Mitigation opportunities in cities

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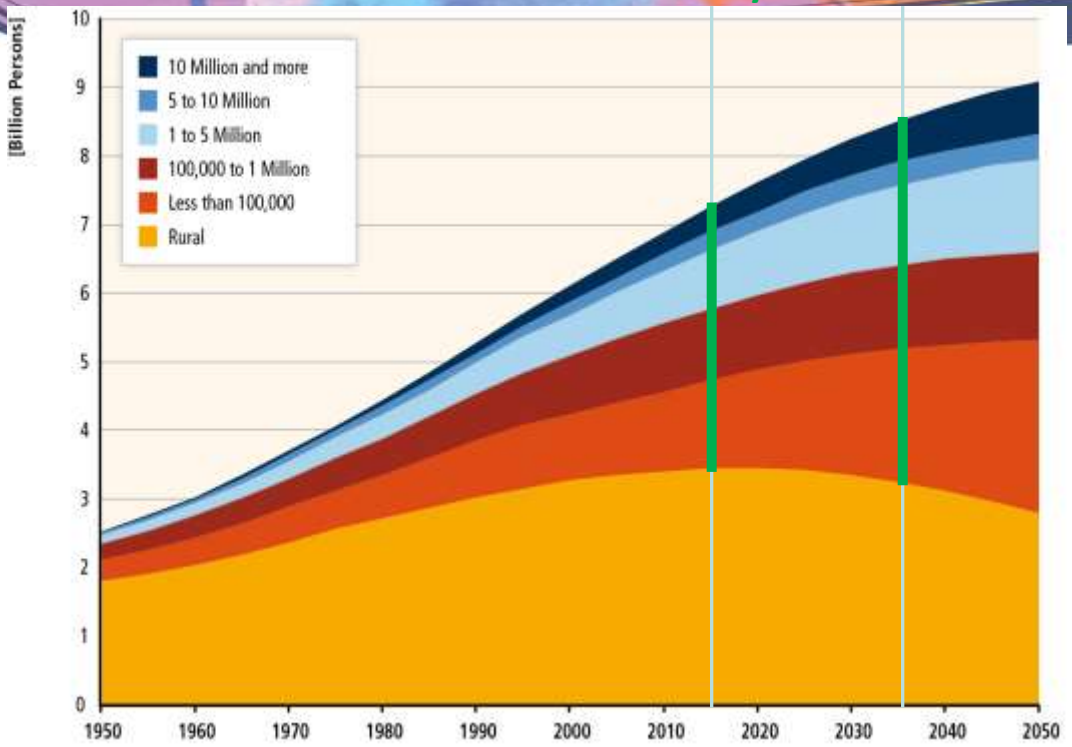


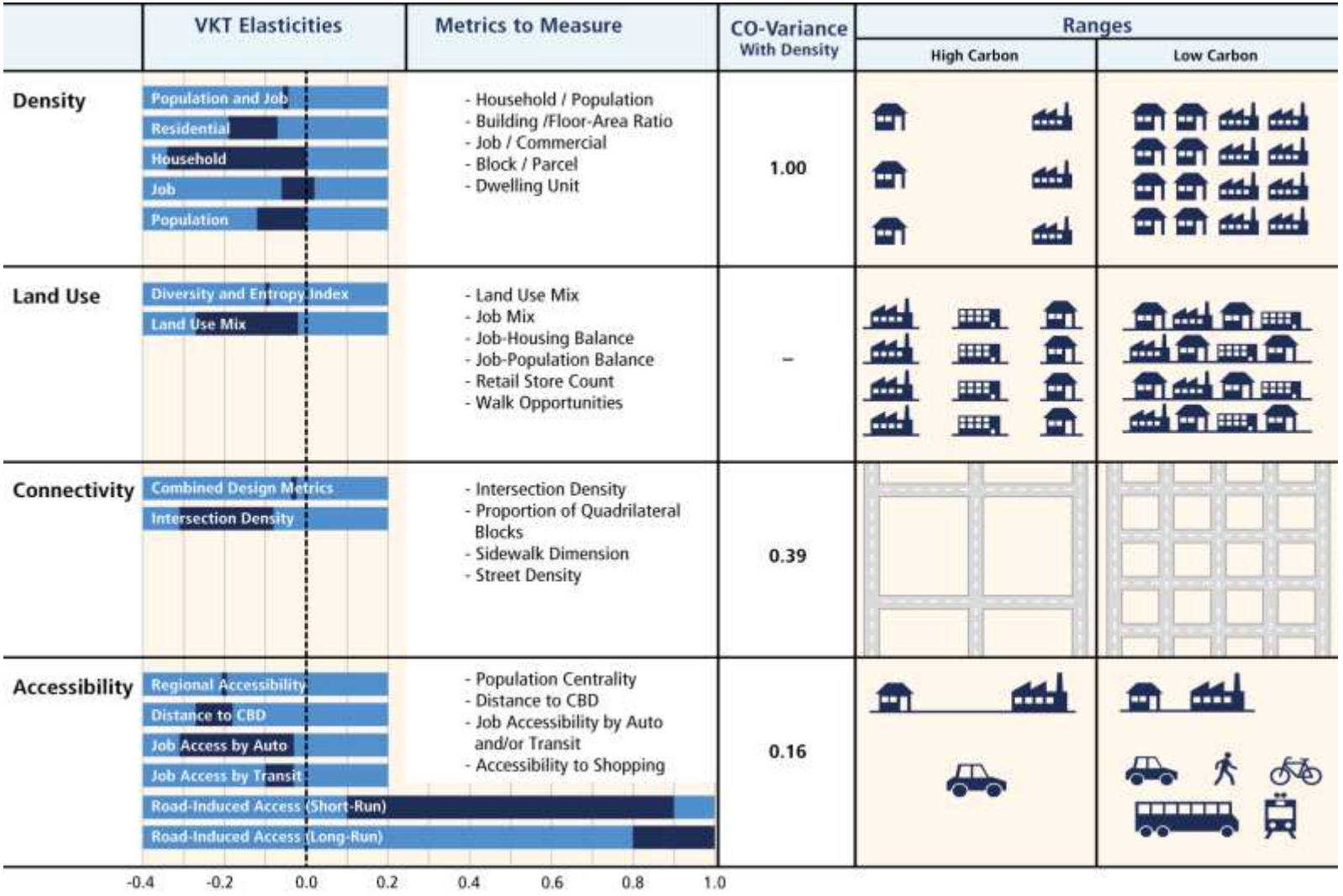
A substantial share of emission increase in the next few decades will come from cities

- Urban areas generate 80% of GDP and 71% - 76% of CO2 emissions from global energy use
- Each week the urban population increases by 1.3 million
- Over 70% of global building energy use increase will take place in developing country cities
- This enormous expected increase poses both an opportunity and responsibility

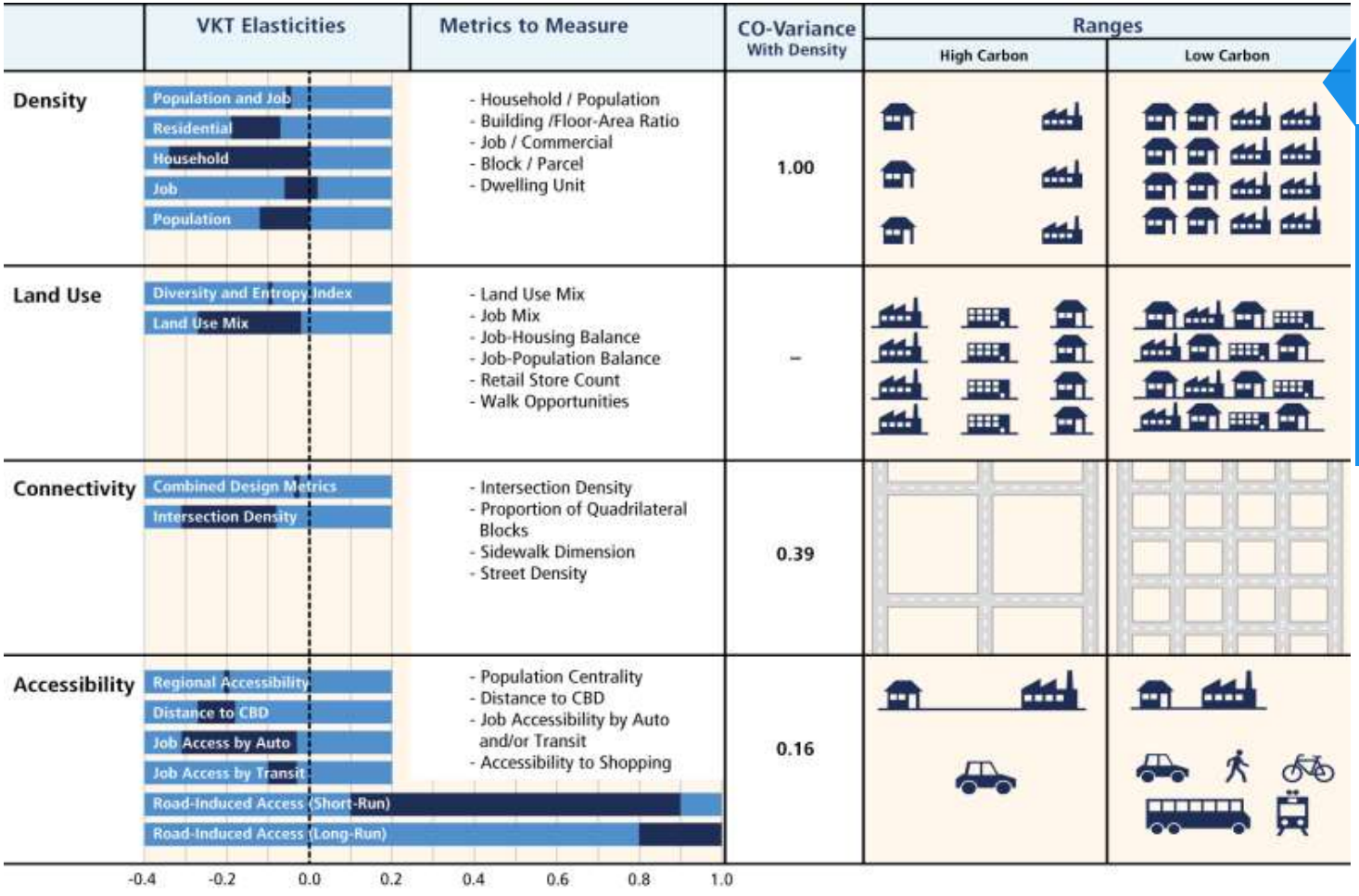
A broad array of opportunities exist to keep urban emissions at bay while maintaining or increasing service levels

- Urban design and form
- Energy-efficient transport systems
  - Encouraging non-motorized and public transport
  - Efficient, small vehicles
- Energy efficient buildings
  - low-energy architecture
  - High-efficiency appliances, lighting and equipment
  - High performance operation of buildings (mainly commercial)
- Fuel switch to low-carbon energy sources (RES) or high-efficiency equipment using energy contributing to CC
  - Hi eff cookstoves; electrification
- Lowering embodied energy in the built infrastructure and products –
  - affordable low-carbon, durable construction materials
  - Towards the circular economy: reuse and sharing economy
- Carbon storage in construction materials
  - Bio-based materials (timber, bamboo, straw, etc)
  - CCU(S)
- Lifestyle, behavior, culture

Infrastructure and urban form are strongly linked and lock-in patterns of land use, transport and housing use, and behavior

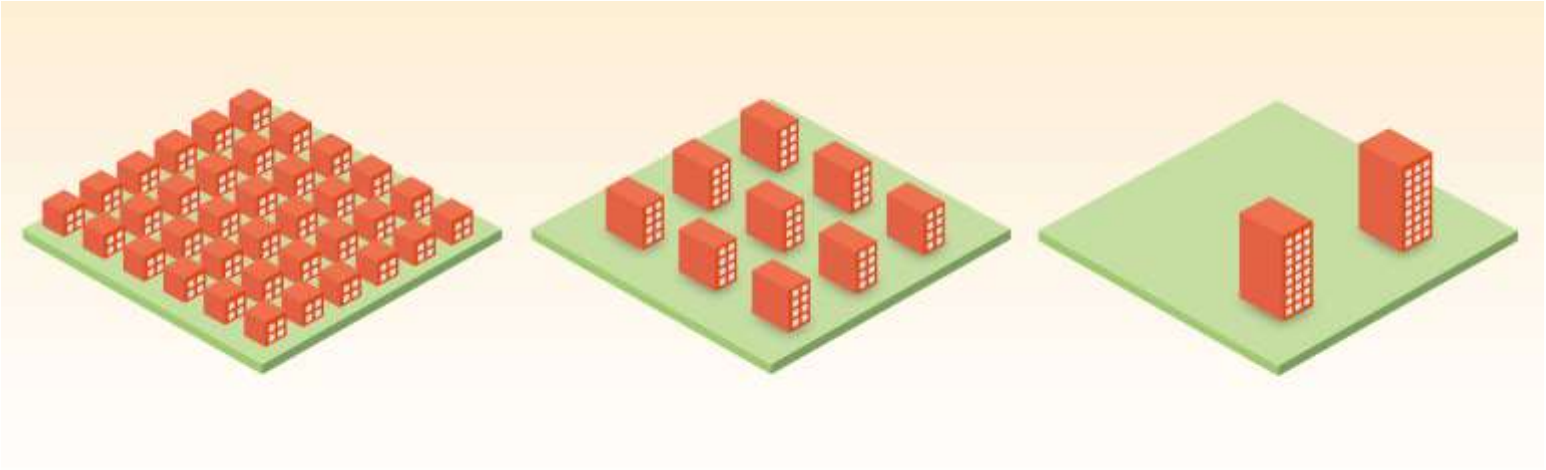


Increasing and co-locating residential and employment densities can lower emissions



Higher density leads to less emissions (i.a. shorter distances travelled).

Increasing urban density is a necessary but not sufficient condition for lowering urban emissions



Working Group III contribution to the IPCC Fifth Assessment Report, courtesy of Karen Seto

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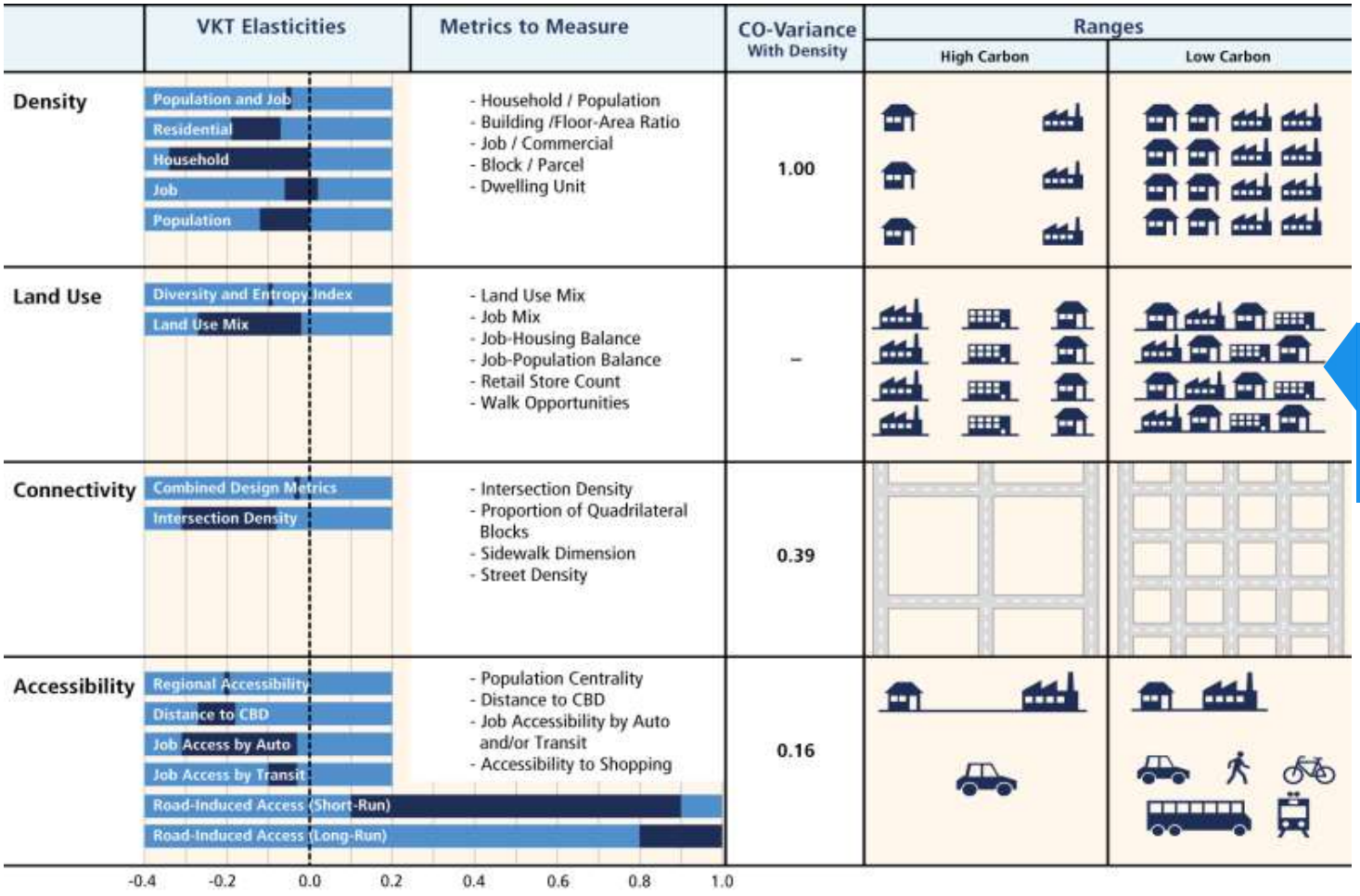
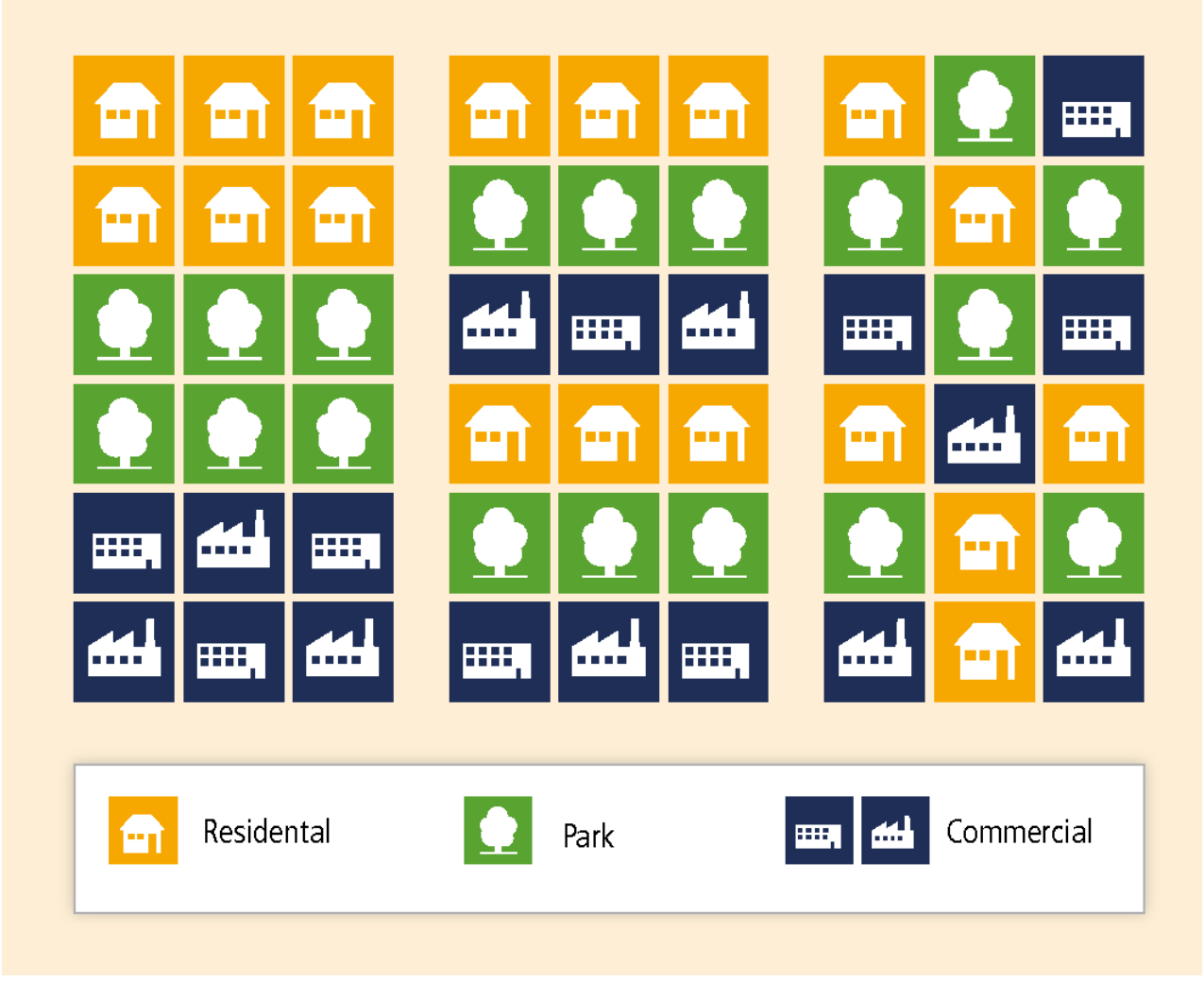
Increasing land use mix can significantly reduce emissions



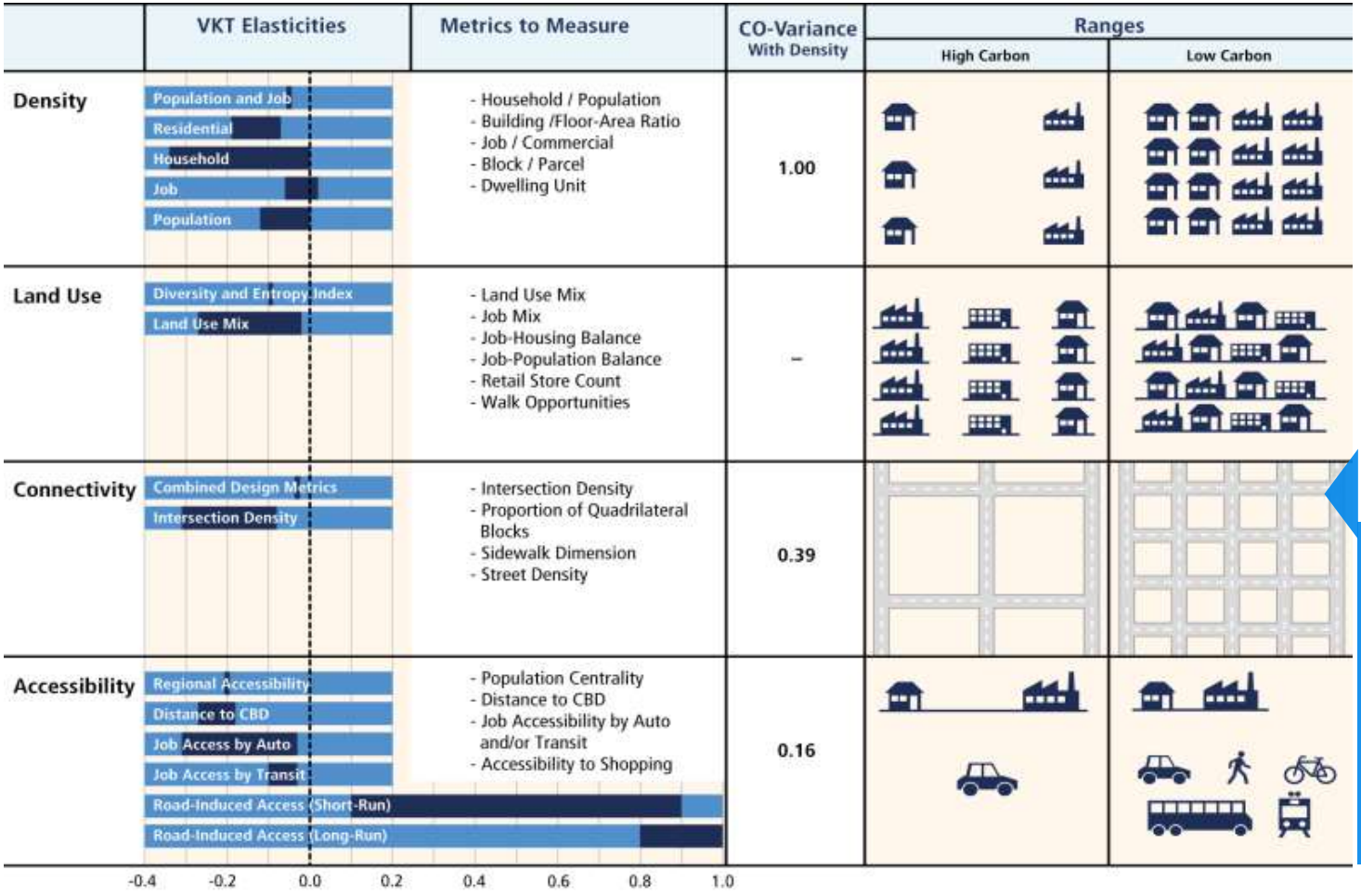
Mix of land-use reduces emissions.

To lower urban emissions, need diverse urban land use



Working Group III contribution to the IPCC Fifth Assessment Report

Increasing connectivity can enable multiple modes of transport



Improved infrastructural density and design (e.g. streets) reduces emissions.

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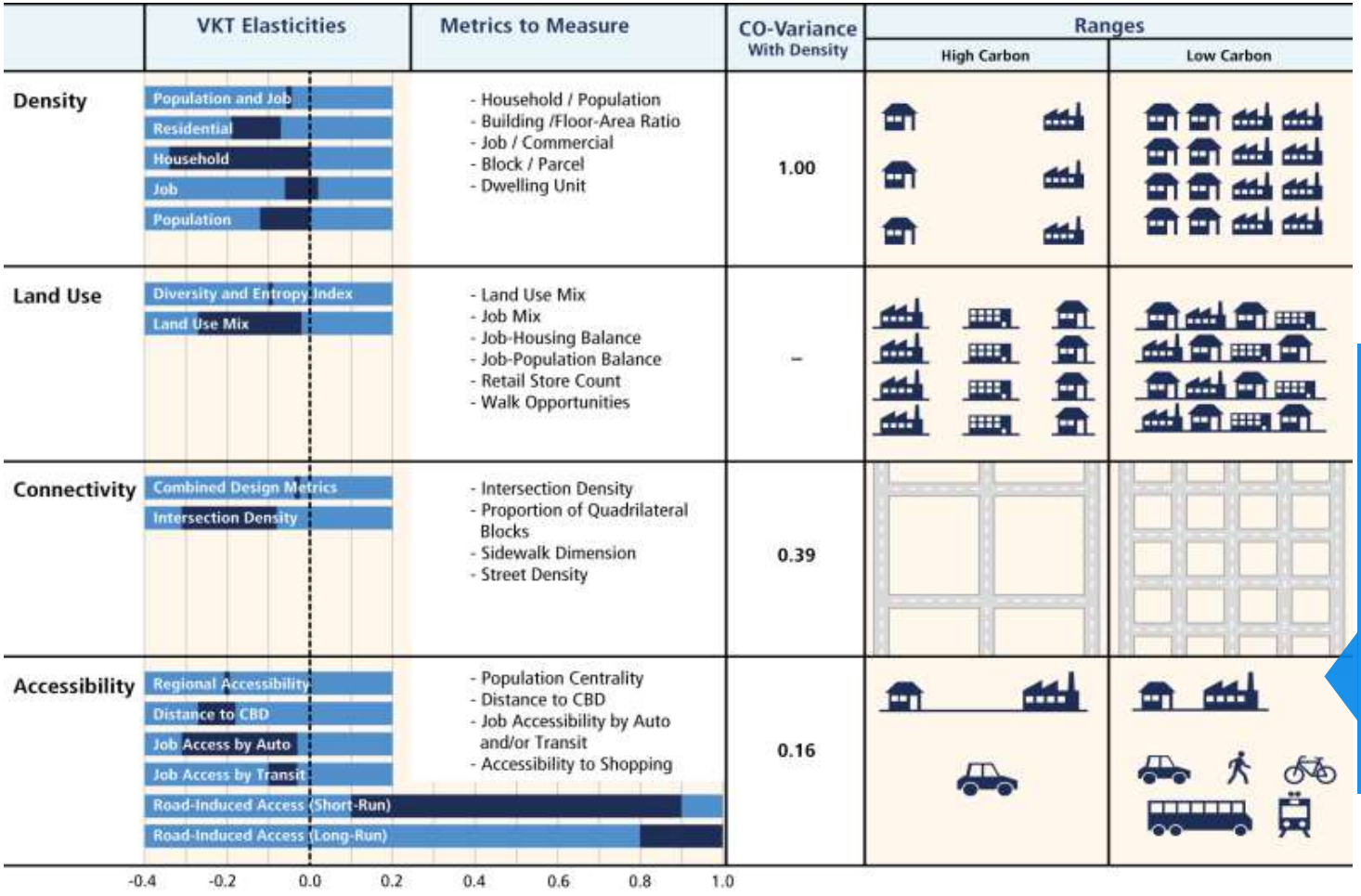
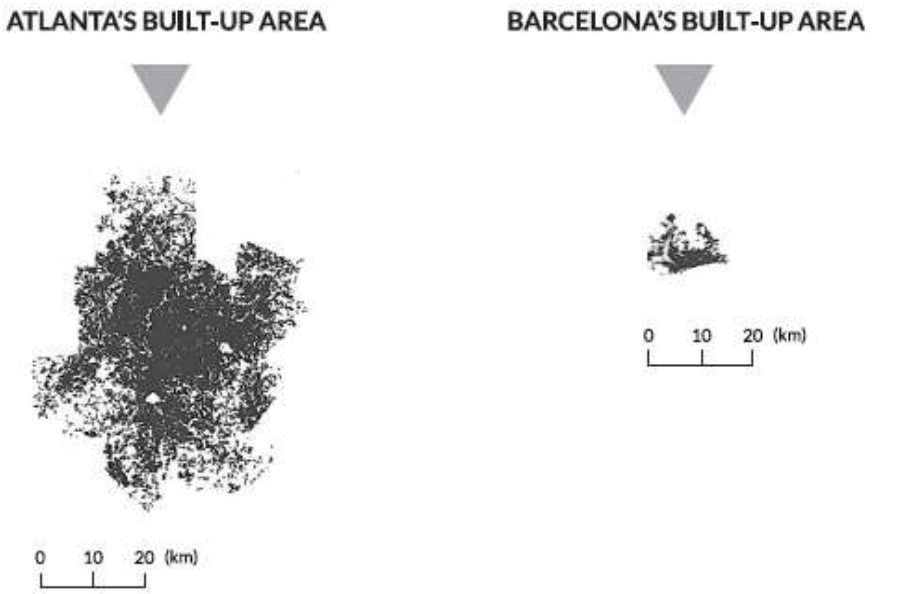
Co-location of activities reduces direct and indirect GHG emissions



Accessibility to people and places (jobs, housing, services, shopping) reduces emissions.

Barcelona vs atlanta



Urban planning can make a very significant difference in urban emissions

Source: UN 2014 as cited by Fischedick, CFCC 2015

Mitigation opportunities through urban planning:

1. increasing accessibility
2. increasing connectivity
3. increasing land use mix
4. increasing transit options
5. increasing and co-locating employment and residential densities
6. increasing green infrastructure and other carbon sinks
7. Increasing white and light-colored surfaces

opportunities from green urban infrastructure

a locally appropriate combination of green space, ecosystem goods and services and the built environment can increase the set of urban mitigation and adaptation options

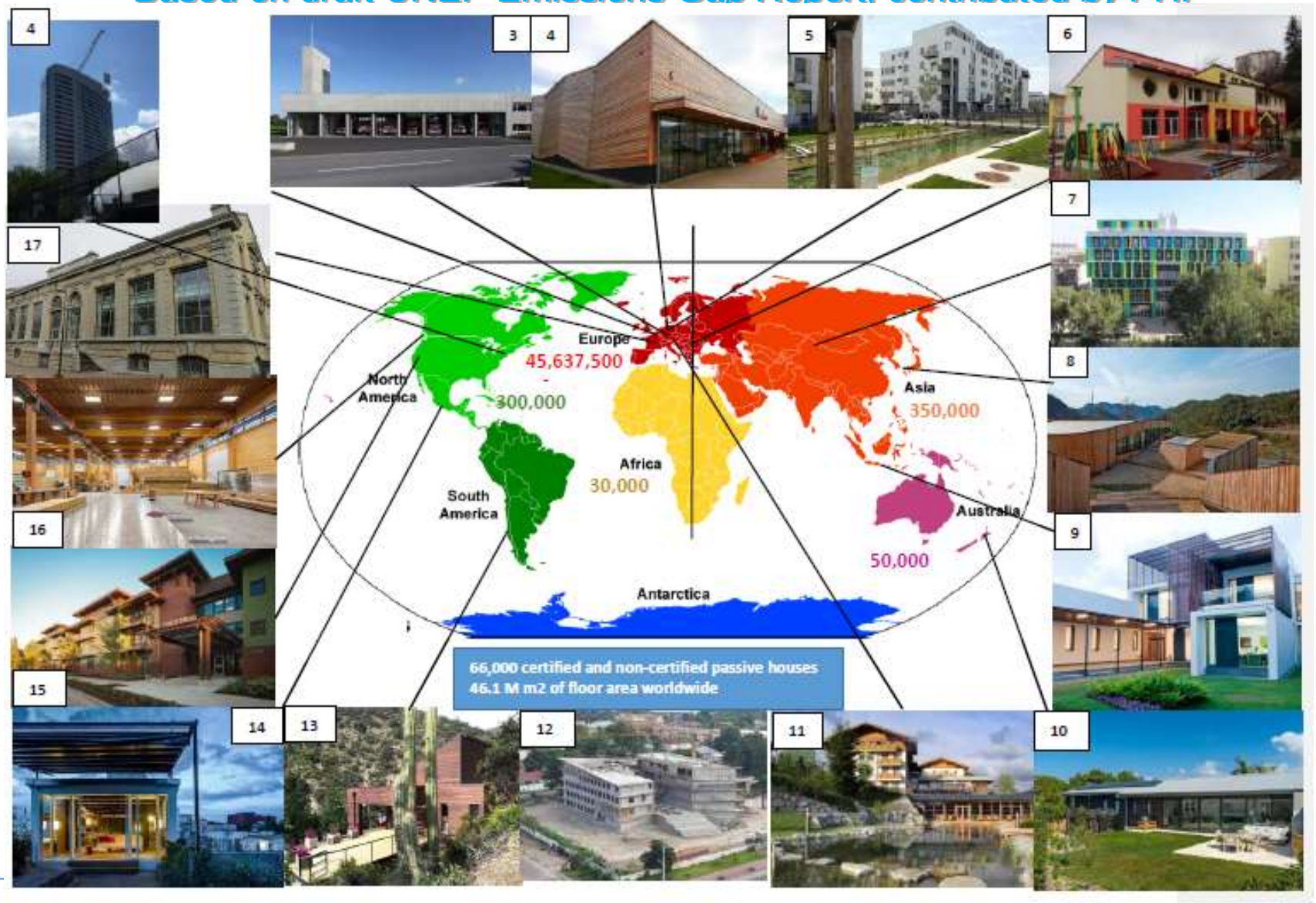
Green infrastructure	Adaptation benefits	Mitigation benefits
Urban trees planting, urban parks	Reduced heat island effect, psychological benefits	Less cement, reduced air-conditioning
Permeable surfaces	Water recharge	Less cement in city, some bio-sequestration, less water pumping
Forest retention, and urban agricultural land	Flood mediation, healthy lifestyles	Air pollution reduction
riparian buffer zones	skilled local work, Sense of place	energy spent on water treatment
Biodiverse urban habitat	Psychological benefits, inner-city recreation	Carbon sequestration

From E-On Energy Globe Award Hungary 2018

From E-On Energy Globe Award Hungary 2018

Passsive houses spread around the world

Based on draft UNEP Emissions Gap Report, contributed by PHI



World's largest Passive House city district

Zero-Emission-City areal **Heidelberg-Bahnstadt**
116 ha, 1,700 flats
Passive House as Standard for urban development

www.heidelberg-bahnstadt.de

PASSIVHAUS Austria
PASSIVE HOUSE IPHA
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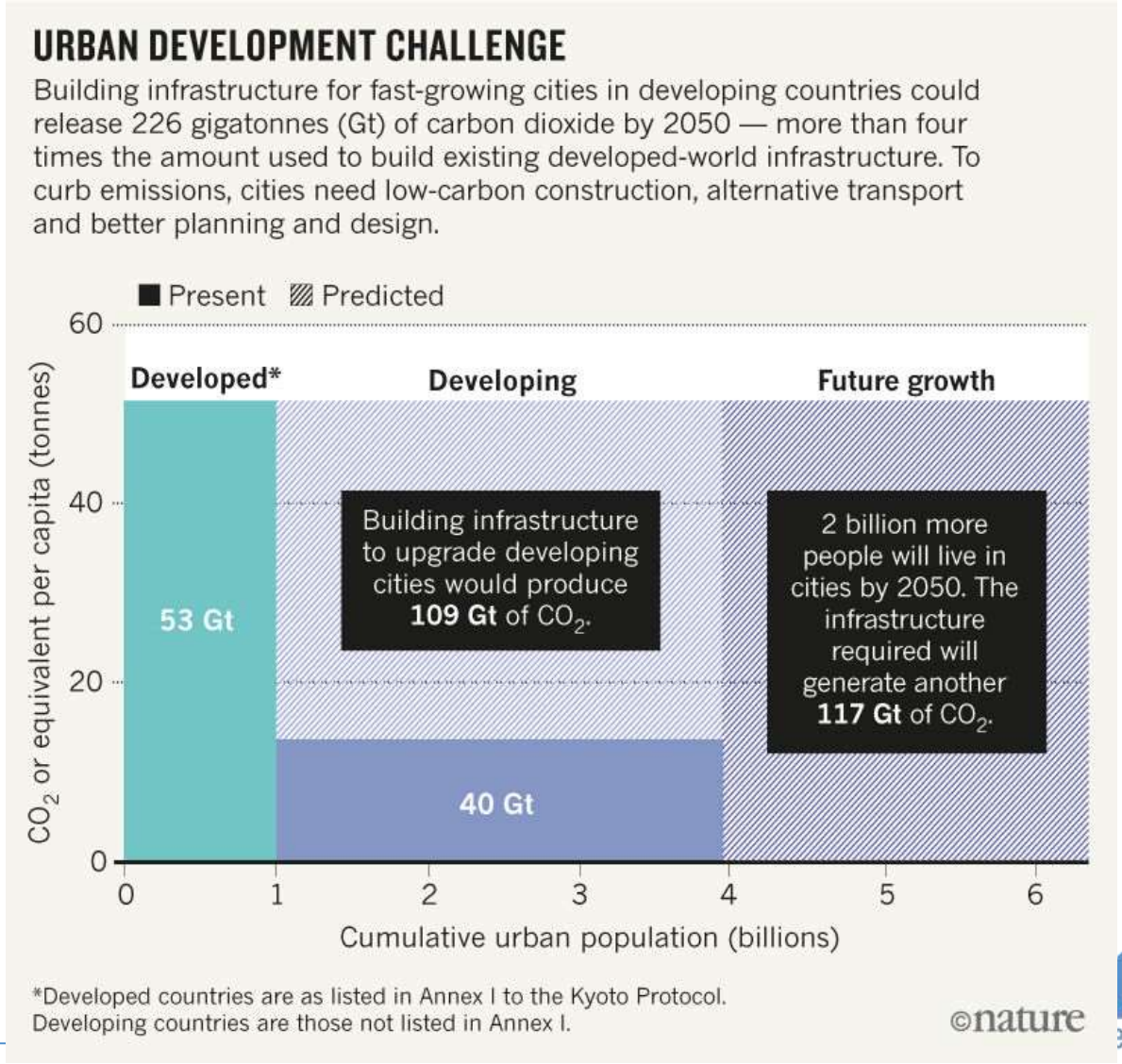
Put into context: Urban infrastructure development can consume app a third of our remaining carbon budget to a 1.5C target?



Source: Bai, X. et al. Six Research Priorities for Cities and Climate Change. Nature, Mar 1, 2018.

Brock Commons Carbon Impact

Volume of wood:
2,233 cubic meters of CLT and Glulam

U.S. and Canadian forests grow this much wood in:
6 minutes

Carbon stored in the wood:
1,753 metric tons of CO_2

Avoided greenhouse gas emissions:
679 metric tons of CO_2

TOTAL POTENTIAL CARBON BENEFIT:
2,432 metric tons of CO_2

EQUIVALENT TO:

511 cars off the road for a year

Energy to operate a home for 222 years

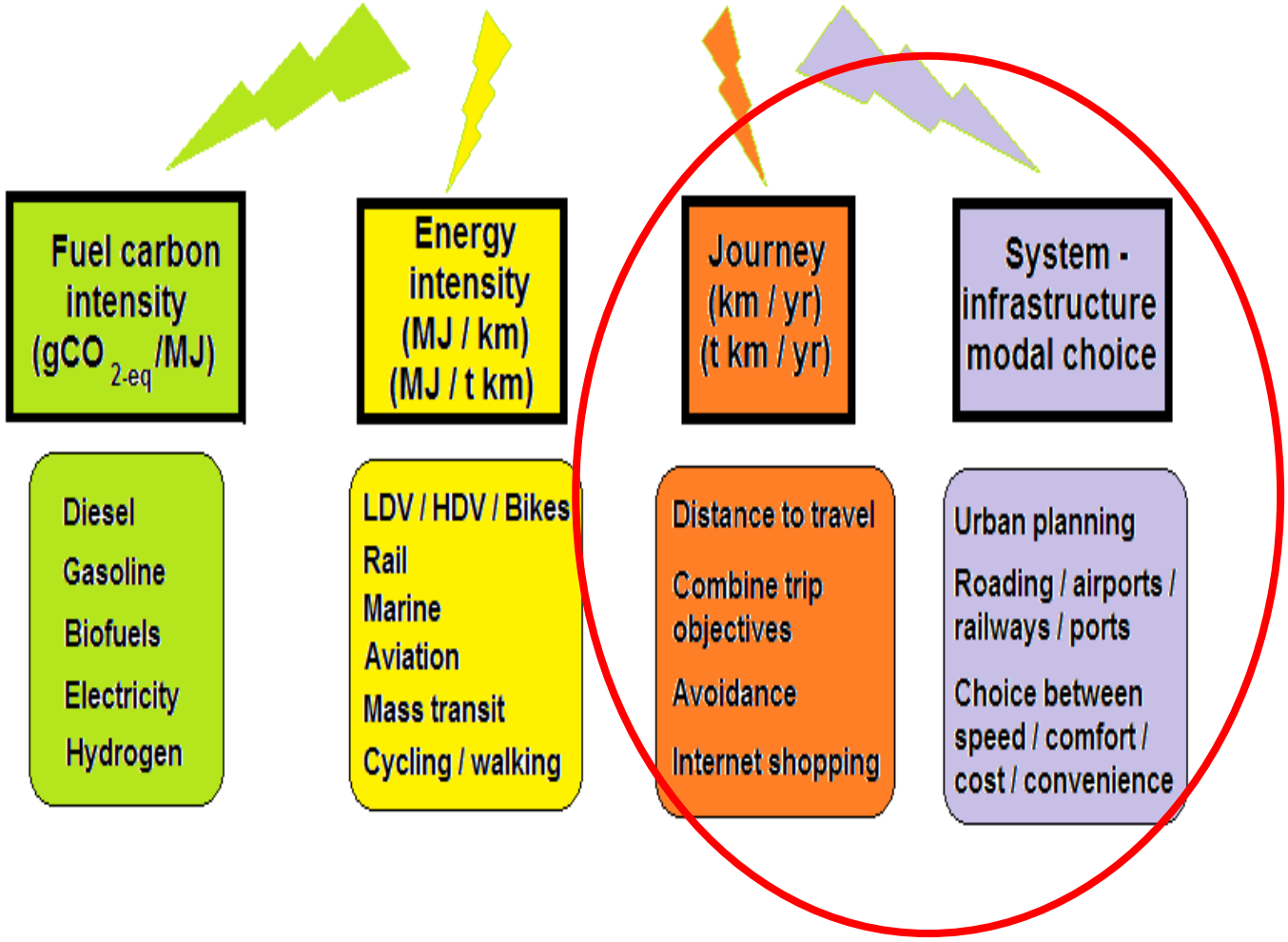
Source: US EPA

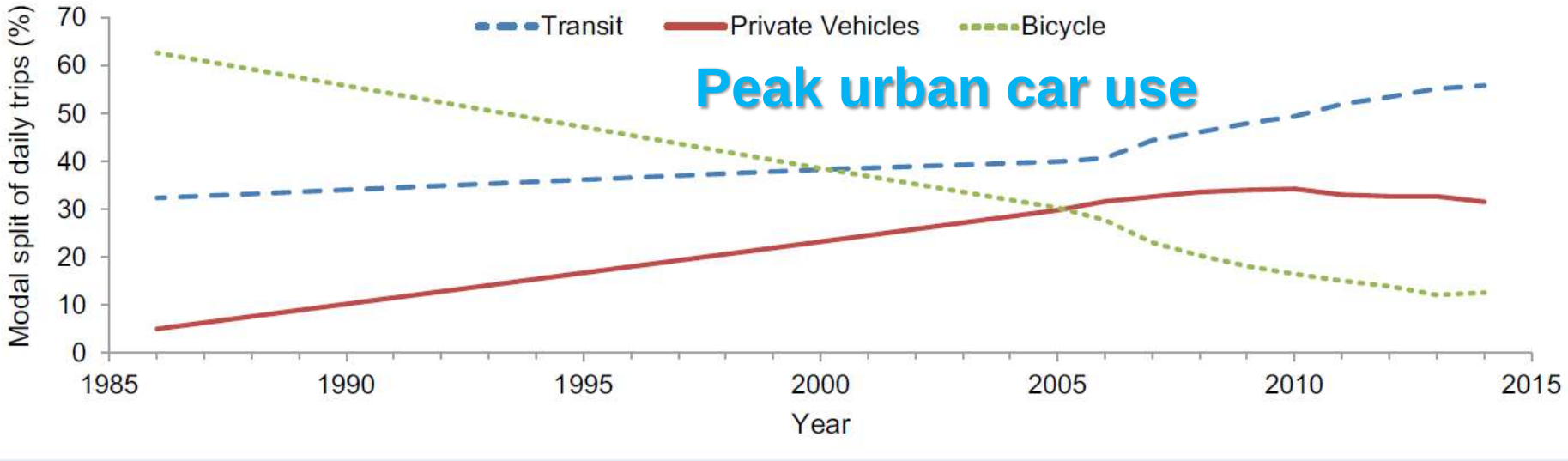
Source: Naturallywood

Urban mobility

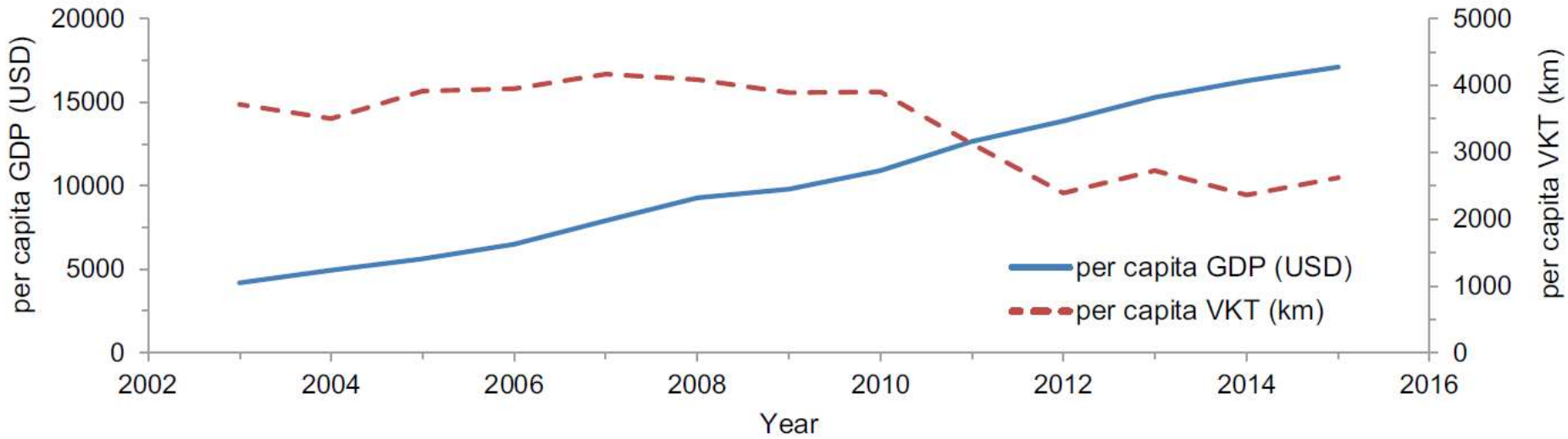
- The global transport system could reduce 4.7 GtCO2e yr-1 by 2030
  - Significantly more than IAMs show
- This needs cities that enable:
  - modal shifts
  - avoided journeys (mobility services replacing real mobility, such as e-banking, teleworking, etc)
  - incentives for uptake of improved fuel efficiency
  - changes in urban design
  - Encouraging walkable cities, non-motorized transport and shorter commuter distances

TOTAL GHG emissions



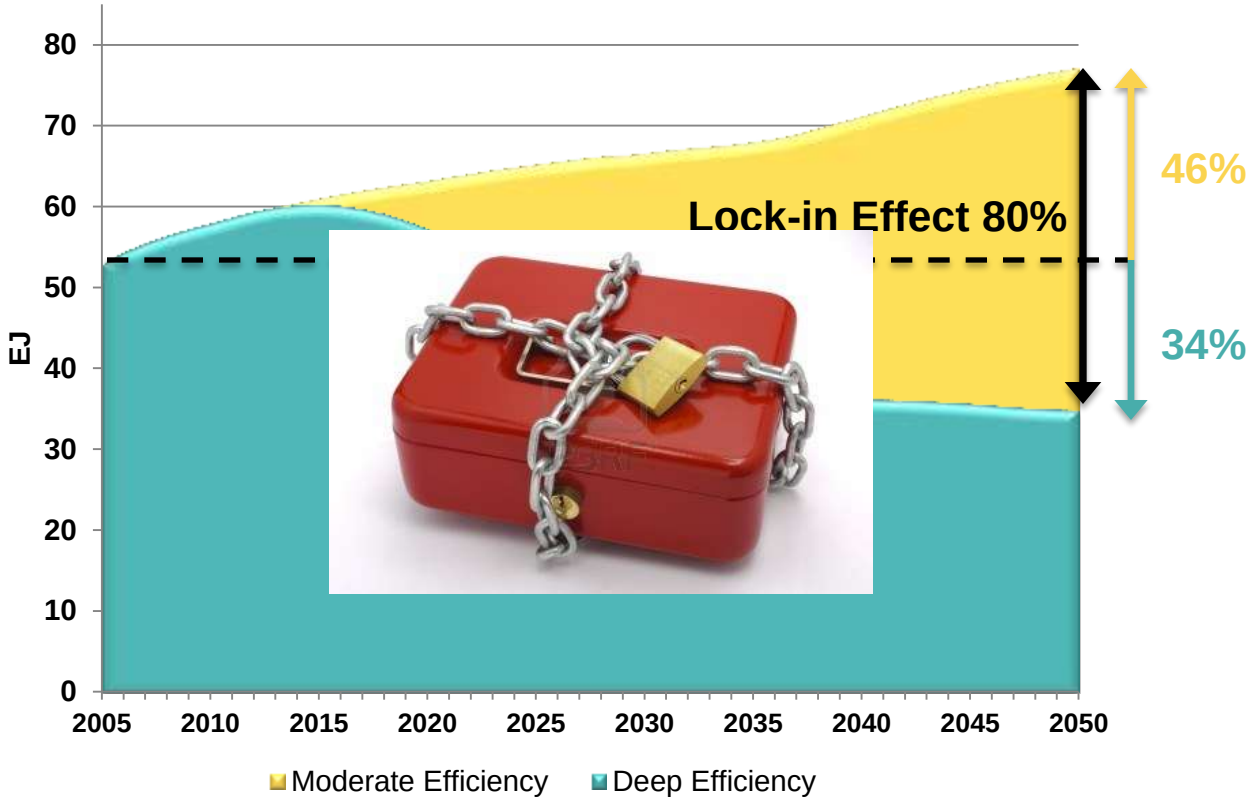


Box 4.9, Figure 1 | The modal split data in Beijing between 1986 and 2014. Source: (Gao and Newman, 2018).

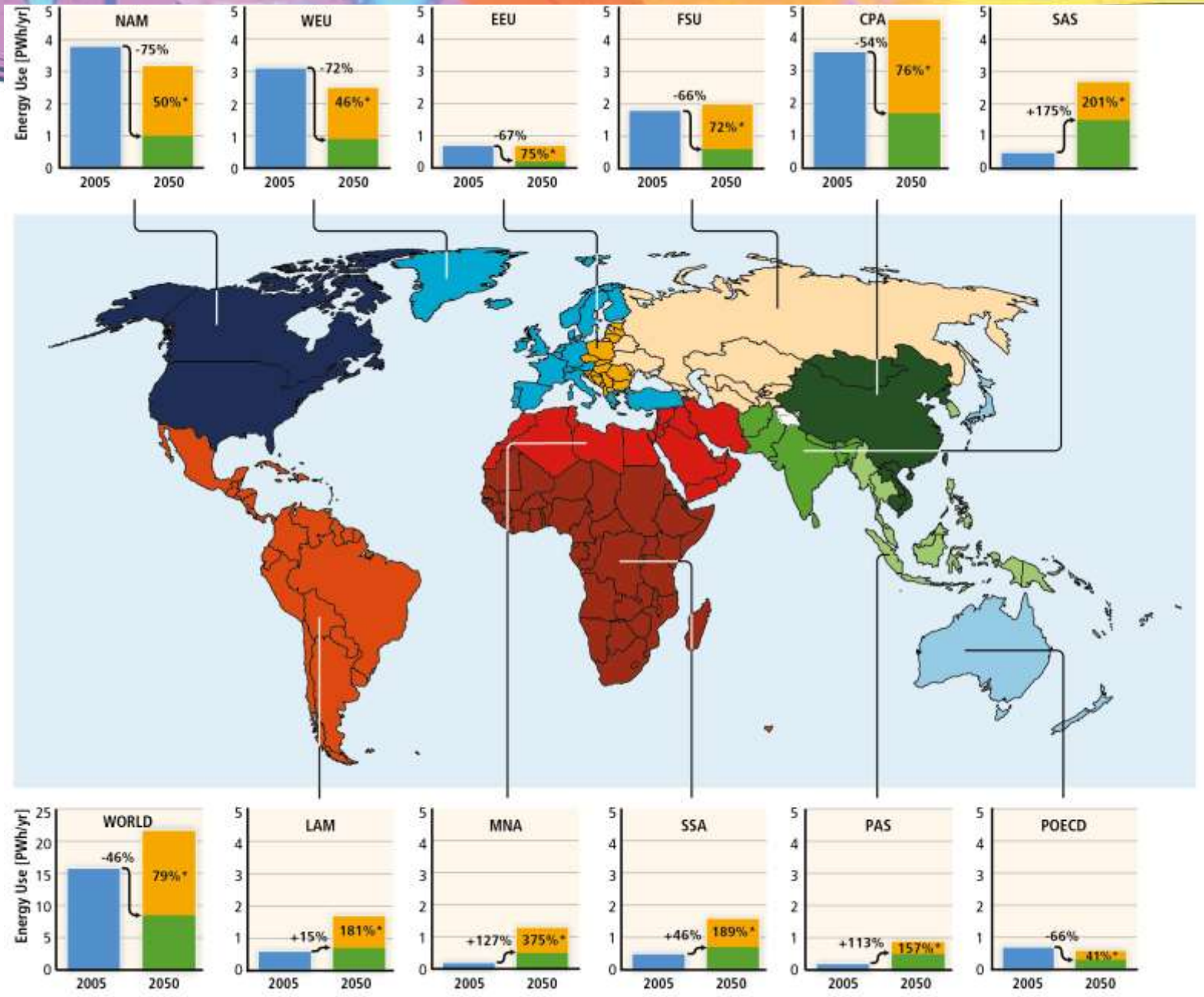


Box 4.9, Figure 2 | Peak car in Beijing: relationships between economic performance and private automobile use in Beijing from 1986 to 2014. VKT is vehicle kilometres of travel. Source: (Gao and Newman, 2018).

The Lock-in Risk: global heating and cooling final energy in two scenarios



Diana Urge-Vorsatz, Ksenia Petrichenko, Maja Staniec, Jiyong Eom, Energy use in buildings in a long-term perspective. Current Opinion in Environmental Sustainability, Volume 5, Issue 2, 2013, Pages 141-151,



Source: Lucon and Urge-Vorsatz et al, Chapter 9, IPCC AR5, WGIII

comment

Locking in positive climate responses in cities

Well-intended climate actions are confounding each other. Cities must take a strategic and integrated approach to lock into a climate-resilient and low-emission future.

Diana Ürge-Vorsatz, Cynthia Rosenzweig, Richard J. Dawson, Roberto Sanchez Rodriguez, Xuemei Bai, Aliyu Salisu Barau, Karen C. Seto and Shobhakar Dhakal

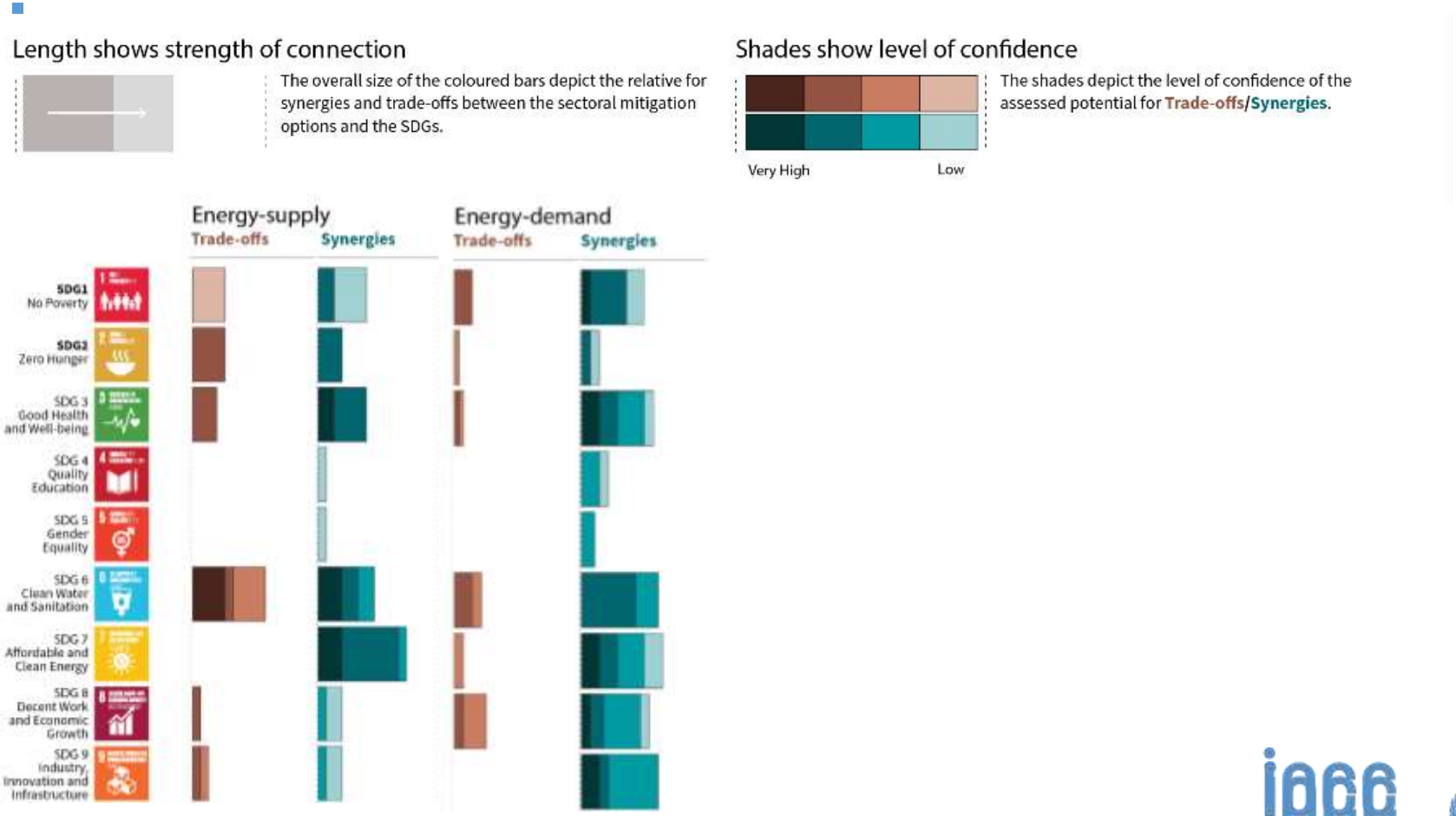
Lock-in risks related to key urban Mitigation Strategies

Key urban mitigation strategy	Infrastructural lock-in		Institutional lock-in	Behavioural lock-in	
Urban design, land-use planning, relocation	Urban form, structure and density; utility networks		Urban decision-making not able to plan for long-term benefits	Preference for low to medium density parts of the city	
Modal shift, shared mobility, mobililty services, traffic optimization	Public transport infrastructure is long-lasting	Shared urban mobility schemes have lower investment needs	Incumbent industries oppose transformational change	Shared mobility requires behavioural change	Accepted public and non-motorised transport locks culture in
High efficiency, low-emission, smaller vehicles	Charging points, autoservices infrastructure may be lacking		Policies in favour of private versus public transportation	Automobiles as status symbols	
Low-energy demanding, resilient, cool architecture	High-performance buildings can have 90% lower emissions versus conventional ones		Financing challenges to many 'small' investments with long payback	Resistance to ventilation systems, opening windows	
High-efficiency equipment and building operation	(Relatively short lifetimes)				
Reducing UHI (including white and green surfaces, and so on)	Lack of space for urban greening. Availability of construction materials with high albedo		Poor and outdated building codes and regulations	Cultures favouring certain construction aesthetics	
Infrastructure-integrated renewable energy systems generation	Existing infrastructure may limit opportunities		Unfavourable financial incentives and tax regimes; incumbents	Lack of ability to judge potential financial and other gains	
Fuel switch to low(er) carbon generation	Infrastructure is often not available		Financial policies, incumbents; stranded assets	High, or perceived higher cost of lower carbon technologies	
Affordable low-carbon, durable construction materials; timber infrastructure	Alternative utilization of biomass resources		Market inertia; stranded assets and incumbents	Lack of awareness; culture of taste	
Carbon capture and utilization in construction materials	Inertia from existing industries		Lack of adequate carbon pricing	Fear of losing jobs from innovations; concern about potential risks	
Lifestyle, behaviour, sustainable consumption and production, sharing economy, circular economy	Lack of choice of alternative infrastructure		Competition between states and cities for regional prosperity	Resistance to change, long inertia in cultures, norms and values	

How mitigation options can go hand-in-hand with development goals (co-benefits)

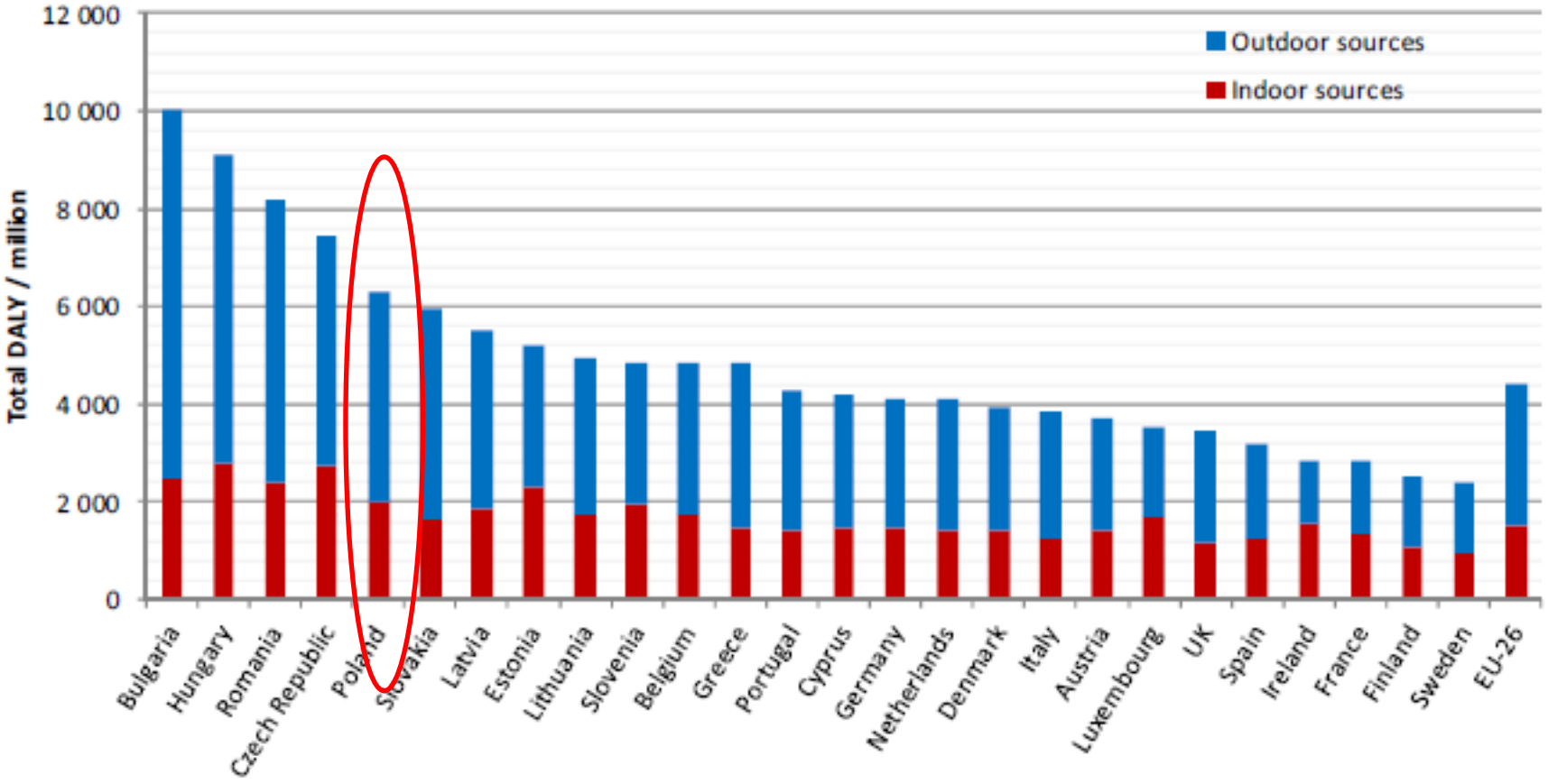
- Air quality improvement – indoor and outdoor
- Health – e.g. through indoor and outdoor air quality improvement, reduced thermal stress, increased activity
- Energy security
- Efficiency increases access to energy services
  - fuel poverty could be eliminated
- Better employment and economic opportunities through accessivity
- Reduced congestion
- Others: biodiversity conservation, water availability, food security, income distribution, improved productivity, efficiency of the taxation system, labour supply and employment, urban sprawl, and the sustainability of the growth of developing countries

SPM4 Indicative linkages between mitigation and sustainable development using SDGs (the linkages do not show costs and benefit)



Total burden of disease from indoor exposures in European countries

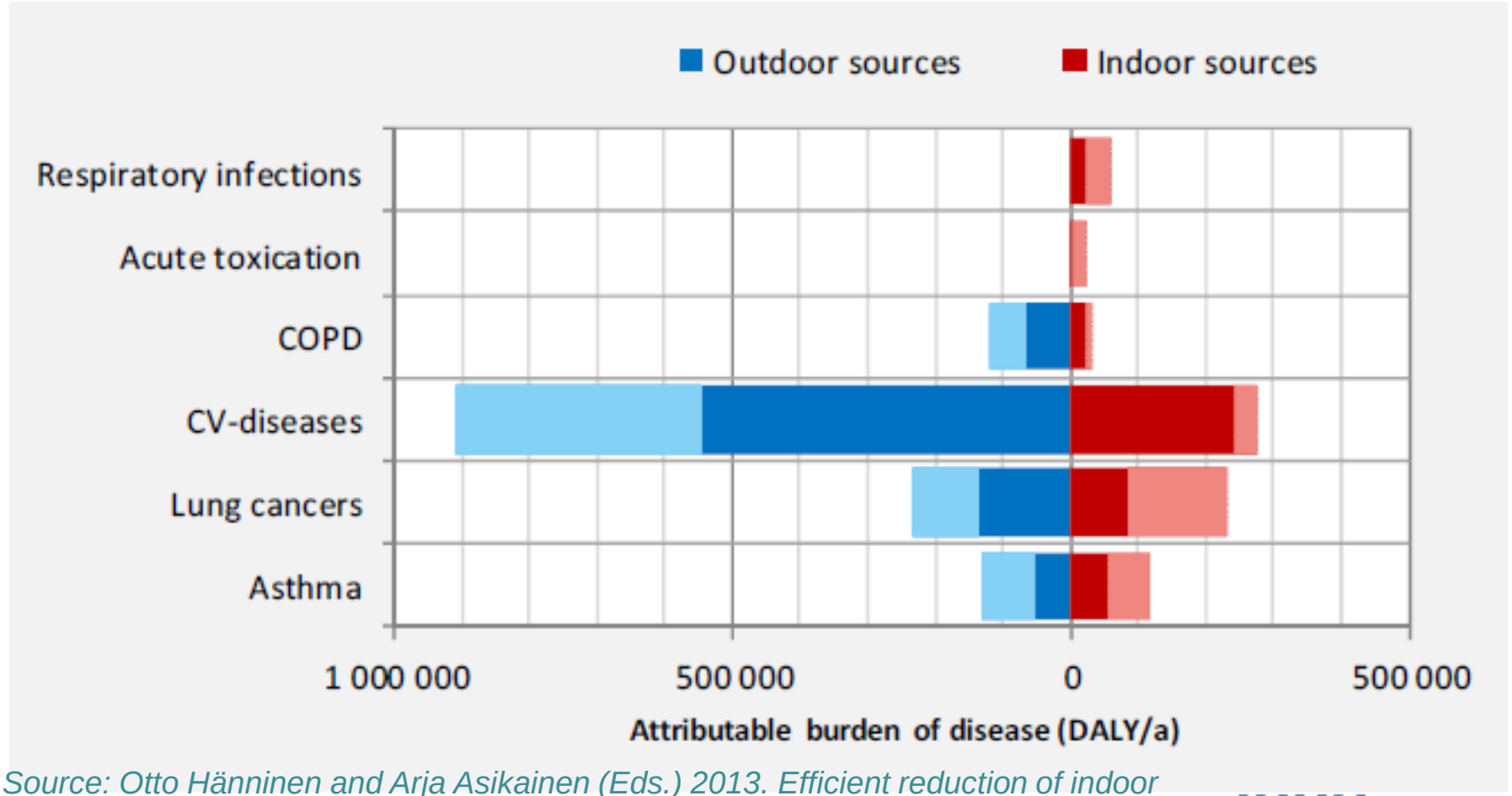
as DALY/million population with division to indoor and outdoor sources in the 2010 building stock



Source: Otto Hänninen and Arja Asikainen (Eds.) 2013. Efficient reduction of indoor exposures Health benefits from optimizing ventilation, filtration and indoor source controls

Attributable burden of diseases due to indoor exposures in 2010 in EU26

The lighter shade represents the maximum reducible fraction through well operated ventilation systems in high-efficiency buildings



Source: Otto Hänninen and Arja Asikainen (Eds.) 2013. Efficient reduction of indoor exposures Health benefits from optimizing ventilation, filtration and indoor source controls

Thank you for your attention

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