

EMISSION CONTROL IN BEIJING

An Potential Emission Pricing Strategy Based
On Urban Heat Island Effect



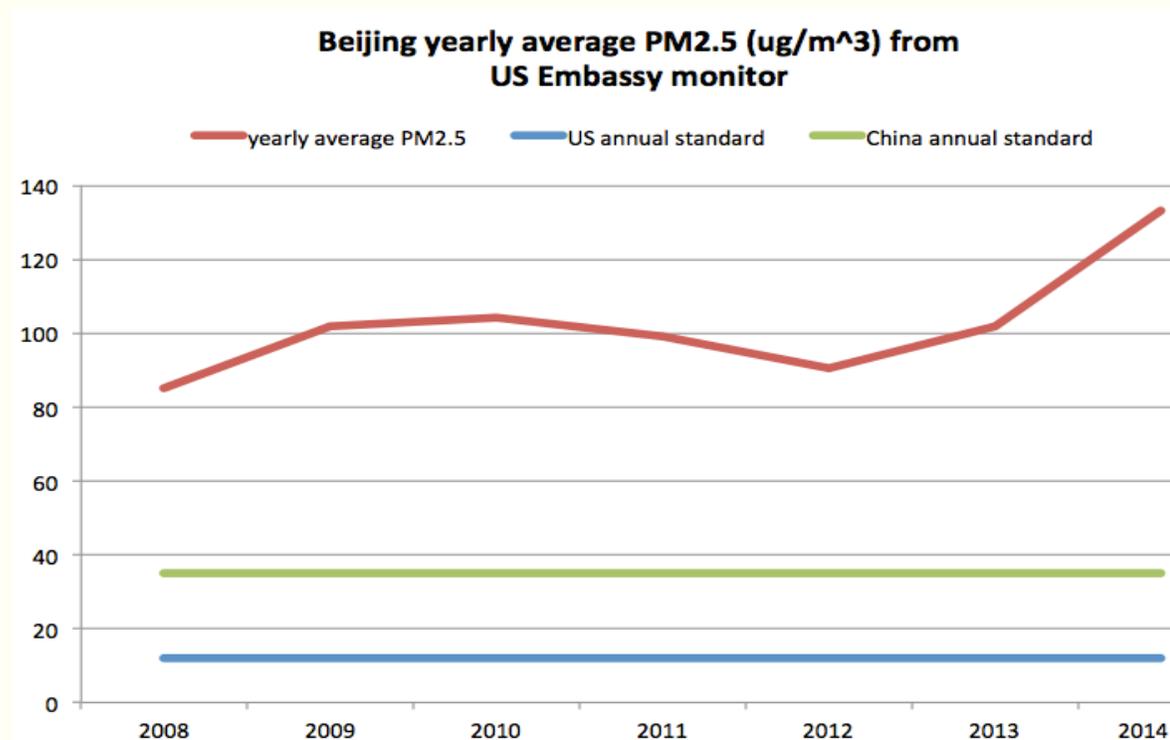
Professor Jianping Wu
Tsinghua University, Beijing, China

Background

- Mid-eastern China has been suffering significant negative effects from fine particle matters with aerodynamic diameter less than $2.5\mu\text{m}$ (PM2.5), especially in large cities like Beijing, prompting warnings for people to stay indoors as smog levels in some areas significantly exceeded World Health Organization-recommended.



*According to US embassy monitoring, there is no prominent decrease of PM2.5 in Beijing since 2008.



Background

- The government work plans released in recent years display the ambition of local government to further improving air quality in Beijing.

Government plan	Schedule	Details
Beijing Clean Air Action Plan	2013-2017	reducing the citywide concentration of fine particulate matter by 25% compared to the year 2012
Beijing 2013-2017 work program for vehicle emission pollution control	2013-2017	develop public transport, in 2017 the proportion of public transport in central area should reach 52%; a stricter regulation for total vehicle numbers...
Promote the use of electric vehicles in Beijing Action Plan	2014-2017	150,000 new energy vehicles will gradually be put into use with annual increase in the number of electric vehicles in the next three years being 30,000, 60,000 and 60,000...

Background

- Some ad-hoc measures to curb air pollution have also been initiated by Beijing municipality, like the giant outdoor air purifier and anti-haze truck, which draw a lot of media attention but with questionable real effects.



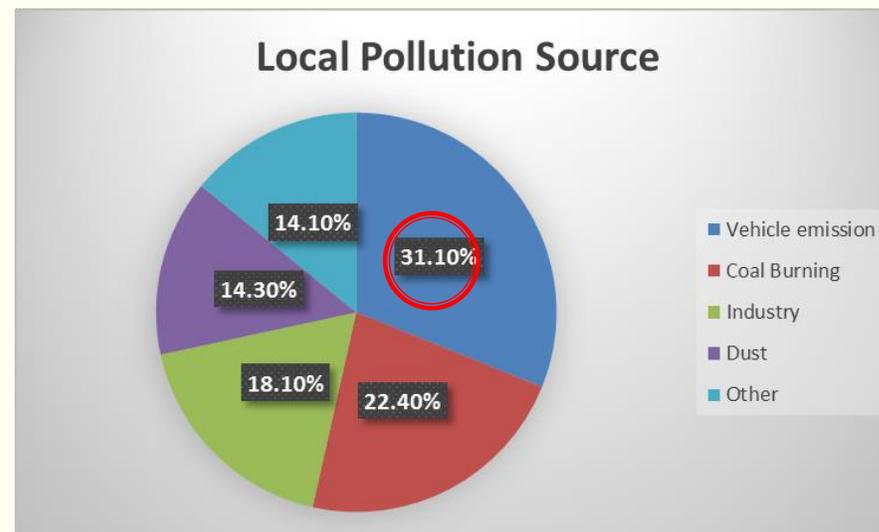
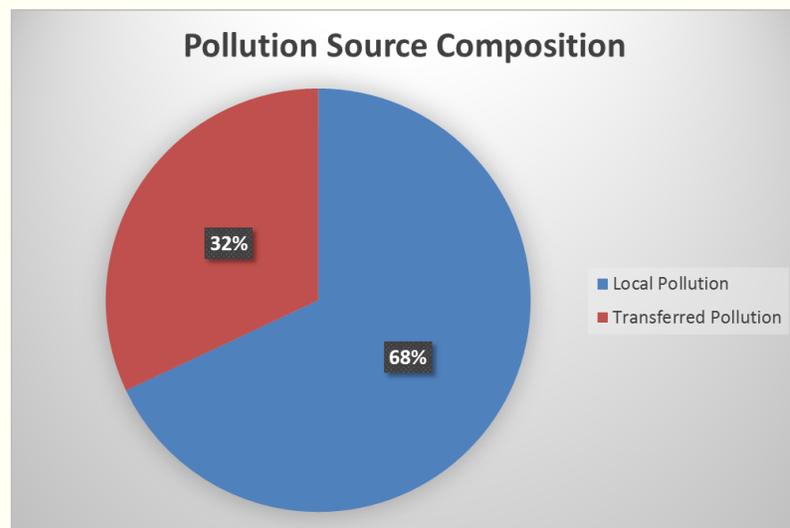
Anti-haze truck, with a giant mist sprayer



Outdoor air purifier

Background

- A report released by Beijing Municipal Environmental Protection Bureau showed the pollution source details of PM2.5 in Beijing, which stated **28-36%** of pollution source comes from pollution **transported from other regions** and **64-72%** comes from **local pollution**. And the detailed proportion of local source is plotted as follows:



Background

- Industry contributes most to air pollution in Beijing (from Beijing and transported from Tianjin and Hebei)
- Vehicles contribute most NOX (one of the major air pollutants) in Beijing

	in tons	Beijing	Tianjin	Hebei
SO ₂	Total	87,042	216,832	1,284,697
	Industry	52,041	207,793	1,173,147
	Domestic	34,967	8,959	111,524
NO _x	Total	166,329	311,719	1,652,470
	Industry	75,927	250,646	1,105,630
	Domestic	13,638	5,221	23,319
	Vehicle	76,472	55,669	523,476
Dust Emission	Total	59,286	87,457	1,313,313
	Industry	27,182	62,766	1,187,198
	Domestic	28,258	18,400	77,015
	Vehicle	3,806	6,267	49,057

2013 Major Air Pollutants Sources in
Beijing, Tianjin, Hebei

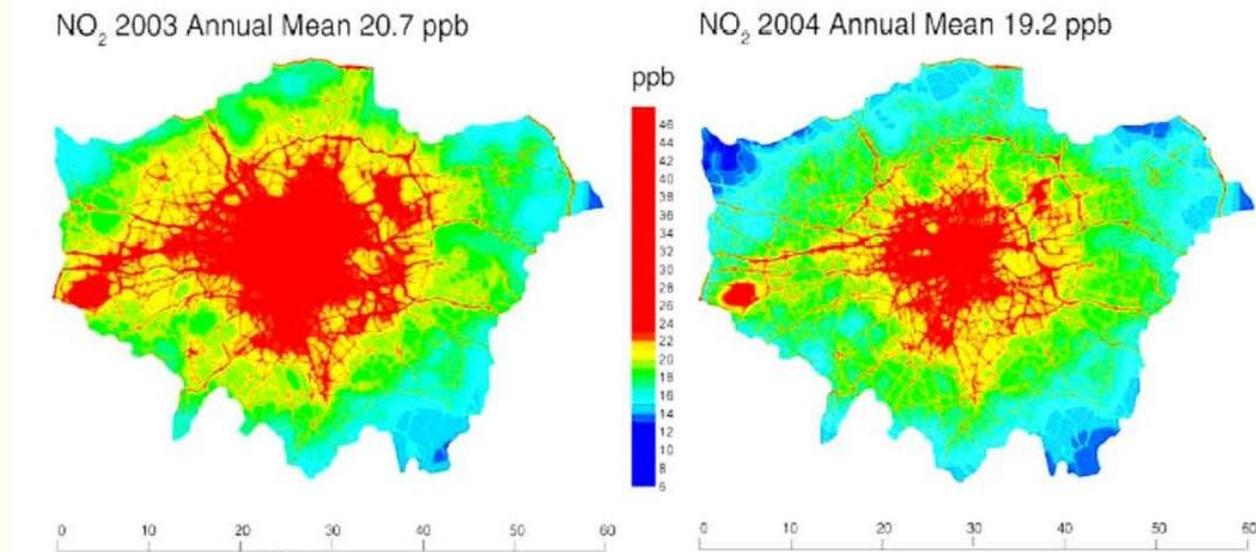
Background

- Many mega-cities worldwide have adopted different strategies to tackle the local air pollution problem, including :
 - a) Promote **public transport** usage which is considered a much cleaner travel mode (Curitiba, Copenhagen, Paris, Oslo , etc.)
 - b) Promote **walking and cycling** by building dedicated lanes and public bike sharing schemes (Copenhagen, Freiburg, etc.)
 - c) Harsh **vehicle control strategies**, including number-plate control, zero emission zone, congestion charging (London, Beijing, Delhi, Paris, Zurich , etc.)

Background

- Data reveal the effectiveness of London congestion charge, yet it also cause controversies.

Charging zone	Inner Ring Road					
	NO _x	PM10	CO ₂	NO _x	PM10	CO ₂
Overall traffic emissions change 2003 versus 2002	-13.4	-15.5	-16.4	-6.9	-6.8	-5.4
Overall traffic emissions change 2004 versus 2003	-5.2	-6.9	-0.9	-5.6	-6.3	-0.8
Changes due to improved vehicle technology 2003-2006	-17.3	-23.8	-3.4	-17.5	-20.9	-2.4



Before-and-after air quality comparison of London

Background

Advantages for congestion charges:

1. Reduce congestion and journey time.
2. Reduce pollution.
3. Make city centers more attractive for pedestrians and cyclists.
4. Raise revenue.
5. Make drivers pay social cost of driving
6. ...

Beijing: the Geography

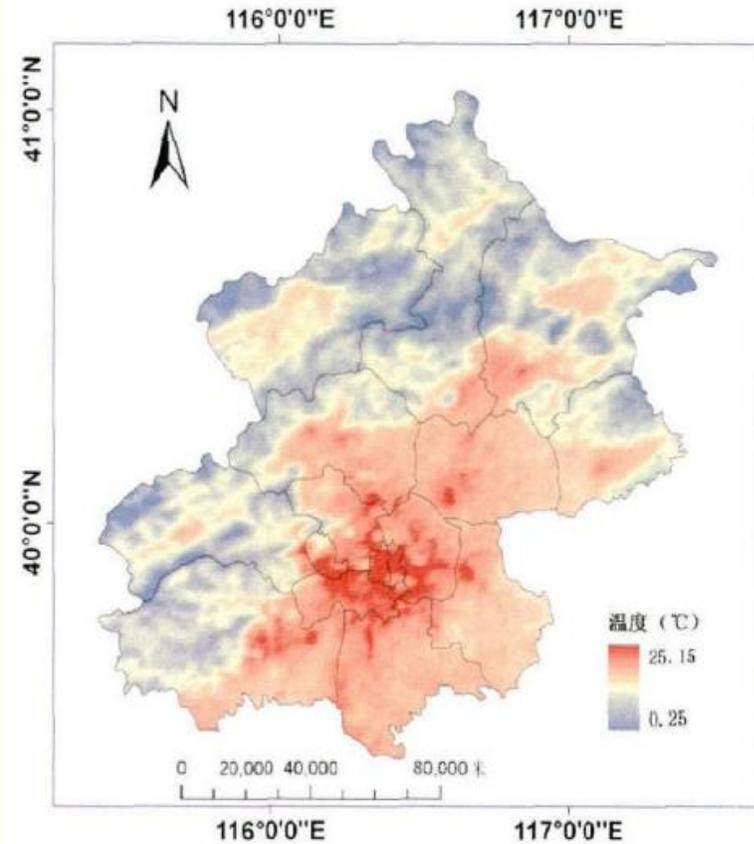
- Beijing is located at the north side of North China Plain, with Taihang and Yan Mountain standing in the north and west sides. The atmospheric **self-purification ability is weak**.



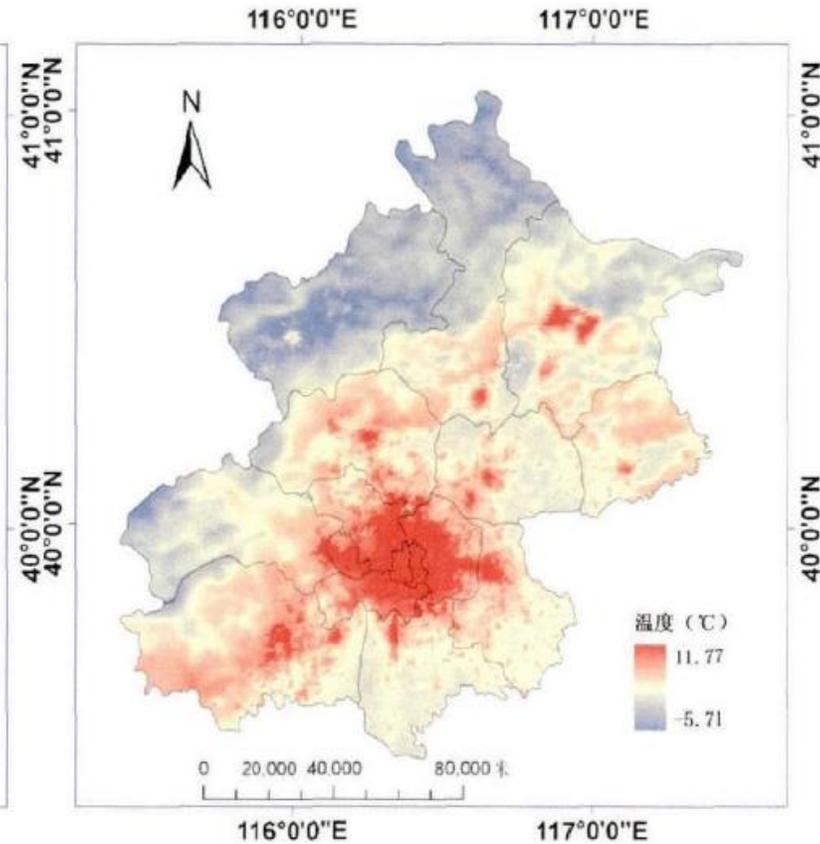
Bronze Sand Table
Beijing Planning Exhibition Hall

Beijing: UHI Effects

Day



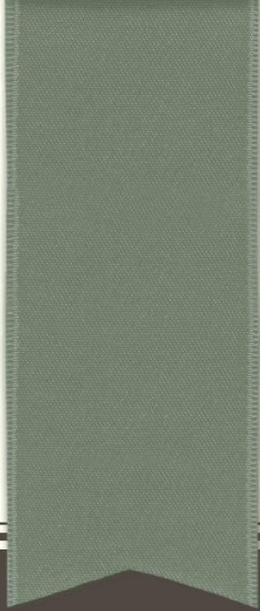
Night



Temperature difference grows larger by night, pollutants starts to circulate back to urban area

An Potential Emission Pricing Strategy

- Use UHI intensity of night to divide Beijing into regions
 - Most mobile heat sources disappear, land Surface Temperature (LST) will represent the most accurate UHI
- Use UHI intensity of day to decide price tier



THANK YOU