Building momentum for a circular urban economy

Andy Gouldson, Sarah Colenbrander, Andrew Sudmant, Niall Kerr, Faye McAnulla, Stephen Hall, Joyashree Roy, Effie Papargyropoulou, Paola Sakai and Sofia Castro

Centre for
Climate Change
Economics and Policy

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Cities consume:

75% of natural resources

67-76% of energy

IPCC (2014) *Climate Change 2014: Mitigation of Climate Change*. Intergovernmental Panel on Climate Change.
UNEP (2012) *Global Initiative for Resource Efficient Cities*. United Nations Environmental Programme.

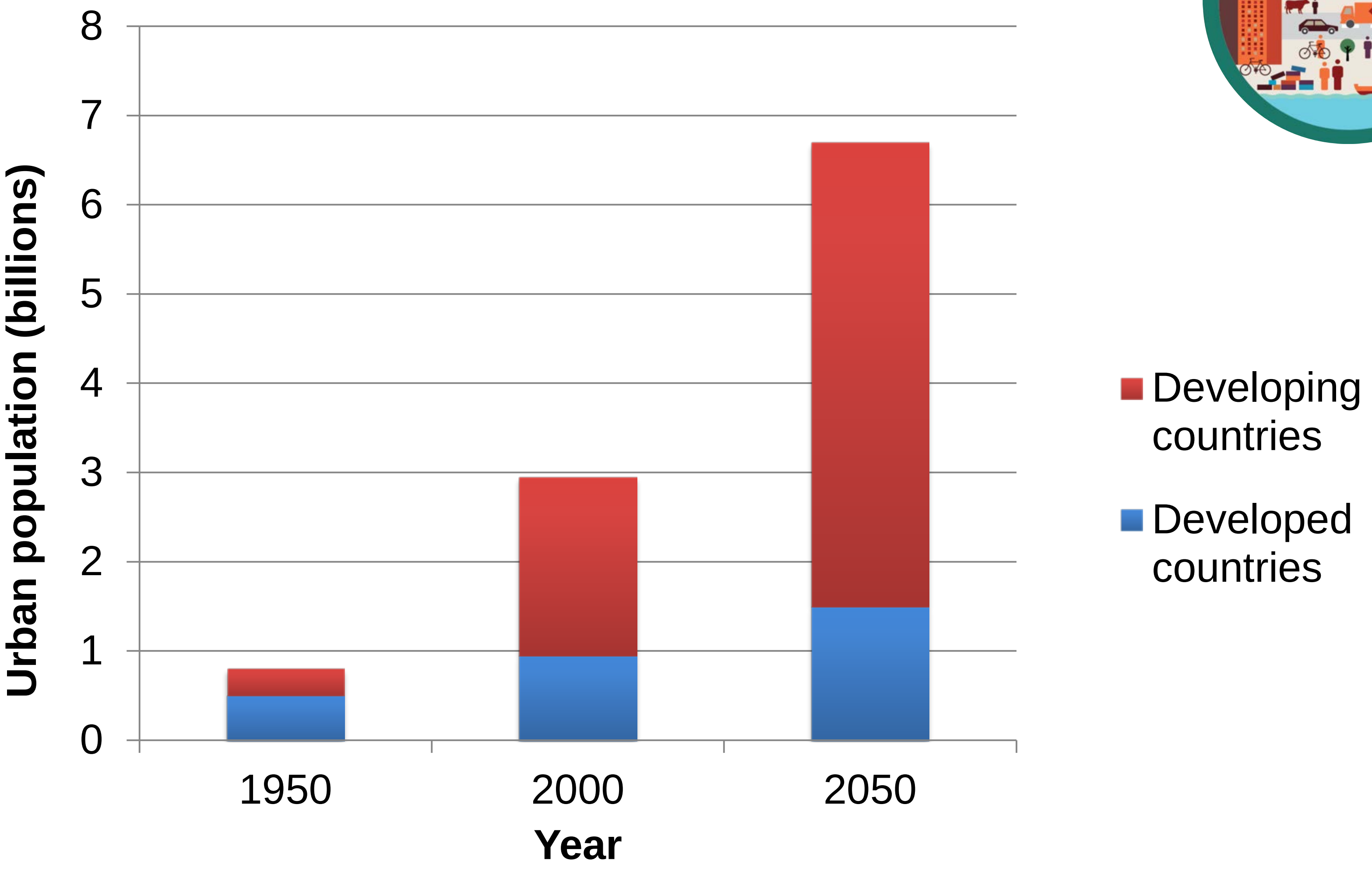
Cities produce:

>70% of global GDP.

50% of waste.

71-76% of energy-related GHG emissions.

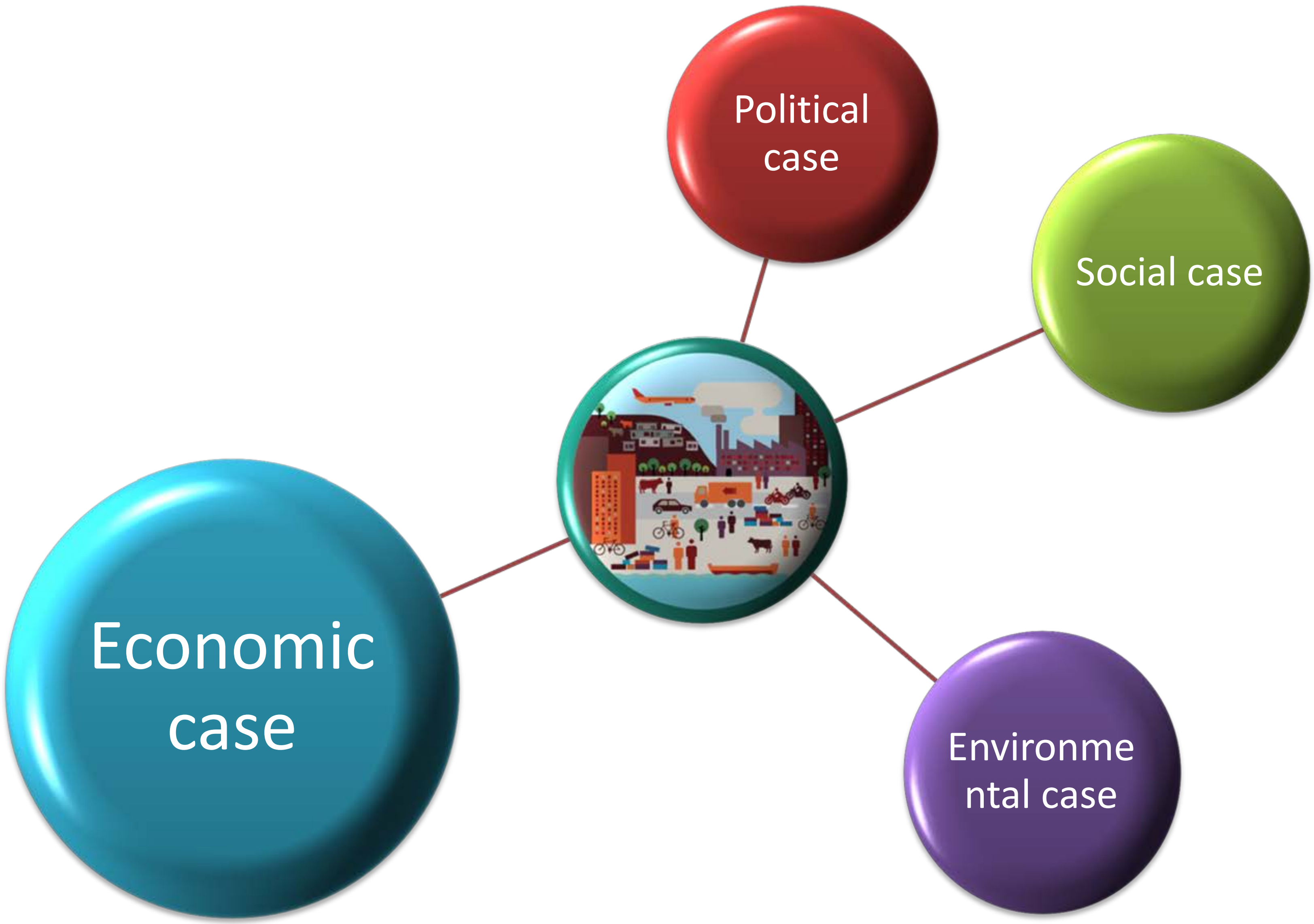
IPCC (2014) *Climate Change 2014: Mitigation of Climate Change*. Intergovernmental Panel on Climate Change.
UNEP (2012) *Global Initiative for Resource Efficient Cities*. United Nations Environmental Programme.



UNDESA (2012) *World Urbanization Prospects: The 2011 Revision*. United Nations Department of Economic and Social Affairs. New York.

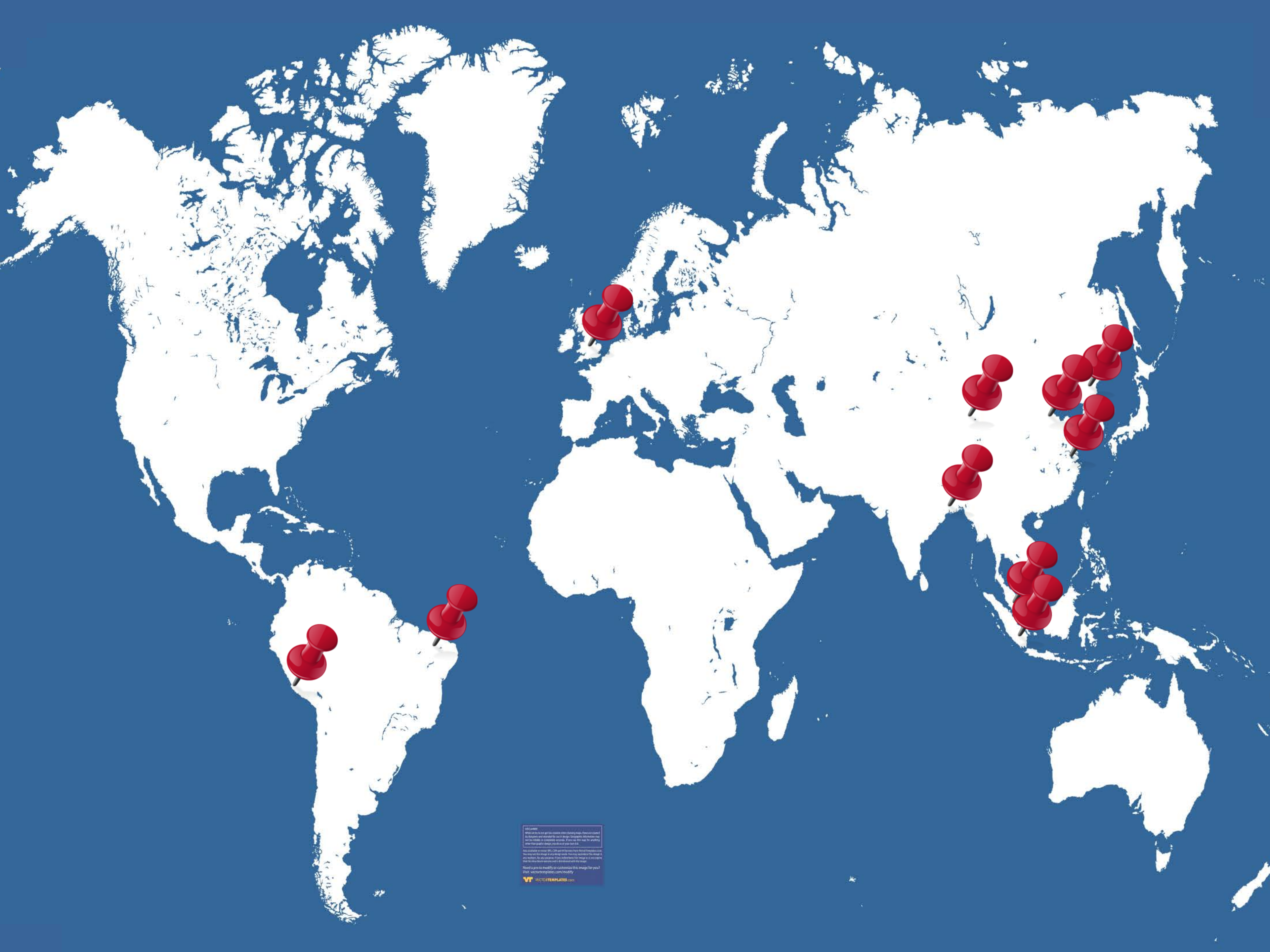
This implies an urgent need to transition to a **circular urban economy** (cradle-to-cradle) instead of a **linear urban economy** (make, use dispose).

How can we build momentum for a circular urban economy?



Our Approach

1. Build a **baseline of 'business as usual' trends** to project energy use, energy bills and carbon emissions.
2. Identify **lists of low carbon measures** that could be adopted in each sector.
3. Collect realistic data on the **costs, benefits and lifetimes** of measures.
4. Calculate **scope for deployment** of each measure.
5. Aggregate all of the above to build a **'macro' (city scale) picture** of investment needs, payback periods and carbon savings.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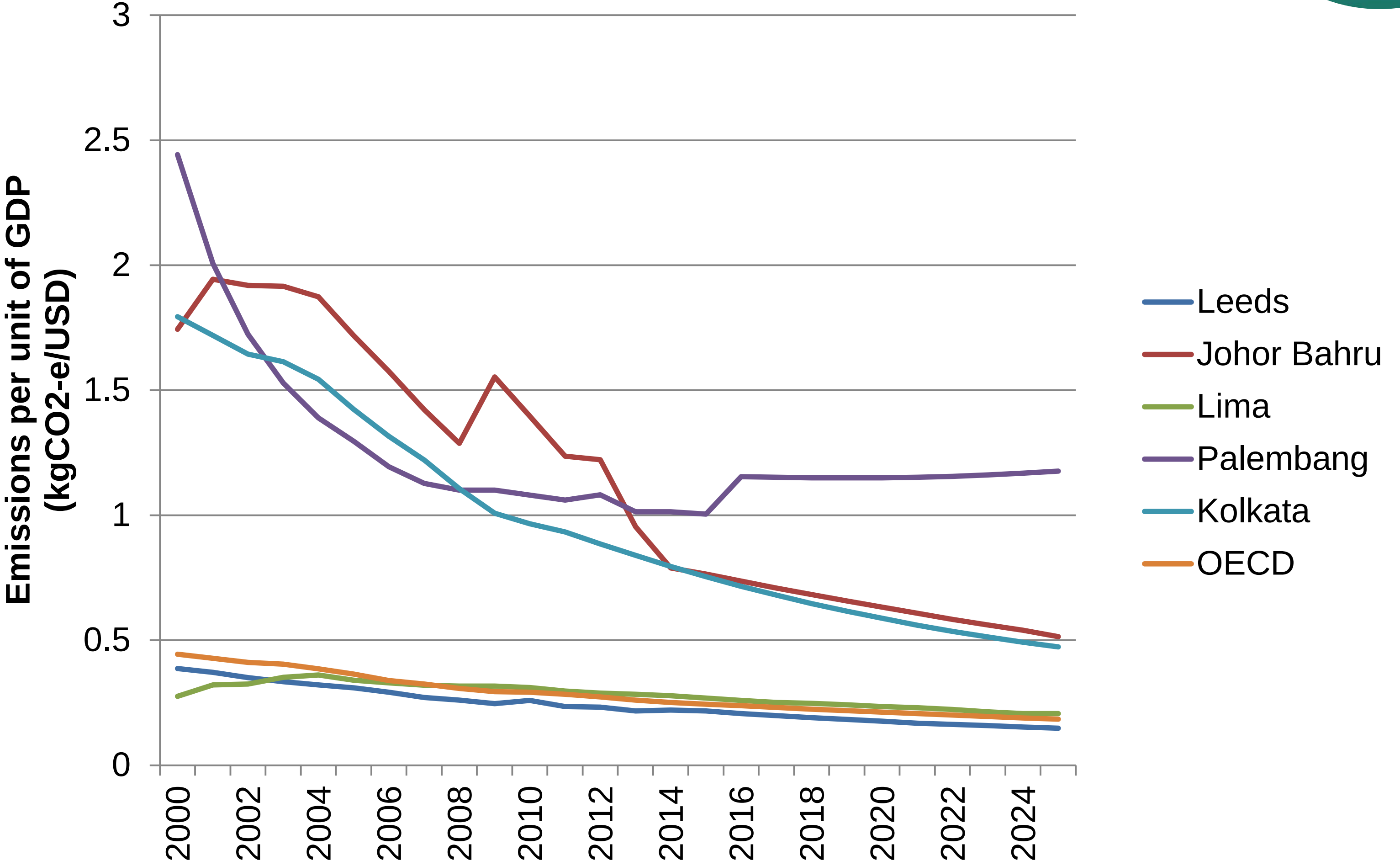
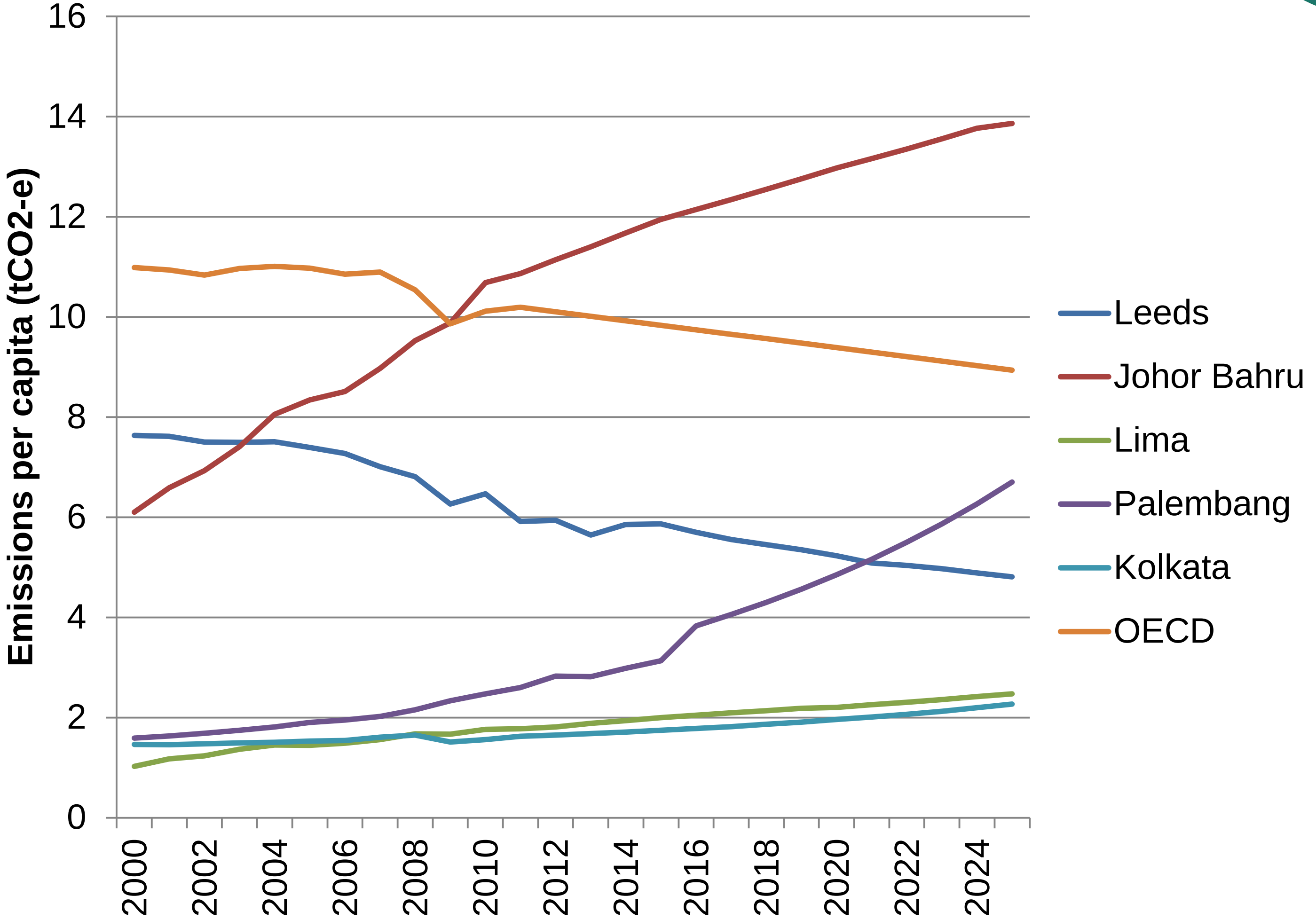
‘Business as usual’ trends: emissions per unit of GDP



‘Business as usual’ trends: emissions per capita



Economics of low carbon measures: industrial sector in Leeds, United Kingdom

Most cost-effective (£/tCO_2)

1. Burners (806)
2. Refrigeration & air-conditioning (244)
3. Compressed air (230)
4. Lighting (196)
5. Fabrication and machining (167)
6. Design (148)
7. Building energy management (130)
8. Operation and maintenance (120)
9. Heat recovery (120)
10. Drying and separation (119)

Most carbon-effective: ($ktCO_2$)

1. Renewable heat (517)
2. Process improvement (102)
3. Drying and separation (101)
4. High temperature heating (93)
5. Controls (57)
6. Heat recovery (45)
7. Low temperature heating (42)
8. Operation and maintenance (40)
9. Energy management (35)
10. Space heating (17)

Economics of low carbon measures: domestic sector in Kolkata, India

Most cost-effective ($/t$CO_2$)

1. Solar water heaters with FiT (94)
2. 4kW solar panels with FiT (85)
3. Banning incandescent light bulbs (57)
4. Raising thermostat 1C (43)
5. Entertainment appliances – standby (42)
6. More efficient air conditioners (39)
7. 4kW solar panels (38)
8. Turning off lights (36)
9. Green Building Standards (35)
10. More efficient water heaters (32)

Most carbon-effective: (ktCO_2)

1. More efficient air conditioners (6,003)
2. More efficient entertainment appliances (3,529)
3. Turning off lights (3,519)
4. Retrofitting insulation to 10% of households (2,494)
5. More efficient water heaters (2,205)
6. Entertainment appliances – standby (1,710)
7. Banning incandescent light bulbs (1,426)
8. Raising thermostat 1˚C (1,174)
9. Installing 10MW of 4kW solar panels (887)
10. Installing solar water heaters on 10% of households (852)

Economics of low carbon measures: waste sector in Palembang, Indonesia

Most cost-effective ($/t$CO_2$)

1. Waste prevention (58)
2. Centralised compositing (52)
3. Landfill gas utilisation (27)
4. Energy from waste – Combined Heat and Power (6)

Most carbon-effective: (ktCO_2)

1. Landfill gas utilisation (3,802)
2. Energy from waste – Combined Heat and Power (3,414)
3. Centralised composting (732)
4. Waste prevention (118)

What is the economic case for low carbon investment?

Johor Bahru and Pasir Gudang, Malaysia

Today

15.2% of city-scale GDP leaves the local economy every year through payment of the energy bill. In 2025, energy expenditure will remain substantial at 13.1%

Tomorrow

0.4% of GDP could be profitably invested, every year for ten years, to exploit commercially attractive energy efficiency and low carbon opportunities.

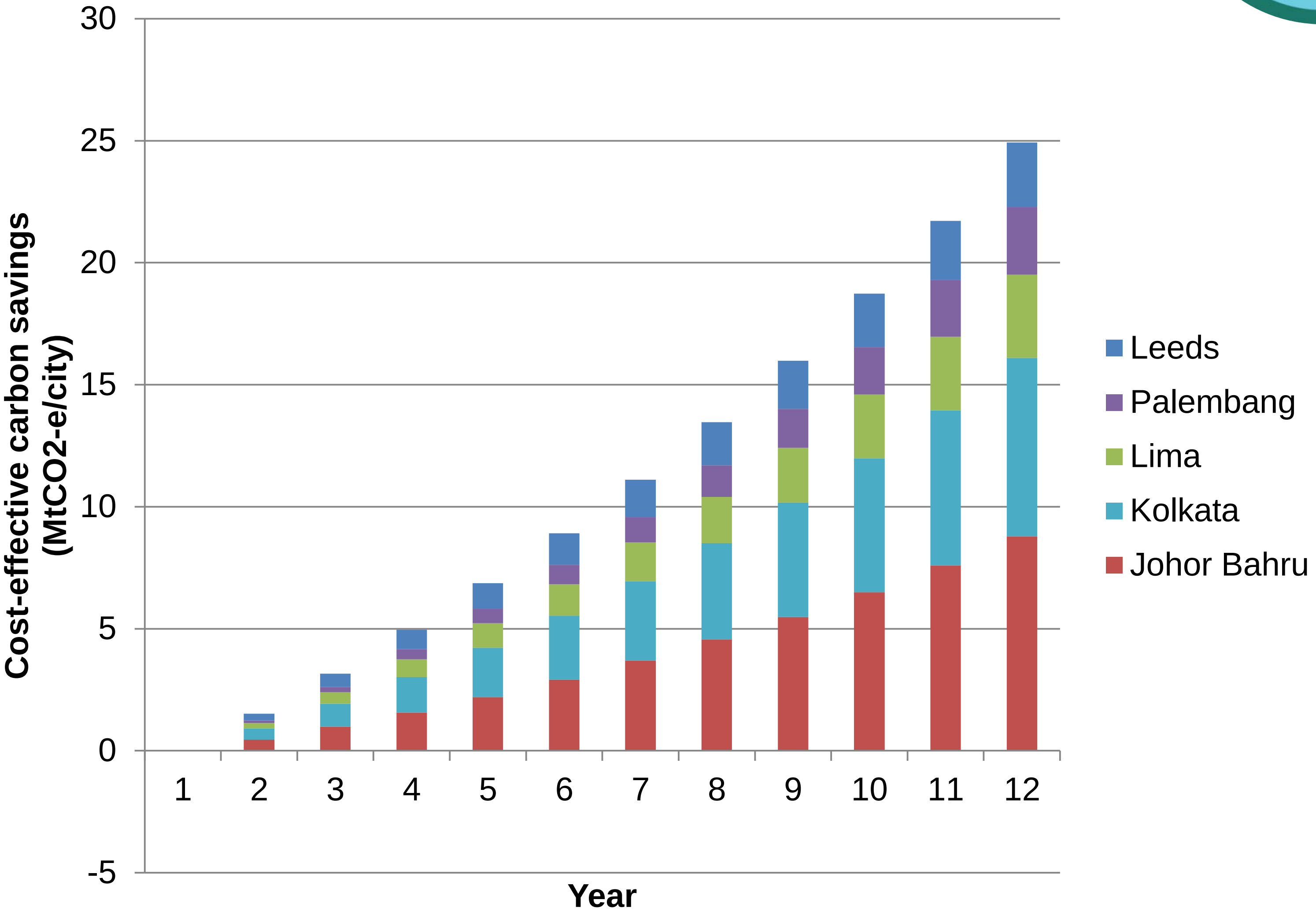
- **Energy**
  reductions in the energy bill equalling 1.0% of GDP
- **Financial viability**
  four years for measures to pay for themselves
- **Employment**
  more jobs and skills in low carbon goods and services
- **Wider economic benefits**
  energy security, increased competitiveness, extra GDP
- **Wider social benefits**
  reductions in fuel poverty, improvements in health

The economic case at the city scale:

	Leeds, UK	Johor Bahru, Malaysia	Lima, Peru	Palembang, Indonesia	Kolkata, India
Investment needs (USD billion)	7.7	1.0	5.0	0.4	2.0
Annual savings (USD billion)	1.9	0.8	2.1	0.4	0.5
Payback period (years)	4.1	1.3	2.4	<1	3.9
Carbon savings in 2025 (% of BAU)	15.6	24.2	14.7	24.1	20.7

Exploiting economically attractive low carbon options improves cities' energy efficiency and reduce their carbon footprints. These investments also reduce cities' dependence on linear energy systems, unlocking financial resources and building human capital to enable a local circular economy.

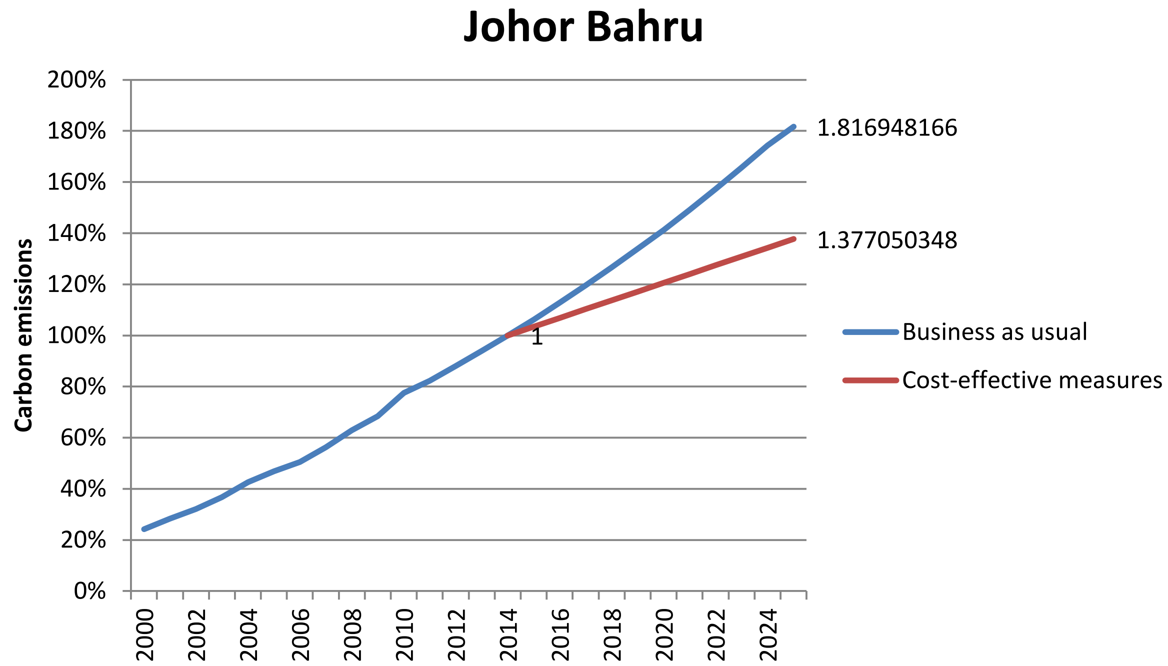
Economically attractive carbon saving potential per city

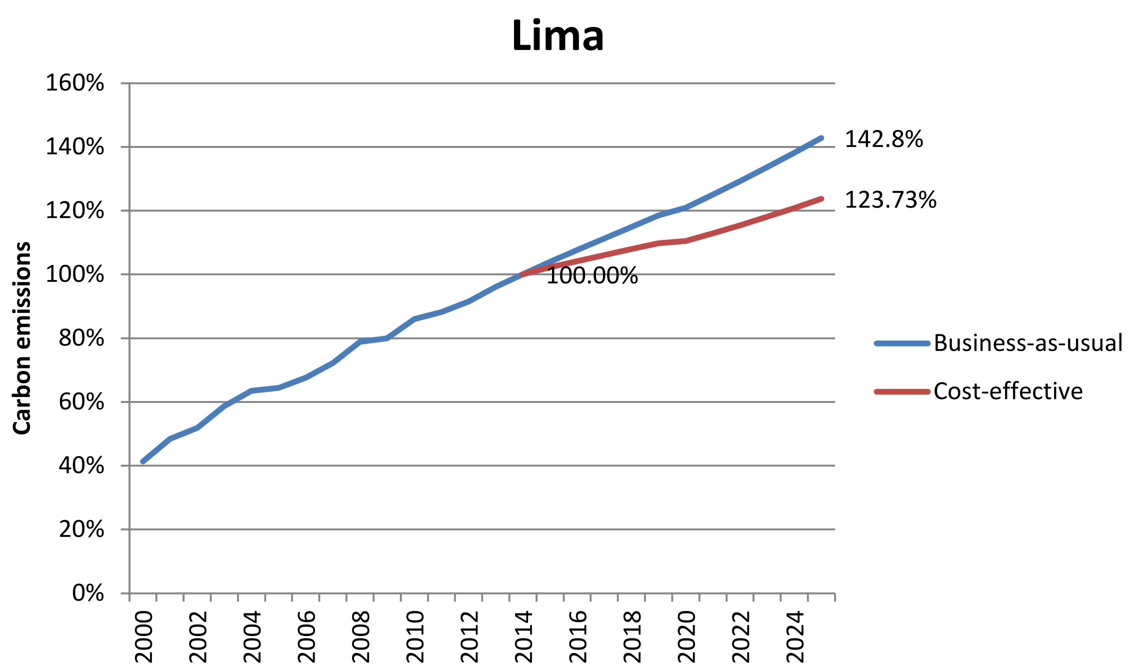


Can we transition to a circular urban economy just by exploiting economically attractive options?

N

The economically attractive options reduce the carbon intensity of development – but net emissions continue to rise.





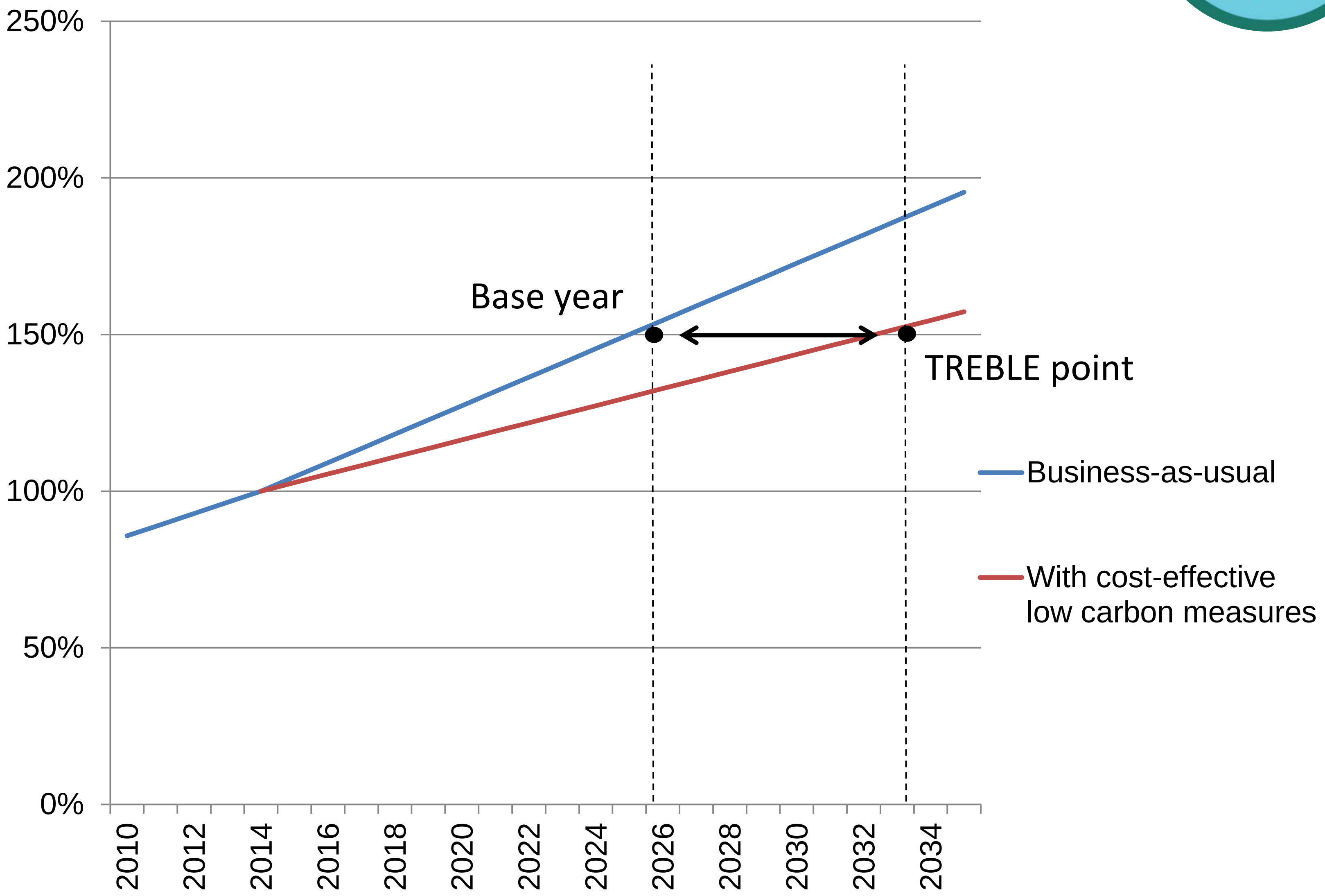
Introducing the TREBLE point

- **“Time to Regain Baseline Level Emissions”**

- Recognises that the BAU level of emissions expected in a particular year would still be realised with low carbon investments – but at a later time.

- Measures the **amount of time** that a particular low carbon investment can ‘buy’ a city seeking overall and permanent emission reductions in the context of ongoing growth.

The TREBLE point



The TREBLE point

	Leeds, UK	Johor Bahru, Malaysia	Lima, Peru	Palembang, Indonesia	Kolkata, India
TREBLE point	-6	11	7	8	15

These cities could generate real reductions in their carbon emissions – relative to the BAU prediction for 2025 – that would last for 7-15 years before being outweighed by the impacts of sustained (if more carbon efficient) growth. Exploiting these options could buy substantial time to prepare the ground for the more politically, economically and socially challenging actions that are necessary to transition to a circular economy.

We cannot transition to a **circular urban economy** within the current economic paradigms – but the presence of a **compelling economic case** can help to build **momentum and capacities** for more transformative change.

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Sarah Colenbrander
Research Fellow

E: s.colenbrander@leeds.ac.uk

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Further reading

Gouldson, A., Colenbrander, S., McAnulla, F., Sudmant, A., Kerr, N., Sakai, P., Hall, S. and Kuylenstierna, J.C.I. (2014). *Exploring the Economic Case for Low-Carbon Cities*.
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