

The health and climate benefits of economic dispatch in China's power system

Qian Luo¹, Fernando Garcia-Menendez¹, Haozhe Yang², Ranjit Deshmukh², Gang He³, Jiang Lin^{4,5,*}, and Jeremiah X. Johnson¹

¹Department of Civil, Construction, and Environmental Engineering, North Carolina State University, Raleigh, NC, 27695, USA

²Bren School of Environmental Science and Management, University of California at Santa Barbara, Santa Barbara, CA, 93117, USA

³Department of Technology and Society, Stony Brook University, Stony Brook, NY, 11794, USA

⁴Department of Electricity Market and Policy, Lawrence Berkeley National Laboratory, Berkeley, CA, 94720, USA

⁵Department of Agricultural and Resources Economics, University of California at Berkeley, Berkeley, CA 94720, USA

*J.Lin@lbl.gov

Table S1 includes location and gross domestic product (GDP) information for each load zone used in this study. GDP is for year 2020¹. Table S2 includes emissions and mortality changes relative to economic dispatch under emission externalities internalization scenarios. Figure S1 shows marginal emission costs for NO_x and PM_{2.5} in each load zone.

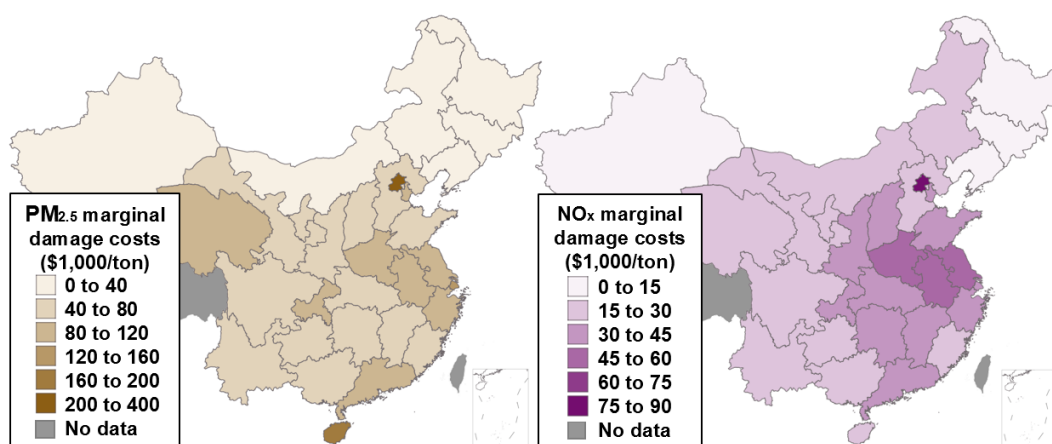


Figure S1. Province-level marginal damage costs from power plant NO₂ and PM_{2.5} emissions in mainland China. Value of Statistic Life of \$1.2 million is used.

Table S1. Information for each load zone.

Full name	Abbreviation	Region	GDP per capita (\$)
Guangdong	GD	Central South	12,743
Guangxi	GX	Central South	6,408
Hainan	HN	Central South	7,956
Henan	HEN	Central South	8,025
Hubei	HUB	Central South	10,906
Hunan	HUN	Central South	9,117
Anhui	AH	East	9,189
Fujian	FJ	East	15,323
Jiangsu	JS	East	17,573
Jiangxi	JX	East	8,243
Shangdong	SD	East	10,443
Shanghai	SH	East	22,560
Zhejiang	ZJ	East	14,508
Beijing	BJ	North	23,908
East Inner Mongolia	EIM	North	10,466
Hebei	HEB	North	7,036
Shanxi	SX	North	7,330
Tianjin	TJ	North	14,726
East Inner Mongolia	WIM	North	10,466
Heilongjiang	HLJ	Northeast	6,236
Jilin	JL	Northeast	7,414
Liaoning	LN	Northeast	8,649
Gansu	GS	Northwest	8,564
Ningxia	NX	Northwest	7,892
Qinghai	QH	Northwest	7,357
Shaanxi	SAX	Northwest	9,603
Xinjiang	XJ	Northwest	7,738
Chongqing	CQ	Southwest	11,309
Guizhou	GZ	Southwest	6,702
Sichuan	SC	Southwest	8,421
Yunnan	YN	Southwest	7,531

Table S2. Reductions in emissions (CO₂, SO₂, NO_x, and PM_{2.5}) and premature mortality attributed to power plant emissions in China with climate and health damages internalization into power sector economic dispatch operations. Climate cost internalization scenarios are based on carbon prices of \$25/ton CO₂ (CP25) and \$55/ton CO₂ (CP55). Health damages internalization scenarios are based on regionally-varying (HD6cities) and national-level VSL estimates of \$1.2M (HD1M) and \$9.5M (HD9M). Reduced emissions, premature deaths, and percentages reported are relative to economic dispatch operations without climate and health damages internalization.

	CP25	CP55	HD1M	HD9M	HD6cities
CO ₂ emitted (M tons per year)	71 (1.5%)	242 (5.2%)	245 (5.2%)	243 (5.2%)	144 (3.1%)
SO ₂ emitted (Tons per year)	27,700 (3.3%)	82,600 (9.9%)	53,300 (6.4%)	132,000 (15.7%)	35,000 (4.2%)
NO _x emitted (Tons per year)	25,200 (2.1%)	45,500 (3.8%)	31,400 (2.6%)	20,900 (1.8%)	28,600 (2.4%)
PM _{2.5} emitted (Tons per year)	23,600 (2.9%)	24,200 (5.1%)	24,600 (6.5%)	24,200 (5.2%)	24,600 (6.4%)
Premature deaths (per year)	2,560 (3.7%)	3,460 (5.1%)	8,340 (12.2%)	17,400 (25.4%)	4,590 (6.7%)

References

1. National Bureau of Statistics of China. Per Capita Gross Regional Product in China. <https://data.stats.gov.cn/english/easyquery.htm?cn=E0103>. Accessed 22 April 2022.