Assessment of Traffic Emission in Asian Cities and Co-Benefit of Faster Technology Intrusion

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Air Quality Challenges: Tackling the Changing Face of Emission

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Presentation highlights

- Mobile source emission in Asian cities
- Survey results of vehicle fleets in selected cities
- EI results and climate co-benefit assessment

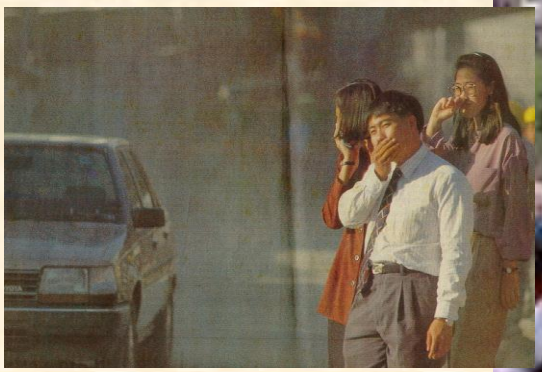
Air pollution in Asia

- Fast increase in emission sources: traffic, industry, open burning …
- High pollution levels and air quality is worsening in urban areas
  - PM is most significant (primary & secondary PM)
  - Surface ozone air quality
  - Air toxics
- Impact on human health, crops/ecosystem ➔ economical effect is serious but not well studied
- Other issues: Indoor air pollution, Trans-boundary (Acid rain, ABC, regional haze, dust storm, etc.)

(1) Traffic emission in Asian Cities

- Vehicles and emission control:
  - Low technology levels: second-hand and long life
  - Large share of motorcycles
  - No enforcement of control devices for in-use vehicles
- Urban planning issue, slow increase of road network, fast increase in vehicle population ➔ congestion
- Non-road emissions are important but normally overlooked
- Positive development: observed improvement in vehicle technologies & fuel quality, alternative fuels …

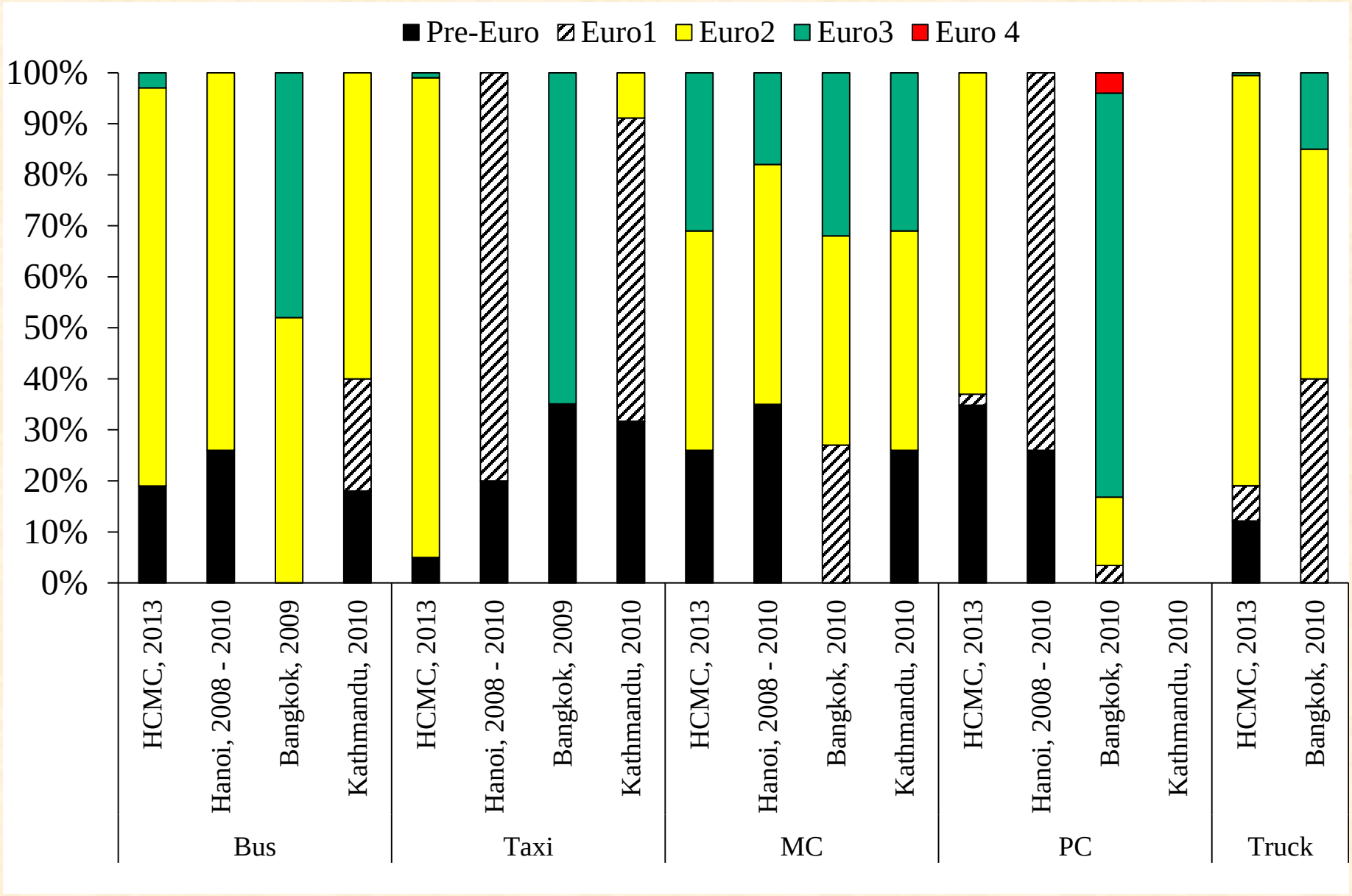
On-road vehicles contribute over 60-80% of total urban air pollution burden in developing countries



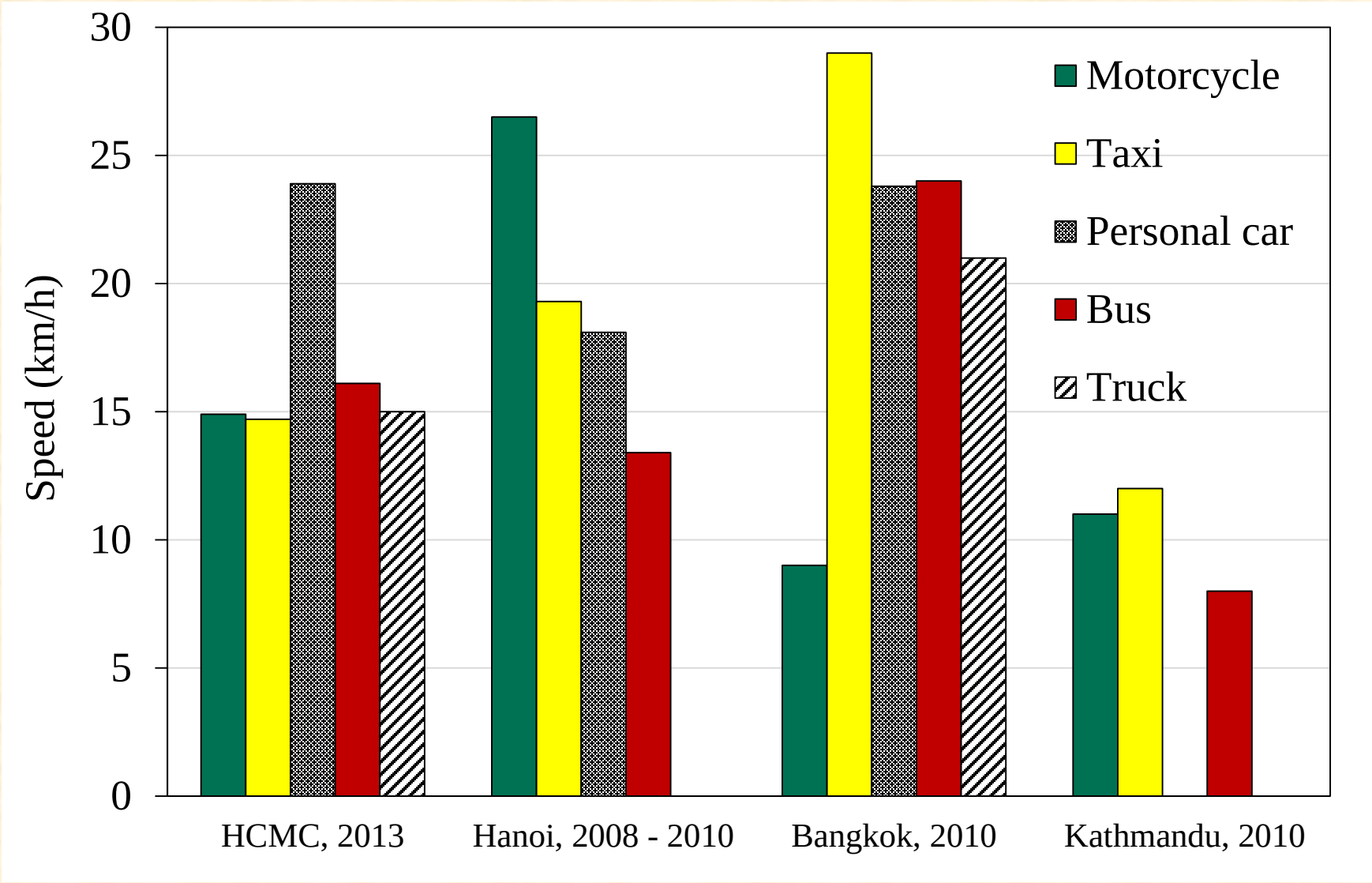
(2) Fleet analysis: survey and results

- Four cities: Bangkok, Kathmandu, Hanoi and Ho Chi Minh City (HCMC)
- IVE survey methods:
  - Parking lot and gasoline stations survey for vehicle technologies, age, mileage, odometer, fuel types, etc. (500-1000 vehicles per city)
  - GPS surveys for driving activities: 6-10 vehicles per fleet type in a city
  - Traffic counting: video camera

Vehicle Technology Distribution



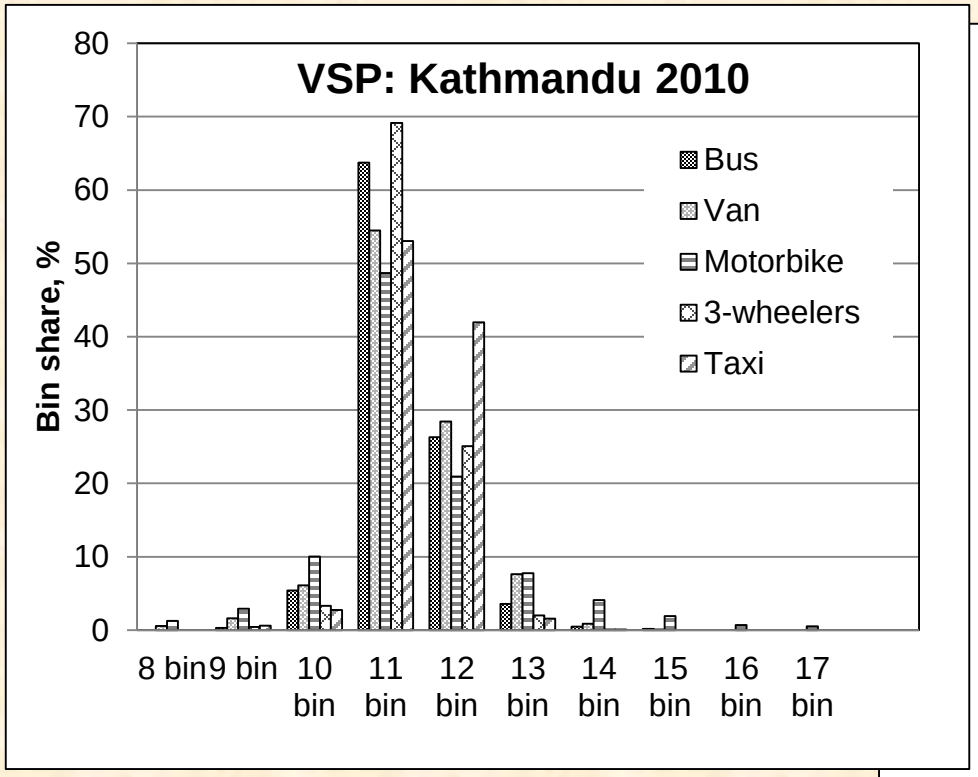
Vehicle speeds

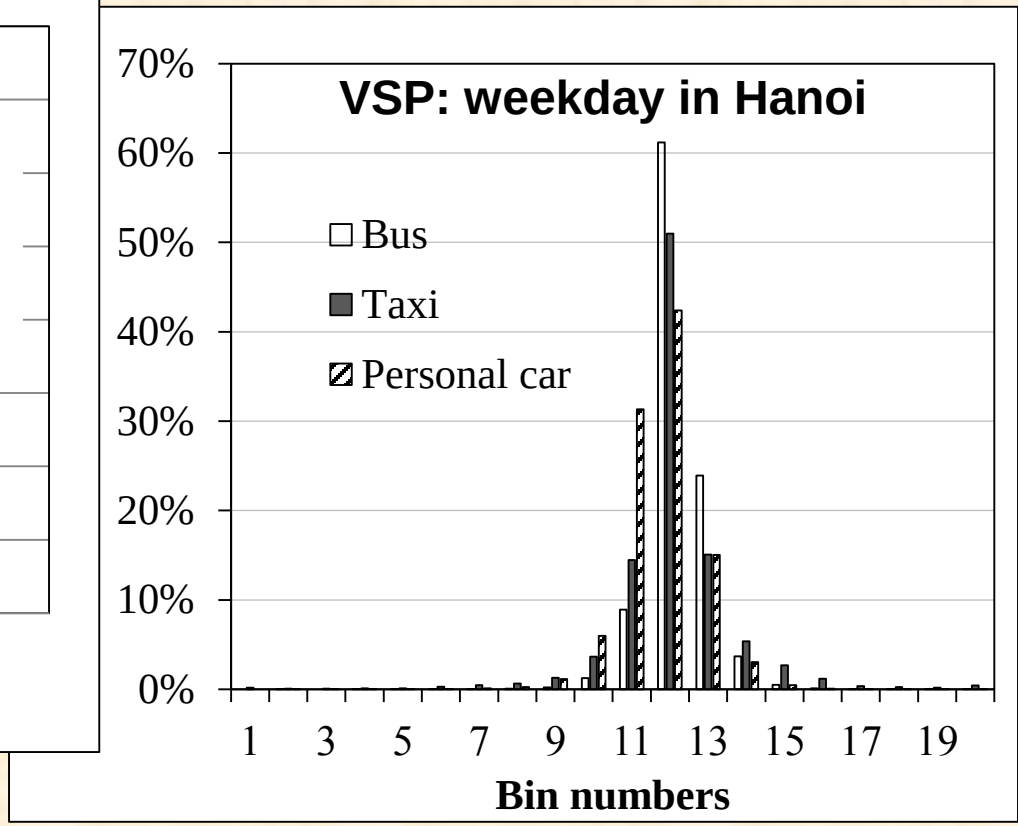


Driving activities

	HCMC, 2013	Hanoi, 2008	Kathmandu, 2010	Bangkok, 2013
Motorcycles				
Active population	5,004,831	2,339,519	394,420	1,298,765
Average age	4.6 (1-29)	3.6 (1-10)	4.3 (1-27)	5.7 (1-20)
Daily VKT (km/veh)	19	20	15	16
Taxi				
Active population	17,802	12,189	6,206	83,742
Average age	6 (2-10)	2.11 (1-4)	9.5 (1-21)	3.6 (0-14)
Daily VKT (km/veh)	124	157	87	280
Personal car				
Active population	315,943	100,359		1,202,499
Average age	7.6 (0-16)	2.44 (1-8)	NA	5.3 (1-20)
Daily VKT (km/veh)	33.4	42	NA	70
Bus				
Active population	3,358	1,118	11,328	18,850
Average age	6.4 (1-11)	6.31 (2-10)	8.9 (1-47)	8.8 (1-30)
Daily VKT (km/veh)	197	212	96	137
Truck				
Active population	185,501			61,720
Average age	11.7 (1-27)	NA	NA	6.2 (1-17)
Daily VKT (km/veh)	31	NA	NA	112

Driving activities: VSP

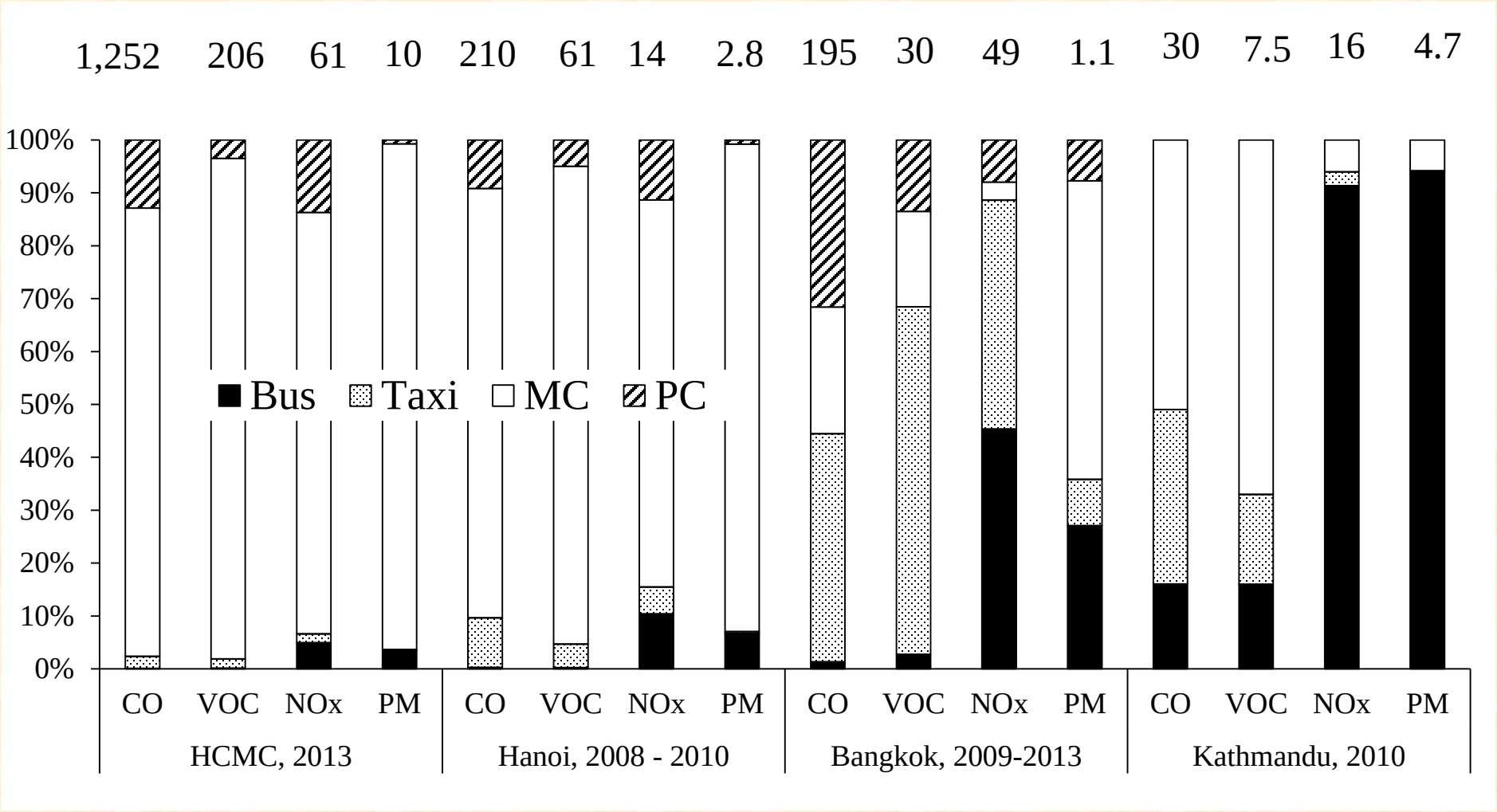




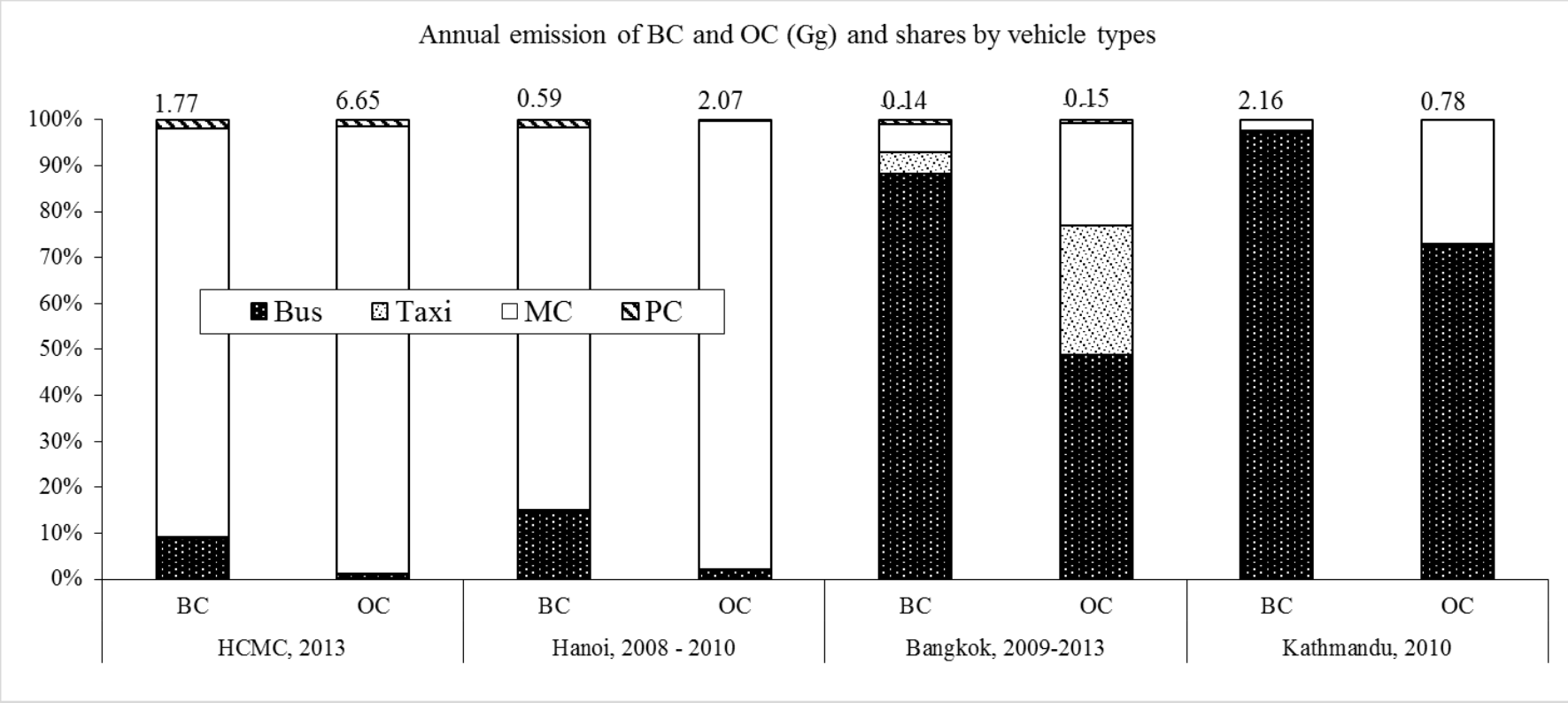
Common for all 4 cities: Bins No. 11-13

- Bin 11 & 12: low speeds with stops/idling (traffic jams)
- Bin 13: slight accelerations (ISSRC, 2008)

(3) EI results: annual emission (Gg) and shares

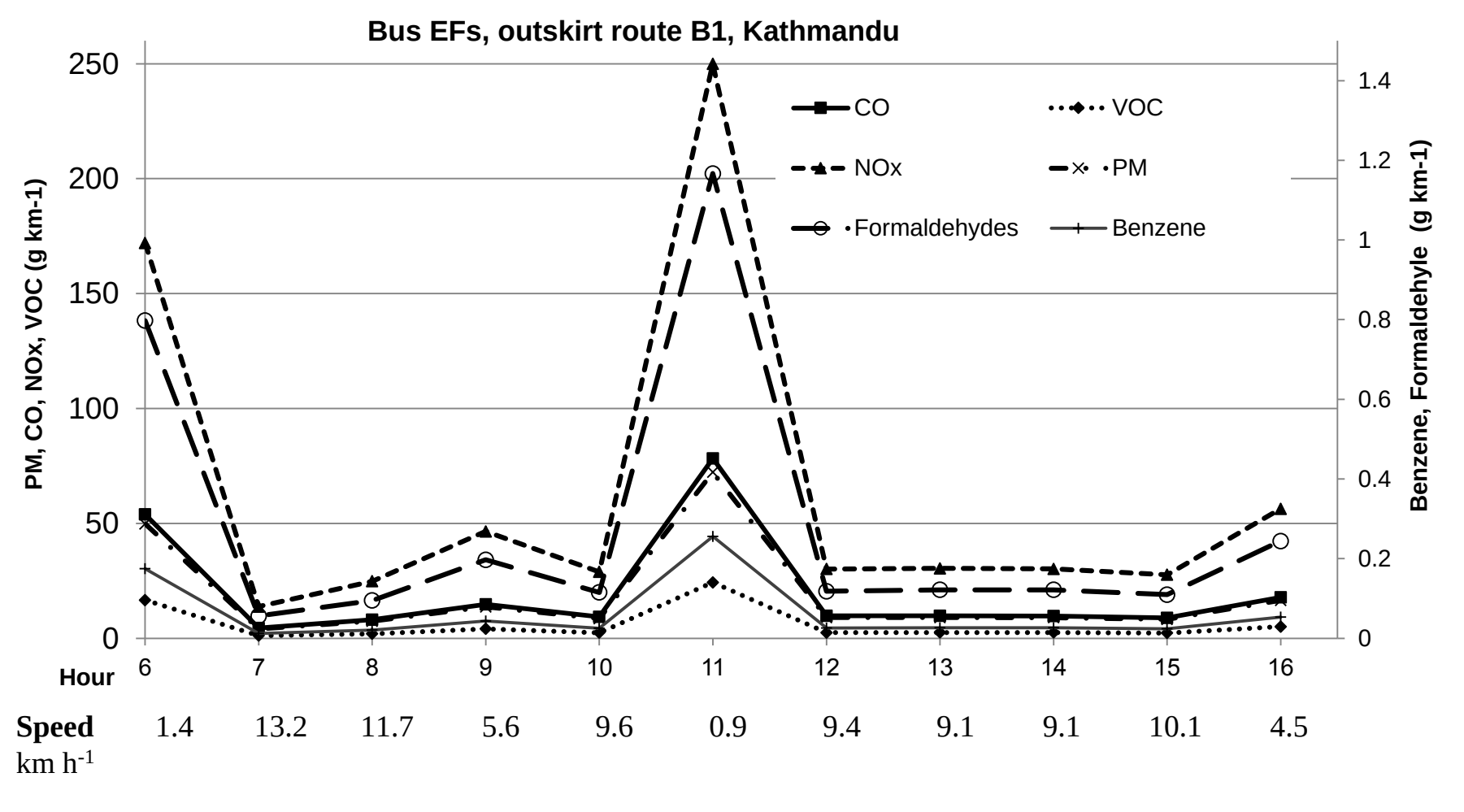


Annual emission of BC and OC



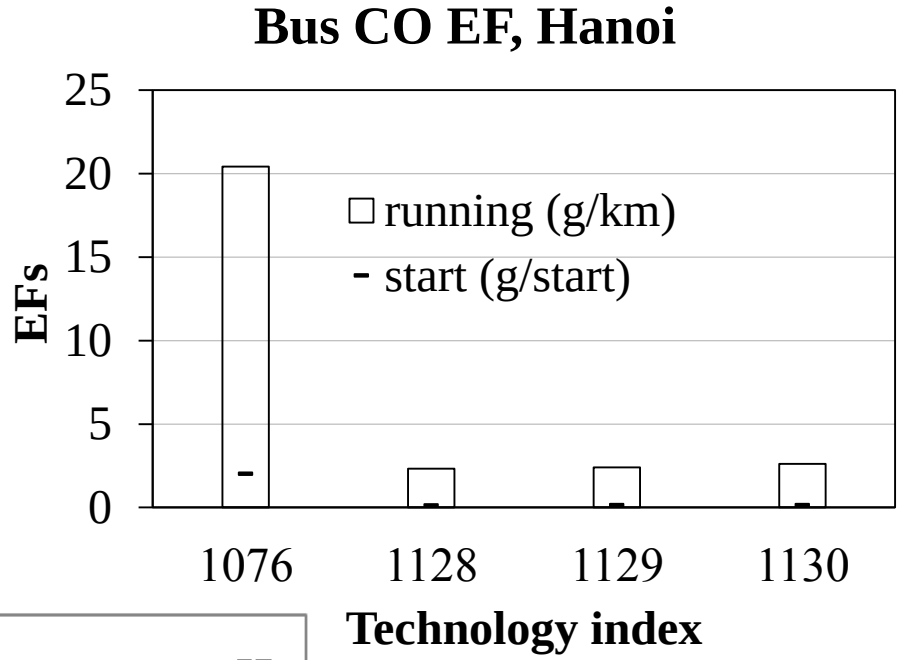
Bus fleet in Kathmandu: high mileage, old and low speeds

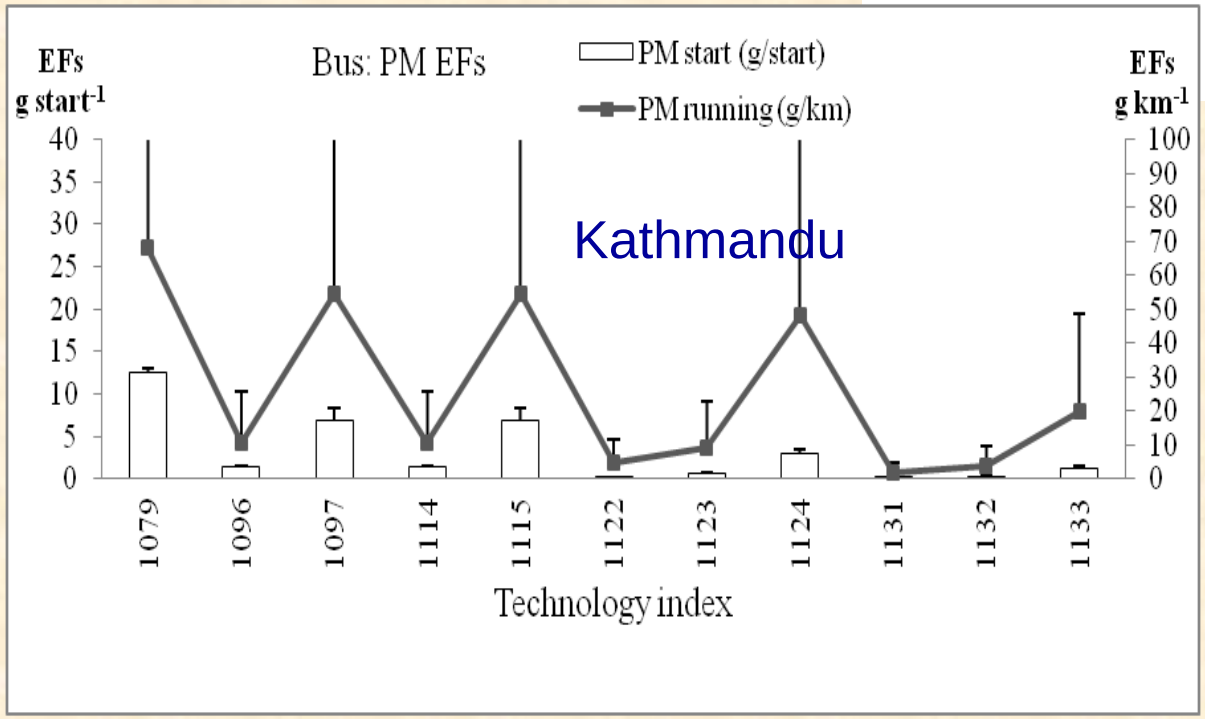
Running EFs vs. speed



Extremely high EFs of buses when speeds are low

EFs vs. Technologies





Old technologies with high mileage have high EFs

Co-benefit of faster Euro3 Intrusion

Species	Emission reduction under Euro3 scenario, %		
	Hanoi	HCMC	Kathmandu
CO	89	57	51
VOC (exh+evap)	92	42	48
NOx	36	57	31
Sulfate	44	45	-4
PM	61	60	45
BC	*68*	*69*	*46*
OC	*28*	*50*	*46*
CO_2	-7	3	-2
N_2O	44	5	-627
CH_4	97	39	40
Air Toxics	87	43	-39
Total pollutants*	**85**	**55**	**44**
Total GWP **	**28**	**42**	**31**

* Excluded BC, OC and GHGs

** SLCPs (BC, OC, VOC etc.) are included

Summary

- Low levels of engine technologies: only a small percentage of Euro4 present
- Wide age span, slow speeds
- High EF of old and high mileage vehicle and slow speeds
- Substantial benefits to air quality and climate mitigation if at least Euro3 implemented

Thank You!