Dominant role of emission reductions in $PM_{2.5}$ air quality improvement in Beijing during 2013-2017: a model-based decomposition analysis

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Supporting information

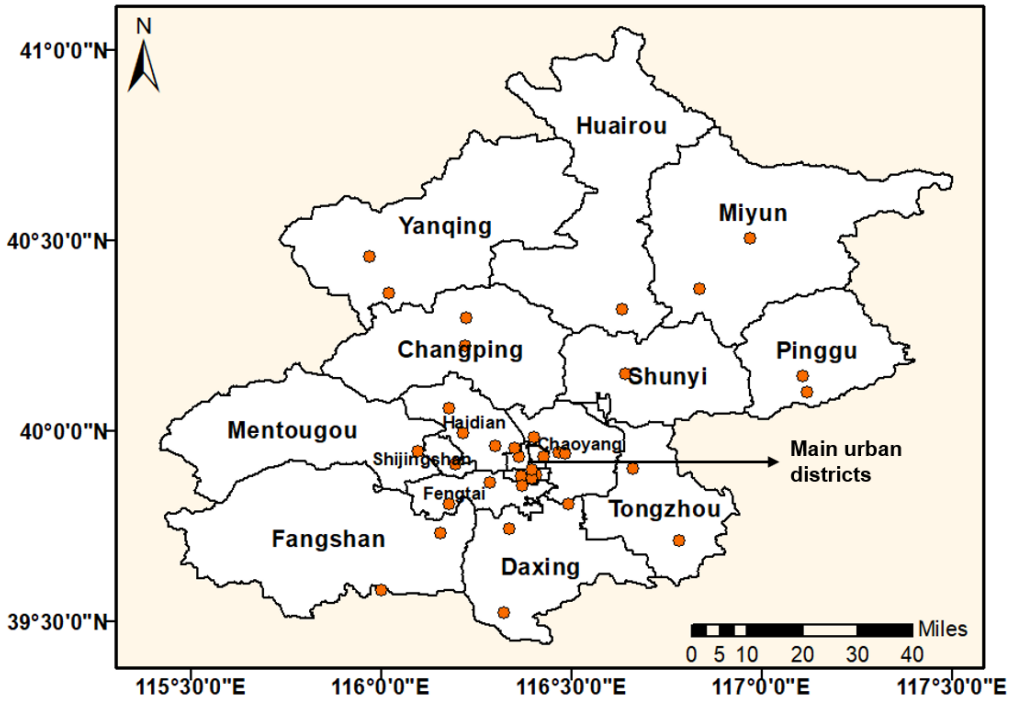
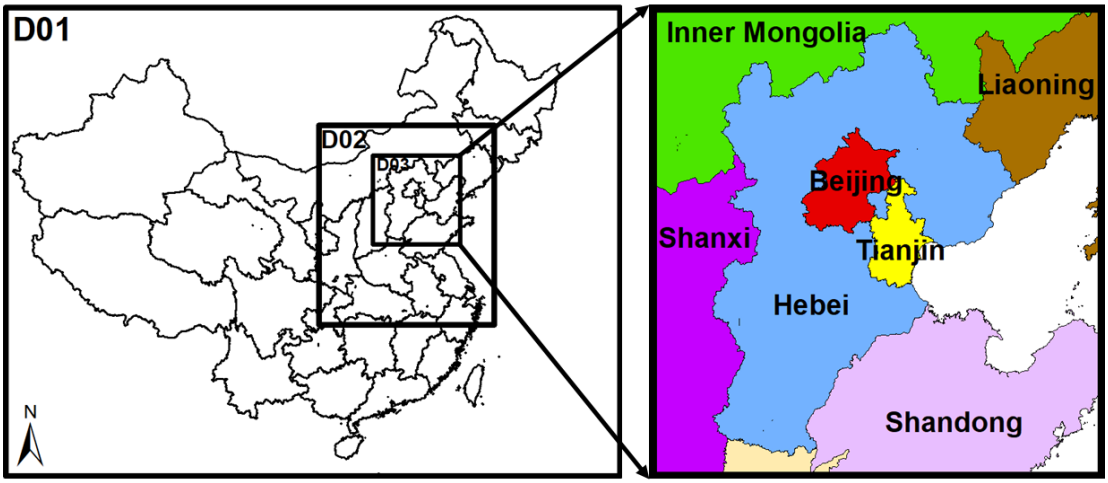


Figure S1. Automatic ambient air quality monitoring system in Beijing, including 35 stations.



FigureS2. Three nested modeling domains for the research, with the first domain covering the whole China, the second domain covering the most east and north of China, the third domain covering Beijing and its surroundings.

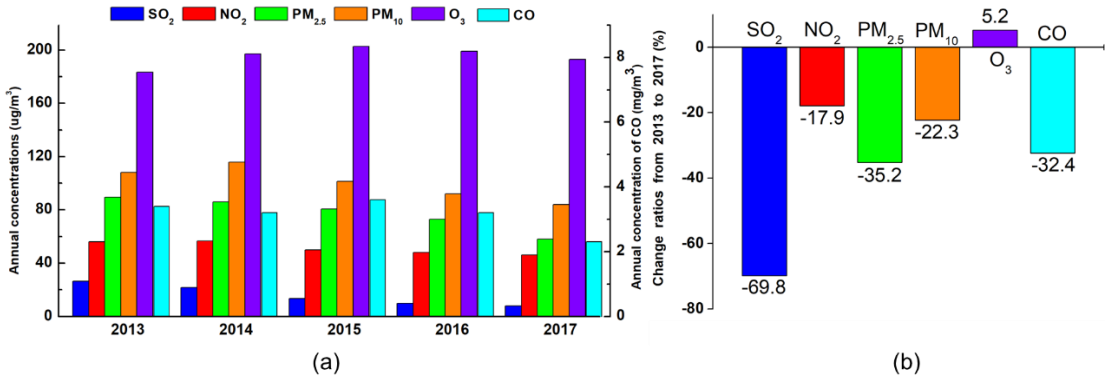


Figure S3 (a). The annual concentrations of major air pollutants, including SO_2, NO_x, $PM_{2.5}$, PM_{10}, O_3, CO in Beijing during 2013 to 2017. The annual concentration of each air pollutant per year is calculated by the annual average observation data from the 35 observation stations in Beijing. (b). The relative change rates of Beijing's air pollutants annual concentration during 2013 to 2017: -69.8% for SO_2, -17.9% for NO_x, -35.2% for $PM_{2.5}$, -22.3% for PM_{10}, +5.2% for O_3, -32.4% for CO.

Table S1, (a). Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulation for 41 stations in D03 region in 2017.

Variable	Month	Mean_obs	Mean_sim	Sample	Corr	MB	ME	RMSE	NMB(%)	NME(%)
Temperature	1	268.9	268.3	11573	0.97	-0.6	1.1	1.4	-0.2	0.4
	2	272.8	271.8	10835	0.97	-1	1.3	1.5	-0.4	0.5
	3	278.4	278	11995	0.95	-0.4	0.8	1.3	-0.1	0.3
	4	287.2	287.1	11604	0.94	-0.1	0.7	1.2	0	0.3
	5	293.5	293.7	11973	0.93	0.2	0.7	1.2	0.1	0.3
	6	296	296.8	11487	0.93	0.9	1	1.5	0.3	0.3
	7	299	299.9	11997	0.92	0.9	1.1	1.4	0.3	0.4
	8	296.8	297	11801	0.94	0.2	0.7	1.1	0.1	0.2
	9	293.3	293.3	11561	0.94	0.1	0.8	1.2	0	0.3
	10	284.1	285.4	11993	0.97	1.3	1.3	1.6	0.5	0.5
	11	275.7	277.1	11578	0.98	1.3	1.4	1.7	0.5	0.5
	12	270.1	270.4	11957	0.98	0.3	0.8	1.1	0.1	0.3
Relative humidity	1	56.5	55.4	11571	0.64	-1.2	8.3	9.8	-2.1	14.7
	2	46.6	50.4	10828	0.67	3.8	6	7.4	8.2	12.8
	3	44.8	44.1	11964	0.52	-0.6	5.3	6.4	-1.4	11.8
	4	42.1	40.1	11587	0.86	-2	4.6	6	-4.8	11
	5	44.2	39.6	11949	0.85	-4.5	5.5	7	-10.3	12.5
	6	54.7	48.6	11463	0.75	-6.1	7	8.1	-11.1	12.9
	7	71.9	64.2	11996	0.82	-7.7	8.2	9.3	-10.7	11.3
	8	73.4	69.9	11791	0.81	-3.5	5.2	6.1	-4.7	7
	9	62.1	58.5	11552	0.74	-3.6	6.2	7.7	-5.8	9.9

	10	68.2	56.8	11981	0.56	-11.4	11.5	13.3	-16.8	16.8
	11	45.9	38.5	11574	0.5	-7.4	7.9	9.7	-16	17.3
	12	45.9	43.4	11956	0.71	-2.4	4.4	5.7	-5.3	9.7
Wind Speed	1	2.6	3.2	11003	0.61	0.6	0.9	1.1	23.2	33.6
	2	3	3.7	10435	0.57	0.7	1	1.2	24.1	32.5
	3	2.9	3.5	11639	0.4	0.6	0.8	0.9	19.3	26.6
	4	3.2	3.9	11317	0.5	0.6	0.9	1.1	19.4	27.7
	5	3.3	4	11707	0.46	0.7	1	1.1	20.1	28.8
	6	2.7	3.2	11134	0.36	0.5	0.8	0.9	19.6	28.4
	7	2.5	2.9	11583	0.41	0.4	0.7	0.9	16.5	28.6
	8	2.3	2.6	11487	0.48	0.3	0.6	0.7	14.2	25.3
	9	2.4	2.9	11259	0.6	0.5	0.8	0.9	22.8	31.3
	10	2.3	3	11360	0.48	0.7	0.9	1.1	31.8	41.6
	11	3	3.9	11280	0.66	0.9	1.2	1.4	30.2	39.1
	12	2.8	3.5	11717	0.71	0.7	1	1.2	26.1	36.1
Wind direction	1	211.6	206.4	10156	0.6	-5.2	28.3	35.1	-2.4	13.4
	2	214.2	217.6	9613	0.66	3.4	22.4	29.9	1.6	10.4
	3	208.9	207.3	10573	0.64	-1.6	20.1	25.9	-0.7	9.6
	4	210.2	212.8	10069	0.67	2.6	15.5	21.9	1.2	7.4
	5	197.9	195.5	10404	0.56	-2.4	16.3	21.5	-1.2	8.2
	6	181.8	174.4	9810	0.59	-7.3	15.9	19.8	-4	8.7
	7	179.6	167.5	10243	0.57	-12.1	18.5	22.4	-6.7	10.3
	8	194.2	178.4	10079	0.61	-15.8	22.7	28.4	-8.1	11.7
	9	202.4	192.8	9951	0.68	-9.6	18.7	24.4	-4.7	9.2
	10	197.7	173	10125	0.58	-24.6	29.6	36.7	-12.5	15

	11	221.7	218.4	10164	0.82	-3.4	17.7	22.9	-1.5	8
	12	231.2	228.4	10549	0.69	-2.8	19.5	24.5	-1.2	8.4

Table S1, (b). Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulation for 41 stations in D03 region in 2016.

Variable	Month	Mean_obs	Mean_sim	Sample	Corr	MB	ME	RMSE	NMB(%)	NME(%)
Temperature	1	265.8	265.2	11969	0.97	-0.6	1.2	1.7	-0.2	0.5
	2	271.2	269.7	11059	0.96	-1.6	1.9	2.3	-0.6	0.7
	3	279.5	278.5	11786	0.95	-1.1	1.4	1.8	-0.4	0.5
	4	287.1	287.4	11515	0.95	0.3	0.8	1.1	0.1	0.3
	5	291.3	292.6	11976	0.93	1.2	1.4	1.7	0.4	0.5
	6	295.7	296.8	11591	0.95	1.1	1.2	1.5	0.4	0.4
	7	298	298.5	11992	0.94	0.5	0.7	1.1	0.2	0.2
	8	297.4	297.8	11969	0.94	0.4	0.8	1.1	0.1	0.3
	9	292.5	292.8	11597	0.96	0.3	0.8	1.2	0.1	0.3
	10	284.8	286	11997	0.98	1.2	1.2	1.4	0.4	0.4
	11	276	277	11135	0.98	1	1.1	1.3	0.4	0.4
	12	271.3	271.5	11996	0.97	0.2	0.9	1.1	0.1	0.3
Relative humidity	1	50.7	51.4	11963	0.7	0.7	7.9	9.5	1.3	15.6
	2	45.6	52.1	11046	0.75	6.5	8.6	11.1	14.4	18.8
	3	40.3	41	11743	0.79	0.7	5.4	6.6	1.8	13.3
	4	44.2	39.4	11467	0.82	-4.8	5.9	7.4	-10.8	13.4
	5	48.4	40.4	11960	0.73	-8	8.2	9.6	-16.5	16.9
	6	59.1	51.2	11584	0.83	-7.9	7.9	8.9	-13.4	13.4
	7	73.9	68	11992	0.78	-5.9	6.1	6.9	-7.9	8.3

	8	71.8	65.7	11967	0.83	-6.1	6.7	8.2	-8.5	9.3
	9	66.6	60.8	11590	0.78	-5.8	6.7	8.2	-8.7	10
	10	68.3	57.8	11994	0.79	-10.5	10.6	11.8	-15.4	15.4
	11	62.1	53.4	11133	0.72	-8.6	9.5	11.7	-13.9	15.3
	12	62.6	57.7	11993	0.63	-4.9	10	11.9	-7.8	16
Wind Speed	1	2.9	3.5	11548	0.62	0.6	0.9	1.1	20.8	30.4
	2	3.2	4	10748	0.66	0.8	1	1.2	23.6	30.7
	3	3.1	3.7	11438	0.5	0.6	0.9	1	19.4	27.5
	4	3.4	4	11241	0.43	0.7	0.9	1.1	20.2	27.9
	5	3.3	3.9	11664	0.52	0.5	0.9	1.1	16.5	26.7
	6	2.8	3.3	11297	0.35	0.6	0.8	0.9	20.2	28.4
	7	2.4	2.9	11510	0.31	0.5	0.7	0.9	19.7	29.5
	8	2.3	2.8	11418	0.41	0.5	0.7	0.8	19.5	28.7
	9	2.3	2.7	10949	0.49	0.4	0.6	0.8	17	27.4
	10	2.6	3.4	11325	0.45	0.8	1.1	1.2	31.5	40.6
	11	2.7	3.6	10556	0.64	0.8	1	1.2	30	38.3
	12	2.4	3.1	11262	0.61	0.7	0.9	1.1	27.6	38.1
Wind direction	1	218.7	211.6	10703	0.72	-7.1	25.6	35.6	-3.2	11.7
	2	232.6	233	9939	0.57	0.4	24.3	32	0.2	10.4
	3	206.1	202.7	10439	0.56	-3.3	21.8	30.5	-1.6	10.6
	4	197.6	192.4	10224	0.69	-5.2	17.2	23.6	-2.6	8.7
	5	205.4	199.4	10546	0.46	-6	17.1	22.3	-2.9	8.3
	6	193.2	191.3	10125	0.35	-1.9	17.9	26.1	-1	9.3
	7	175.4	168.3	10415	0.49	-7.1	16.2	22.5	-4	9.2
	8	188.9	166.9	10320	0.28	-22	27.1	37.5	-11.7	14.3

	9	195.1	184.1	9880	0.47	-11	22.5	32.5	-5.7	11.5
	10	191.8	178.7	10290	0.6	-13.1	22.1	30.4	-6.8	11.5
	11	204.3	197.5	9599	0.68	-6.8	21.3	27.3	-3.3	10.4
	12	209	202	10324	0.58	-7	27.8	36.7	-3.3	13.3

Table S1, (c). Descriptive Statistic of the comparison of the hourly observational temperature, relative humidity, wind speed, wind direction and WRF model simulation for 41 stations in D03 region in 2013.

Variable	Month	Mean_obs	Mean_sim	Sample	Corr	MB	ME	RMSE	NMB(%)	NME(%)
Temperature	1	266.4	264.6	11986	0.96	-1.8	2.2	2.6	-0.7	0.8
	2	269.9	268.2	10824	0.96	-1.7	2	2.7	-0.6	0.7
	3	277.8	277.5	11988	0.96	-0.4	1	1.4	-0.1	0.3
	4	282.8	283.1	11602	0.96	0.2	0.6	1.1	0.1	0.2
	5	292.5	292.7	11951	0.92	0.2	0.6	1	0.1	0.2
	6	295.4	296.6	11592	0.94	1.2	1.2	1.6	0.4	0.4
	7	297.9	298.8	12076	0.95	0.9	1	1.3	0.3	0.3
	8	297.9	298.3	11885	0.95	0.3	1	1.3	0.1	0.3
	9	291.9	292.3	11586	0.96	0.5	0.9	1.2	0.2	0.3
	10	284.7	285.8	11986	0.97	1.1	1.2	1.5	0.4	0.4
	11	276.8	277.4	11578	0.97	0.7	0.9	1.2	0.2	0.3
	12	270.1	270.1	11958	0.97	0	0.9	1.2	0	0.3
Relative humidity	1	64.7	70.4	11986	0.53	5.7	9.2	10.9	8.9	14.3
	2	58.1	64.7	10820	0.72	6.6	14.2	18.4	11.4	24.5
	3	46.1	46.1	11981	0.78	0	11.2	14.8	0	24.3
	4	44.4	41.2	11587	0.83	-3.2	9.8	13.7	-7.3	22.1
	5	50.8	45.7	11945	0.87	-5.1	10.2	13.9	-10	20

	6	66.5	57	11590	0.81	-9.5	12.8	16.3	-14.3	19.3
	7	74.3	65.2	12071	0.84	-9.1	11.4	14.3	-12.3	15.3
	8	69.1	64	11884	0.78	-5.1	10.4	13.5	-7.3	15.1
	9	67	60.9	11577	0.82	-6.1	10.6	14.1	-9.2	15.8
	10	59.7	49.9	11984	0.79	-9.8	12.9	16.9	-16.4	21.6
	11	49.4	44	11573	0.8	-5.4	11	14.9	-10.9	22.3
	12	49.1	46.6	11952	0.73	-2.5	11.1	14.8	-5	22.6
Wind Speed	1	2.3	2.9	11987	0.62	0.6	0.9	1.2	26.2	38.2
	2	2.7	3.3	10824	0.62	0.5	1.5	1.9	19.2	32.4
	3	3.3	4	11989	0.49	0.6	1.6	2.1	19.1	34.2
	4	3.6	4.2	11602	0.47	0.6	1.6	2.1	16.3	31.4
	5	3.2	3.8	11954	0.47	0.6	1.5	2	19	33.8
	6	2.8	3.4	11593	0.43	0.6	1.5	1.9	23.2	38.1
	7	2.2	2.7	12077	0.43	0.5	1.3	1.7	22.3	38.3
	8	2.4	2.8	11386	0.54	0.3	1.2	1.7	14	31.5
	9	2.3	2.7	10952	0.53	0.4	1.2	1.6	19	34.7
	10	2.4	3.1	11154	0.52	0.7	1.4	1.8	27.9	42.8
	11	2.9	3.7	10838	0.68	0.9	1.6	2	29.5	41.2
	12	2.7	3.4	11102	0.67	0.7	1.5	1.9	25.7	39.3
Wind direction	1	207.3	198.8	10921	0.67	-8.5	29	38	-4.1	14
	2	200.4	192.7	10195	0.82	-7.7	20.8	29.9	-3.9	10.4
	3	191.3	188.2	11463	0.84	-3.1	16.4	22.2	-1.6	8.6
	4	204.4	203.4	11170	0.86	-1	11.4	15.1	-0.5	5.6
	5	185.2	181.3	11415	0.8	-3.9	12.3	16.1	-2.1	6.6
	6	178.5	170	11010	0.64	-8.5	16	20.4	-4.8	9

7	191.9	185.5	11157	0.53	-6.5	16.8	22.4	-3.4	8.8
8	194.8	192.1	10491	0.7	-2.7	15.4	20.3	-1.4	7.9
9	191.6	182.4	10044	0.73	-9.2	16.8	22.3	-4.8	8.7
10	202	193.9	10242	0.67	-8.2	19.7	26.9	-4	9.7
11	235.9	244.5	10058	0.74	8.6	17.8	22.5	3.6	7.5
12	227.1	234.3	10312	0.7	7.2	22.1	30.1	3.2	9.7

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Table S2. Descriptive Statistic of the comparison of the hourly observational SO_2, NO_2, CO, O_3, $PM_{2.5}$, PM_{10} and CMAQ model simulation for 12 national stations in Beijing in 2017.

Variable	Month	Mean_obs	Mean_sim	Corr	MB	ME	RMSE	NMB(%)	NME(%)
SO_2	1	19.29	31.90	0.61	12.61	14.48	23.78	61.67	61.39
	2	18.78	23.10	0.83	4.32	6.33	11.87	38.96	49.70
	3	11.59	11.76	0.85	0.17	3.31	4.51	1.45	28.55
	4	7.41	6.87	0.81	-0.54	2.18	3.10	-7.30	29.46
	5	7.44	6.81	0.71	-0.63	2.55	3.40	-8.41	34.30
	6	6.62	6.18	0.59	-0.43	2.60	3.57	-6.56	39.24
	7	3.05	5.29	0.45	2.24	3.35	3.85	56.09	59.77
	8	2.71	4.94	0.45	2.24	3.35	4.33	69.59	64.00
	9	4.05	8.64	0.51	4.59	6.71	8.32	72.79	75.85
	10	3.38	8.32	0.34	4.94	7.33	9.83	75.35	76.87
	11	6.00	11.24	0.46	5.23	10.23	12.72	60.50	60.50
	12	8.37	14.02	0.75	5.65	9.71	12.82	55.23	56.02
NO_2	1	67.34	77.19	0.66	9.85	25.95	29.94	14.63	38.54
	2	54.17	63.14	0.72	8.97	19.33	21.94	22.10	35.68
	3	50.47	52.21	0.87	1.74	8.12	9.25	3.45	16.08
	4	49.88	48.63	0.57	-1.25	12.05	14.88	-2.51	24.15
	5	37.67	43.77	0.56	6.11	10.72	12.41	16.22	28.46
	6	39.03	48.20	0.40	9.17	13.07	17.17	23.49	33.47
	7	35.46	45.47	0.49	10.02	18.14	22.64	40.82	41.17
	8	36.80	51.23	0.43	14.43	17.74	21.35	47.35	48.21
	9	51.43	60.21	0.57	8.78	11.87	15.33	17.07	23.08
	10	46.80	53.34	0.67	6.54	14.47	16.93	24.65	30.93

	11	50.77	60.70	0.72	9.93	15.10	18.01	19.56	29.74
	12	49.88	57.56	0.88	7.68	13.40	16.63	23.43	26.87
CO	1	2.27	3.26	0.61	0.99	1.61	1.86	43.60	50.70
	2	1.30	2.10	0.79	0.80	0.82	1.01	51.75	53.37
	3	0.87	0.80	0.81	-0.07	0.20	0.29	-7.77	23.04
	4	0.68	0.55	0.82	-0.13	0.17	0.22	-19.30	24.39
	5	0.64	0.51	0.66	-0.13	0.16	0.27	-20.38	25.16
	6	0.74	0.56	0.52	-0.18	0.18	0.24	-23.86	24.87
	7	0.85	0.66	0.49	-0.18	0.23	0.30	-21.39	27.01
	8	0.76	0.71	0.50	-0.05	0.15	0.22	-6.08	20.11
	9	0.84	0.83	0.68	-0.01	0.18	0.23	-1.48	21.39
	10	0.88	0.81	0.83	-0.08	0.18	0.21	-8.52	20.62
	11	0.90	1.28	0.69	0.38	0.47	0.52	42.33	52.65
	12	1.01	1.29	0.86	0.29	0.36	0.43	28.29	35.62
O_3	1	28.27	19.36	0.82	-8.91	14.08	18.44	-39.22	39.81
	2	42.30	29.27	0.82	-13.02	17.47	20.19	-40.24	41.31
	3	51.72	41.96	0.71	-9.76	12.56	14.06	-18.86	24.28
	4	57.24	47.89	0.47	-9.35	13.62	17.93	-16.34	23.79
	5	97.41	76.49	0.81	-20.92	25.92	28.98	-26.61	26.61
	6	113.33	88.91	0.80	-24.42	26.03	32.80	-21.55	22.97
	7	102.55	92.12	0.52	-10.43	27.71	34.71	-10.17	27.02
	8	74.18	58.47	0.69	-15.70	18.66	23.51	-21.17	25.16
	9	67.05	52.41	0.50	-14.65	23.08	29.30	-21.84	34.41
	10	27.97	31.78	0.46	3.81	10.99	13.69	13.62	39.28
	11	28.52	26.10	0.80	-2.43	6.57	8.53	-8.50	23.04

	12	28.24	22.50	0.91	-5.74	7.03	9.29	-20.33	24.91
$PM_{2.5}$	1	116.55	110.21	0.65	-6.34	21.23	30.75	5.10	56.32
	2	69.64	71.73	0.80	2.10	7.57	26.11	21.57	49.06
	3	63.07	52.22	0.83	-10.85	24.29	22.27	-32.33	38.93
	4	53.36	40.01	0.72	-13.36	24.41	26.58	-44.99	45.68
	5	58.81	39.04	0.53	-19.77	33.66	45.81	-46.51	56.69
	6	44.64	35.26	0.69	-9.38	15.78	16.08	-31.85	37.12
	7	51.25	45.21	0.41	-6.04	13.23	22.30	-32.81	42.81
	8	40.56	37.64	0.82	-2.93	5.82	11.10	-0.56	28.60
	9	52.98	48.86	0.87	-4.11	8.81	14.64	-4.21	26.67
	10	56.44	53.54	0.89	-2.90	5.88	15.97	-5.51	26.26
	11	45.92	54.77	0.69	8.85	13.40	23.21	22.21	53.34
	12	43.35	54.03	0.82	10.68	18.83	21.10	25.01	49.50
PM_{10}	1	148.09	193.53	0.64	45.44	59.91	56.08	37.44	47.46
	2	84.25	133.51	0.73	49.26	68.29	59.76	50.33	51.05
	3	92.07	76.70	0.85	-15.38	26.49	38.26	-16.70	28.77
	4	106.89	70.62	0.47	-36.27	48.63	60.24	-43.29	45.49
	5	135.40	83.63	0.37	-51.77	72.70	69.15	-60.39	61.08
	6	77.58	59.90	0.52	-17.68	23.09	31.87	-22.79	29.76
	7	74.45	72.64	0.40	-1.81	7.82	31.48	-2.44	13.33
	8	61.00	75.71	0.74	14.71	19.37	22.75	24.11	31.76
	9	97.59	100.01	0.73	2.42	11.17	28.85	2.48	21.69
	10	64.62	96.47	0.78	31.84	35.00	42.04	49.27	54.15
	11	74.17	96.94	0.62	22.76	32.24	50.19	44.17	56.95
	12	68.70	97.37	0.76	28.68	31.34	51.70	56.30	60.18

Table S3. The estimated emission reductions of each control policy from 2013-2017 and 2016-2017.

Policy type	Measure ID	Emission reduction from 2013 to 2017 (ton)				Emission reduction from 2016 to 2017 (ton)			
		SO_2	NO_x	VOCs	$PM_{2.5}$	SO_2	NO_x	VOCs	$PM_{2.5}$
Coal-fired boilers control	1-1	16848	10248	3024	4358	529	723	136	214
	1-2	17950	11749	6649	5731	6550	3982	3827	2785
	subtotal	34798	21997	9673	10089	7079	4705	3963	2999
Clean fuels in residential sector	2-1	26784	6236	6686	7486	8010	2887	4108	4552
	2-2	1050	3025	7987	5278	0	0	0	0
	subtotal	27834	9261	14673	12764	8010	2887	4108	4552
Optimize industrial structure	3-1	7895	6040	7916	3503	1058	1472	3905	169
	3-2	1488	2764	5278	2527	2707	1615	6215	2180
	subtotal	9383	8804	13194	6030	3765	3087	10119	2350
Improve end-of-pipe control	4-1	6841	2047	2263	2912	642	969	903	506
	4-2	142	7597	179	45	102	5095	100	35
	subtotal	6983	9644	2442	2957	744	6065	1003	542
Vehicles emission control	5-1	81	31570	15746	519	20	8688	5207	228
	5-2	22	12174	2913	793	9	3599	1190	339
	subtotal	103	43744	18659	1312	29	12287	6397	567
Integrated treatment of VOCs	6-1	0	0	34942	0	0	0	10347	0

	6.2	0	0	22040	0	0	0	6997	0
	subtotal	0	0	56982	0	0	0	17345	0
	7-1	0	0	0	7503	0	0	0	3259
Fugitive dust control	7-2	0	0	0	3443	0	0	0	1394
	subtotal	0	0	0	10946	0	0	0	4653

Table S4. The brief description and simulation results of all the base and sensitive experiments. The simulated and normalized contributions are calculated based on The seven policy types refer to *Coal-fired boiler control* (*i*=1), *Clean fuels in the residential sector* (*i*=2), *Optimize industrial structure* (*i*=3), *Improve end-of-pipe control* (*i*=4), *Vehicles emission control* (*i*=5), *Integrated treatment of VOCs* (*i*=6) and *Fugitive dust control* (*i*=7)

Case Number	Meteo-rology	Emission level of Beijing	Emission level of surroundings	Local air pollution control policies (type and periods)	Simulation targets	Simulated $PM_{2.5}$ ($\mu g\ m^{-3}$)	Simulated contributions ($\mu g\ m^{-3}$)	Normalized contributions ($\mu g\ m^{-3}$)
SIM_{E13M13}	2013	2013	2013	no policy	reproduce the actual air quality in 2013	86.3 (89.5)	-	-
SIM_{E16M16}	2016	2016	2016	all policy from 2013 to 2016	reproduce the actual air quality in 2016	70.1 (72.9)	-	-
SIM_{E17M17}	2017	2017	2017	all policy from 2013 to 2017	reproduce the actual air quality in 2017	53.5 (58.0)	-	-
SIM_{E17M13}	2013	2017	2017	all policy from 2013 to 2017	quantify the impact of meteorology compared with 2013	57.4	3.9	3.8
SIM_{E17M16}	2016	2017	2017	all policy from 2013 to 2017	quantify the impact of meteorology compared with 2016	57.8	4.3	4.4
$SIM_{E17_{S13}M17}$	2017	2017	2013	all policy from 2013 to 2017	quantify contribution of surroundings from 2013 to 2017	60.9	7.4	7.1
$SIM_{E17_{S16}M17}$	2017	2017	2016	all policy from 2013 to 2017	quantify contribution of surroundings from 2016 to 2017	55.9	2.4	2.5
$SIM_{E17_{L13}M17}$	2017	2017	2017	policy type1 from 2013	quantify the contribution of policy1 compared with 2013	59.7	6.2	5.9

$SIM_{E17_{L23}M17}$	2017	2017	2017	policy type2 from 2013	quantify the contribution of policy 2 compared with 2013	59.1	5.6	5.3
$SIM_{E17_{L33}M17}$	2017	2017	2017	policy type3 from 2013	quantify the contribution of policy 3 compared with 2013	56.8	3.3	3.2
$SIM_{E17_{L43}M17}$	2017	2017	2017	policy type4 from 2013	quantify the contribution of policy 4 compared with 2013	55.4	1.9	1.8
$SIM_{E17_{L53}M17}$	2017	2017	2017	policy type5 from 2013	quantify the contribution of policy 5 compared with 2013	55.5	2.0	1.9
$SIM_{E17_{L63}M17}$	2017	2017	2017	policy type6 from 2013	quantify the contribution of policy 6 compared with 2013	55.9	2.4	2.3
$SIM_{E17_{L73}M17}$	2017	2017	2017	policy type7 from 2013	quantify the contribution of policy 7 compared with 2013	53.7	0.2	0.2
$SIM_{E17_{L16}M17}$	2017	2017	2017	policy type1 from 2016	quantify the contribution of policy 1 compared with 2016	55.3	1.8	1.9
$SIM_{E17_{L26}M17}$	2017	2017	2017	policy type2 from 2016	quantify the contribution of policy 2 compared with 2016	55.5	2.0	2.1
$SIM_{E17_{L36}M17}$	2017	2017	2017	policy type3 from 2016	quantify the contribution of policy 3 compared with 2016	54.9	1.4	1.5
$SIM_{E17_{L46}M17}$	2017	2017	2017	policy type4 from 2016	quantify the contribution of policy 4 compared with 2016	54.0	0.5	0.5
$SIM_{E17_{L56}M17}$	2017	2017	2017	policy type5 from 2016	quantify the contribution of policy 5 compared with 2016	54.2	0.7	0.8
$SIM_{E17_{L66}M17}$	2017	2017	2017	policy type6 from 2016	quantify the contribution of policy 6 compared with 2016	54.5	1.0	1.1
$SIM_{E17_{L76}M17}$	2017	2017	2017	policy type7 from 2016	quantify the contribution of policy 7 compared with 2016	53.6	0.1	0.1

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