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Supplementary materials for

**Achieving air pollutant emission reduction targets with  
minimum abatement costs: An enterprise-level allocation  
method with constraints of fairness and feasibility**

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**Table A1** Descriptive statistics of enterprises' pollutant treatment parameters (Sample size: 64 enterprises)

Parameter	Unit	Mean	Median	Max.	Min.
$R_{ki}$	t	1,156	114	17,420	5
$S_{ki}$	t	669	6	15,370	0
$Q_{ki}$	t	486	57	13,097	3
$TCP_k$	million RMB	27	2	1005	0.07
$I_k$	million RMB	2,120	303	43,242	10

**Table A2** Specific data of the energy equipment parameters (Sample size: 46 enterprises<sup>a</sup>)

	$\tau_l$ (h)	$l_l$ (MW)	$I_l/l_l$ (RMB/kW)	$t_l$ (a)	$\eta_l$ (%)	$CFP_{lf}$ (RMB/tce RMB/m <sup>3</sup> )	$H_l$ (MJ/kg MJ/m <sup>3</sup> )
Coal-fired Units	5,500	2X350	3,924	20	30	700	21.55
Gas Unit	8,400	2X45	2,435	20	38	3	36.33

a: These 46 enterprises are among the 64 companies that have fuel use data in the Environmental Statistical Reports.

**Table A3** Total industrial output value and total profits of the industries

Industry	$I_j$ (10 <sup>4</sup> RMB)	$M_j$ (10 <sup>4</sup> RMB)
Processing of Foods	29,106	362
Manufacture of Beverages	31,613	191
Manufacture of Paper & Paper Products	14,058	1,648
Processing of Petroleum, Coking, &Fuel	21,282	447
Manufacture of Raw Chemical Materials	4,415	429
Manufacture of Medicines	1,385	52
Manufacture of Rubber and Plastics	3,202	25
Manufacture of Non-metallic Mineral Goods	12,315	1,394
Smelting & Pressing of Ferrous Metals	94,599	10,852
Smelting & Pressing of Non-ferrous Metals	983	101
Manufacture of Metal Products	4,887	131
Manufacture of Automobile	28,726	407
Electrical Machinery & Equipment	1,269	10
Manufacture of Electricity	7,534	842
Total	247,705	16,992

Note: Listed are the industries with annual NO<sub>x</sub> emissions of more than 10 t.

**Table A4** Descriptive statistics of enterprises' energy consumption parameters (Sample size: 46 enterprises)

Parameter	Unit	Mean	Median	Max.	Min.
$l_{coal_k}$	10 <sup>4</sup> t	25.85	22.68	373.97	0.08
$l_k$	10 <sup>4</sup> tce	36.09	43.15	1043.21	0.17

**Table A5** Government subsidy ratio and environmental protection tax rate of City M

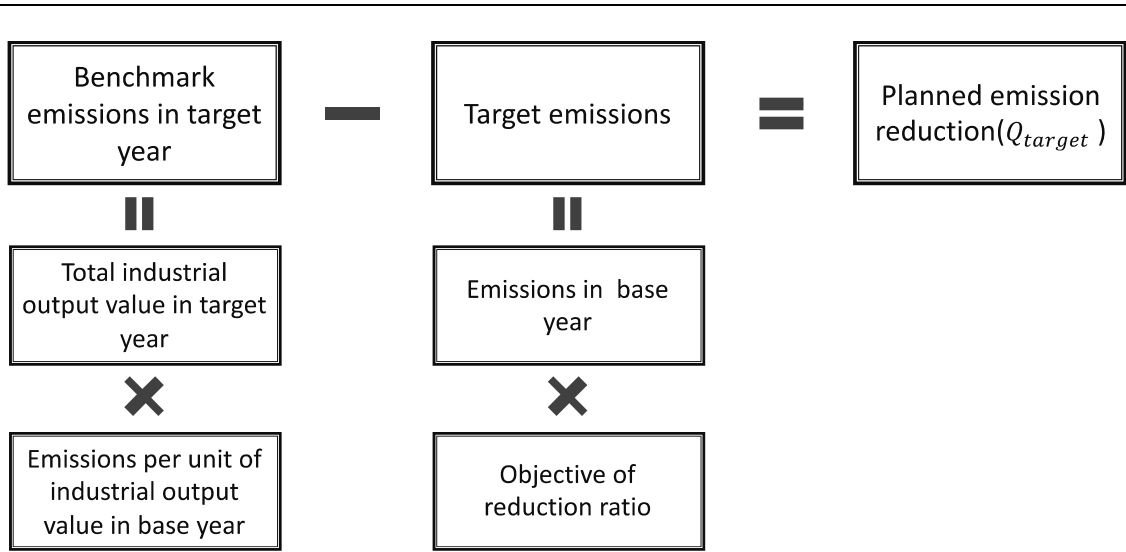
	Unit	Value
$\epsilon_{cp}$	%	0
$TR_n$	RMB/kg	6

**Table A6** Descriptive statistics of NOx unit abatement cost of PEER (Unit: RMB/t)

	Mean	Median	Max.	Min.
Unit abatement cost of PEER	18,000	9,200	258,000	6,300

**Table A7** Abbreviations in the study

<b>Abbreviations</b>	
ERMs	Emission reduction measures
TAC	Total abatement cost
EPERA	Enterprise-level pollutant emission reduction allocation
PEER	Pollutant engineering emission reduction
ISA	Industrial structure adjustment
ESA	Energy structure adjustment
GCAC	Gini coefficient of abatement contribution
RR	Reduction rate
ACPOV	Abatement cost as a percentage of output value
ME	Manufacture of Electricity
SPFM	Smelting & Pressing of Ferrous Metals
MNMG	Manufacture of Non-metallic Mineral Goods
MPPP	Manufacture of Paper & Paper Products
PPCF	Processing of Petroleum, Coking, & Fuel
MM	Manufacture of Medicines
MA	Manufacture of Automobile



**Fig. A1** The overall calculation process for pollutant emission reduction target.