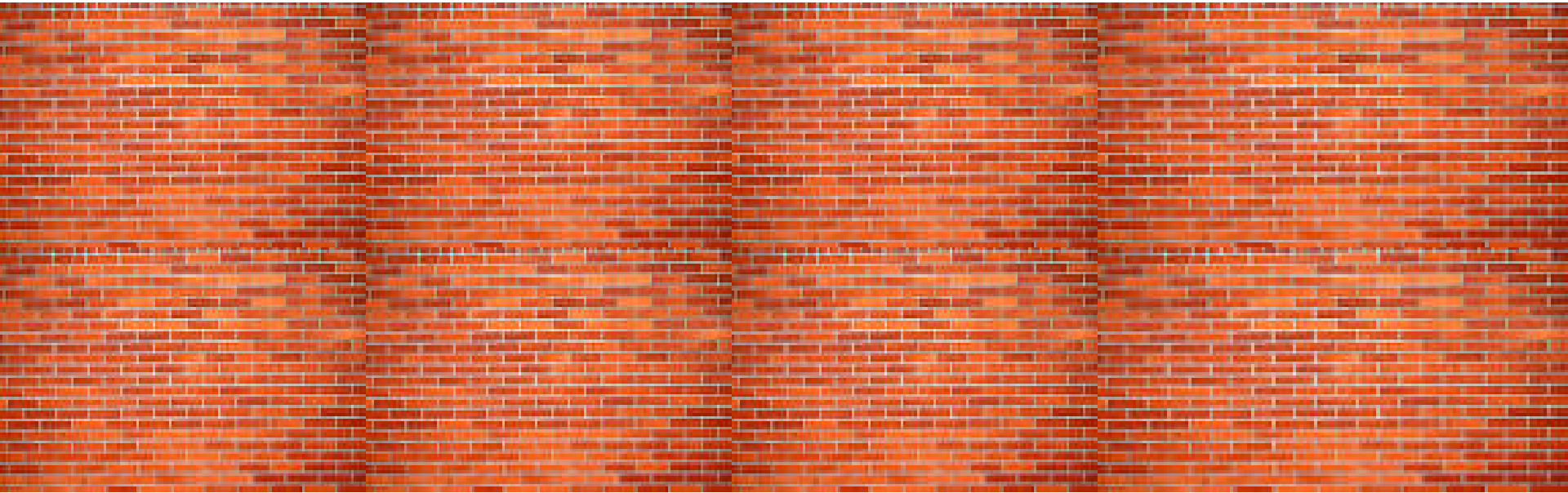


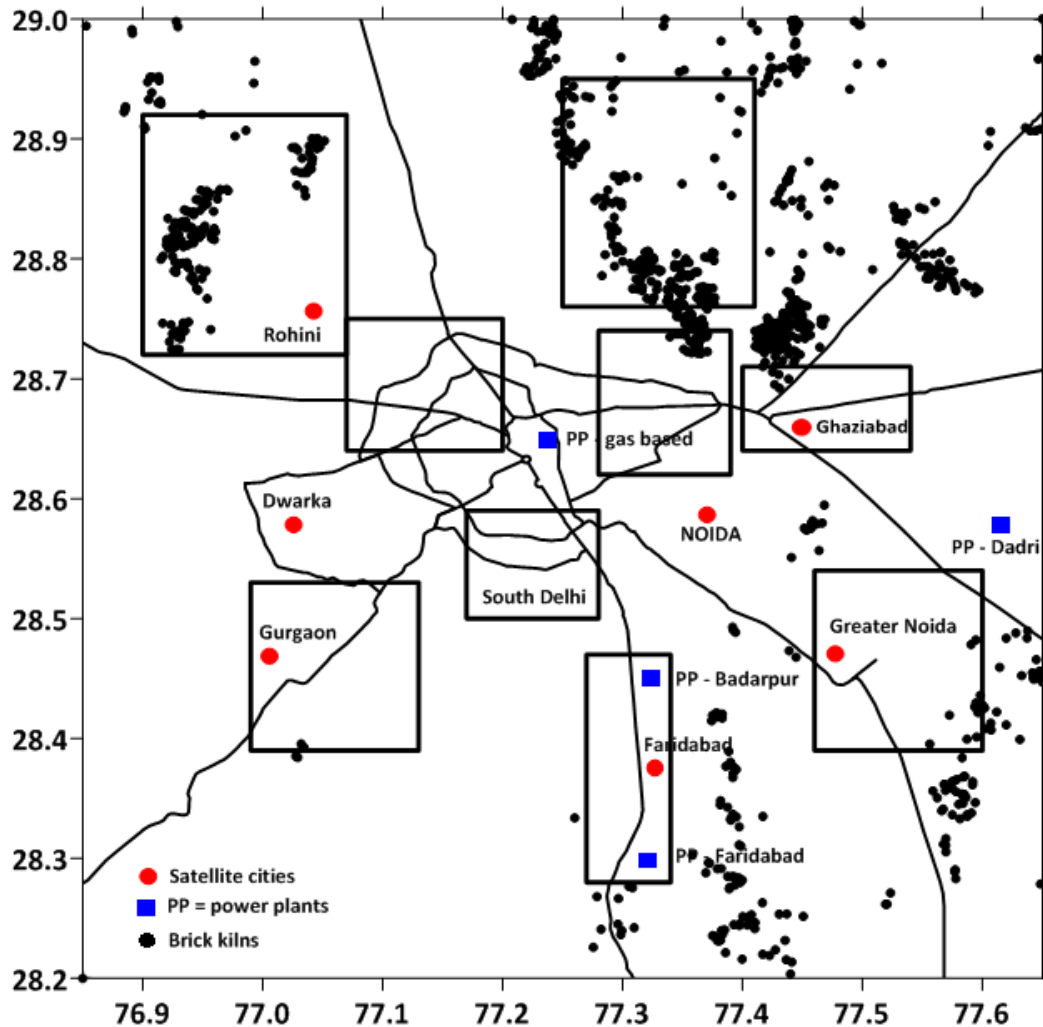
Particulate pollution and its health impacts from brick kiln clusters in South Asian cities



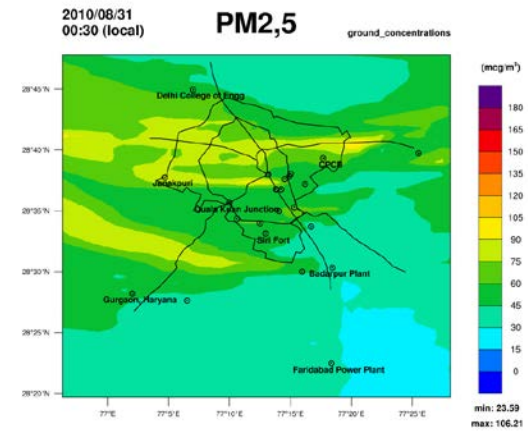
Dr. Sarath Guttikunda

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This is still an Urban problem

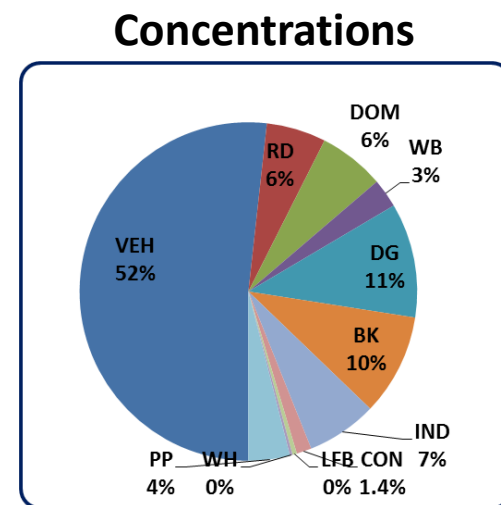
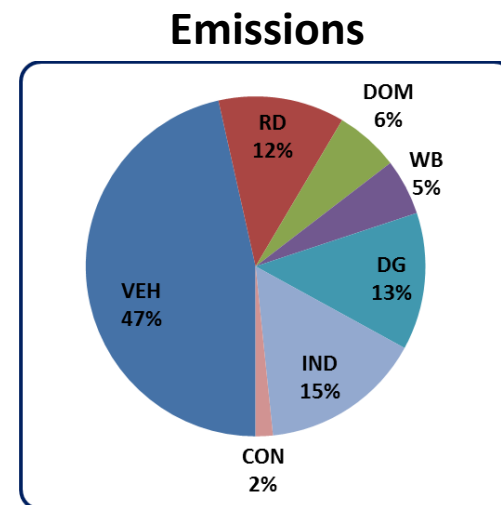
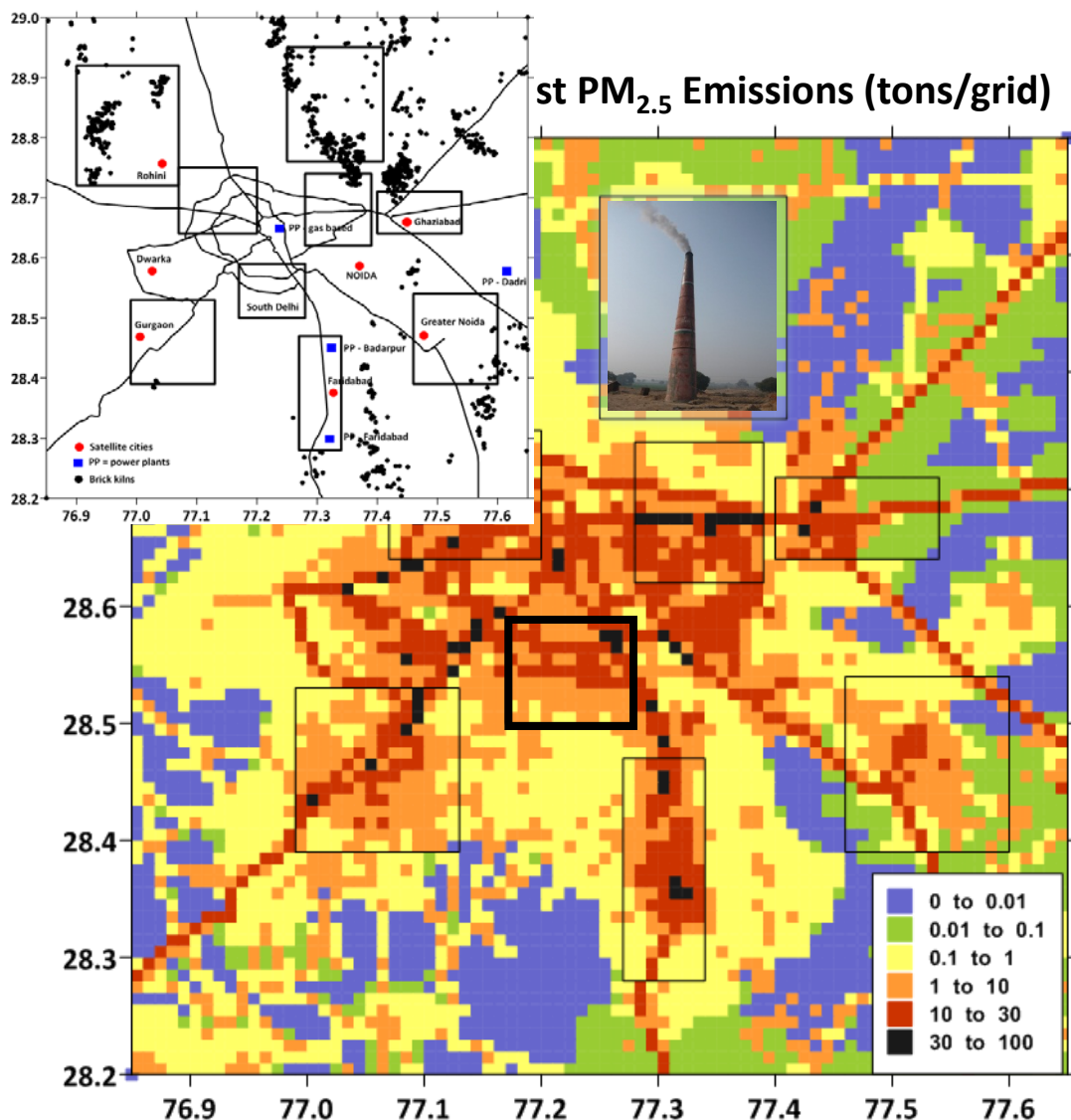


**Moved but
not
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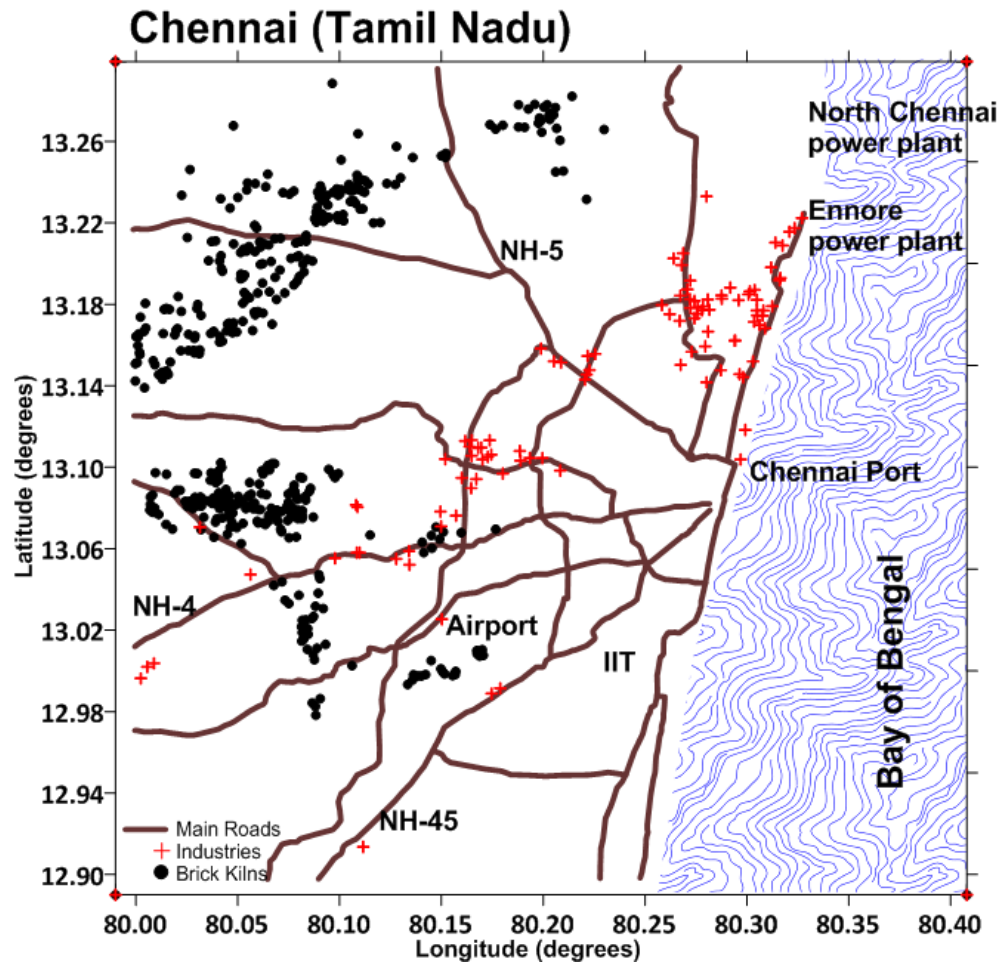
Advected pollution

% ground based emissions in south Delhi



IND = industries; PP = power plants; DOM = domestic; TR = transport; RD = road dust;
 WB = waste burning; CON = construction activities; BK = brick kilns; DG = diesel generator sets; LFB = landfill burning

This is still an Urban problem



**Moved but
not
cleaned**

What is burning at the kilns?



Workers pushing a mixture of agri-waste and powdered coal at a kiln outside Delhi, India



What else is burning at the kilns?



**Workers cut
firewood to light a
brick kiln in Kabul,
Afghanistan.**

What else is burning at the kilns?



A worker soaks dry cow dung in a mixture of kerosene and gasoline at a kiln near Amritsar, India.

What else is burning at the kilns?



A boy transports a discarded tire, to use in a kiln near Dhaka, Bangladesh

What else is burning at the kilns?



**Workers pour coal into the fire of a Bull's trench kiln
outside Kabul, Afghanistan**

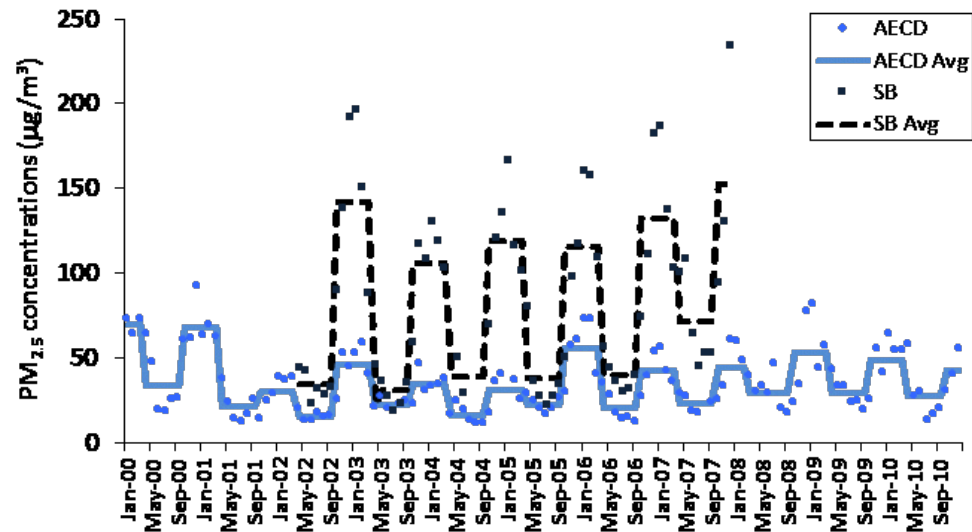
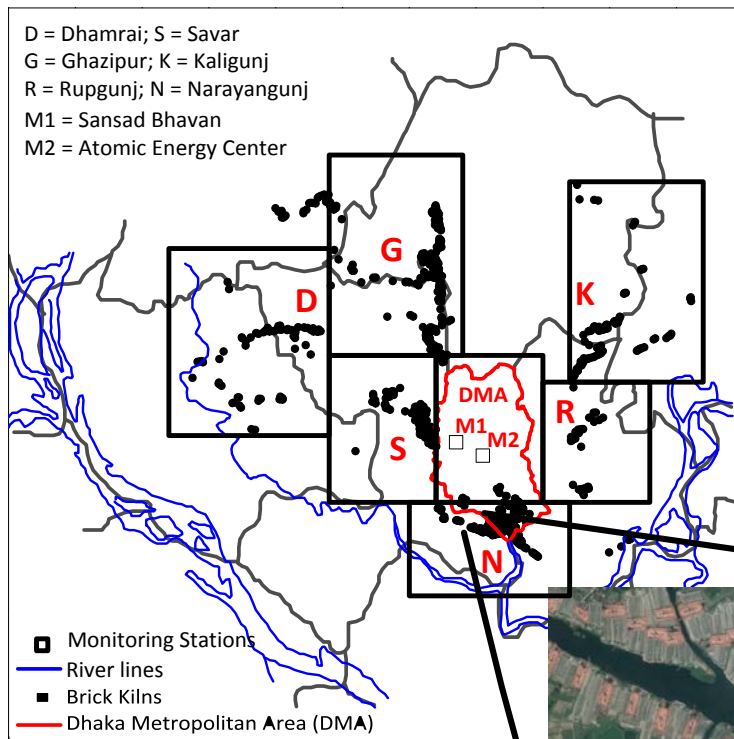
What else is burning at the kilns?



A worker removes sand from a batch of fired bricks in Amritsar, India

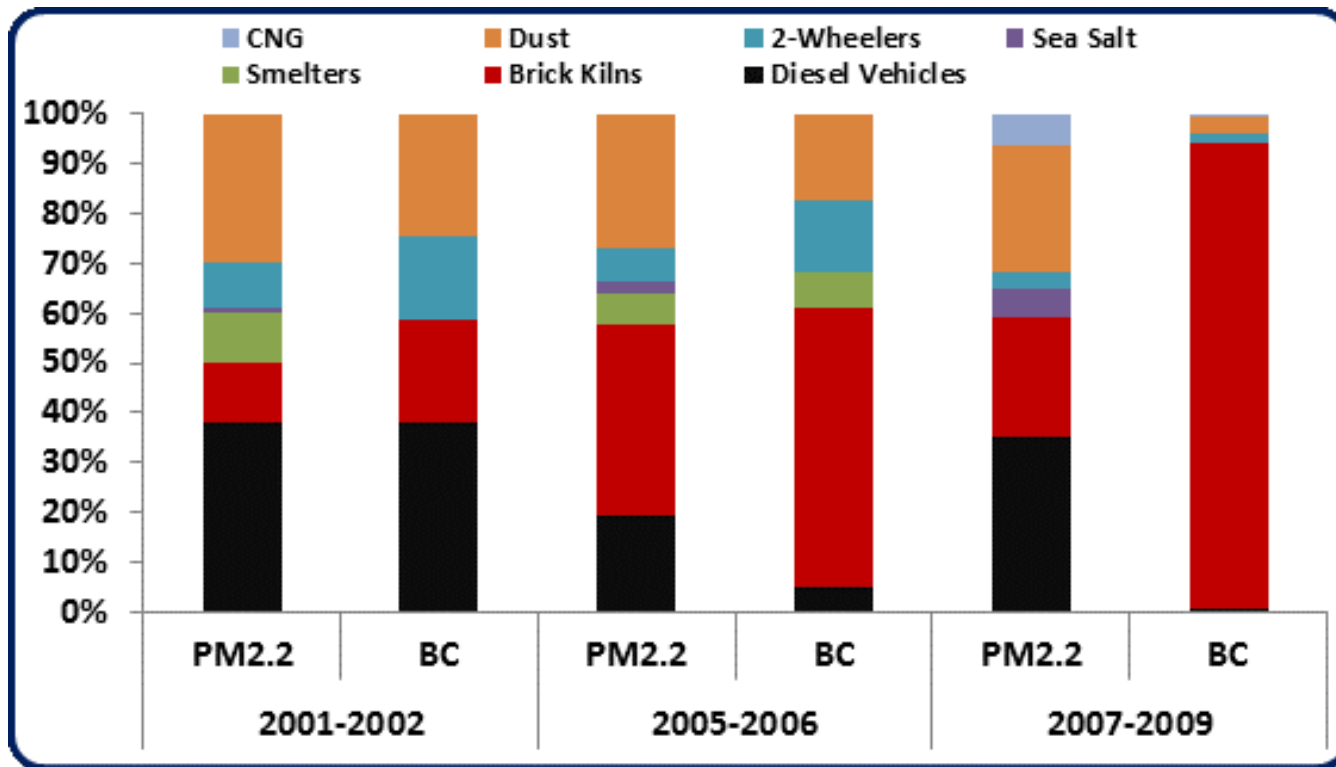
Dhaka, Bangladesh

~30% of the ambient PM_{2.5} pollution is attributed to brick kilns



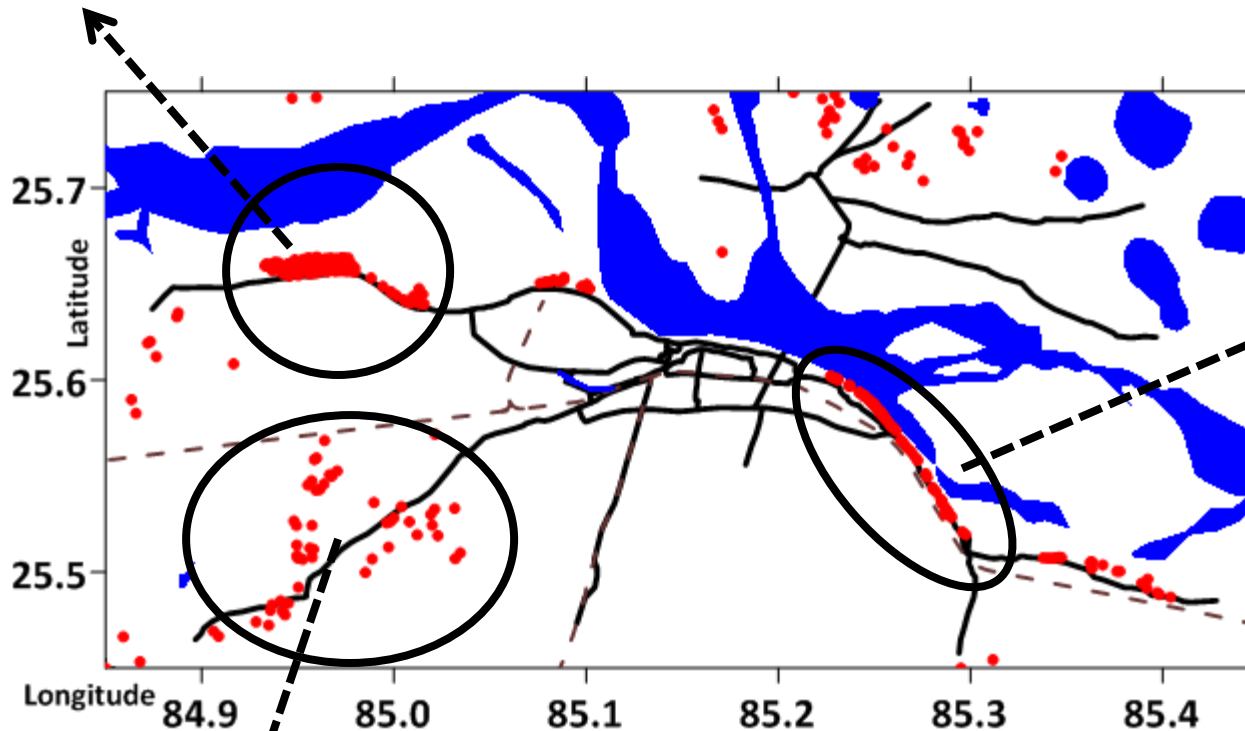
Dhaka, Bangladesh

PM/BC source apportionment results for samples collected on AECD campus



Patna, India

100 stacks

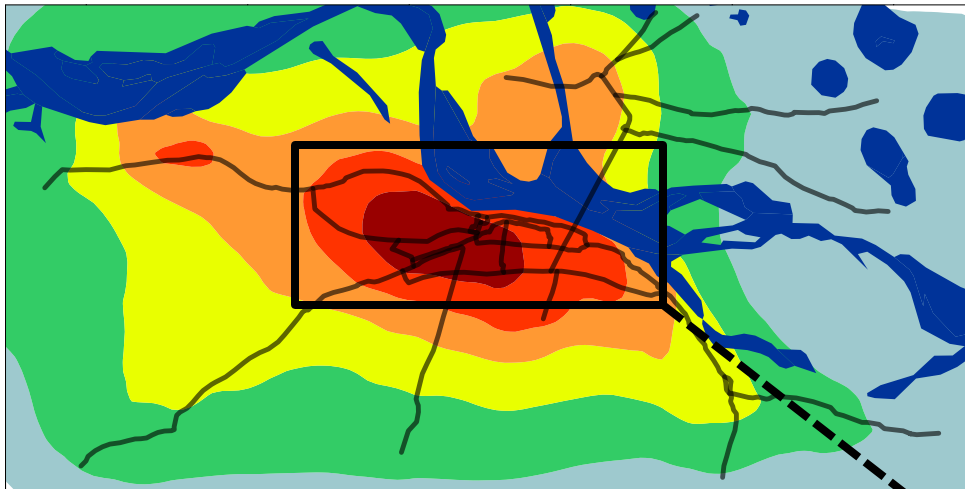


75 stacks

Major roads (black lines), rail lines (hash lines), water ways, and brick kilns (red dots)

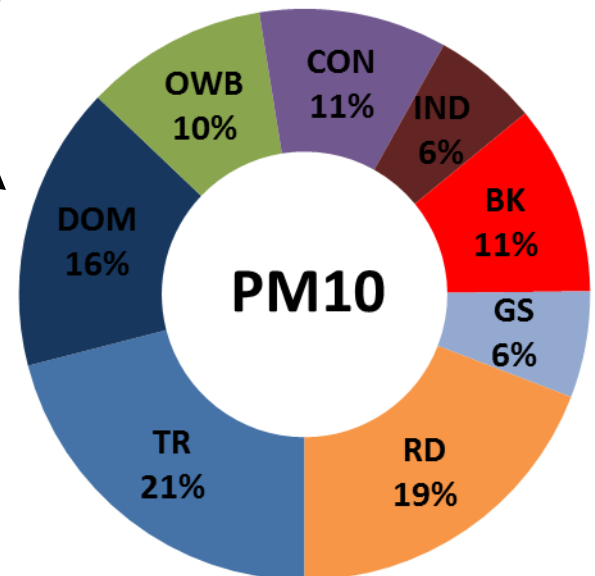
50 stacks

Patna, India



Sectoral contributions
in the select region for
ambient PM₁₀ (2012)

TR = transport (including road, rail, and air); RD = road dust; DOM = domestic (including household and kiosks); GS = generator sets; OWB = open waste burning; IND = manufacturing industries (other than brick kilns); BK = brick kilns; CON = construction activities



Health impact shares

GBD assessments estimate 627,000 premature deaths (2010) in India due to outdoor air pollution

National share of impacts from brick kiln emissions is ????

At urban scale, this can be 5-15%, and as high as 30% in cases like Dhaka

At source solutions

Table 1 Comparison of technical and operational benefits and constraints of current and alternative brick manufacturing technologies available in Bangladesh

Technology	Fuel consumed per 100,000 bricks	Average tons of CO ₂ produced per 100,000 bricks	Average reduction in PM emissions compared to FCBTK (%)
FCBTK	20–22 t coal	50	
Zigzag ^a	16–20 t coal	40	40
Hoffmann ^b	15,000–17,000 m ³ NG	30	90
Hoffmann ^c	12–14 t coal	30	60
VSBK ^d	10–12 t coal	25	60

The table is a summary of information presented in World Bank 2007

FCBTK fixed chimney bull trench kiln, *NG* natural gas, *VSBK* vertical shaft brick kiln

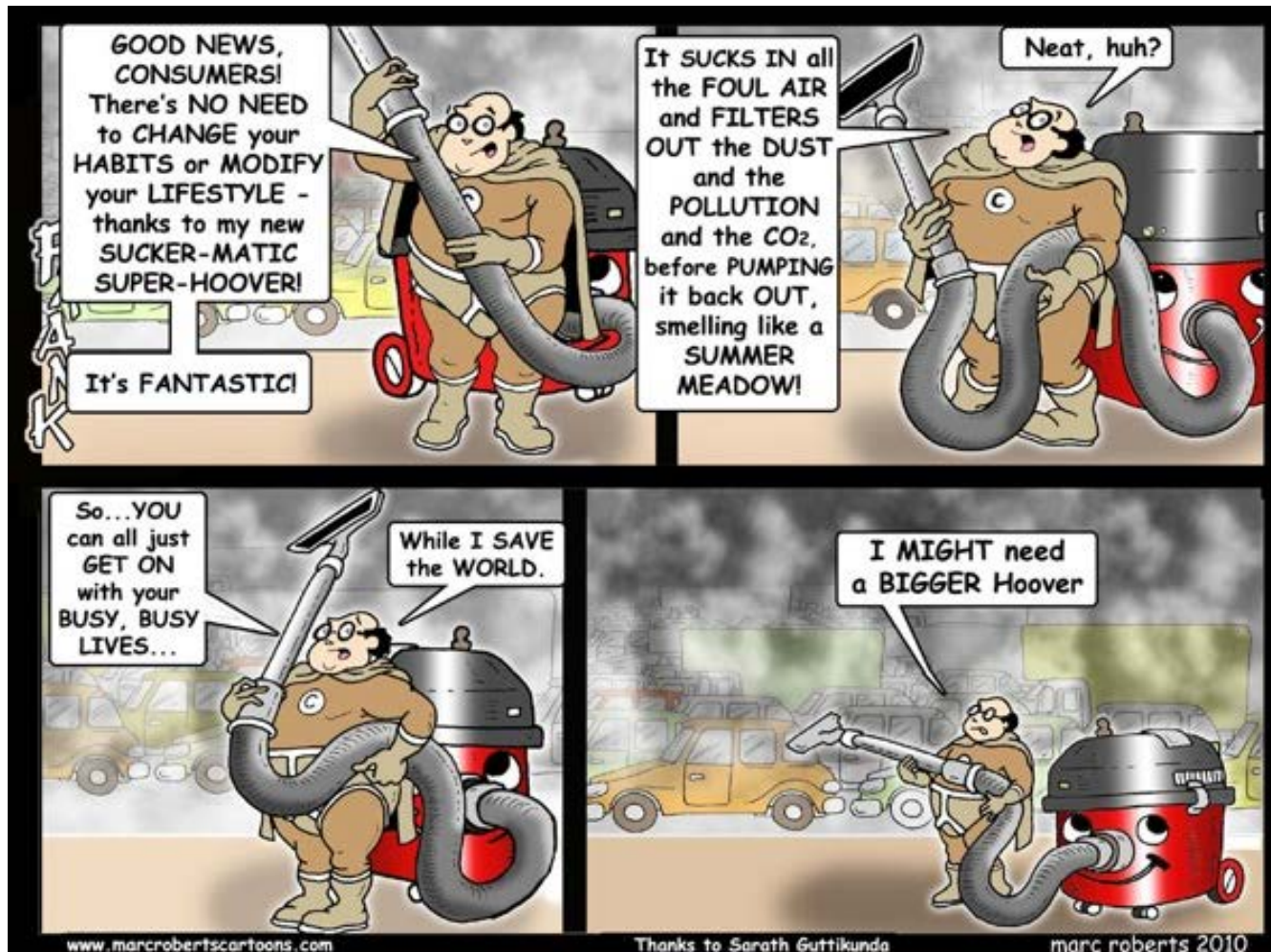
^a Some zigzag pilot kilns are in operation, listed as poor to medium performance. Any improvement in the efficiency of operations can lead to further reductions in coal consumption

^b Manufacturing period for Hoffmann kilns is round the year, compared to the six month operations for the other kilns; thus increasing the land and raw material requirements; Link to natural gas grid and continuous supply is a major constraint

^c Initial investments are higher for Hoffmann kilns

^d Operational models are available in India and Kathmandu (CAI-Asia 2008)

Giant vacuum cleaner?



Giant vacuum cleaner?



Each costs 2.5 crores (0.5 million USD)



Thank
you

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