

# Emission trends and mitigation options for air pollutants in East Asia

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Table S 1 Penetrations of major control technologies for industrial process in China.

## (a) SO<sub>2</sub>

Industrial process	Control technology	Base year		BAU[0]/PC[0]		BAU[1]/PC[1]		BAU[2]/PC[2] 2030
		2005	2010	2020	2030	2020	2030	
Sintering	FGD	0	10	20	40	95	100	100
Coke oven	FGD for coal-charging process	0	0	0	0	10	10	0
	FGD for coke oven gas	0	0	0	0	10	10	0
	Combination of the technologies above	0	0	0	0	30	50	100
Glass production (float process)	FGD	0	0	0	0	50	90	100
Sulfuric acid production	Ammonia acid desulfurization method	0	0	0	0	40	80	100
Other industrial process	PRSO <sub>2</sub> (70% efficiency)	0	0	0	0	0	0	100

Notes: FGD, flue gas desulfurization; PRSO<sub>2</sub>, general SO<sub>2</sub> removal technology with 70% removal efficiency for industrial processes other than those listed above.

## (b) NO<sub>x</sub>

Industrial process	Control technology	Base year		BAU[0]/PC[0]		BAU[1]/PC[1]		BAU[2]/PC[2] 2030
		2005	2010	2020	2030	2020	2030	

Sintering	SNCR	0	0	0	0	36	54	20
	SCR	0	0	0	0	24	36	80
Precalciner cement kiln	LNB	30	35	35	35	30	25	0
	LNB+SNCR	0	0	0	0	30	45	0
	LNB+SCR	0	0	0	0	20	30	100
Glass production (float process)	OXFL	0	0	0	0	80	88	70
	SCR	0	0	0	0	10	12	30
Nitric acid (dual pressure process)	ABSP	10	12	12	12	18	18	18
	SCR	15	18	18	18	72	82	82
	ABSP+SCR	0	0	0	0	0	0	0
Nitric acid (other process)	ABSP	60	63	66	66	5	5	0
	SCR	30	32	34	34	15	15	0
	ABSP+SCR	0	0	0	0	80	80	100
Other industrial process	PRNOX (40% efficiency)	0	0	0	0	0	0	100

1 Notes: LNB, low-NO<sub>x</sub> burner; SCR, selective catalytic reduction; SNCR, selective non-catalytic reduction;  
2 ABSP, absorption method; OXFL, oxy-fuel combustion technology; PRNOX, general NO<sub>x</sub> removal  
3 technology with 40% removal efficiency for industrial processes other than those listed above.

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5 (c) PM

Industrial process	Control technology	Base year		BAU[0]/PC[0]		BAU[1]/PC[1]		BAU[2]/PC[2]
		2005	2010	2020	2030	2020	2030	2030
Sintering (flue gas)	CYC	5	0	0	0	0	0	0
	WET	20	5	0	0	0	0	0
	ESP	65	75	80	80	70	60	0
	HED	10	20	20	20	30	40	100
Sintering (fugitive)	CMN	80	60	50	50	30	10	0
	HIEF	20	40	50	50	70	90	100
Blast furnace (flue gas)	WET	100	100	100	100	100	100	100
	ESP	100	100	100	100	100	100	100
Blast furnace (fugitive)	CMN	0	0	0	0	0	0	0
	HIEF	100	100	100	100	100	100	100
Basic oxygen furnace	ESP	40	30	20	20	10	0	0
	HED	60	70	80	80	90	100	100
Electric arc furnace	WET	60	30	20	20	0	0	0
	ESP	30	50	50	50	40	20	0
	HED	10	20	30	30	60	80	100
Casting (flue gas)	CYC	40	40	40	40	0	0	0
	WET	40	40	40	40	40	20	0
	ESP	20	20	20	20	60	80	0
	HED	0	0	0	0	0	0	100
Casting (fugitive)	CMN	70	70	50	50	50	30	0

	HIEF	10	30	50	50	50	70	100
Hot rolling	ESP	0	0	0	0	70	95	100
Cold rolling	HED	0	0	0	0	70	95	100
Coke oven	WET	100	100	100	100	50	30	0
	HED	0	0	0	0	50	70	100
Alumina production	ESP	35	30	30	30	20	0	0
	HED	65	70	70	70	80	100	100
Electrolytic aluminium production	CYC	40	30	30	30	0	0	0
	ESP	40	60	60	60	80	40	0
	HED	0	10	10	10	20	60	100
Copper production	WET	5	0	0	0	0	0	0
	ESP	35	30	20	20	20	0	0
	HED	60	70	80	80	80	100	100
Shaft cement kiln	CYC	13	0	0	0	0	0	0
	WET	41	5	0	0	0	0	0
	ESP	40	60	50	50	45	35	0
	HED	6	35	50	50	55	65	100
Precalciner cement kiln	WET	1	0	0	0	0	0	0
	ESP	52	40	35	30	20	5	0
	HED	47	60	65	70	80	95	100
Other rotary cement kiln	WET	13	0	0	0	0	0	0
	ESP	77	50	50	50	40	30	0
	HED	10	50	50	50	60	70	100
Glass production	CYC	5	0	0	0	0	0	0
	WET	25	20	20	20	0	0	0
	ESP	68	75	75	75	85	75	0
	HED	3	5	5	5	15	25	100
Brick production	CYC	40	30	30	30	20	0	0
	WET	8	20	20	20	40	50	0
	ESP	0	20	20	20	40	50	0
	HED	0	0	0	0	0	0	100
Lime production	CYC	50	40	35	30	35	30	0
	WET	28	30	30	30	30	30	0
	ESP	8	20	25	30	25	30	0
	HED	3	10	10	10	10	10	100

1 Notes: CYC, cyclone dust collector; WET, wet scrubber; ESP, electrostatic precipitator; HED, high  
2 efficiency deduster; CMN, common control of fugitive emissions; HIEF, high-efficiency control of fugitive  
3 emissions.

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5 (d) NMVOC

Industrial process	Control technology	Base year		BAU[0]/PC[0]		BAU[1]/PC[1]		BAU[2]/PC[2] 2030
		2005	2010	2020	2030	2020	2030	
Hot rolling	No control	100	100	94	90	65	55	0
	Good housekeeping	0	0	6	10	35	45	100
Coke oven	No control	100	100	100	100	55	20	0

Refinery	End of pipe control measures	0	0	0	0	45	80	100
	No control	100	100	87	80	20	0	0
	Leak detection and repair program	0	0	10	15	30	15	0
	Covers on oil and water separators	0	0	3	5	10	5	0
Paint production	Combination of the above options	0	0	0	0	40	80	100
	No control	100	100	90	85	25	0	0
	Primary measures	0	0	10	15	45	50	5
	Primary and end of pipe measures	0	0	0	0	30	50	95
Adhesive production	No control	100	100	90	85	25	0	0
	Primary measures	0	0	10	15	45	50	5
	Primary and end of pipe measures	0	0	0	0	30	50	95
	No control	100	100	90	85	25	0	0
Ink production	Primary measures	0	0	10	15	45	50	5
	Primary and end of pipe measures	0	0	0	0	30	50	95
	No control	100	100	94	90	30	5	0
	Substitution	0	0	6	10	20	20	0
Synthesized rubber production	Incineration	0	0	0	0	30	35	0
	Combination of the above options	0	0	0	0	20	40	100
	No control	100	100	94	90	30	5	0
	Primary measures	0	0	6	10	35	45	0
Tyres production	Incineration	0	0	0	0	30	40	0
	Combination of the above options	0	0	0	0	5	10	100
	No control	100	100	94	90	30	5	0
	Primary measures	0	0	6	10	35	45	0
Production of other rubber products	Incineration	0	0	0	0	30	40	0
	Combination of the above options	0	0	0	0	5	10	100
	No control	100	100	94	90	30	5	0
	Primary measures	0	0	6	10	35	45	0
Plant oil extraction	Incineration	0	0	0	0	30	40	0
	Combination of the above options	0	0	0	0	5	10	100
	No control	95	90	84	80	20	0	0
	Activated carbon adsorption	5	10	13	15	50	50	0
Pharmacy	Schumacher type DTDC and activated carbon adsorption	0	0	3	5	25	35	0
	Schumacher type DTDC and new recovery section	0	0	0	0	5	15	100
	No control	100	100	90	85	15	0	0
	Primary measures and low-level end-of-pipe measures	0	0	10	15	50	30	0
Food industry	Primary measures and high-level end-of-pipe measures	0	0	0	0	35	70	100
	No control	100	100	100	100	100	100	40
	End of pipe control measures	0	0	0	0	0	0	60
	No control	100	100	100	100	100	100	0
Paper pulp production	End of pipe control measures	0	0	0	0	0	0	100
	No control	100	100	100	100	100	100	50
	Improved ignition system on flares	0	0	0	0	0	0	0
	Alternatives and increased recovery for venting	0	0	0	0	0	0	50
Crude oil exploitation	No control	100	100	100	100	100	100	0
	Leak detection and repair program	0	0	0	0	0	0	20

Gasoline storage	Flaring	0	0	0	0	0	0	30
	Add-on techniques mainly thermal and catalytic incineration	0	0	0	0	0	0	50
	No control	100	95	75	60	25	0	0
	IFC (Internal floating covers or secondary seals)	0	5	25	40	75	100	100
Gasoline loading and unloading service station	No control	100	85	50	50	25	0	0
	Stage IA (Vapor recovery systems and modified loading techniques)	0	15	50	50	75	100	100
	No control	100	85	50	50	25	0	0
	Stage IB + Stage II (Improvement in service station tank and vapor balancing system between a vehicle and service station tank)	0	15	50	50	75	100	100
Crude oil storage and distribution	No control	100	100	100	100	75	50	0
	IFC + Stage IA + Stage IB + Storage II	0	0	0	0	25	50	100

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2 Table S 2 Penetrations of major control technologies for NMVOC emissions from solvent use  
3 in China.

Solvent use type	Control technology	Base year		BAU[0]/PC[0]		BAU[1]/PC[1]		BAU[2]/PC[2]
		2005	2010	2020	2030	2020	2030	2030
Paint use in interior wall of buildings	No control (GB18582-2001)	100	0	0	0	0	0	0
	Decrease of solvent content--GB18582-2008	0	100	95	90	70	0	0
	Decrease of solvent content--2004/42/EC stage 1	0	0	5	10	30	80	0
	Decrease of solvent content--2004/42/EC stage 2	0	0	0	0	5	20	100
Paint use in external wall of buildings	No control (solvent-based paint)	81.5	78	72.5	68.5	70	50	0
	Substitution with water-based paint	18.5	22	27.5	32.5	30	50	100
Paint use in vehicle manufacturing	No control (water-based primer, solvent-based paint for other parts)	100	97	91	84	35	0	0
	Substitution with water-based paint	0	2	4	6	15	30	0
	Adsorption, incineration	0	1	5	10	40	65	0
	Substitution + adsorption, incineration	0	0	0	0	0	5	100
Paint use in vehicle refinishing	No control (solvent-based paint)	95	92.5	87.5	82.5	80	40	0
	Sustitution with high solids or water-based paint	5	7.5	12.5	17.5	20	60	100
Paint use in wood coating	No control (solvent-based paint)	93.5	89	79	69	50	15	0
	Incineration	0	0	2	4	15	25	20
	Substitution with high solids paint	2	4	8	12	15	25	20
	Substitution with water-based or UV paint	4.5	7	11	15	20	35	60
Paint use in coil coating	No control (solvent-based paint)	85	82.5	77.5	70	70	35	0
	Substitution with water-based paint	15	17.5	22.5	30	25	35	0

	Incineration	0	0	0	0	5	30	100
Paint use in marine coating	No control (solvent-based paint)	43.7	41	37	33	23	0	0
	Substitution with high solids paint	43.7	45	46	47	45	40	0
	Incineration	0	0	2	4	10	20	0
Paint use in container coating	High solids paint+incineration	0	0	0	0	5	20	60
	Substitution with water-based paint	12.6	14	15	16	17	20	40
	No control (solvent-based paint)	43.7	41	37	33	23	0	0
	Substitution with high solids paint	43.7	45	46	47	45	40	0
	Incineration	0	0	2	4	10	20	0
Paint use in other industrial protection	High solids paint+incineration	0	0	0	0	5	20	60
	Substitution with water-based paint	12.6	14	15	16	17	20	40
	No control (solvent-based paint)	87.4	85	79.5	72.5	50	5	0
	Substitution with high solids paint	0	1	3	5	15	20	0
	Incineration	0	0	2	4	10	30	0
Other paint use	High solids paint+incineration	0	0	0	0	5	20	60
	Substitution with water-based paint	12.6	14	17.5	22.5	20	25	40
	No control	100	97.5	92.5	87.5	90	80	50
	Substitution with high solids or water-based paint	0	2.5	7.5	12.5	10	20	50
	Offset printing	94	90	85	80	60	15	0
Flexography and rotogravure printing (for packaging)	Substitution with water-based or UV ink	6	10	15	20	20	30	10
	Add-on control technology	0	0	0	0	20	55	90
	No control (solvent-based ink)	70	64	55	45	30	0	0
	Substitution with low solvent or water-based ink	30	35	40	45	40	30	0
Flexography and rotogravure printing (for publication)	Add-on control technology	0	1	5	10	10	30	0
	Substitution + add-on control technology	0	0	0	0	20	40	100
	No control (solvent-based ink)	90	85	80	75	62.5	5	0
	Substitution with low solvent or water-based ink	10	15	20	25	22.5	40	0
Screen printing	Add-on control technology	0	0	0	0	15	50	0
	Substitution + add-on control technology	0	0	0	0	0	5	100
	No control (solvent-based ink)	90	85	80	75	62.5	5	0
	Substitution with low solvent or water-based ink	10	15	20	25	22.5	40	0
Adhesive use in wood processing	Add-on control technology	0	0	0	0	15	50	0
	Substitution + add-on control technology	0	0	0	0	0	5	100
	No control	100	97.5	92.5	87.5	90	60	0
	Add-on control technology	0	2.5	7.5	12.5	10	40	100
Adhesive use in manufacturing of shoes	No control (solvent-based adhesive)	90	87	82.5	80	70	50	10
	Substitution with low solvent adhesive	10	13	17.5	20	30	50	90
	Add-on control technology	0	0	0	0	0	0	0
	No control (solvent-based adhesive)	4	4	1	1	1	1	0
Other adhesive use	Substitution with water-based dispersion adhesive	68	68	69	59	70	50	40
	Substitution with UV adhesive	28	28	30	40	30	50	60
	No control (the 2005 status)	100	98	94	90	65	20	0
	Substitution with water-based paint	0	1	3	5	10	20	10

Application of pesticides	Add-on control technology	0	1	3	5	25	60	90
	No control (traditional pesticides)	82	65	60	55	60	35	0
	Substitution with environmental pesticides	18	35	40	45	40	65	100
Wood-protection (not creosote)	No control	100	97	88	70	75	20	0
	Substitution with water-based preservatives	0	3	7	15	10	30	50
	Incineration	0	0	5	15	15	50	50
Dry cleaning	No control (open dry cleaning machine)	100	80	50	15	0	0	0
	Refrigeration compressor	0	10	30	50	50	0	0
	Conventional closed circuit machine	0	5	15	30	40	80	0
	Hydrocarbon machine	0	3	5	5	5	5	10
Degreasing	New generation closed circuit machine	0	0	0	0	5	15	90
	No control	90	87.5	77.5	67.5	65	10	0
	Add-on control technology	0	0	5	10	15	50	10
	Substitution with low-solvent degreaser	10	12.5	17.5	22.5	20	40	90

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2 Table S 3 NMVOC emission factors for solvent use in 2005 and 2010

Activity	2005	2010
paint--interior wall (g/kg)	200	120
paint--external wall (g/kg)	597	580
paint--manufacturing of vehicle (g/kg)	470	460
paint--wood coating (g/kg)	662	637
adhesive--wood processing (g/kg)	90	88
adhesive--manufacturing of shoes (g/kg)	684	664
ink--offset-printing (g/kg)	683	658
ink--flexography and rotogravure in the packaging (g/kg)	555	515
ink--rotogravure in publication (g/kg)	695	668
ink--screen printing (g/kg)	695	668
solvent--leather production (g/kg)	245	224

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4 Table S 4 Provincial emissions in China during 2005-2030 (kt).

5 (a) NO<sub>x</sub>

	Base year		BAU[0]		BAU[1]		BAU[2]		PC[0]		PC[1]		PC[2]
	2005	2010	2020	2030	2020	2030	2030	2020	2030	2020	2030	2030	
Beijing	406	475	469	457	333	229	128	389	321	270	157	91	
Tianjin	306	408	456	494	242	202	124	369	339	196	138	88	
Hebei	1347	1622	2114	2302	1272	1037	595	1773	1673	1070	756	439	
Shanxi	838	1053	1350	1496	762	629	406	1093	1036	622	446	290	
Inner Mongolia	699	1160	1522	1699	753	616	465	1224	1166	613	443	316	
Liaoning	897	1145	1401	1555	875	738	412	1161	1111	722	527	304	
Jilin	462	639	682	781	417	370	211	581	587	350	271	158	
Heilongjiang	597	718	880	970	540	427	248	740	699	451	308	185	
Shanghai	412	468	592	651	328	276	173	478	443	272	198	125	
Jiangsu	1492	1748	2072	2224	1153	928	581	1708	1568	966	692	429	
Zhejiang	1076	1267	1541	1632	825	643	425	1264	1137	682	472	311	
Anhui	678	990	1211	1404	687	558	397	1034	1044	593	430	300	

Fujian	429	730	1023	1159	680	613	390	833	804	554	438	278
Jiangxi	356	499	617	735	412	350	235	532	542	352	262	175
Shandong	1968	2515	3006	3129	1956	1503	890	2453	2182	1587	1061	647
Henan	1400	1860	2159	2446	1367	1135	630	1819	1773	1144	818	489
Hubei	650	961	1092	1236	680	564	377	912	886	568	414	270
Hunan	635	840	1037	1210	647	563	335	886	905	555	430	253
Guangdong	1350	1763	2158	2399	1359	1132	743	1774	1646	1125	811	528
Guangxi	394	582	715	840	460	390	229	615	621	396	296	175
Hainan	62	93	116	137	73	58	38	101	101	63	44	28
Chongqing	265	461	524	609	341	292	178	444	444	290	219	131
Sichuan	598	978	1097	1271	751	606	399	933	911	627	432	278
Guizhou	424	517	689	807	386	336	279	556	547	318	242	182
Yunnan	358	516	633	752	402	345	191	532	546	339	258	143
Tibet	14	25	27	33	20	14	7	24	23	17	10	6
Shaanxi	459	682	861	1021	491	425	272	720	730	408	300	198
Gansu	316	456	594	699	341	294	183	501	514	285	211	137
Qinghai	60	90	101	115	64	52	33	85	81	53	36	22
Ningxia	183	302	395	457	193	174	106	318	317	156	123	79
Xinjiang	343	491	560	632	367	316	166	474	463	304	225	124
China	19477	26055	31694	35351	19176	15816	9847	26324	25159	15949	11469	7183

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2 (b) SO<sub>2</sub>

	Base year		BAU[0]		BAU[1]		BAU[2]	PC[0]		PC[1]		PC[2]
	2005	2010	2020	2030	2020	2030	2030	2020	2030	2020	2030	2030
Beijing	329	325	434	435	258	209	138	333	270	197	131	86
Tianjin	468	332	390	415	267	232	170	294	255	200	145	107
Hebei	1670	1164	1621	1731	1168	1003	701	1237	1099	886	633	436
Shanxi	1339	1023	1287	1353	944	832	650	957	812	701	503	389
Inner Mongolia	1082	1054	1328	1341	933	878	711	983	790	683	504	406
Liaoning	1143	954	1158	1229	727	658	419	903	801	565	438	279
Jilin	399	401	424	439	300	271	176	325	283	228	179	116
Heilongjiang	270	283	313	316	219	213	126	248	211	172	146	85
Shanghai	760	620	755	732	359	333	253	592	477	282	217	162
Jiangsu	1811	1185	1391	1445	997	872	600	1059	946	751	560	374
Zhejiang	2453	1592	1772	1606	1118	1003	774	1322	1003	830	633	485
Anhui	625	576	678	741	477	452	334	539	510	376	305	222
Fujian	521	555	695	695	467	417	305	519	431	349	263	191
Jiangxi	449	390	447	485	324	297	202	348	320	250	192	127
Shandong	3358	2465	2650	2687	1916	1599	1124	1970	1662	1428	996	693
Henan	1517	1187	1313	1382	951	827	567	1003	892	728	547	373
Hubei	1016	1182	1255	1364	888	765	562	974	877	686	477	341
Hunan	1004	849	1007	1103	746	649	463	777	712	574	418	291
Guangdong	1460	1259	1490	1517	1007	914	643	1125	947	764	581	404
Guangxi	762	798	1091	1208	795	641	449	872	837	642	480	354
Hainan	73	75	96	98	68	67	41	73	62	51	43	27
Chongqing	744	1201	1290	1467	975	805	604	996	938	751	499	366
Sichuan	1598	1709	1851	2056	1382	1198	919	1380	1236	1035	727	560
Guizhou	1323	954	1495	1777	1238	1262	1096	1180	1112	972	747	631
Yunnan	391	434	594	681	419	320	194	494	517	347	234	138
Tibet	3	5	7	9	5	6	4	6	6	4	4	3
Shaanxi	1006	727	907	973	704	671	521	696	592	527	411	323
Gansu	289	276	360	400	262	242	160	287	274	208	162	104
Qinghai	32	42	52	55	36	33	22	39	35	27	20	13



Ningxia	307	267	316	327	217	204	162	240	204	164	130	103
Xinjiang	500	540	607	616	418	351	227	462	380	314	225	148
China	28701	24423	29073	30684	20585	18226	13318	22236	19494	15694	11548	8335

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2 (c) PM<sub>10</sub>

	Base year		BAU[0]		BAU[1]		BAU[2]	PC[0]		PC[1]		PC[2]
	2005	2010	2020	2030	2020	2030	2030	2020	2030	2020	2030	2030
Beijing	193	128	157	149	120	100	65	121	106	98	71	47
Tianjin	146	151	164	156	131	108	70	129	111	104	73	49
Hebei	1319	1146	1258	1182	1018	823	513	1018	886	832	598	383
Shanxi	793	629	698	669	576	478	299	559	475	465	332	211
Inner Mongolia	485	554	590	548	481	388	222	449	368	368	255	149
Liaoning	653	610	647	590	530	422	251	500	425	417	297	186
Jilin	472	452	461	423	370	298	152	360	305	301	217	116
Heilongjiang	489	497	495	422	404	304	126	382	301	322	218	95
Shanghai	223	160	183	178	150	132	91	147	131	123	95	67
Jiangsu	1317	969	968	895	774	601	298	797	694	641	457	238
Zhejiang	831	485	514	491	376	303	166	428	386	321	234	139
Anhui	817	784	766	705	634	495	196	629	509	520	348	142
Fujian	341	302	325	315	251	203	109	268	236	209	150	87
Jiangxi	508	384	381	362	319	254	113	321	275	265	186	85
Shandong	1814	1397	1389	1269	1119	843	446	1106	958	898	622	339
Henan	1348	1149	1159	1099	931	716	322	976	856	788	548	253
Hubei	793	775	774	762	643	533	308	627	523	514	353	220
Hunan	842	701	731	701	594	489	234	611	533	505	370	180
Guangdong	975	713	716	684	559	450	215	592	507	467	331	173
Guangxi	625	588	582	551	492	375	174	503	425	423	287	148
Hainan	63	55	51	47	42	32	15	44	36	36	24	13
Chongqing	363	316	318	318	270	226	127	262	226	221	158	99
Sichuan	949	852	809	742	685	523	243	643	494	537	333	175
Guizhou	569	446	538	566	477	436	264	423	355	372	267	174
Yunnan	501	433	402	351	343	244	138	308	263	256	180	115
Tibet	9	10	9	8	8	6	2	8	7	7	5	2
Shaanxi	418	402	406	379	332	260	131	326	265	266	175	94
Gansu	265	245	256	239	210	166	84	204	168	168	112	59
Qinghai	60	63	64	60	48	36	22	50	41	36	24	15
Ningxia	132	119	132	132	101	86	47	106	96	81	63	36
Xinjiang	294	293	295	266	248	195	105	230	192	195	140	78
China	18609	15807	16238	15261	13237	10526	5546	13128	11153	10755	7522	4168

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4 (d) PM<sub>2.5</sub>

	Base year		BAU[0]		BAU[1]		BAU[2]	PC[0]		PC[1]		PC[2]
	2005	2010	2020	2030	2020	2030	2030	2020	2030	2020	2030	2030
Beijing	134	89	104	99	82	66	41	81	69	66	46	29
Tianjin	99	114	119	112	95	76	44	93	78	75	50	31
Hebei	942	861	911	848	725	556	307	738	628	586	395	226
Shanxi	547	471	509	483	387	290	139	406	337	309	195	97
Inner Mongolia	359	413	427	394	348	270	137	326	261	264	173	89
Liaoning	477	462	471	425	385	293	156	363	299	299	199	114
Jilin	349	341	334	303	275	212	95	261	211	220	148	70
Heilongjiang	383	397	380	320	318	230	79	292	219	250	158	58
Shanghai	152	112	124	121	98	83	53	101	90	81	60	39

Jiangsu	936	703	684	624	556	417	184	563	477	458	311	145
Zhejiang	545	327	339	323	254	197	98	284	251	216	150	82
Anhui	611	609	575	518	492	371	127	466	358	397	250	88
Fujian	232	216	225	215	178	138	67	185	158	146	100	53
Jiangxi	339	261	255	239	212	160	69	212	175	173	112	51
Shandong	1245	1026	998	903	809	580	285	795	670	645	418	214
Henan	929	847	833	780	670	484	201	699	597	562	363	158
Hubei	566	569	553	535	466	371	191	440	351	365	234	131
Hunan	602	510	512	484	426	338	143	426	358	358	249	107
Guangdong	668	507	486	456	388	297	131	399	328	320	211	104
Guangxi	474	456	437	404	371	267	112	373	301	314	195	94
Hainan	49	43	38	35	32	24	10	33	25	27	17	8
Chongqing	274	233	229	224	195	156	78	185	151	155	102	58
Sichuan	751	668	619	554	529	387	154	481	347	404	228	105
Guizhou	439	353	410	424	362	319	178	319	255	278	185	112
Yunnan	375	329	295	253	252	172	85	225	182	187	121	70
Tibet	7	8	7	6	6	4	2	6	5	5	3	1
Shaanxi	300	311	305	278	250	186	77	241	187	196	120	54
Gansu	198	193	195	179	161	122	57	154	122	127	80	39
Qinghai	45	48	48	45	36	26	14	38	31	27	17	10
Ningxia	93	84	91	90	68	56	26	72	65	54	40	20
Xinjiang	222	225	221	197	187	141	66	172	138	146	99	48
China	13343	11786	11736	10872	9612	7290	3408	9428	7725	7711	5028	2502

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## 2 (e) NMVOC

	Base year		BAU[0]		BAU[1]		BAU[2]	PC[0]		PC[1]		PC[2]
	2005	2010	2020	2030	2020	2030	2030	2020	2030	2020	2030	2030
Beijing	343	371	421	483	349	286	184	384	409	318	239	148
Tianjin	213	295	369	419	306	280	191	338	357	279	234	158
Hebei	1156	1439	1616	1749	1261	1086	747	1470	1493	1133	900	620
Shanxi	560	640	686	719	568	483	340	584	542	484	365	262
Inner Mongolia	397	569	605	637	492	427	278	526	509	420	320	205
Liaoning	691	905	1230	1369	1062	937	596	1128	1170	973	793	491
Jilin	376	459	509	573	468	431	232	455	480	418	357	189
Heilongjiang	502	576	619	643	564	498	292	540	512	491	393	233
Shanghai	397	541	904	1023	751	631	368	867	935	721	574	321
Jiangsu	1658	1933	2267	2483	1985	1741	957	2067	2148	1804	1483	809
Zhejiang	1058	1586	1940	2091	1542	1234	800	1832	1900	1447	1103	704
Anhui	849	1041	1083	1132	1017	920	527	930	876	868	691	416
Fujian	449	633	772	878	707	641	400	724	785	663	571	349
Jiangxi	384	459	519	598	472	445	299	474	507	430	377	256
Shandong	1659	2254	2772	3184	2346	2147	1263	2539	2774	2141	1850	1065
Henan	1107	1360	1487	1635	1328	1217	714	1333	1372	1183	1006	594
Hubei	698	910	999	1101	908	839	549	877	878	791	649	436
Hunan	651	757	822	920	758	718	449	751	785	691	607	377
Guangdong	1573	1601	1923	2203	1670	1512	979	1796	1924	1556	1311	837
Guangxi	663	736	763	846	709	662	356	688	704	636	542	299
Hainan	98	133	174	216	159	158	99	163	188	150	140	87
Chongqing	387	403	431	465	392	340	205	368	352	332	245	156
Sichuan	1285	1279	1303	1330	1199	1061	610	1078	957	981	727	451
Guizhou	362	350	405	461	383	394	261	330	303	312	250	170
Yunnan	424	434	403	431	369	334	217	348	352	323	270	180

Tibet	11	16	16	18	14	12	8	14	14	12	10	7
Shaanxi	338	472	495	538	438	386	261	433	419	381	296	202
Gansu	198	247	266	294	239	226	160	231	226	207	172	123
Qinghai	43	53	57	62	52	48	34	49	47	44	36	26
Ningxia	81	82	81	88	71	63	42	71	69	61	49	32
Xinjiang	279	327	359	385	320	297	201	316	306	283	238	159
China	18889	22860	26295	28974	22900	20457	12621	23704	24297	20534	16796	10367

Table S 5 Results of the uncertainty analysis of the emissions in East Asia during 2005-2010. The numbers in the table except the last line are the coefficients of variation (CVs). The last line shows the average 90% confidence intervals of the total emissions during 2005-2010.

		NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>2.5</sub>	NMVOC
power plants	range of CVs during 2005-2010	± 33%-± 35%	± 29%-± 31%	± 30%-± 32%	--
	average CV	± 34%	± 30%	± 31%	--
industrial sector	range of CVs during 2005-2010	± 39%-± 44%	± 47%-± 51%	± 49%-± 57%	± 62%-± 64%
	average CV	± 41%	± 49%	± 53%	± 63%
residential sector	range of CVs during 2005-2010	± 55%-± 56%	± 49%-± 53%	± 67%-± 69%	± 61%-± 69%
	average CV	± 55%	± 51%	± 68%	± 65%
transportation sector	range of CVs during 2005-2010	± 63%-± 70%	± 47%-± 49%	± 52%-± 53%	± 53%-± 60%
	average CV	± 66%	± 48%	± 52%	± 57%
solvent use sector	range of CVs during 2005-2010	--	--	--	± 74%-± 81%
	average CV	--	--	--	± 78%
other sectors (mainly biomass open burning) <sup>a</sup>	range of CVs during 2005-2010	± 172%-± 183%	± 163%-± 196%	± 212%-± 220%	± 183%-± 186%
	average CV	± 177%	± 179%	± 216%	± 184%
total emissions	range of CVs during 2005-2010	± 23%-± 26%	± 25%-± 30%	± 37%-± 40%	± 41%-± 43%
	average CV	± 25%	± 28%	± 39%	± 42%
	average 90% confidence interval	[-31%, 44%]	[-29%, 45%]	[-39%, 49%]	[-42%, 67%]

<sup>a</sup> "Other sectors" represent biomass open burning for NO<sub>x</sub>, SO<sub>2</sub>, and PM<sub>2.5</sub>; for NMVOC, they include biomass open burning, waste treatment, cooking, and smoking, with biomass open burning contributing over 80% of the total NMVOC emissions from these sources.