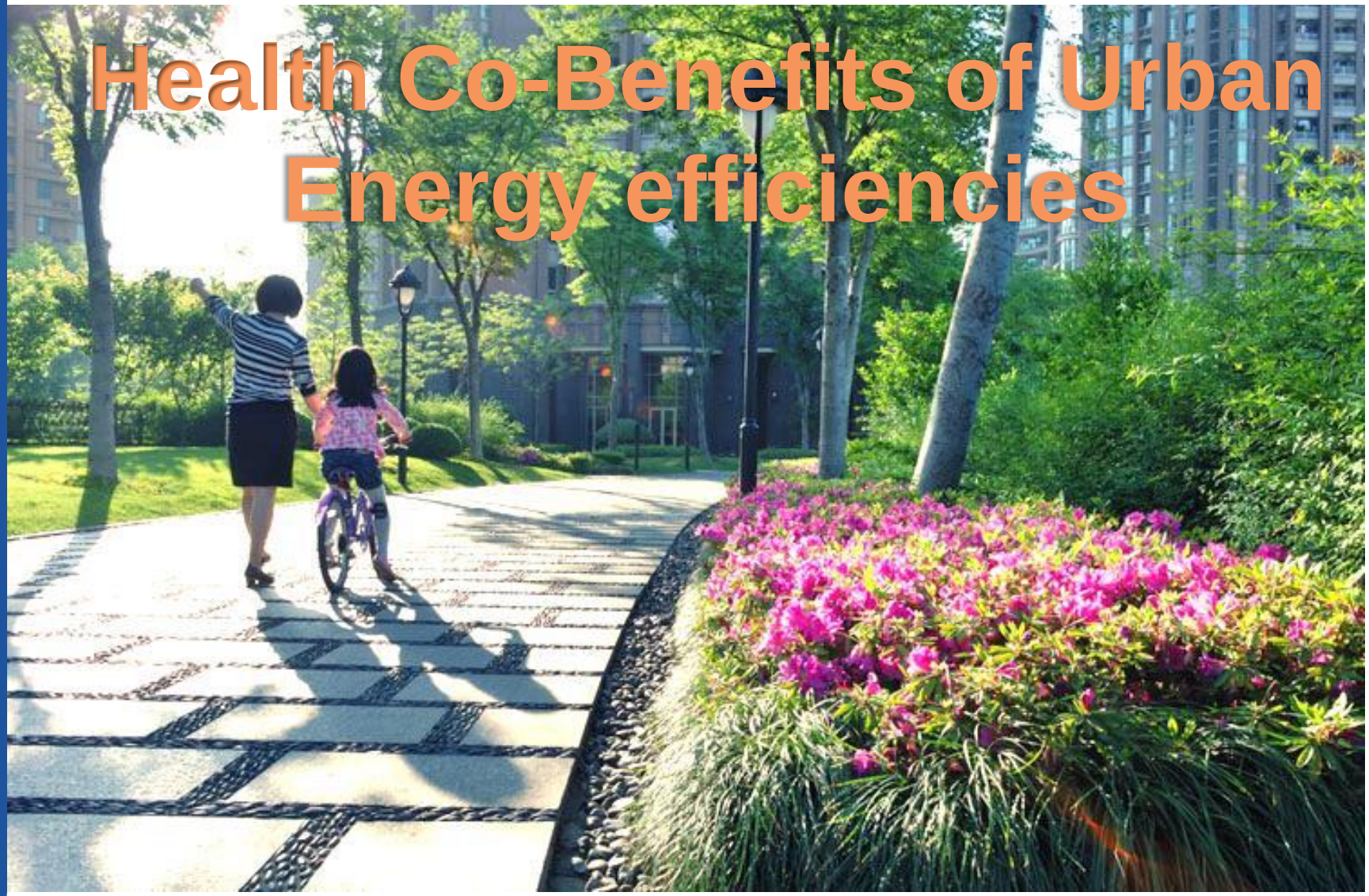
Health Co-Benefits of Urban Energy efficiencies



Housing, Land Use & Transport

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World Health Organization

Focusing on housing and health in the urban context is particularly important in light of:

- Our planet's rapid and dramatic urbanization
- Soaring increase in urban housing & transport energy use and pollution/climate emissions
- Continued growth of slums, sprawl, substandard housing & health impacts




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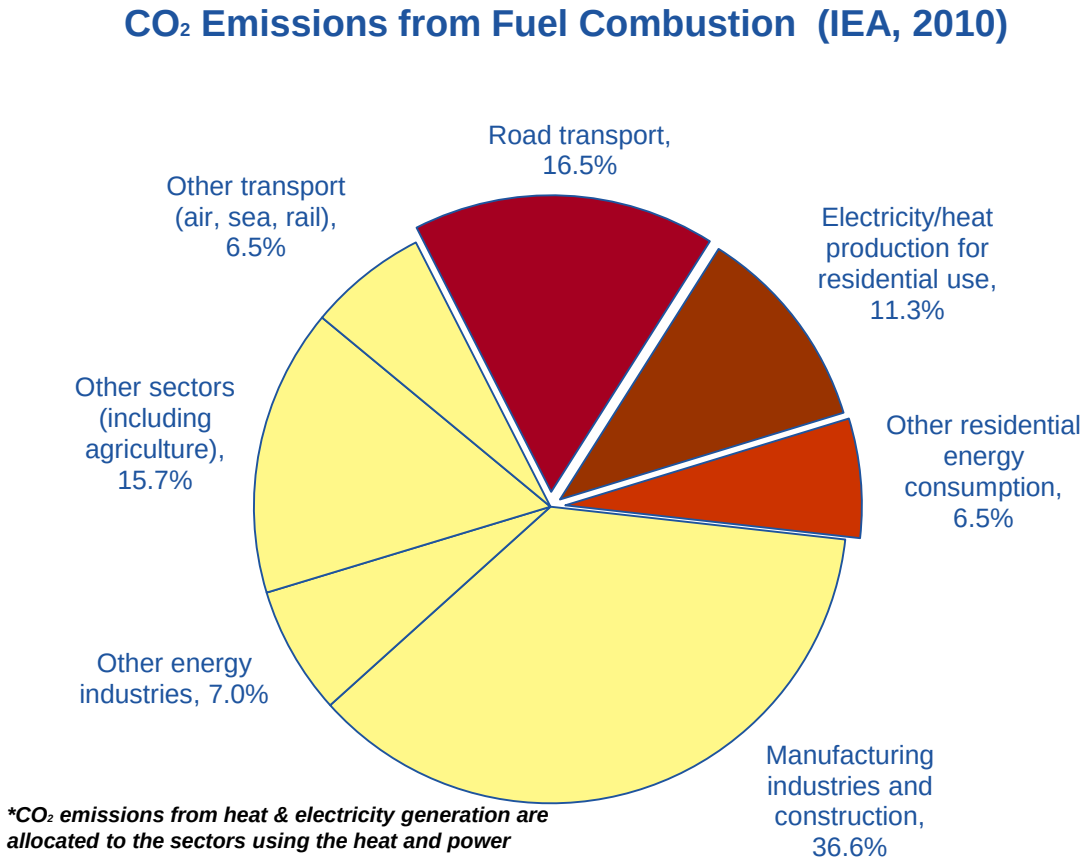
ENERGY: Vehicles & housing energy use comprises one-third of global CO_2 emissions



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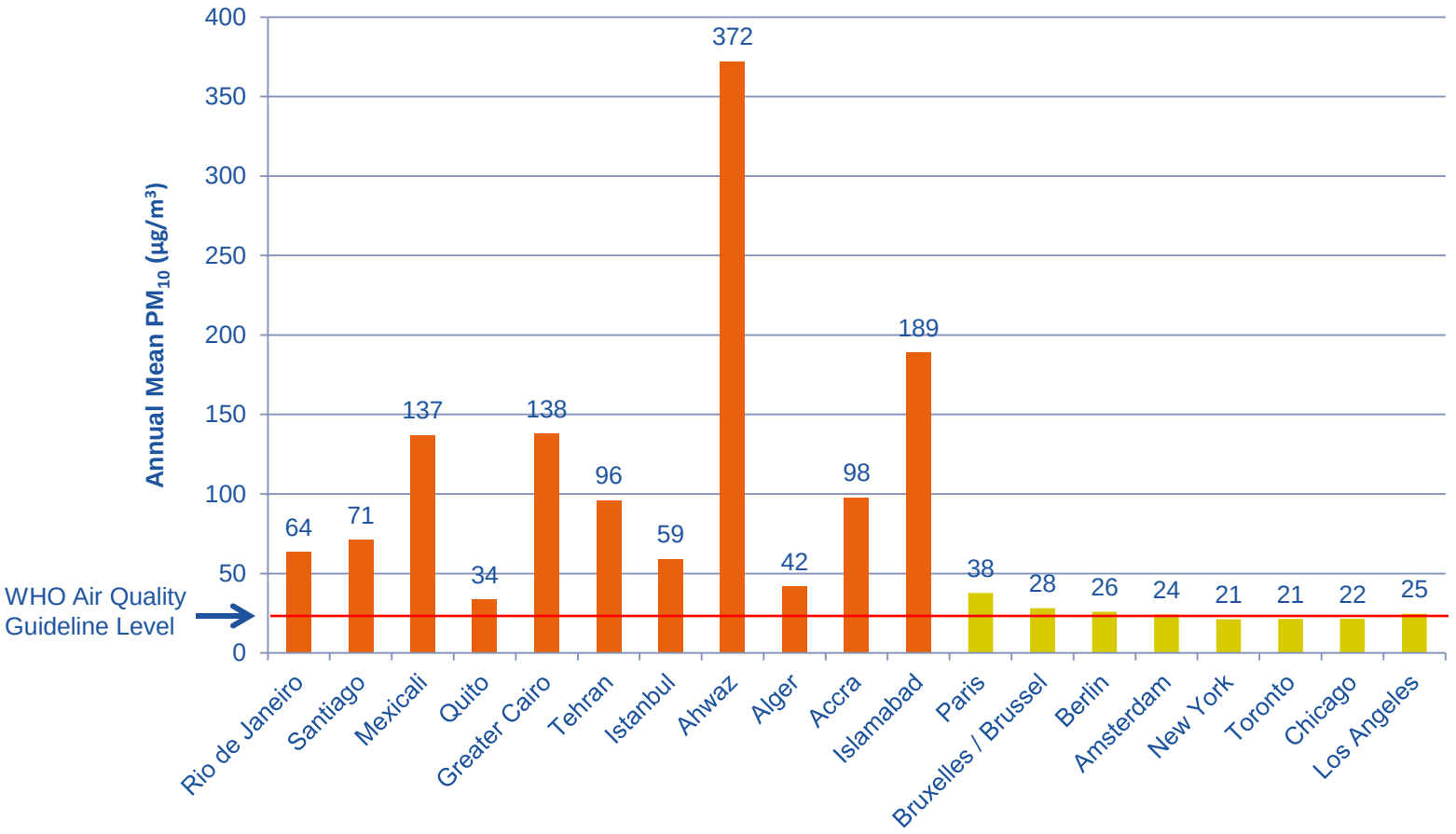
HEALTH: Excessive exposures to urban air pollution – particularly in developing cities



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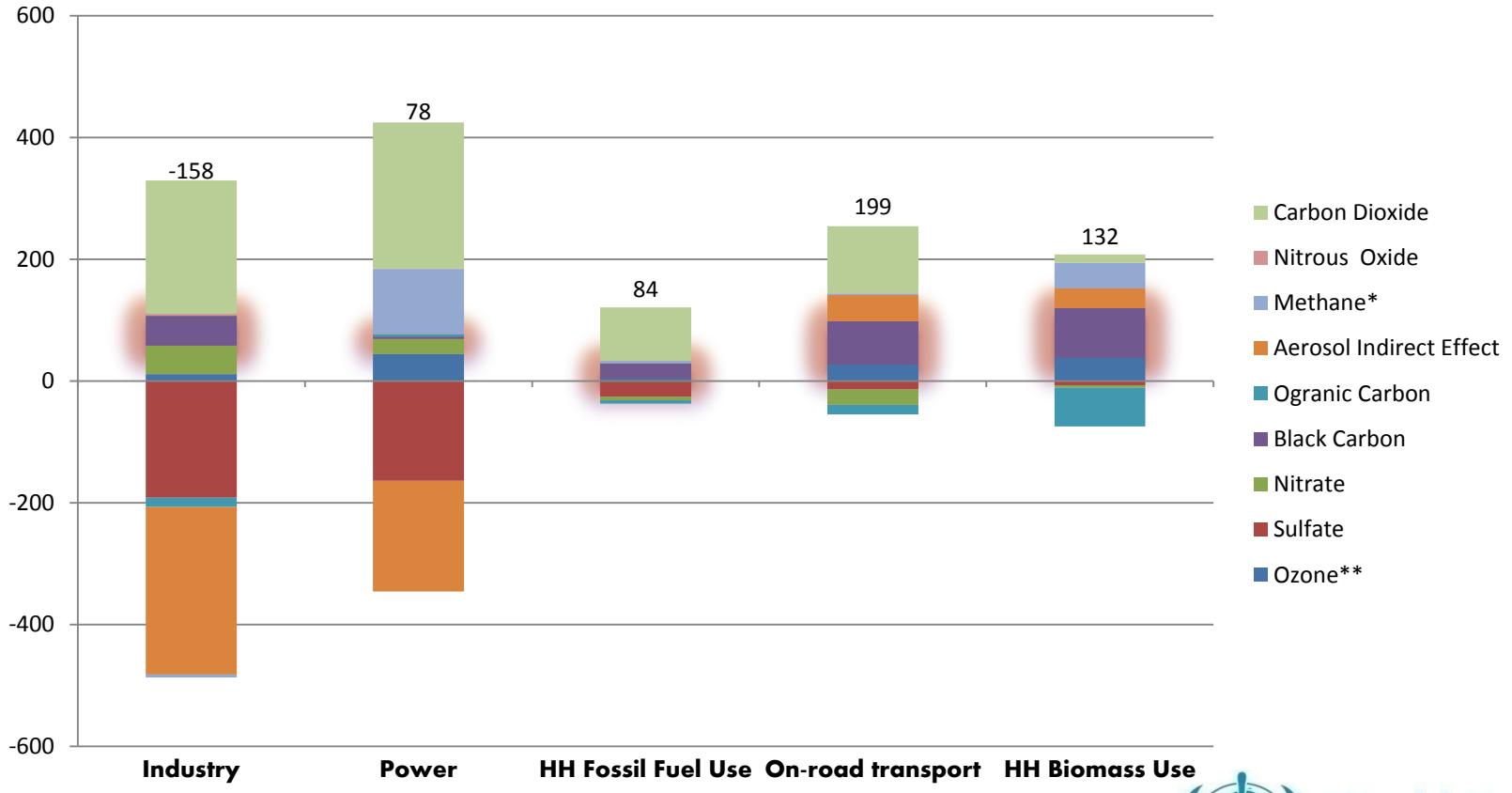
CLIMATE : Road transport/household biomass - greatest potential for reducing black carbon by 2020

Radiative forcing (Global warming) by sector - 2000-2020 ***(Unger, 2010)***



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Multiple Synergies

"If the policy goal is to achieve rapid and immediate reduction in anthropogenic RF, then effective opportunities lie in reducing emissions from the on-road transportation, household biofuel and animal husbandry sectors.

"The on-road transportation total RF is fairly robust with uncertainty in the range 20-40%, whereas uncertainties are higher for household biofuel ~ 160% and animal husbandry ~90%)

"Reducing emissions from the on-road transportation sector is particularly attractive because this action yields both rapid and long term climate benefits.

"Newly emerging public health research indicates that traffic related particulate matter is more toxic than inorganic components like sulfate and nitrate from the power sector, so reducing emissions from on road transportation has additional benefits." (Unger et al, PNAS, 2010.)

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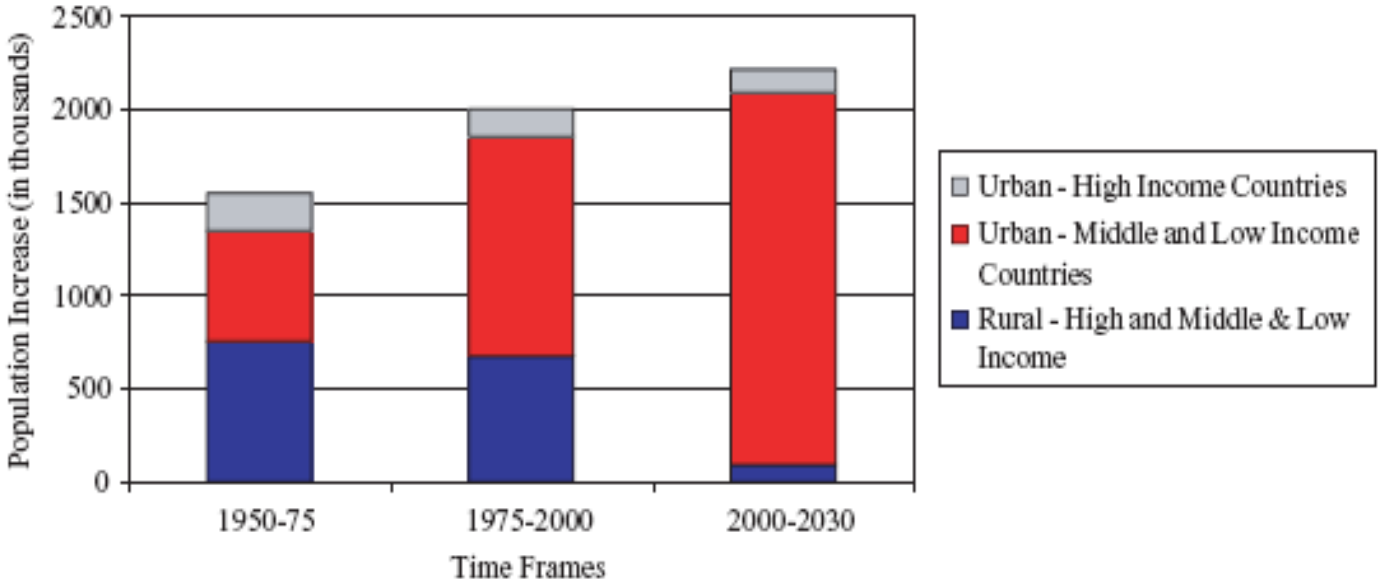
Mid/low-income cities are the "*Future*" - experiencing the most growth

Distribution of world population growth 1950-2030



Source: United Nations (2002), World Bank (2002)

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Cities are the *Frontier:* for Energy-related health challenges

1. Outdoor air pollution → 3.3 million deaths/yr – mostly urban *(Lancet, 2012)*
2. Physical inactivity → 3.2 million deaths/yr *(WHO, 2009)*
3. Traffic injuries → 1.3 million deaths/yr *(WHO, 2009)*
4. Water & Sanitation → 25% of urban residents globally lack access to good sanitation. Safe drinking water also a problem for urban poor *(WHO, 2009)*
5. Climate Change → 140,000 deaths/yr – Coastal cities vulnerable *(WHO, 2009)*
6. Household Air Pollution →3.5 million deaths/yr *(Lancet, 2012)* → 25% of city dwellers in developing countries and 70% in least developed countries use cook on primitive biomass/coal stoves.

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Against this global context: 3 urban housing and health synergies urgently need attention

We need to look beyond the building shell at :

1. Housing densities & compact urban design as a key defining factor in urban housing & transport energy use – and urban pollution emissions
2. Spatial integration of housing in neighborhood business, schools and green spaces - for healthy active travel
3. Housing/neighborhood urban connectivity to urban centres via transit, walking and cycling infrastructure

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These factors define the “shape” of a urban growth as energy “obese” or “trim”

Suburban USA

Coyoacan, Mexico City

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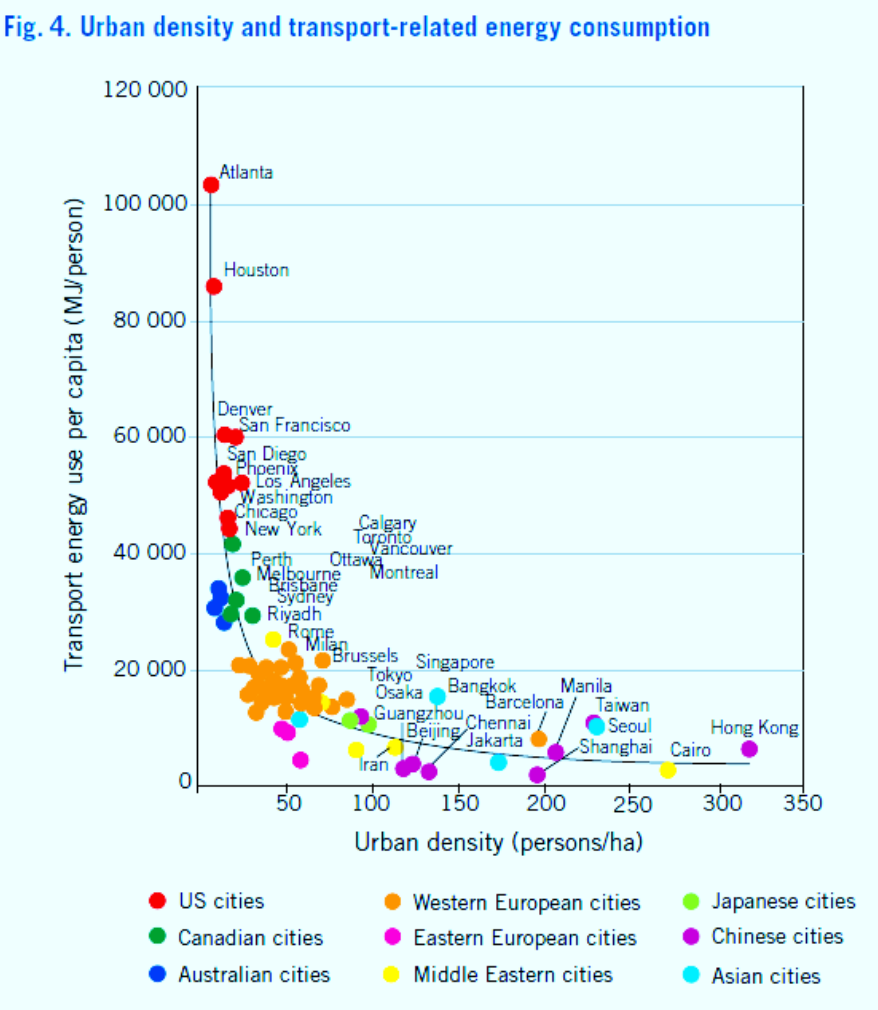
1. The Geometry of Housing Densities-Transport Energy



Medium density (European) cities achieve largest energy efficiency gains in comparison to **North America.**

Longer vehicle travel distances = more pollution emissions – although tailpipe controls may mitigate some emissions.

Public transport systems are less efficient in low-density/sprawl – destinations are too dispersed. So patronage declines sharply.

Source. WHO, 2012/International Association of Public Transport , 2005

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Housing Density – also a determinant of home energy efficiencies, e.g.

Multi-unit buildings share walls, utility points and energy systems

Planned, multi-unit development is an also an entry point for scaling up resilient, energy-efficient building technologies

- Cities with higher densities and mixed residential/commercial neighborhoods had significantly lower CO_2 emissions than suburban areas with strictly separated zones. (*Glaeser & Kahn, 2008*)
- In Toronto, a low-density suburban development used 2.5 X more energy than a condominium development in the centre city (*Norman J., et al 2006*)

Many developing cities, however, also are growing horizontally - in low-density extremes of slums and suburbs – the latter pictured below.

New suburb in China

Guragaon, India

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2. Integration of housing, services/schools and recreation reduces travel & promotes active travel

- Land use planning one of most effective measures to promote physical activity (*WHO, 2009*)
- & reduce pollution: e.g. schools within walking distance to homes – reduce CO_2 emissions by 12%; shrinking business-home distance by 20% in Santiago, Chile (*Barias et al, 2005*)

Copenhagen

Zona Rosa, Mexico City

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More active travel from home to work = greater health

People who cycled to work had 30% lower premature mortality rates, on average, in long-term large population studies of Copenhagen and Shanghai commuters *(Andrews et al, 2000; Matthews et al, 2007)*

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3. Urban transit – completing the package

- Integrated urban energy use planning – linking housing-density, services proximity, could reduce urban GHG emissions in Canada by 40-50% (*Bataille et al, 2009*)
- Packages of walkways, cycleways and BRT could reduce emissions by 25% in developing countries at low cost (*Wright, Fulton, 2005*)
- Efficient public transit, walking & cycling consistently associated with more physical activity, less obesity, and lower risk of road traffic injuries in WHO Health in Green Economy review (*WHO, 2011*)

Bus Rapid Transit - Curitiba, Brazil

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Diversity of existing urban models demonstrates critical importance of planning growth

- Many cities' housing and mobility needs have outstripped inefficient planning/land use and transit systems. How this crisis is addressed will determine if cities become:
- More car-dependent and sprawling (USA model)
- Or, more energy-efficient & walkable (European)

% by travel mode	European cities	Asian cities (high/low income)	USA
Active travel	18%	19%	5%
Transit	23%	43%	3%

Source: Peterson R. Sustainable Transport, a Sourcebook for Policymakers, BMZ, 2002

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WHO's Health in Green Economy series

Documenting health impacts of energy interventions

WHO has been reviewing the evidence about low-carbon, energy efficient policies that enhance health

- Healthier homes
- Healthier transport
- Healthy cities
- Greater access to clean energy for the poor
- More resilience in emergencies (e.g. health facilities)

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Finding 1: **Energy-efficient homes reduce air pollution & other housing risks such as...**

Housing risks

- Indoor/outdoor air pollution
- Damp, mould & allergens
- Poor indoor ventilation
- Inefficient insulation/energy system
- Planning, transport access
- Urban waste, sanitation & water
- Heat Island
- Storms/flooding

Health impacts

- Chronic/acute respiratory disease
- Allergies, asthma
- Other NCDs
- Cold exposures – morbidity/mortality
- Water and sanitation-borne disease
- Heat strokes
- Injuries

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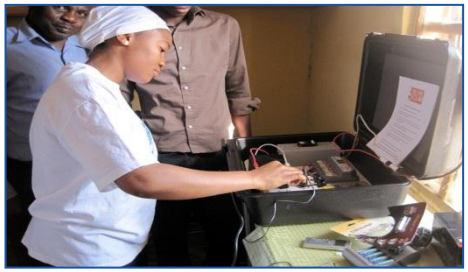
Finding 2: More efficient **power delivery not only reduces air pollution, it improves….**

- Access to clean energy/renewables for the poor
- Resilience in emergencies, including for health facilities
- Grid efficiencies (e.g. through CHP, distributed energy generation reduce pollution/energy unit
- Healthy housing synergies from design efficiencies+ renewables

Solar lanterns, India "Light a Billion Lives"



Solar "suitcase" in primary health facility- Nigeria

Cogeneration of Heat and Power (CHP), New York Presbyterian Hospital

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Finding 3: **Sustainable land use/ transport reduces housing-related air pollution, but also ….**

- Increases physical activity
- Reduces traffic injury
- Frees urban road/parking for green spaces
- Facilitates more equitable access to mobility
- Eases movements of elderly, children, disabled, women
- Promotes social cohesion in local communities

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Conclusion: Powerful health & energy synergies when housing, land use &transport are linked

Factor	Studies finding improved outcomes	Studies finding worse outcomes
Use of different travel modes		
More active transport (walking, cycling)	Increased physical activity[88,185–197] Reduced BMI or obesity[35,109,118,148,188,199–205] Reduced air pollution-related effects[23] Improved quality of life or reported health status[167,183,206] Reductions in specific health problems[188,206] Lower mortality / higher life expectancy[36,37,207]	Increased stress and psychological distress[198] Increased road traffic injury[23]
More use of public transport	Increased walking, cycling or active transport[208] Increased physical activity[185,209,210] Reduced BMI or obesity[148,203,212] Reduced air pollution-related effects[70,213]	Increased air pollution-related effects[185] Increased risk of tuberculosis[211]
Lower car use, car ownership and traffic volumes	Increased walking, cycling or active transport[94,129,132,134,141–143,149,150,152,178,179,214–217] Increased physical activity[160,181,191,218] Reduced BMI or obesity[73,109,148,164,218–221] Improved reported health status[166] Reductions in specific health problems[222]	

- Review of studies on urban travel mode, physical activity and health –
- *WHO/Health in Green Economy (forthcoming)*

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Future actions – How can we explore these issues?

- **Models/Case studies** comparing energy efficiencies, pollution & other health risks/benefits from alternative housing/transport/land use strategies ?
- **Burden of disease** estimates for urban housing & transport ?

'Green' clustered housing developments, Beijing

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Fundamental quantitative associations between land use, transport and energy long familiar to planners. They urgently need health sector attention.

In the 1980s the California Air Resources Board compared pollution emissions generated by a suburban commercial center accessible 90% by car with those of an urban center - accessible 60% by transit, walking/cycling. Conclusion: The suburban center's generated "emissions" roughly equivalent to a 16 MW power plant.

USA strip development in single-use zone

Mixed business-residential district, Mexico City

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Thirty years later – we are replicating the same mistakes globally – who will pay the climate, environment and health consequences?

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(http://www.who.int/hia/green_economy/en/)

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