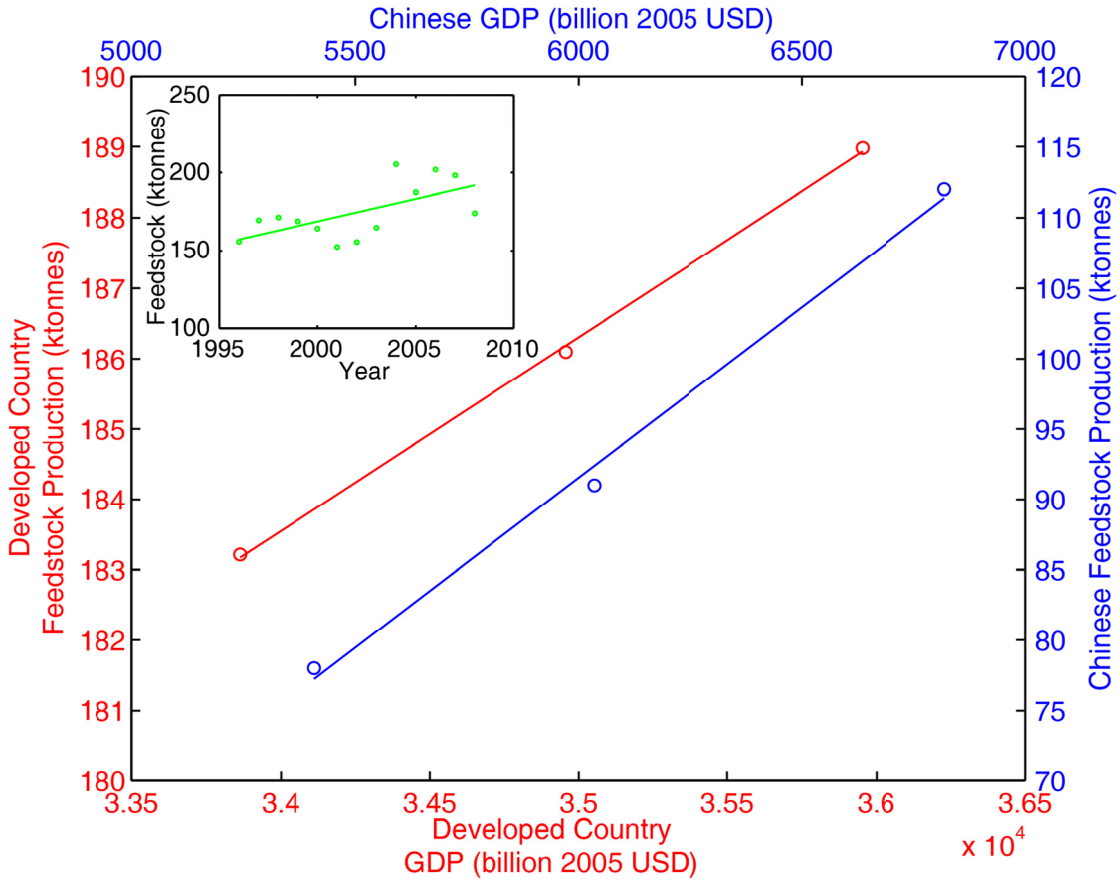

Figure S4. Correlation of Gross Domestic Product (EIA, 2010) for Developed Countries (left and lower axes in red) and China (right and upper axes in blue) with their respective HCFC-22 production for feedstock use (UNEP 2010) for years 2005-2007. Lines represent linear regressions to obtain factors for converting GDP projections into feedstock production projections. Feedstock data for China was regressed directly. However, for the Developed Countries, the feedstock data exhibited large interannual variations. Rather that limit the information derived for Developed Countries to only 2005-2007 (when GDP estimates were available), we chose to first perform a linear regression on the Developed Country feedstock time series (1996 – 2008, inset in green) to better characterize the long term trend. These regressed feedstock time series data were then used in the correlation with Developed Country GDP (red).

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