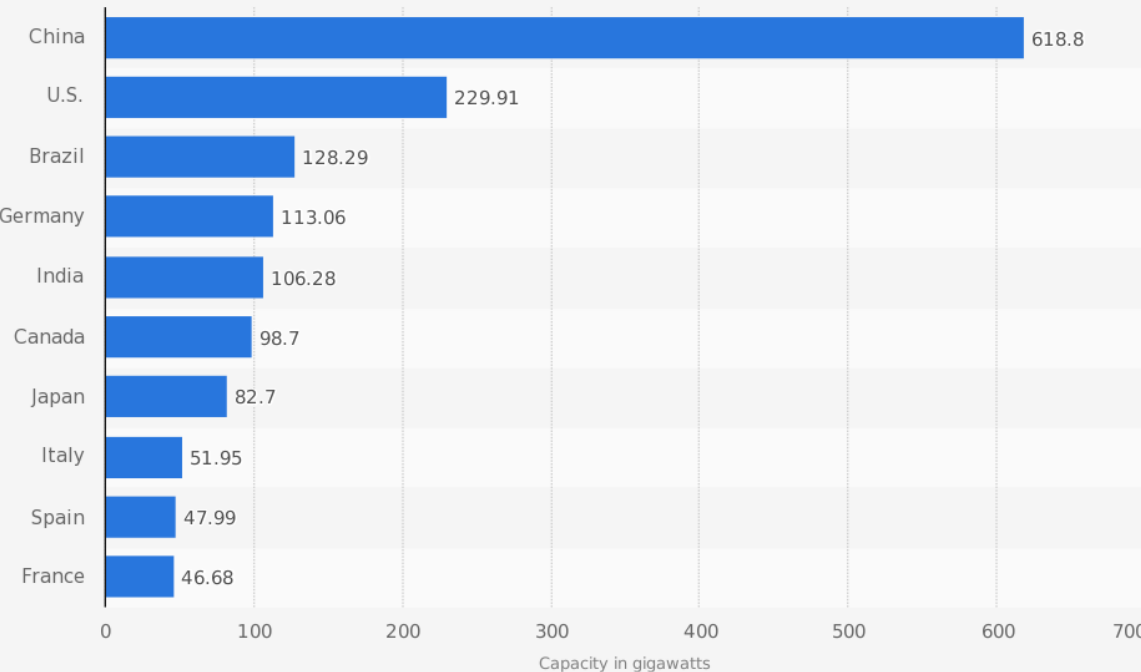


The Impact of Power Generation Emissions on Ambient PM_{2.5} Pollution and Human Health in China and India

Leading countries in installed renewable energy capacity worldwide in 2017 (in gigawatts)



Source: IRENA

Meng Gao

(mgao2@seas.harvard.edu)

Michael B. McElroy



HARVARD-CHINA PROJECT
on Energy, Economy and Environment

John Evans

Yang Liu



HARVARD
T.H. CHAN
SCHOOL OF PUBLIC HEALTH



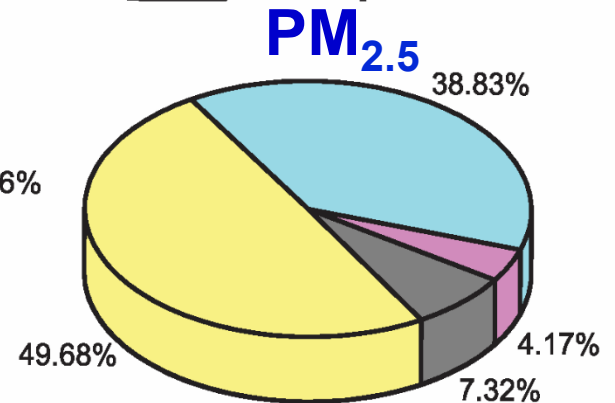
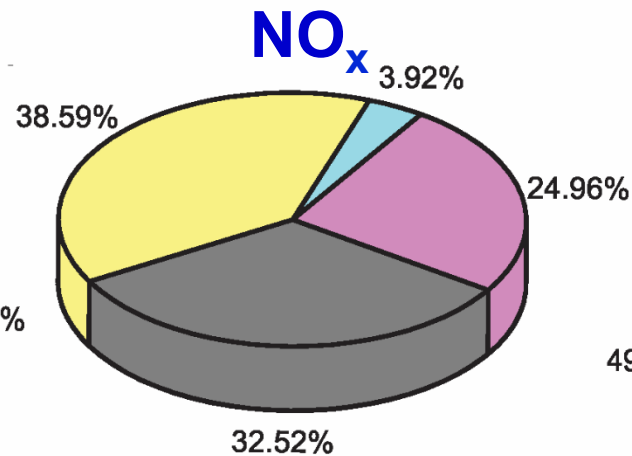
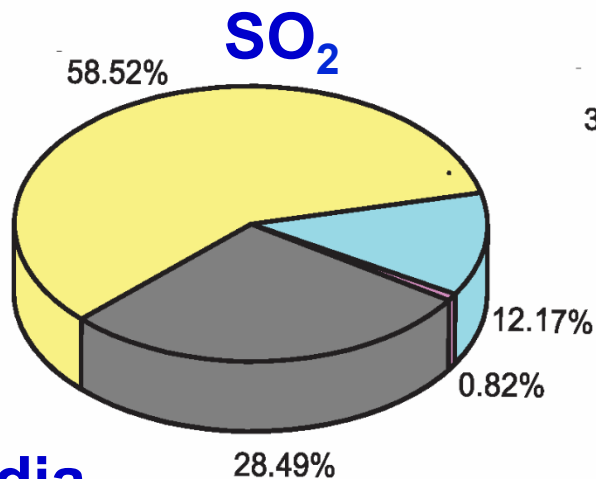
and many others

Power Plant Emissions in China and India

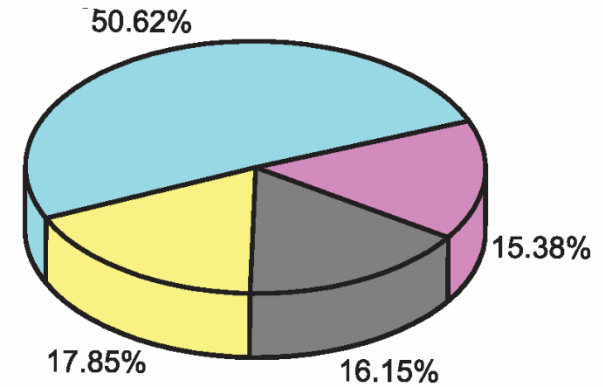
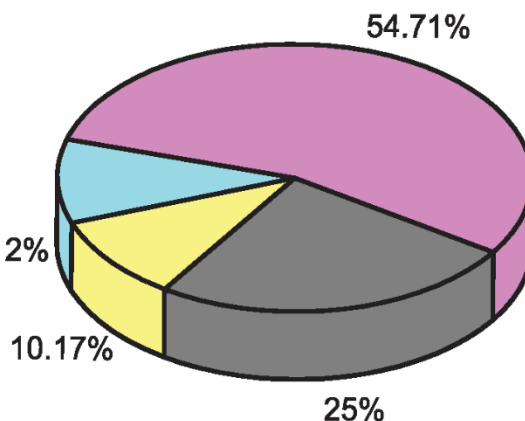
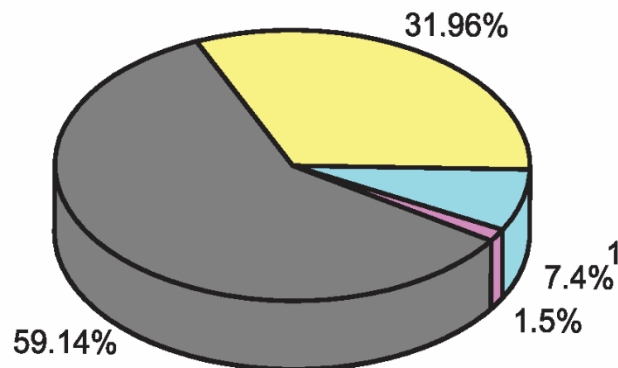
MIX emission inventory 2010



China



India



Mortality Estimation Equations

$$RR(C) = \begin{cases} 1 + \alpha(1 - e^{\beta(C - C_0)})^\gamma, & C \geq C_0 \\ 1, & C < C_0 \end{cases}$$

$$PAF = RR(C) - 1 / RR(C)$$

$$\Delta M = PAF \times \text{Base} \times \text{Pop}$$

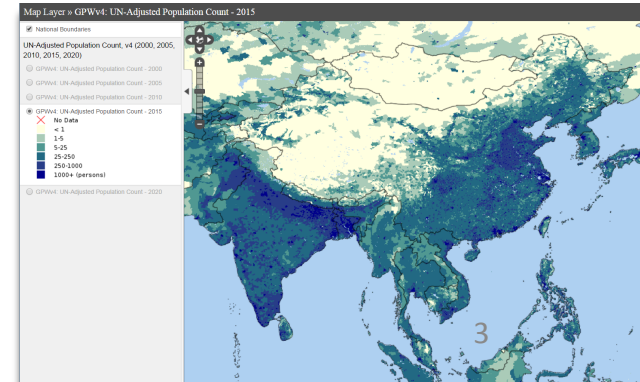
PAF=Population Attributable Fraction

GBD 2015
1000 pairs of IER (Integrated Exposure
Response model) parameters



Global Health Data
Exchange

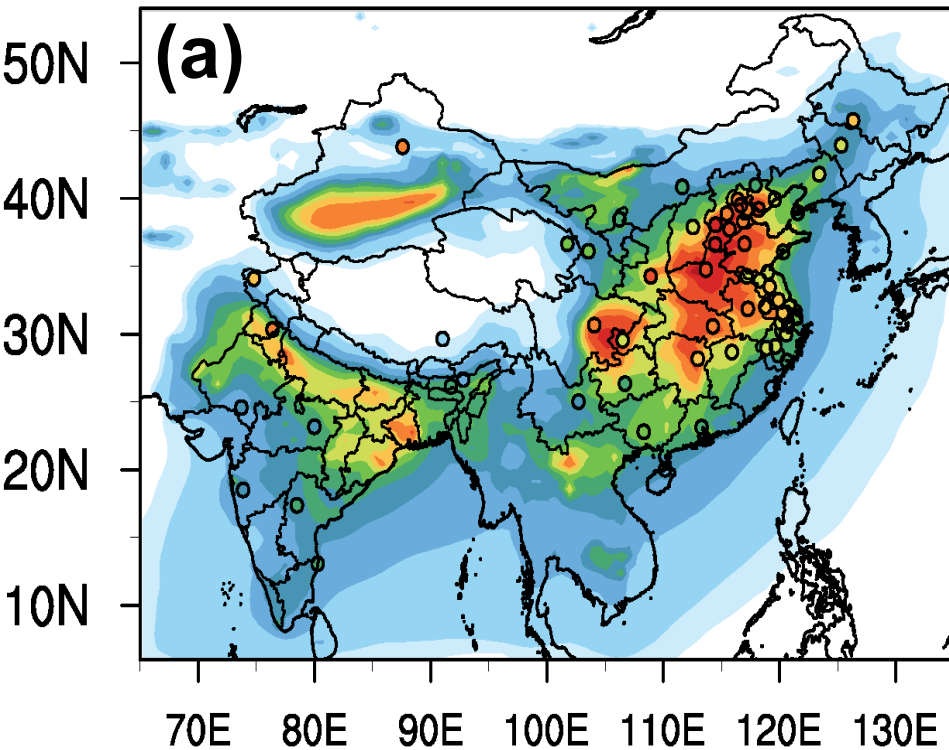
GPW v4



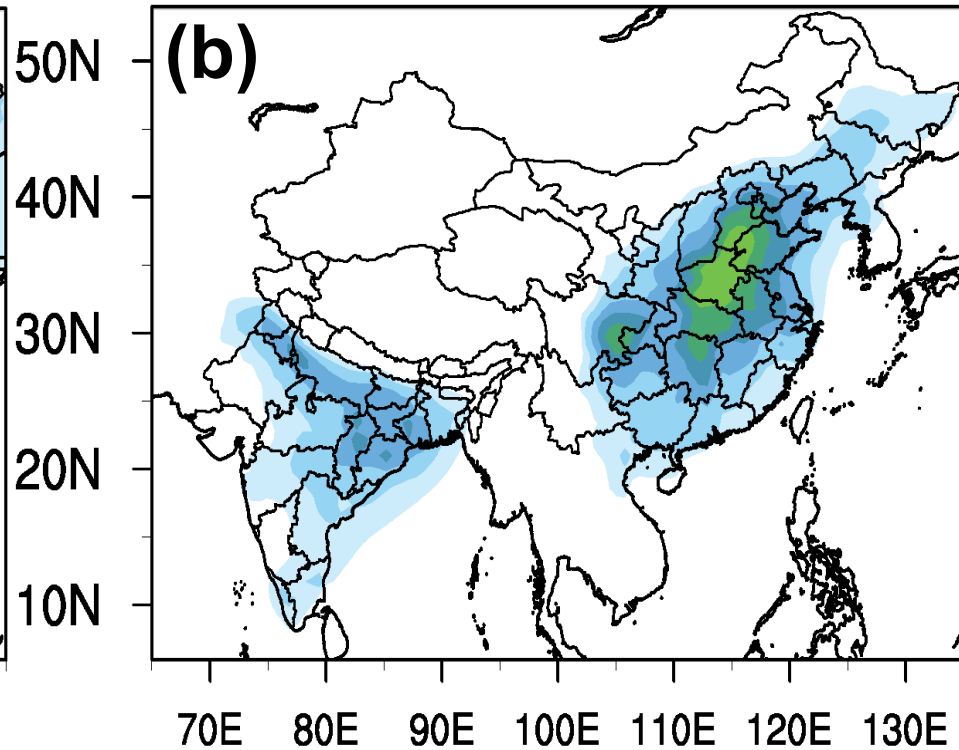
Burnett et al., EHP, 2014
Cohen et al., Lancet, 2017

PM_{2.5} Concentrations

All Emissions Included



Power Emissions Excluded



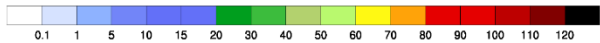
15 35 55 75 100 150

[Annual Mean Surface PM_{2.5}, µg/m³]

Mortality due to Power Plants in China and India

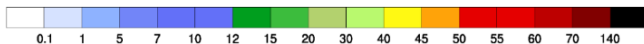
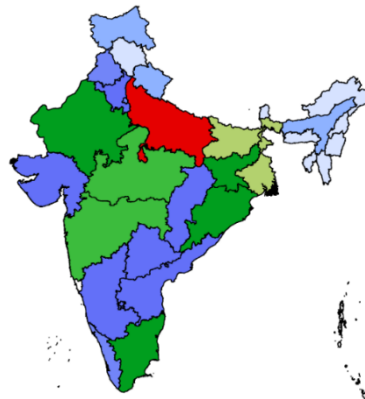
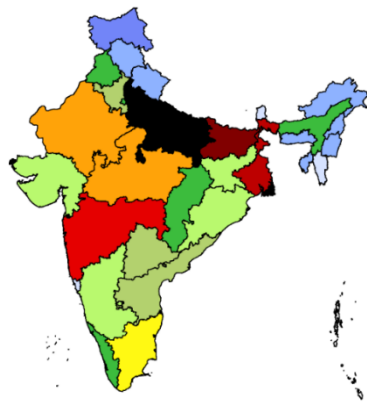
Total

Power



(×1000 deaths)

	Stroke	IHD	COPD	LC	LRI	Total
All	366k	388k	345k	150k	82k	1.3m
Power						0.5m



(×1000 deaths)

	Stroke	IHD	COPD	LC	LRI	Total
All	123k	191k	301k	18k	170k	0.8m
Power						0.27m

Collaborative Clean Air Policy Centre, New Delhi

Policy Paper, edited by Kirk R. Smith

Where Does Ambient PM_{2.5} Come from in China?: A Comparison and Synthesis of Recent Estimates

Meng Gao ¹, Jos Lelieveld ², Frank Dentener ³, Jason West ⁴, Jianlin Hu ⁵, Patrick Kinney ⁶, John Evans

⁷

¹ John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, USA

² Max Planck Institute for Chemistry, Atmospheric Chemistry Department, P.O. Box 3060, 55020 Mainz, Germany

³ European Commission, Institute for Environment and Sustainability Joint Research Centre, 10 Ispra, Italy

⁴ Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

⁵ School of Environmental Science and Engineering, Nanjing University of Information Science & Technology, 219 Ningliu Road, Nanjing 210044, China

⁶ Department of Environmental Health, Boston University School of Public Health, Boston, MA 02118, USA

⁷ Harvard School of Public Health, Boston, Massachusetts 02215, USA