

# Resource Efficient Urbanism: Infrastructures and Strategic Intensification

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# CITY-LEVEL DECOUPLING

Urban resource flows and the governance of infrastructure transitions



UNITED NATIONS ENVIRONMENT PROGRAMME



International Resource Panel



UNEP

## Forthcoming IRP report: *Resource Requirements of Future Urbanization*

— Mark Swilling, Maarten Hajer, Serge Salat, Tim Baynes, Josephine Musango, Anu Ramaswami, Sangwon Suh, Joe Bergeson



Centre for Complex Systems in Transition

Domestic Material Consumption (DMC)/tons

Linear metabolism

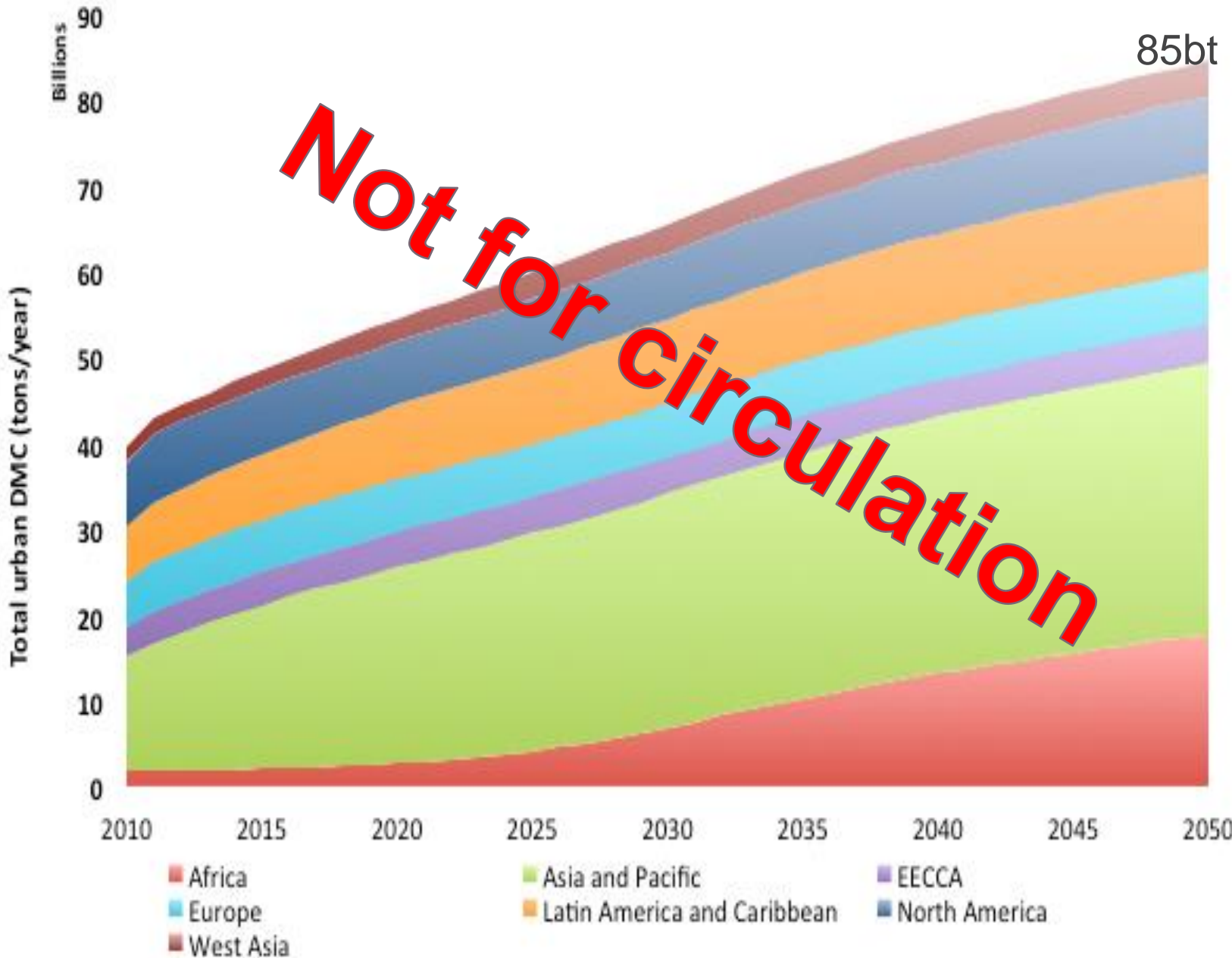


Circular metabolism



resource efficiencies via infrastructure  
reconfigurations and strategic  
intensification



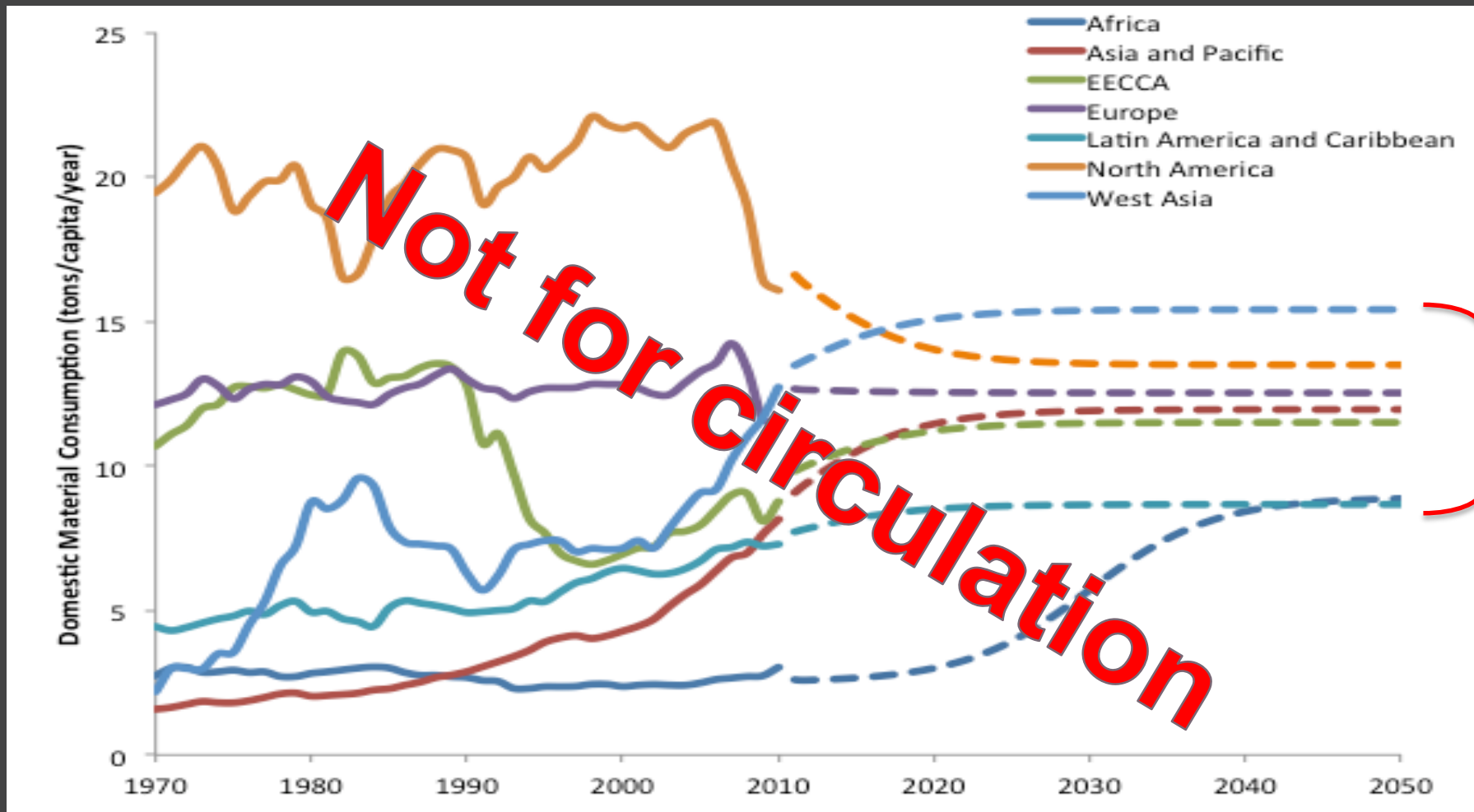


Urban DMC = 40 bt -  
60% of total DMC in  
2010

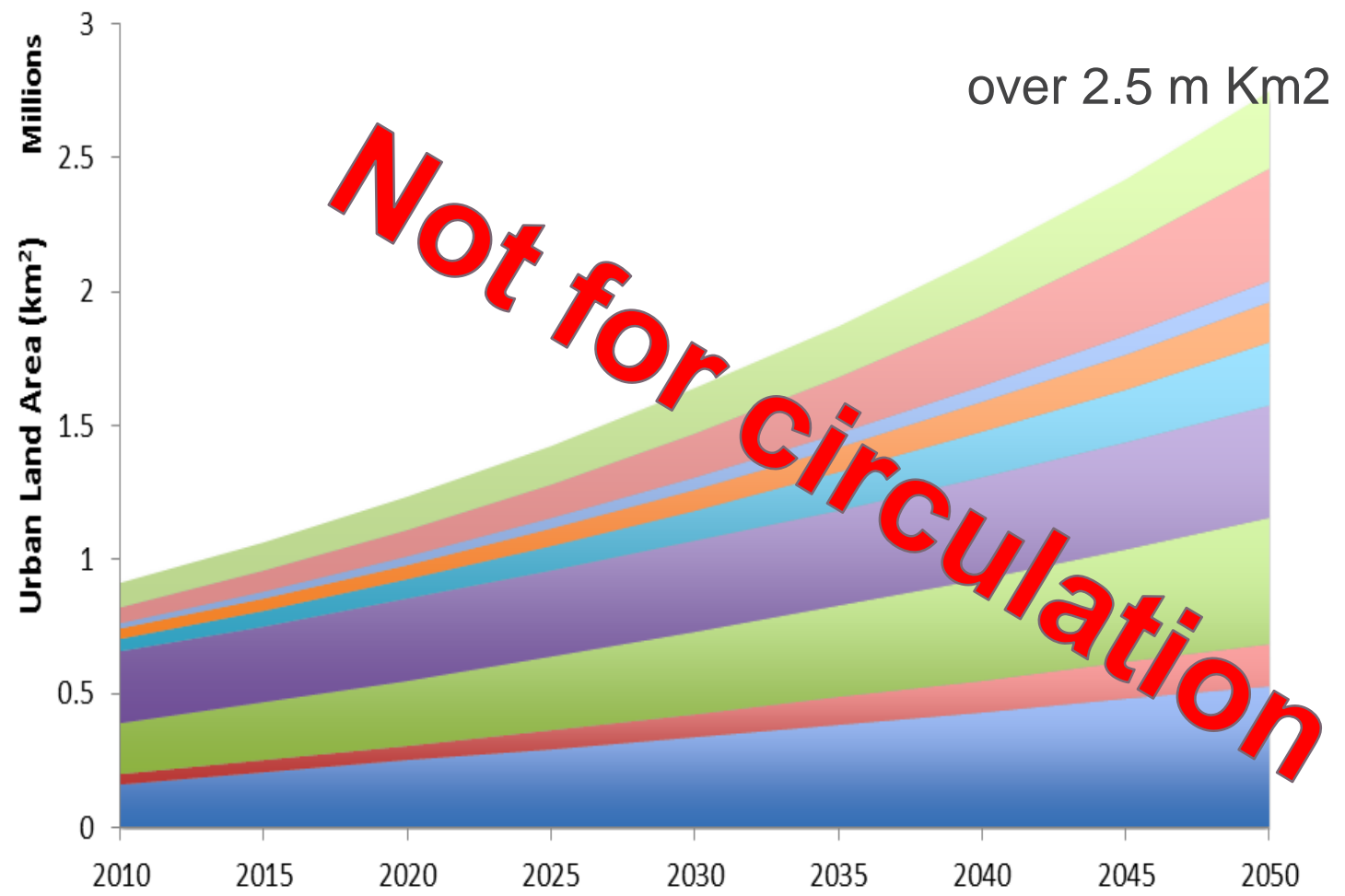
BAU to 2050 = 85bt:  
ave of 13.5t/c/y –  
highly unequal

IRP target of 6-8 t/c/y  
= reduction of 44  
billion tons, i.e. 50%  
reduction, more  
equal, more inclusive





Urban domestic material consumption (DMC) in aggregate world regions – converging in a corridor of 9-15t/c/y by 2050



Growth in urban land area by region and globally, 2010-2050 if historic trend of dedensification of -2% pa continues

- much of the most intensively farmed land surrounds the cities
- target: remain within the 1m Km<sup>2</sup> boundary



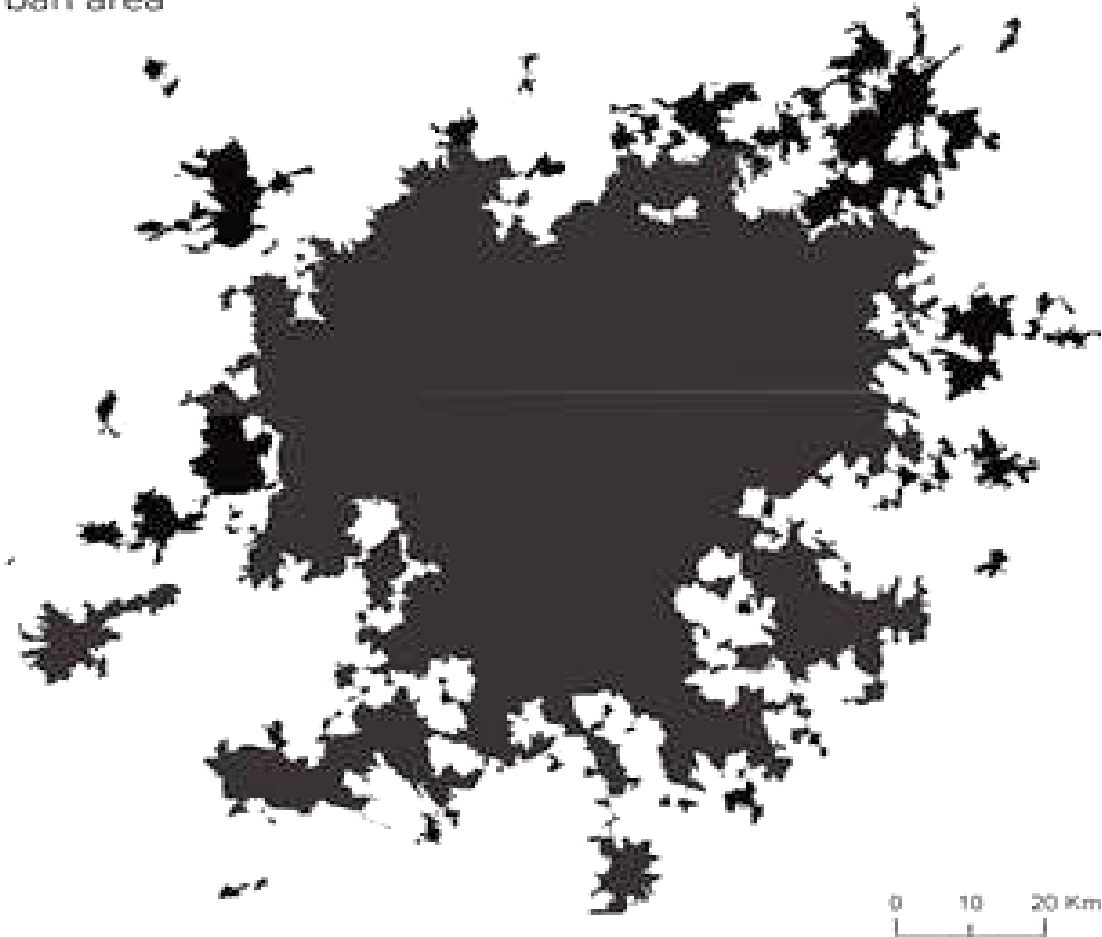


## **three challenges:**

- strategic intensification to create a network of high density nodes interconnected with efficient and affordable transit
- resource efficient urbanism via infrastructure reconfigurations
- entrepreneurial modes of urban governance to foster urban experimentation

# ATLANTA

Urban area



Population	Urban area	Transport carbon emissions p.c
<b>5.3</b> million	<b>7,692</b> km <sup>2</sup>	<b>6.9</b> tonnes

# BARCELONA

Urban area



Population	Urban area	Transport carbon emissions p.c
<b>5</b> million	<b>648</b> km <sup>2</sup>	<b>1.16</b> tonnes

Source: LSE Cities 2014

More compact development can reduce transport emissions by an order of magnitude.

## Strategic intensification (Serge Salat).....

- network of high density nodes interconnected with affordable transit nodes, mixed-use & ecologically designed: energy efficiencies = 0.5 x BAU (factor 2)
- energy-efficient buildings: reductions in energy demand = 0.5 x BAU (factor 2)
- maximum use of renewable energy with integrated demand-supply management: efficiency 20% = 0.8 x BAU
- human behavior change: efficiency = 0.5 x BAU

The cascading multiplicative impact of measures applied to each of the four levers is a multiplication by  $0.5 \times 0.5 \times 0.8 \times 0.5 = 0.1$ , i.e. a 10-fold reduction in energy use compared to BAU

## Design criteria for limiting sprawl:

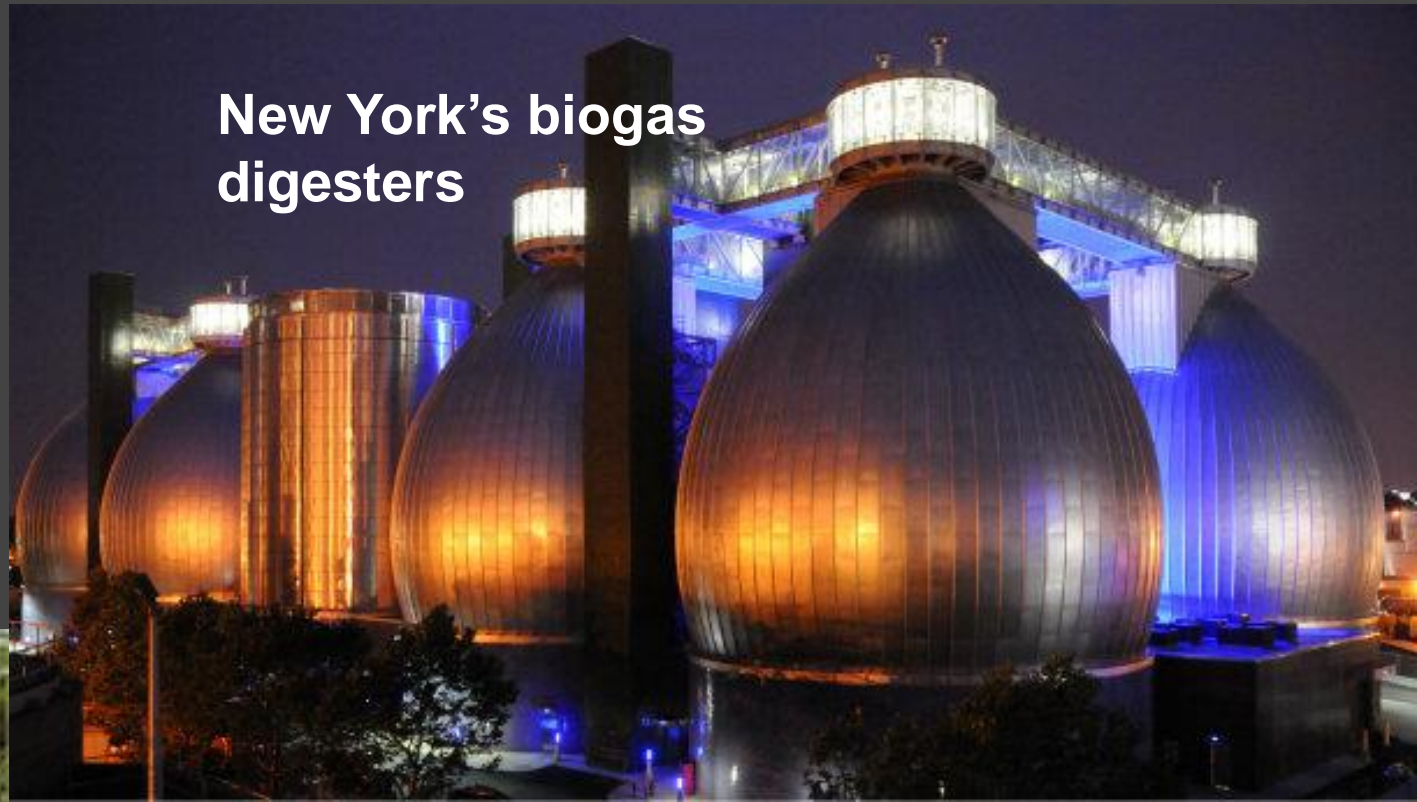
- forget about average densities - leads to compact city notion that can be dysfunctional
- Hierarchical network of high density nodes interconnected with mass transit - average densification becomes an emergent outcome, not a policy objective
- Minimum of 15 000 people/km<sup>2</sup>
- Narrow streets, short blocks, 5-8 stories - no superblocs, wide streets
- 80-100 intersections/km<sup>2</sup>
- High floor-land area- ratios

**LCA of infrastructure alternatives to assess resource efficiency potential:**

- literature review
- model of 84 cities
- with and without densification



Lagos BRT



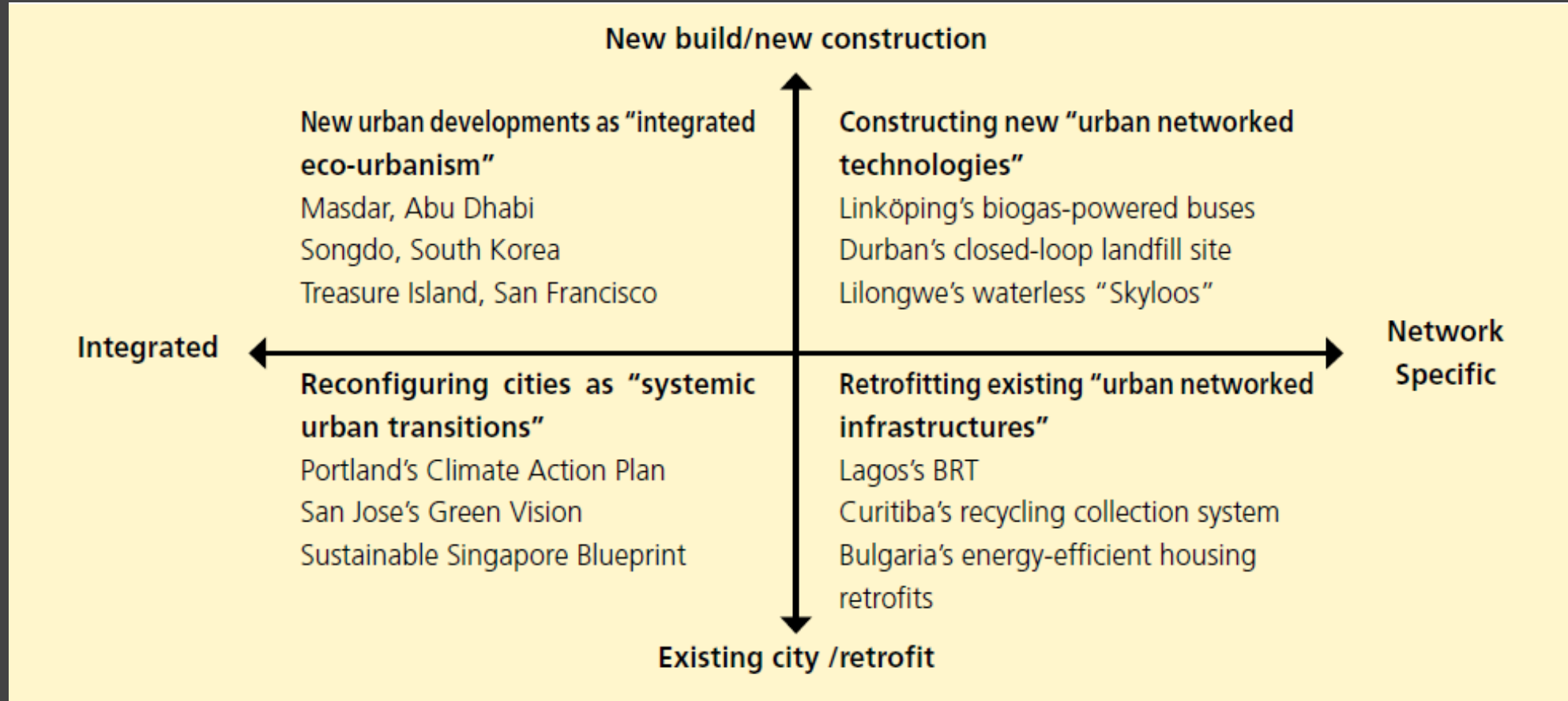
New York's biogas digesters

- Energy efficient commercial buildings
- Bus rapid transition systems
- District energy systems
- Zero waste systems

## Results

- implementation of resource efficient technologies WITHOUT densification in 84 global cities: 24 - 47% reduction in the life cycle environmental and resource impacts by 2050 compared to Baseline Scenario
- implementation of resource efficient technologies WITH densification in 84 global cities: 36 - 54% reduction in the life cycle environmental and resource impacts by 2050 compared to Baseline Scenario

# global outbreak of urban experimentation



taking seriously the evolutionary potential of the present.....

# urban experimentation...

- Urban Experimentation: “An inclusive, practice-based and challenge-led initiative designed to promote system innovation through social learning under conditions of deep uncertainty and ambiguity.” (Sengers *et al* in *The Experimental City*, 2016 - eds Evans, Karvonan, Ravan. )
- 21 case studies: state-led, market-led, citizen-led, technology-led market-led, technology-led and citizen-led



**from corporatist urban  
governance/competing cities  
paradigm (race to the bottom,  
unequal())**



**entrepreneurial urban governance  
of urban experimentation in  
well-ground cities rooted in inclusive  
foundational and biophilic  
economies**

[modes of urban governance over past century aligned – and at times prefigured –  
changes in economic paradigms: managerialist, pluralist, clientilistic, corporatist, populist]

[entrepreneurial governance: derived from the work of Mariana Mazzucato]

“To be truly radical is to make hope possible, rather than despair  
convincing.”

- Raymond Williams