Exploring the Economic Case for Climate Action in Cities

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The Significance of Cities (1)

- Of the 7.1 billion people alive today, more than 3.6 billion live in cities.
- By 2050 the urban population is predicted to pass 6.7 billion (UNDESA, 2014).
- Forecasts suggest that the vast majority of this urban population – some 5.2 billion people – will live in low- and middle-income countries, where the number of city-dwellers is increasing by 1.2 million people per week (WHO, 2014).
- Although the urban population in high-income countries is growing more slowly, it is still forecast that around 1.2 billion people will be living in cities in high-income countries by 2050 (WHO, 2014).

The Significance of Cities (2)

- The IPCC has estimated that the fuel that is consumed and the other activities that take place within cities directly account for 44% of global GHG emissions (IPCC, 2014).
- However, when considering their final consumption of electricity and excluding non-CO_2 GHG emissions, the IPCC estimates that 71–76% of the global CO_2 emissions from final energy use can be attributed to cities (IPCC, 2014).
- Various analyses have suggested that when wider consumption-based impacts are taken into account the share of global energy-related CO_2 emissions attributable to cities would be higher (Satterthwaite, 2008; Khan, 2012; Hoornweg et al., 2011; GEA, 2012; Feng et al., 2014).

Climate, Economics and Finance (1)

- The Stern Review estimated that the costs of avoiding dangerous climate change (1-2% of GDP) are much less than the costs of dangerous climate change (5-20% of GDP).
- The IPCC (2014) estimated that global levels of investment in climate mitigation and adaptation were in the range of USD 343 to 385 billion per year in the period between 2009 and 2012 and Buchner (2013) finds that global climate finance flows have plateaued at USD 359 billion.
- Both of these estimates equate to c.0.5% of global GDP – this is roughly 1/3 to 1/4 of the upper end of estimated investment needs if dangerous climate change is to be avoided (c.f. Stern, 2007; McKinsey, 2010; IIASA, 2012; WEF, 2013; McCullum et al, 2013 and IEA, 2013a).

Climate, Economics and Finance (2)

- The need for an effective response to under-investment in climate mitigation is pressing.
- The IEA (2013a, p3) reported that 'the goal of limiting warming to 2°C is becoming more difficult and more costly with each year that passes' and that 'almost four-fifths of the CO2 emissions allowable by 2035 are already locked-in… If action to reduce CO2 emissions is not taken before 2017, all the allowable CO2 emissions would be locked-in by energy infrastructure existing at that time.'

Climate, Economics and Finance (3)

- Even with a compelling global economic case for action, it is clear that an effective response will still require enormous investment.
- The general, long term, social case for action does not always translate into a specific, short term, private case for investment.
- And the conditions for investment in low carbon development have hardly been ideal in the last few years.
- Market instability and policy uncertainty continue to limit private investment in many markets/sectors
- Budget deficits, austerity and neo-liberal agendas continue to limit policy support and public investment in many countries
- Innovative ways of substantially and rapidly increasing investment in low carbon development are needed.

The Global Case for Ambitious Climate Action in Cities

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Press release: Low-carbon cities are a US$17 trillion opportunity worldwide

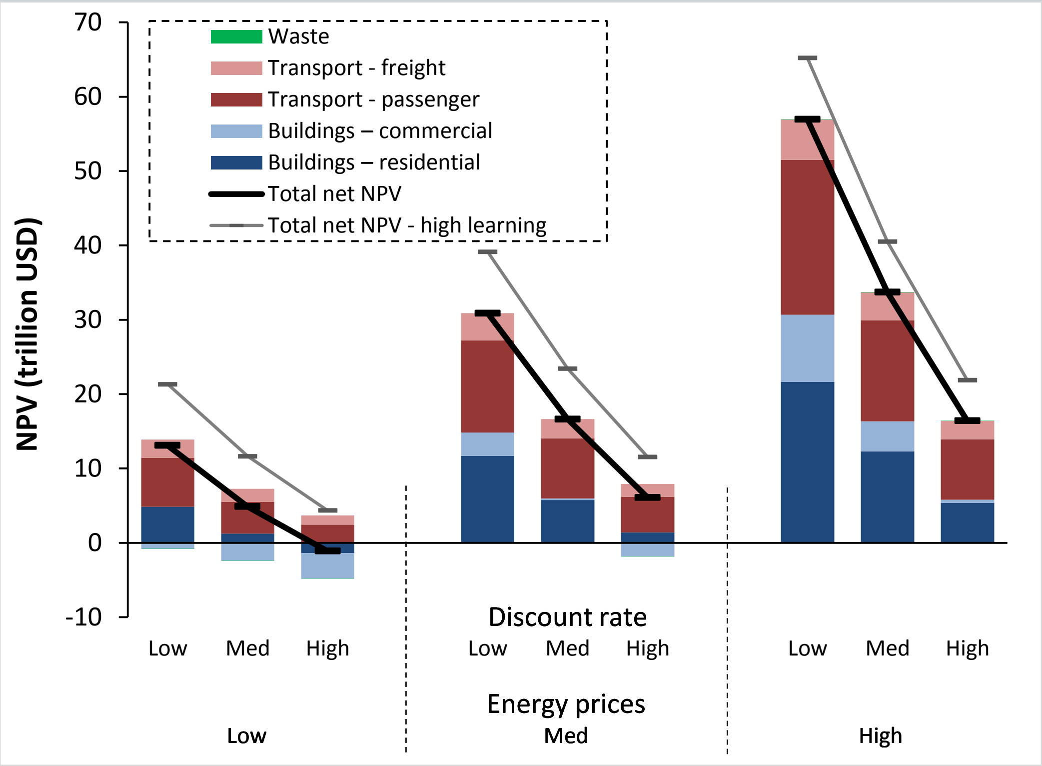
News Article / September 8, 2015

Washington/London, September 8, 2015: New research from the New Climate Economy finds that investing in public and low emission transport, building efficiency, and waste management in cities could generate savings with a current value of US$17 trillion by 2050. These low-carbon investments could also reduce greenhouse gas emissions by 3.7 Gt CO_2e per year by 2030, more than the current annual emissions of India.

With complementary national policies such as support for low-carbon innovation, reduced fossil fuel subsidies, and carbon pricing, the savings could be as high as US$22 trillion.

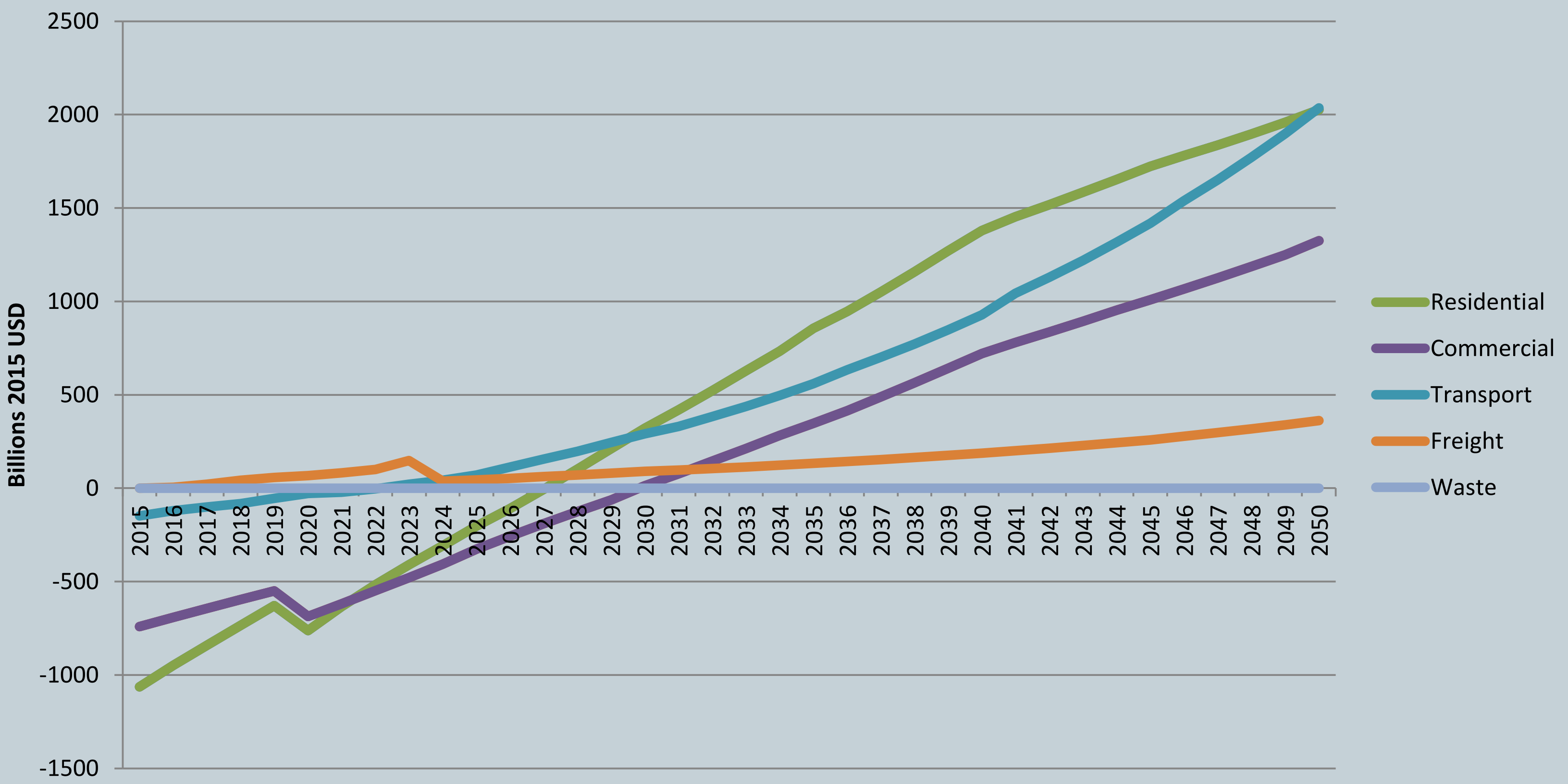
“The steps that cities take to shrink their carbon footprints also reduce their energy costs, improve public health, and help them attract new residents and businesses,” said **Michael R. Bloomberg, UN Secretary-General’s Special Envoy for Cities and Climate**

The Global Case for Ambitious Climate Action in Cities

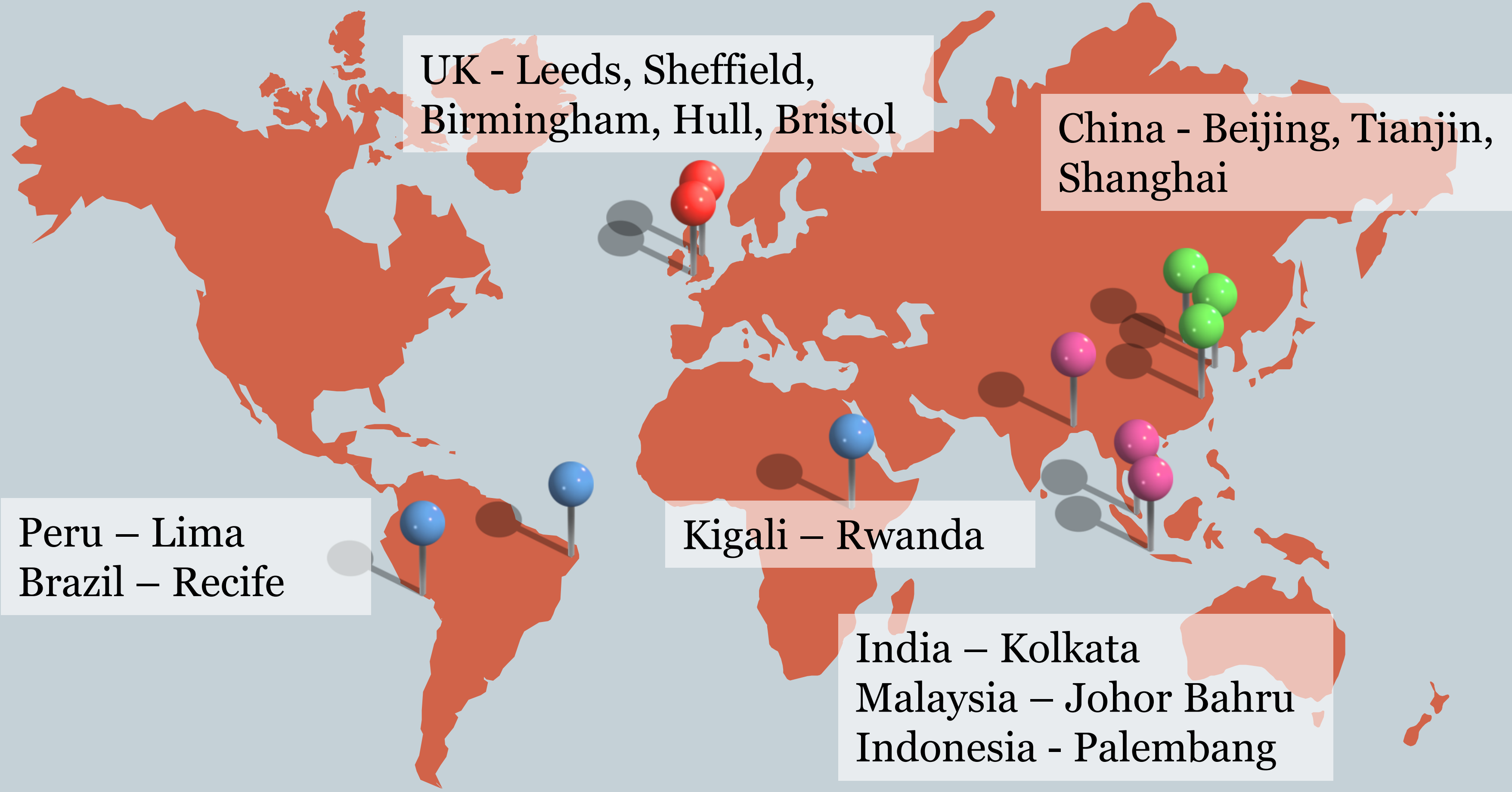


- Cities could make a major contribution to the delivery of a 2DS trajectory.
- The net present value of the savings stream from 2DS oriented low carbon investments in cities to 2050 is $16.6 trillion.
- The gross global costs would be cUS$1 trillion p.a. to 2050, but they would reduce annual energy expenditure by US$1.6 trillion in 2030 and US$5.9 trillion in 2050.

The Global Case for Ambitious Climate Action in Cities



The Climate Smart Cities Programme



Methods (1)

- An assessment of recent trends in the city's energy use, energy expenditure and GHG emissions, and projection of these trends over the next decade (the business as usual (BAU) baselines);
- An evaluation of the costs, benefits and carbon saving potential of a wide range of the low-carbon measures that could be adopted in different sectors in the city in the next decade; and
- An aggregation of the findings and the presentation of the economic case for investment in these options at scale in different sectors in the city over the next decade.

- All based on a form of iterated participatory appraisal
- Geographical, temporal, technical and economic boundaries

Methods (2)

- The Global Protocol for Community Scale GHG Inventories (the GPC)

Scope of baseline inventories, BAU forecasts and measures appraisal.

	Electricity[a]	Transmission losses	Buildings energy use	Transport fuel use[b]	Aviation	Marine	Railways[b]	Biofuels	Industrial processes	Industrial energy use	AFOLU[c]	Waste[d]	Upstream fuels	Embodied carbon
Johor Bahru, Malaysia	B	B	B&M	B&M	–	–	B&M	B&M	–	B&M	–	B&M	–	–
Kolkata, India	B	B	B&M	B&M	–	–	B&M	B&M	–	B&M	–	B&M	–	–
Leeds, UK	B	B	B&M	B&M	–	–	B&M	B&M	–	B&M	–	–	–	–
Lima, Peru	B	B	B&M	B&M	–	–	B&M	B&M	–	B&M	–	B&M	–	–
Palembang, Indonesia	B	B	B&M	B&M	–	–	B&M	B&M	–	B&M	–	B&M	–	–

Source: Adapted from Kennedy et al. (2011) and GHG Protocol (2014).

Key:

B – included in the baseline inventory and the business as usual forecast.

M – included in the measures appraisal.

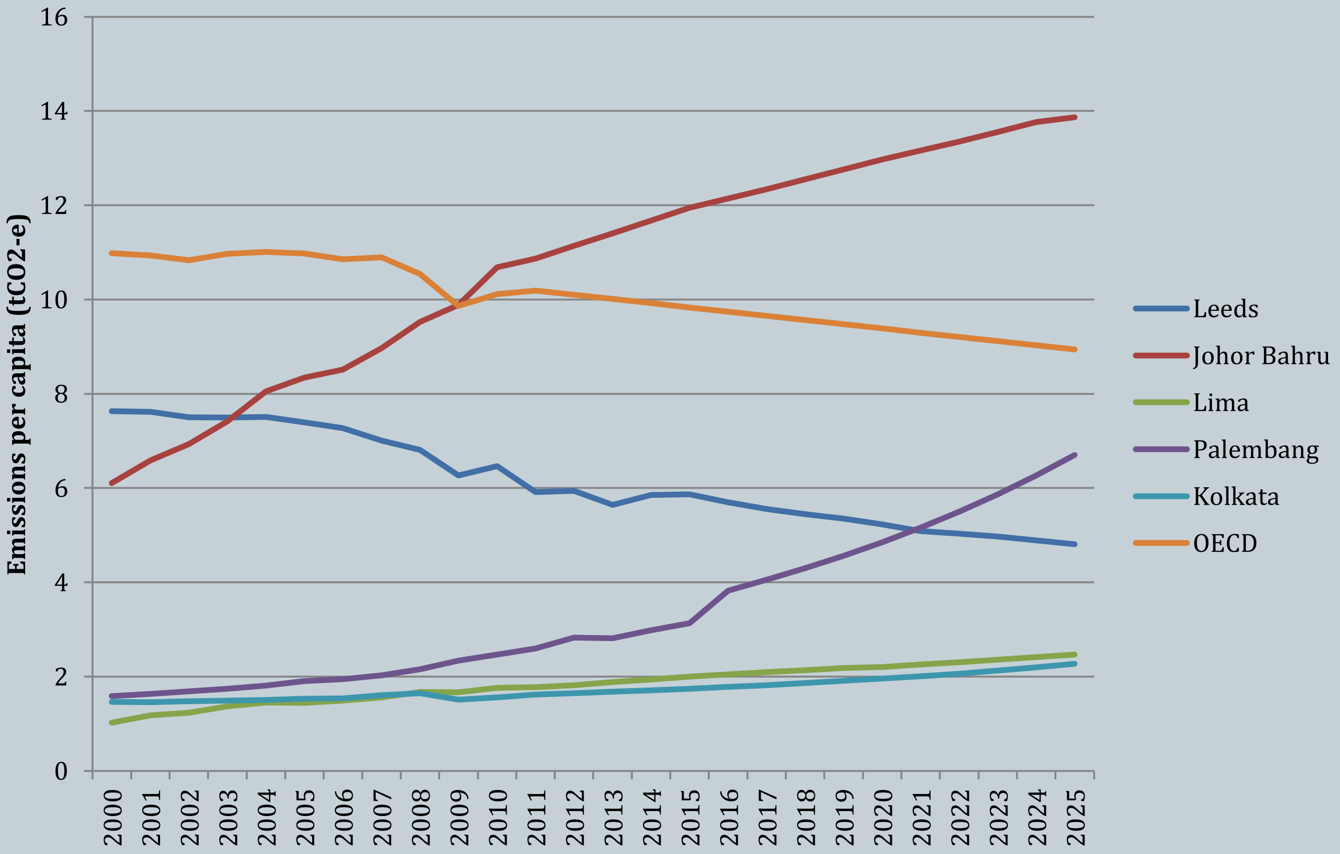
[a] The potential application of low carbon measures in the large-scale generators supplying electricity to the relevant national or regional grids was not considered. However, the potential for the adoption of small-scale renewables within the city was considered.

[b] For travel within the city only.

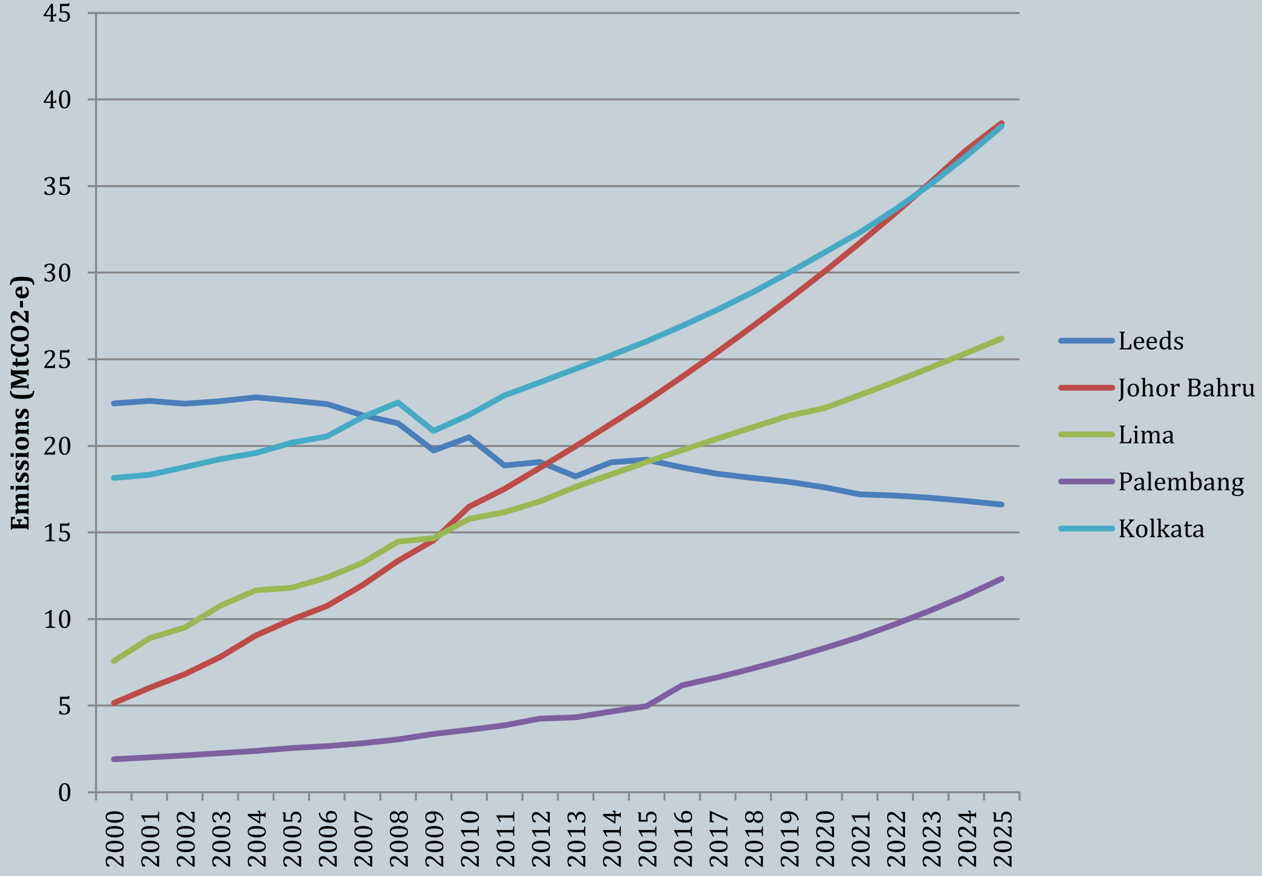
[c] Agriculture, forestry and land use.

[d] For solid waste management options, excluding waste water.

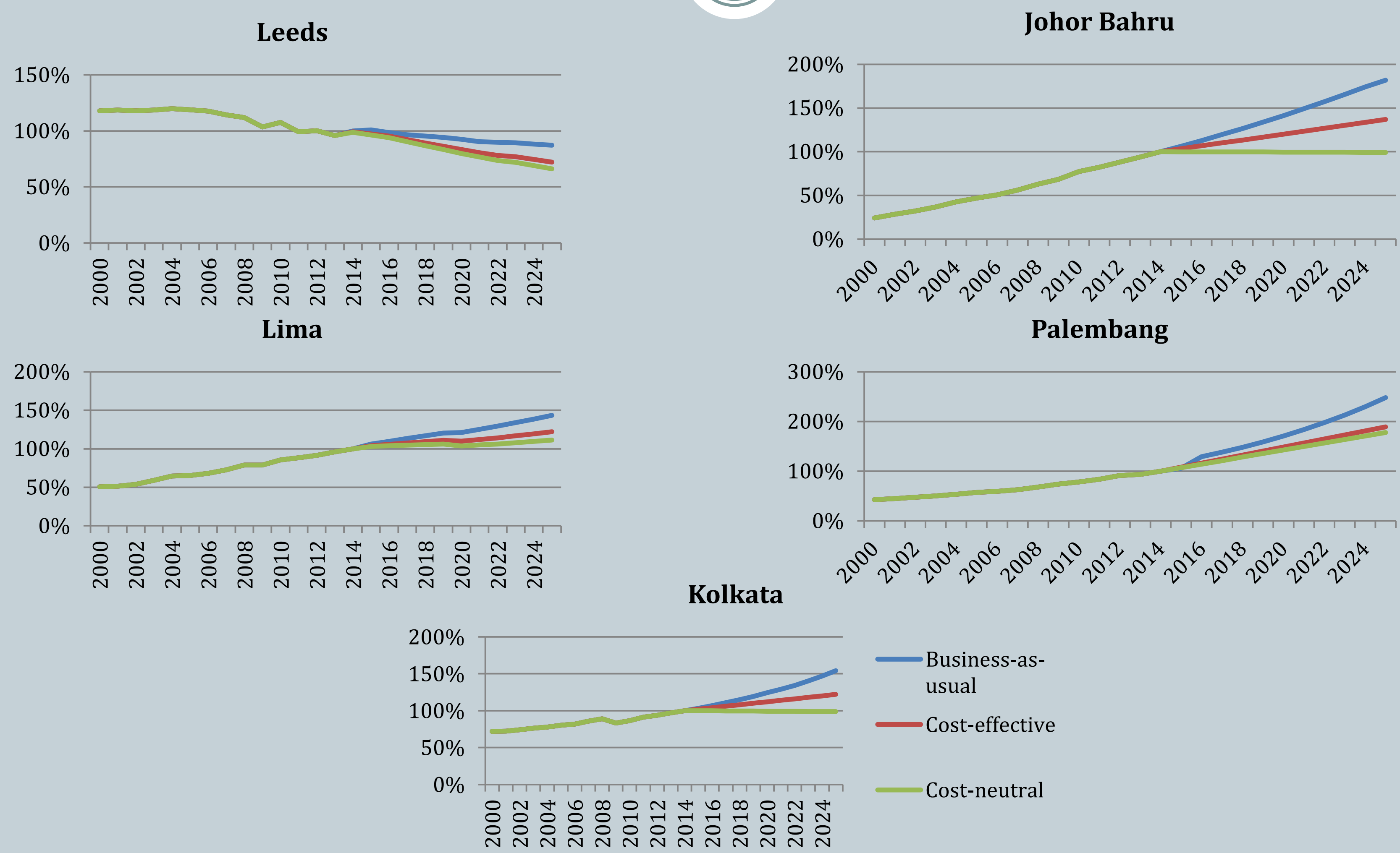
Results – Carbon emissions per capita



Results – Total carbon emissions



Results – Cost-effective carbon saving potential



Summary of Results

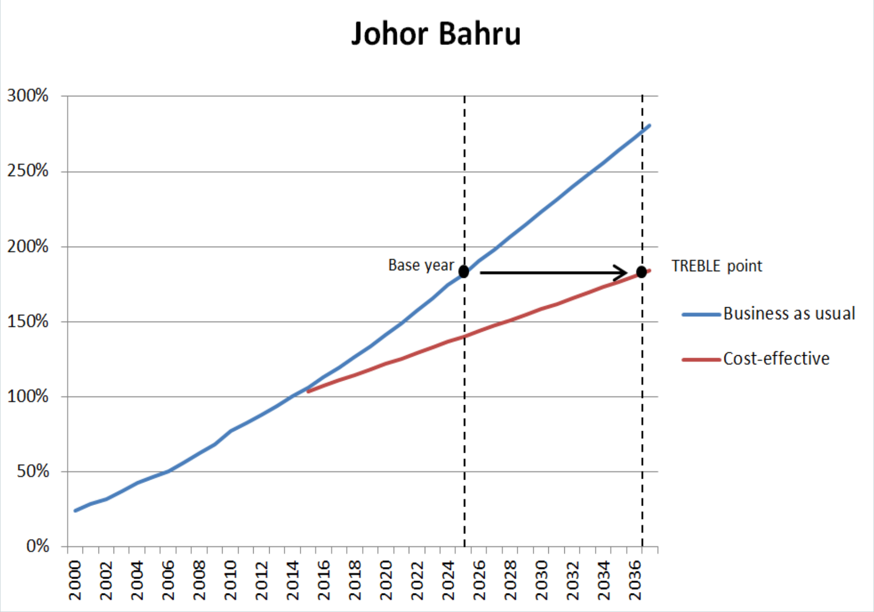
- We find that 0.4-0.9% of city-scale GDP could be invested each year for the next ten years.
- This would generate direct savings of 1.7-9.5% of city-scale GDP in 2025.
- It would also generate carbon reductions of 15-24% relative to BAU trends.
- *If* these findings were replicated and similar investments were made in cities globally, then they could generate reductions equivalent to 10–18% of global energy-related GHG emissions in 2025.

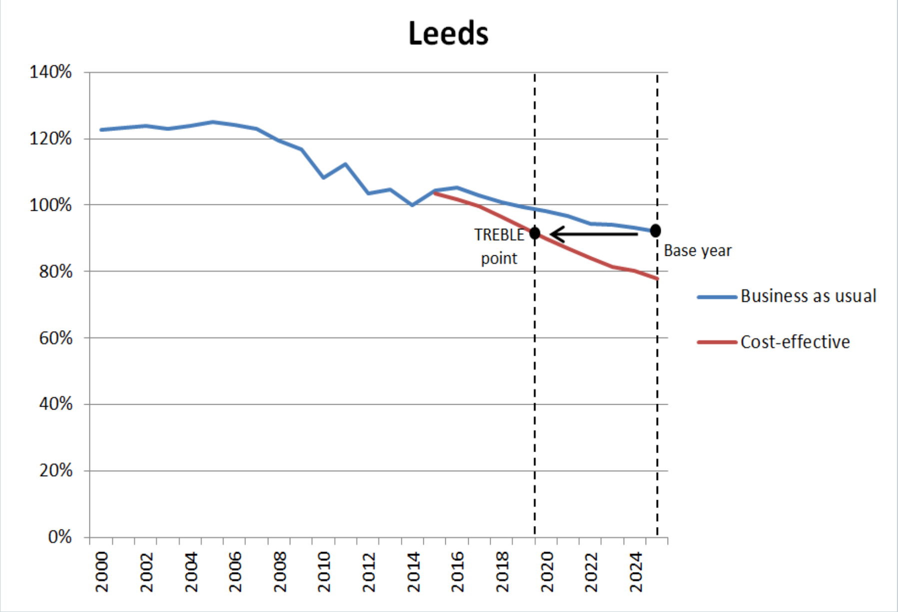
Results – Costs and benefits

	Leeds	Johor Bahru	Lima	Palembang	Kolkata
	Cost-effective scenario				
Investment needs (USD billion)	7.7	1.0	5.0	0.4	2.0
Investment needs (% of city GDP)	8.9	3.4	7.5	9.9	6.3
Annual savings (USD billion)	1.9	0.8	2.1	0.4	0.5
Annual savings (% of city GDP)	2.2	3.0	3.2	8.7	1.6
Payback period (years)	4.1	1.3	2.4	>1	3.9
Carbon savings (MtCO2-e)	2.6	9.4	3.5	3.2	7.6
Carbon savings in 2025 (% of BAU)	15.6	24.2	14.7	24.1	20.7
	Cost-neutral scenario				
Investment needs (USD billion)	18.11	5.6	10.8	1.5	3.6
Investment needs (% of city GDP)	21	19.0	16.3	33.6	11.4
Annual savings (USD billion)	2.5	0.8	2.4	0.5	0.6
Annual savings (% of city GDP)	2.9	3.0	3.6	10.9	1.9
Payback period (years)	7.3	6.8	4.5	3.3	6.2
Carbon savings (MtCO2-e)	3.6	17.5	5.2	3.7	13.5
Carbon savings in 2025 (% of BAU)	21.8	45.4	22.4	28.3	34.5

The Time to Regain BAU Levels (The TREBLE Point) After Investment

The number of years for carbon emissions to reach the BAU level predicted for 2025 after investment in low carbon measures has taken place.





The Time to Regain BAU Levels (The TREBLE Point) After Investment

TREBLE Points with cost-effective levels of investment:

Lima - 7 years, Palembang – 8 years, Johor Bahru - 11 years, Kolkata – 15 years.

Investing in the cost-effective options would mean that these cities reach BAU levels of emissions forecast for 2025 between 7 and 15 years later than they would have done without those investments.

Leeds - -6 years

Investing in the cost-effective options would mean that the Leeds City Region achieves BAU levels of emissions forecast for 2025 6 years earlier than it would have done without those investments.

How this Relates to Energy Efficiency in Buildings

- Globally, 1/3 of all final energy and 1/2 of all electricity are consumed in buildings that are therefore responsible for c1/3 of global carbon emissions (IEA, 2013b).
- But many potentially attractive energy efficiency investments do not meet the short-term financial return criteria of businesses, investors, and individuals (IPCC, 2014).
- As a result, the IEA (2013b) predicts that without a concerted push from policy, 2/3 of the economically viable potential to improve energy efficiency in buildings will remain unexploited by 2035.
- New forms of policy support, new institutional arrangements, new forms of finance and new business models are required if the energy efficiency opportunities in buildings are to be exploited (IEA, 2013a; IPCC, 2014; DECC, 2012a).

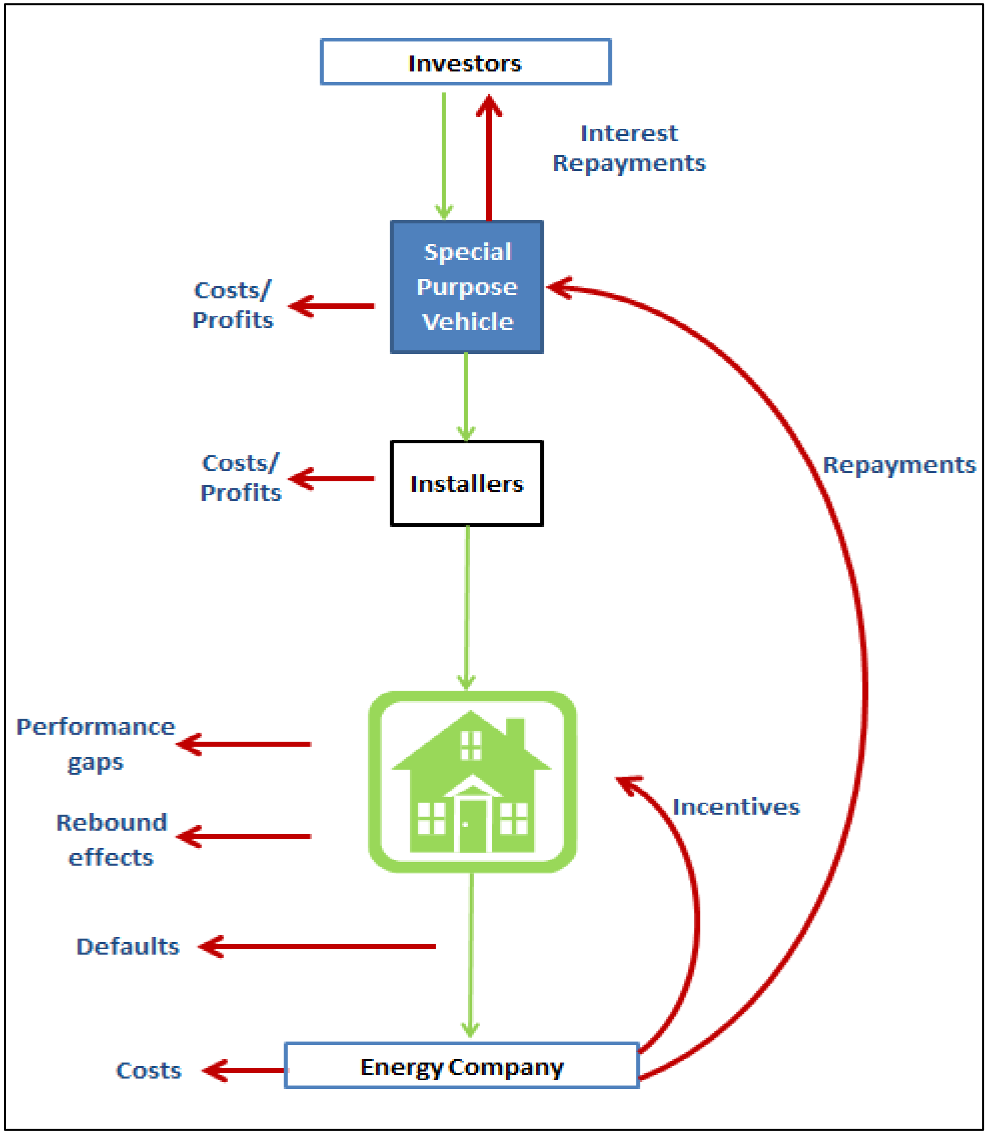
The Potential of Revolving Funds

- In 2008, the IEA argued that one way of mobilising investment in the built environment might be to establish revolving funds for building refurbishment and retrofit (IEA, 2008).
- Revolving funds are where the savings from investments are collected and reinvested to either reduce the need for new finance or to increase the impact of what finance there is.
- Such funds have been discussed before (EC, 2011; Forum for the Future, 2011; DECC, 2012a; IEA, 2013b) and have been adopted in various contexts.
- However, there has never been a formal academic evaluation of the contribution that such funds can make to low carbon transitions.

The Potential of Revolving Funds

- Focusing on the financing of building energy efficiency retrofits, what might revolving funds look like, how could they work and what they could contribute.
- More broadly, how they might be organised and governed, what do they imply for the public, private and civic sectors and what do they tell us about the governance of climate finance and the financing of sustainability?

A Generic Revolving Fund for the Built Environment



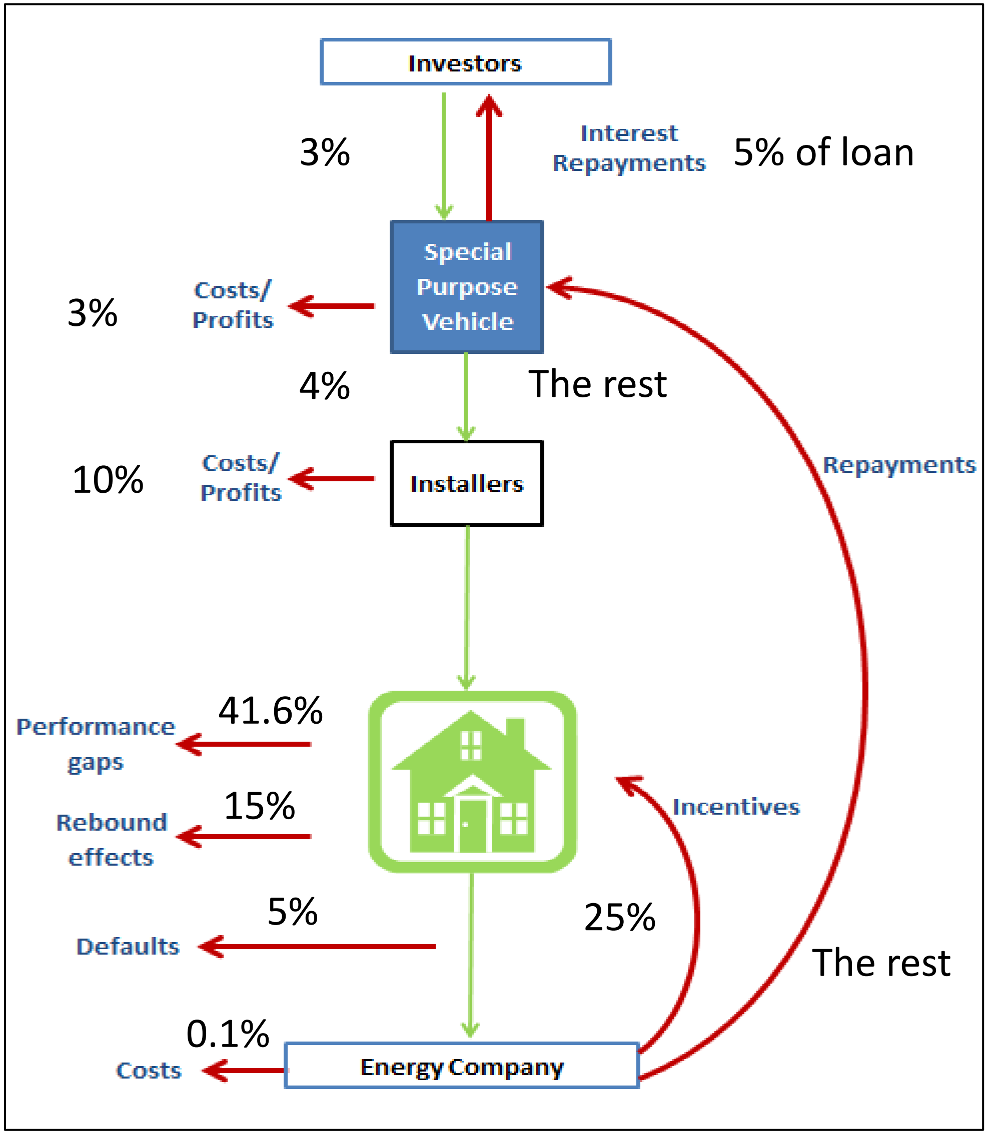
The Case - Domestic Energy Efficiency Retrofit in the UK

- UK has an old and frequently energy inefficient housing stock that accounts for 25% of UK carbon emissions.
- Data on the costs, performance and scope for deployment of a range of energy efficiency and low carbon measures that could be applied in the UK housing stock are drawn from a model developed for the UK CCC.
- Data takes into account the purchase, installation, running and maintenance costs and lifespans of each measure.
- Data evaluates impacts of measures in an ‘average’ UK house already upgraded to a good standard of energy efficiency.
- By considering the scope for deployment of each measure across the UK, assessments of each individual measure can be scaled up to consider aggregated costs and benefits if all measures are installed in every suitable property in the UK.

Energy Efficiency and Low Carbon Measures Considered

1. Loft insulation from 0 - 270mm
2. Loft insulation from 25 - 270mm
3. Loft insulation from 50 - 270mm
4. Loft insulation from 75 - 270mm
5. Loft insulation from 100 - 270mm
6. Cavity wall insulation for homes built before 1976
7. Cavity wall insulation for homes built between 1976 and 1983
8. Cavity wall insulation for homes built after 1983
9. DIY floor insulation for suspended timber floors
10. Solid wall insulation
11. Paper type solid wall insulation
12. Best practice standard windows
13. Uninsulated hot water cylinder to high performance cylinder
14. Modestly insulated hot water cylinder to high performance cylinder
15. Primary pipework insulation
16. Improve airtightness
17. Thermostatic radiator valves
18. Room thermostats
19. Hot water cylinder thermostat
20. Efficient lighting
21. A+ rated wet appliances
22. Photovoltaic generation with FIT
23. Micro wind turbines (1kW) with FIT
24. Mini wind turbines (5kw) with FIT

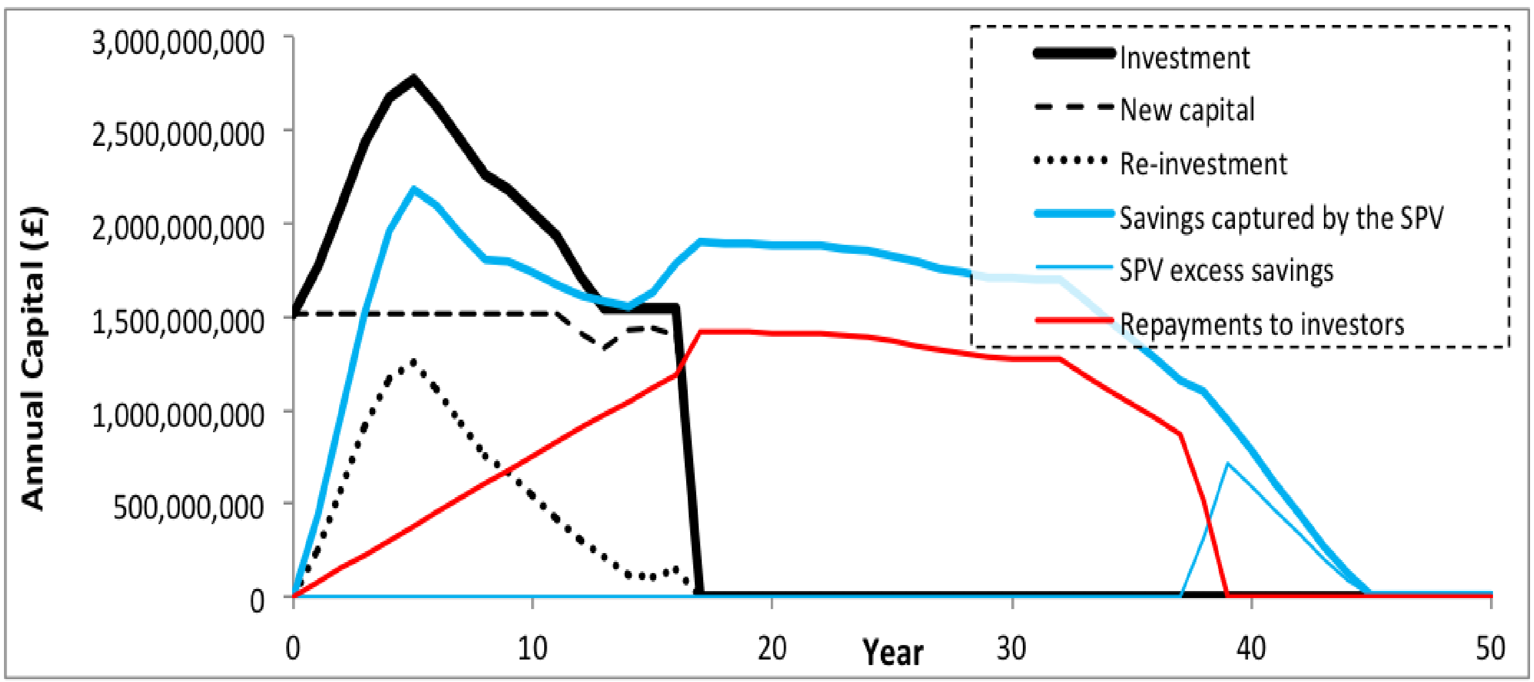
A Generic Revolving Fund for the Built Environment



- Max investment levels p.a.
- Max exploitation of available potential of any option p.a.
- Scope for limited optimisation, i.e. by pay-back period

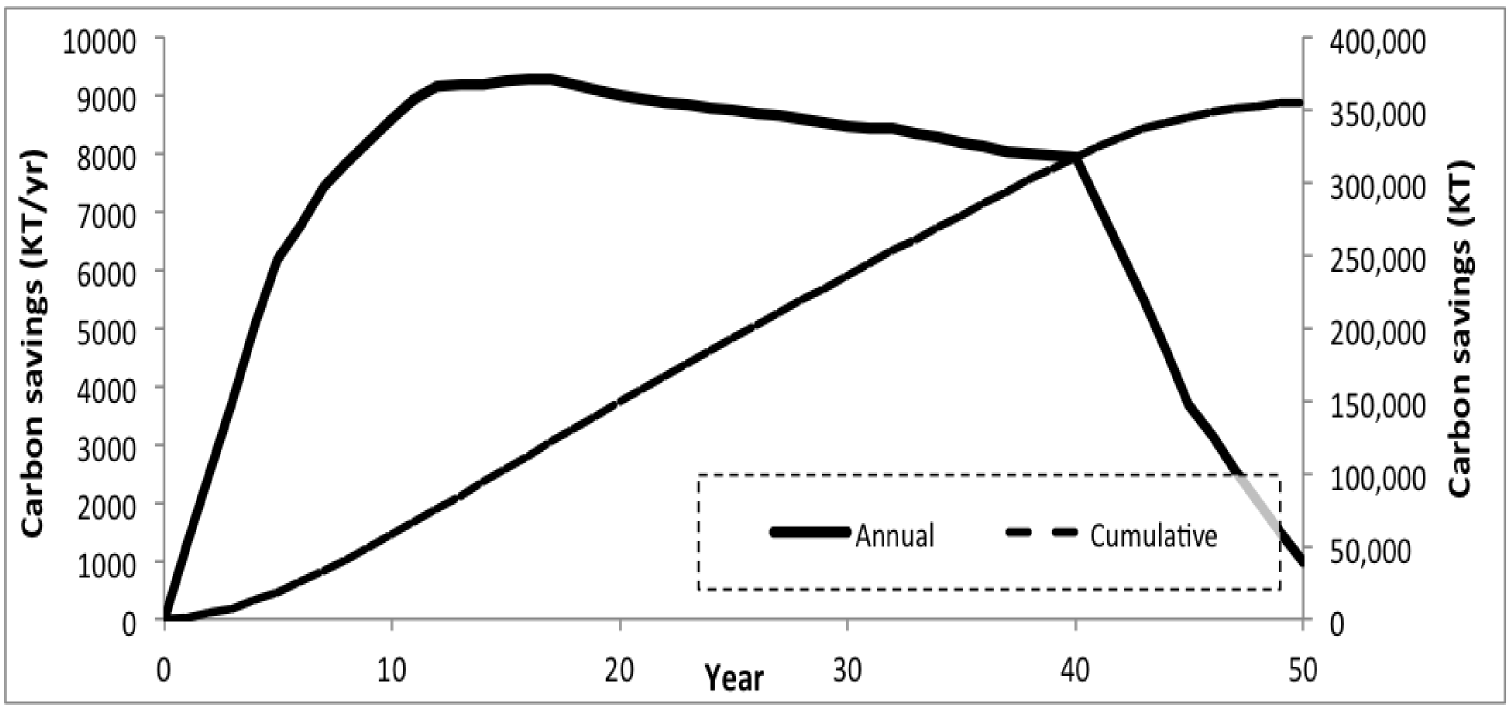
Impacts on Investment

- Total investment required across the UK - £34.7 billion
- £25.2 bn from new capital, £9.5 bn from recycled investment
- All available opportunities exploited within 17 years.
- All loans repaid to investors after 38 years.

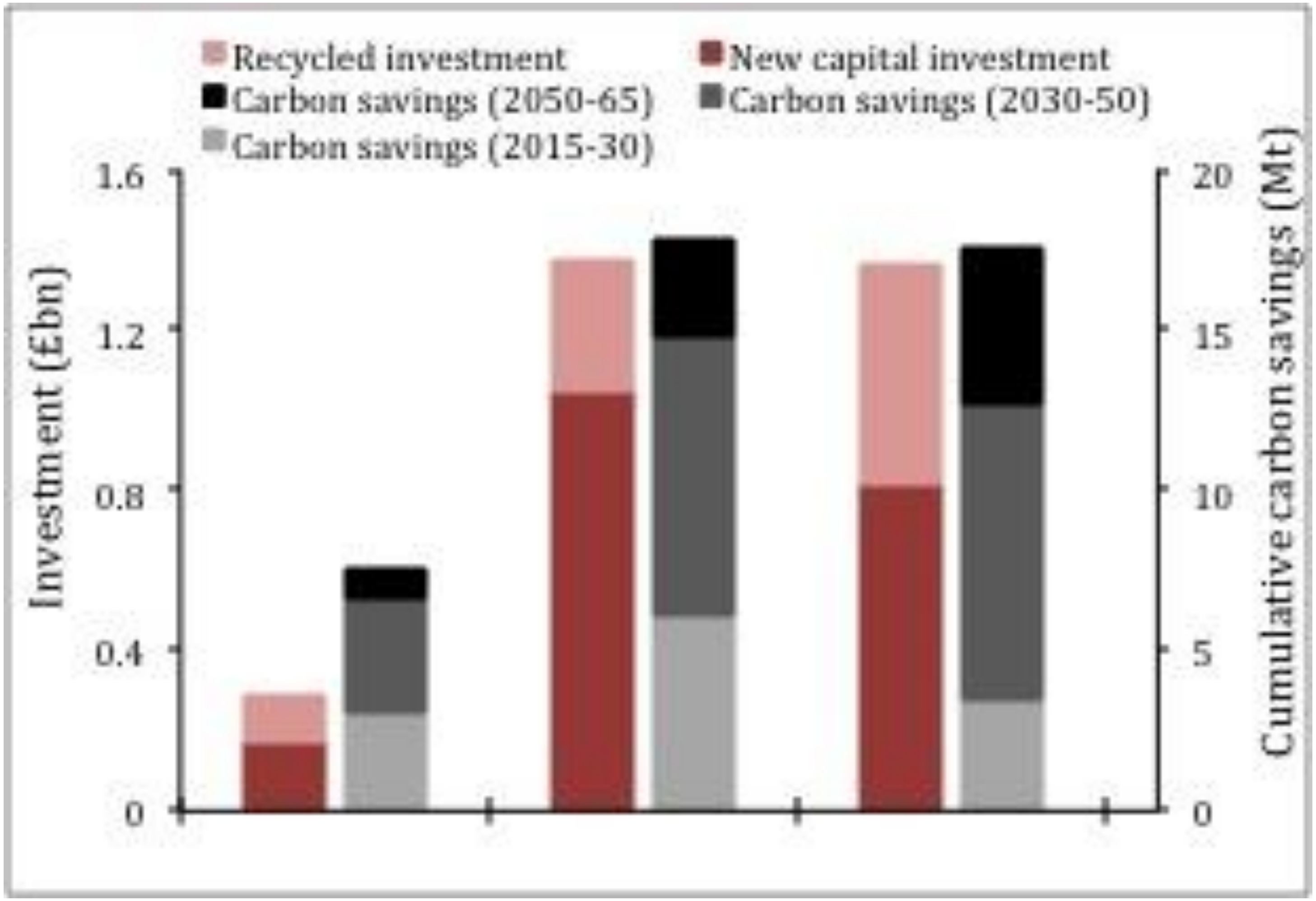


Impacts on Carbon

- Investments would reduce UK domestic carbon emissions by 9 megatonnes (MT) per year ≈ c6.5% of their 2012 level.
- Over the lifetime of the investments, total carbon savings of 363 MT would be generated ≈ 77% of the UK's 2012 emissions.



Private, Public and Civic Modes



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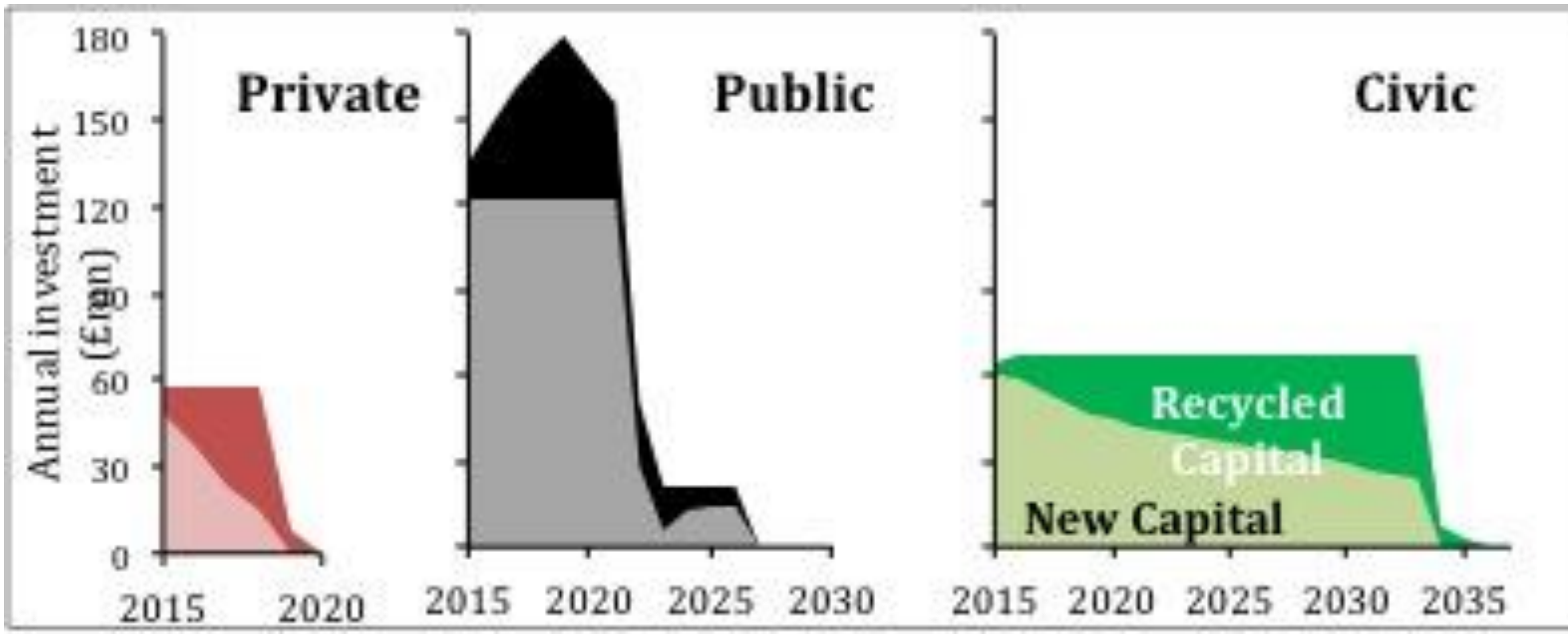

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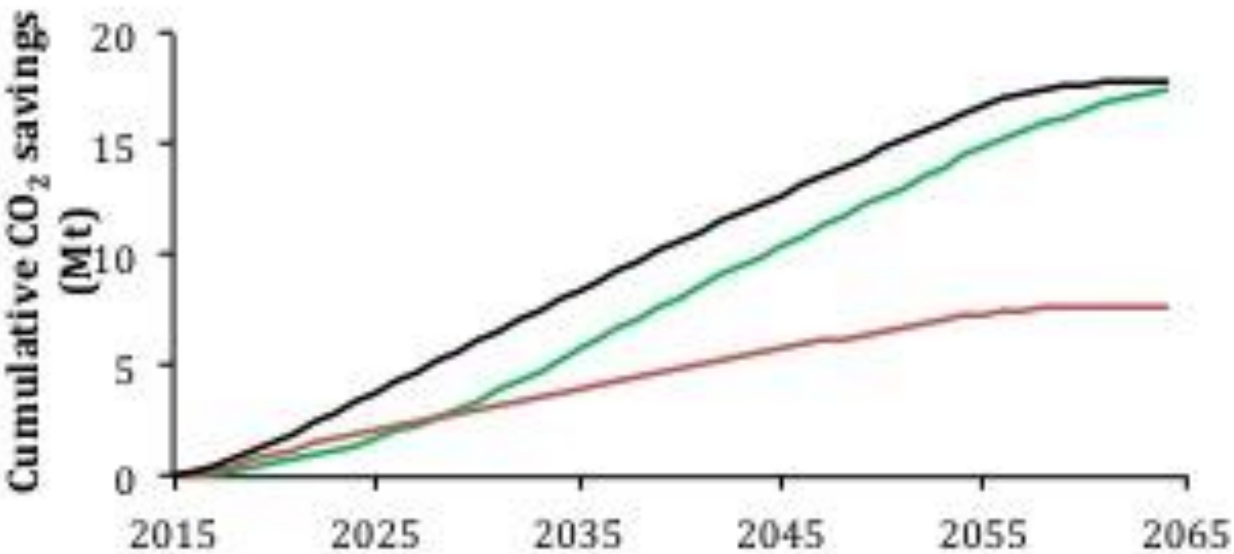

Conclusions and Future Agendas

- The scope for a cities chapter in the UNFCCC
- The potential for Intended Municipal Determined Contributions (IMDCs)
- The need for new support and collaboration frameworks
- The importance of mainstreaming and co-benefits
- The importance of multi-level, cross-sectoral approaches
- The need for new financing mechanisms and to divert existing financial flows
- The potential for innovative urban carbon governance arrangements (covenants, urban CCCs, public-civic partnerships)
- The need to consider the invisible half of urban carbon emissions

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