

Supplementary materials:

Cost benefits analysis of municipal solid waste incineration in Chinese provinces

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Table S1. Annual amount of MSW incineration in 31 Chinese provinces.

	Annual amount of MSW incineration(t)
Beijing	3.27E+06
Tianjin	1.38E+06
Shanghai	3.61E+06
Chongqing	2.14E+06
Hebei	2.85E+06
Shanxi	1.15E+06
Inner Mongolia	6.15E+05
Liaoning	6.55E+05
Jilin	1.62E+06
Heilongjiang	1.00E+06
Jiangsu	1.29E+07
Zhejiang	8.24E+06
Anhui	3.35E+06
Fujian	4.87E+06
Jiangxi	5.35E+05
Shandong	8.97E+06
Henan	1.59E+06
Hubei	3.93E+06
Hunan	1.26E+06
Guangdong	9.11E+06
Guangxi	1.24E+06
Hainan	1.47E+06
Sichuan	4.57E+06
Guizhou	7.14E+05
Yunnan	2.26E+06
Tibet	1.00E+04
Shaanxi	0
Gansu	8.85E+05
Qinghai	0
Ningxia	3.46E+05
Xinjiang	1.48E+05

Table S2. MSW composition in 31 Chinese provinces.

	Kitchen waste	Paper	Plastic and Rubber	Textile	Wood bamboo	Glass	Metal	Lime soil
Beijing	56.84%	18.33%	18.77%	1.00%	0.61%	0.75%	0.56%	1.67%
Tianjin	56.9%	15.3%	16.90%	3.90%	1.60%	1.60%	0.70%	2.90%
Shanghai	60.40%	11.88%	17.56%	2.85%	1.95%	3.57%	1.08%	0.02%
Chongqing	59.20%	10.10%	16.00%	6.10%	4.20%	3.40%	1.10%	0

Hebei	62.71%	3.07%	5.97%	1.61%	0.97%	0.73%	0.48%	19.05%
Shanxi	45.45%	9.97%	18.24%	2.26%	1.30%	2.63%	0.54%	17.81%
Inner Mongolia	32.00%	6.50%	9.20%	0.30%	0.40%	1.15%	0.50%	15.90%
Liaoning	60.40%	7.90%	12.90%	3.60%	2.50%	5.40%	2.10%	5.30%
Jilin	43.00%	4.90%	15.00%	2.70%	2.70%	2.60%	0.50%	4.60%
Heilongjiang	44.80%	13.40%	3.30%	4.70%	0	6.60%	2.70%	24.50%
Jiangsu	66.00%	9.00%	12.00%	1.00%	0	9.00%	1.00%	1.00%
Zhejiang	64.50%	6.70%	10.10%	1.20%	0.10%	2.00%	0.30%	15.10%
Anhui	61.50%	1.90%	11.40%	2.10%	0.90%	0.60%	0	21.70%
Fujian	54.90%	13.73%	13.26%	3.11%	0.26%	2.05%	0.13%	3.34%
Jiangxi	62.50%	5.50%	6.00%	3.00%	3.00%	5.50%	3.00%	20.50%
Shandong	58.70%	11.20%	9.90%	3.00%	1.00%	1.30%	0.30%	14.60%
Henan	55.02%	5.52%	3.97%	1.65%	1.36%	1.56%	0.59%	26.67%
Hubei	55.30%	1.50%	4.50%	0	8.30%	2.00%	1.10%	27.30%
Hunan	47.53%	0.88%	14.07%	7.28%	3.57%	0.23%	1.17%	9.51%
Guangdong	53.40%	8.30%	18.60%	10.00%	1.70%	1.40%	0.40%	6.20%
Guangxi	58.93%	10.74%	10.82%	2.12%	0.56%	4.33%	0.40%	4.04%
Hainan	58.42%	6.44%	11.93%	0.89%	1.60%	0.53%	0.68%	12.92%
Sichuan	64.29%	11.71%	7.45%	1.08%	1.40%	2.80%	0.76%	7.13%
Guizhou	41.46%	13.07%	14.97%	4.42%	2.36%	1.87%	0.72%	21.13%
Yunnan	60.59%	9.69%	9.99%	1.70%	1.21%	1.70%	0.46%	8.03%
Tibet	57.00%	6.00%	12.00%	7.00%	14.00%	0	1.00%	3.00%
Shaanxi	38.60%	9.30%	10.10%	1.40%	7.40%	6.50%	3.40%	23.30%
Gansu	36.38%	9.70%	11.34%	2.10%	1.36%	0.93%	0.23%	37.81%
Qinghai	51.93%	6.85%	9.41%	2.72%	1.75%	2.89%	1.21%	27.22%
Ningxia	35.70%	2.10%	4.10%	1.20%	1.70%	0.40%	0.20%	45.70%
Xinjiang	76.00%	2.40%	5.40%	4.20%	2.50%	2.40%	0.80%	6.40%

Table S3. Power generation structure of 31 Chinese provinces.

	Thermal power generation	Wind power generation	Solar power generation	Nuclear power generation	Hydropower generation
Beijing	96.17%	0.75%	0.25%	/	2.83%
Tianjin	99.02%	0.95%	0.03%	/	0.00%
Shanghai	99.11%	0.83%	0.06%	/	0.00%
Chongqing	64.09%	0.66%	0.00%	/	35.25%
Hebei	90.19%	7.96%	1.01%	/	0.85%
Shanxi	93.21%	4.74%	0.57%	/	1.48%
Inner Mongolia	85.44%	11.75%	2.11%	/	0.70%
Liaoning	78.68%	7.25%	0.19%	11.23%	2.64%
Jilin	77.90%	11.14%	0.12%	/	10.84%
Heilongjiang	89.23%	8.84%	0.05%	/	1.87%
Jiangsu	93.49%	2.00%	0.87%	3.26%	0.37%
Zhejiang	74.24%	0.73%	0.69%	15.75%	8.58%
Anhui	94.76%	1.52%	0.92%	/	2.80%
Fujian	44.84%	2.50%	0.17%	20.38%	32.10%
Jiangxi	78.95%	1.73%	1.03%	/	18.29%
Shandong	96.50%	2.67%	0.56%	/	0.26%
Henan	95.23%	0.68%	0.49%	/	3.60%
Hubei	41.00%	1.63%	0.46%	/	56.91%

Hunan	52.22%	2.86%	0.05%	/	44.87%
Guangdong	69.70%	1.11%	0.10%	16.50%	12.59%
Guangxi	42.67%	1.03%	0.06%	7.65%	48.60%
Hainan	69.49%	2.23%	0.74%	20.89%	6.65%
Sichuan	12.15%	0.55%	0.19%	/	87.12%
Guizhou	58.52%	2.90%	0.05%	/	38.54%
Yunnan	8.84%	5.77%	0.78%	/	84.61%
Tibet	3.40%	0.00%	5.39%	/	91.21%
Shaanxi	89.99%	2.13%	0.76%	/	7.12%
Gansu	57.99%	11.24%	4.96%	/	25.82%
Qinghai	27.52%	1.81%	16.26%	/	54.41%
Ningxia	83.32%	10.96%	4.49%	/	1.23%
Xinjiang	81.62%	7.23%	2.89%	/	8.27%

Note: The data source is (China Energy Statistics Yearbook, 2016).

Table S4. Life cycle inventory of MSW incineration.

	Amount	Unit
Model input		
Energy		
electricity	146.4	kW.h
diesel	0.1370	Kg
fossil fuel	34.40	MJ
Raw Material		
Activated carbon	0.5000	Kg
Ammonia water	2.400	Kg
CaCO ₃	7.100	kg
FeCl ₃	0.06000	Kg
NaOH	0.4000	Kg
Sand	0.2000	T
Aggregate	0.2800	T
Cement	0.02000	T
Water	202.8	Kg
Model output		
Waste		
slag	200.0	Kg
Fly ash	20.00	Kg
Leachate	250.0	Kg
Emissions		
Particulate	5.430	G
CO ₂	257.8 kg	G
SO ₂	48.25	G
CO	95.58	G
HCl	8.357	G
NO _x	411.9	G
Dioxins	3.300×10 ⁻⁹	G

Table S5. LCC of MSW incineration and landfill.

	Incineration (RMB/tMSW)	Landfill (RMB/tMSW)
Investment cost	66.21	182.80
Operating cost		
Material cost	11.74	5.58

Maintenance cost	15.89	20.47
Labor cost	14.95	25.77
Energy cost	64.41	6.67
Depreciation cost	59.59	76.77
Waste disposal cost		
Leachate disposal	9.93	20.38
Slag disposal	7.5	/
Fly ash disposal	18	/
Benefits	Different prices depending on local conditions	/