

# **Rapid assessment of the environmental and health impacts of city sustainability policies**

James Milner

London School of Hygiene & Tropical Medicine

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- Meeting goals for improving **public and planetary health** will require **large-scale changes** across all sectors of society
- To achieve this, **cities will be vital**:
  - large environmental footprints
  - large disease burdens and inequalities
  - high concentrations of people and resources
  - potential for city-level decision-making
- We need to understand both the nature of the required changes and **how to bring about transformative changes** in urban areas

- **Complex Urban Systems for Sustainability and Health (CUSSH)**
- Four-year project funded by the Wellcome Trust
- 12 UK and international research partners
- Six partner cities in the UK (London), France (Rennes), Kenya (Nairobi, Kisumu) and China (Beijing, Ningbo)
- The project aims to **support cities** in bringing about city-wide changes with the aim of **transforming** environmental quality, sustainability, population health and health equity

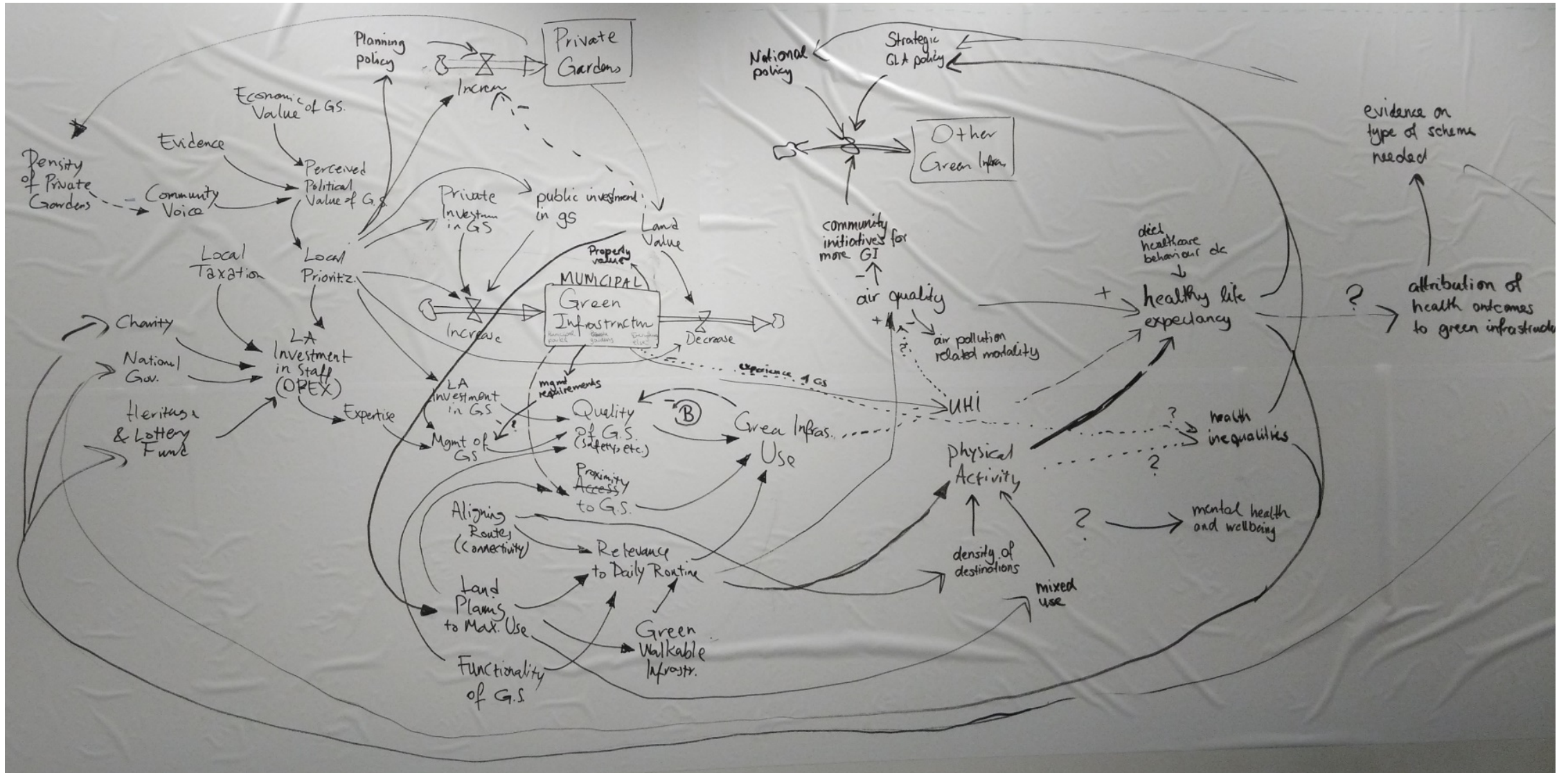


# CUSSH cities



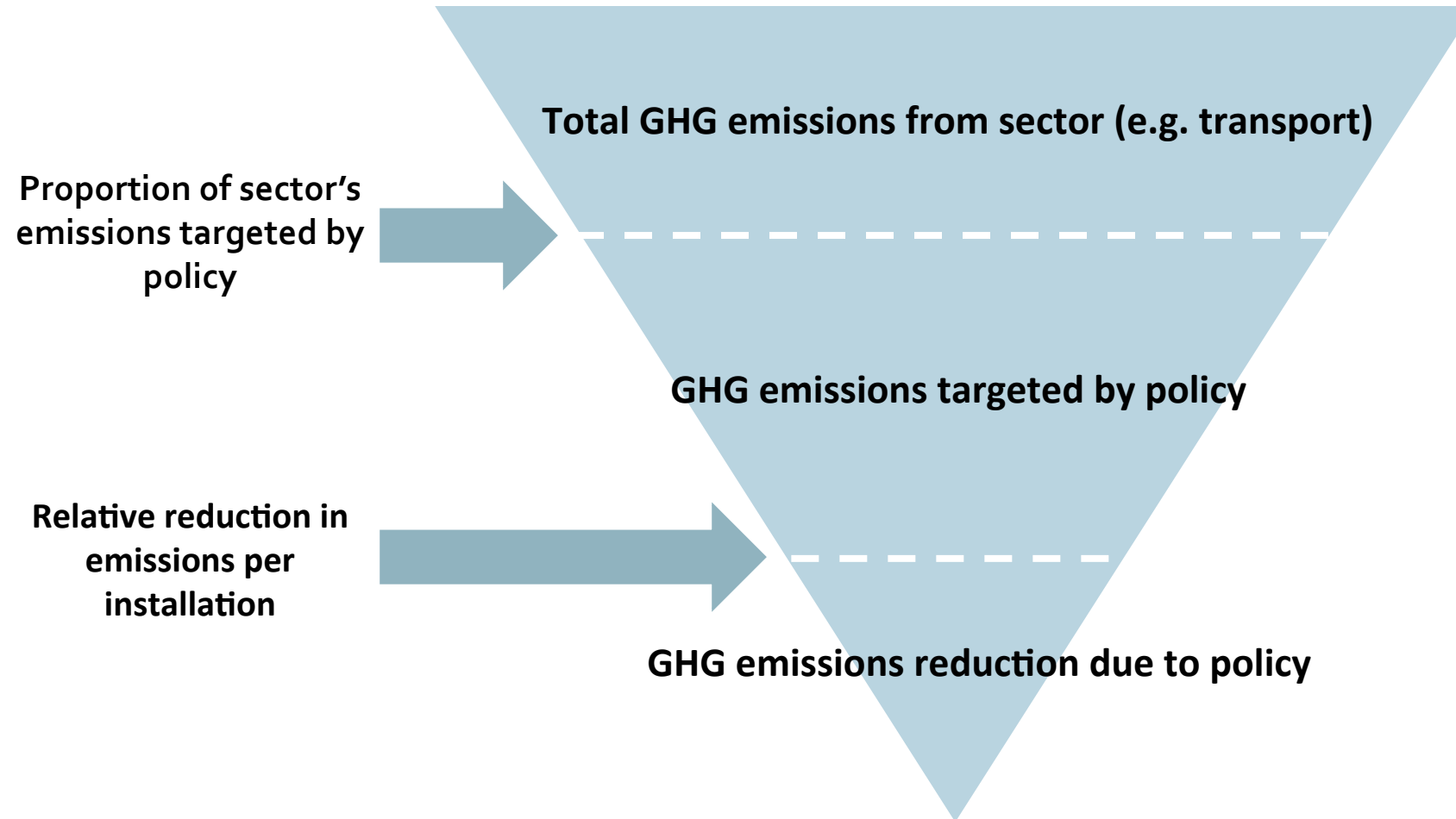


# Systems thinking



- **Cities Rapid Assessment Framework for Transformation (CRAFT)**
- Simple **rapid assessment** model of city-level policies
- Produces estimates of **greenhouse gas (GHG) emissions**, several **environmental exposures/behaviours**, and **health impacts**
- Integrates **health** into policy impact assessment at an early stage
- Intended as a **screening tool** to:
  - approximate the scale of potential impacts
  - compare and prioritise policy options
  - identify synergies between policies
  - identify areas for more detailed assessment

# CRAFT modelling strategy (GHG emissions)



- Based on a similar approach to GHG emissions:
  - **Ambient air pollution** exposure:
    - outdoor particulate matter (PM<sub>2.5</sub>)
    - outdoor nitrogen dioxide (NO<sub>2</sub>)
  - **Indoor air pollution** and other **housing-related risks**:
    - indoor PM<sub>2.5</sub> (from indoor and outdoor sources)
    - radon
    - cold (winter)
    - overheating (summer)
  - **Transport** behaviours:
    - transport-related physical inactivity



- Similar principle to calculations for GHG emissions and environmental hazards
- Start by producing estimates of theoretical **avoidable premature deaths** in one year due to each hazard
- Based on **population attributable fraction (PAF)**
- Relative risks taken from epidemiological literature
- Assume **equivalent proportional change** in health impact as environmental hazard

# Illustrative application to London

- Selected **10 policy objectives** for London from current policy documents covering:
  - transport
  - housing
  - environment
  - sustainable development
- Policies compatible with CUSSSH's core areas of focus
- Potential to result in large benefits for **GHG reduction** and/or **health improvement**



# London results: GHGs and exposures

Policy	GHG emissions		Ambient air pollution		Indoor air pollution and housing risks			Transport-related physical activity
	CO <sub>2</sub> e	PM <sub>2.5</sub>	NO <sub>2</sub>	Indoor source PM <sub>2.5</sub>	Radon	Winter temperatures (absolute change)	Overheating (absolute change)	MET-hrs/week
1. London's entire transport system to be zero emission by 2050	<b>-19%</b>	<b>-4%</b>	<b>-40%</b>					
2. 8/10 trips made on foot, by cycle or by public transport (from 6/10 today) by 2041	<b>-7%</b>	<b>-5%</b>	<b>-11%</b>					<b>+14%</b>
3. Up to 50% of buildings upgraded by 2025, 100% upgraded by 2050	<b>-11%</b>	<b>-5%</b>	<b>-6%</b>	<b>+13%</b>	<b>+49%</b>	<b>+0.5 °C</b> (current: 17.8 °C)	<b>+0.1 °C</b> (current: 29.6 °C)	
4. Up to two million heat pumps installed across London by 2050	<b>-13%</b>	<b>-1%</b>	<b>-7%</b>					
5. Tenfold increase in heat networks by 2025, connecting up to 650,000 homes to waste and environmental heat sources by 2050	<b>-3%</b>	<b>&lt;-1%</b>	<b>-2%</b>					
6. Up to 100,000 photovoltaic installations across London by 2025, increasing to 25% of all viable buildings by 2050	<b>&lt;-1%</b>	<b>&lt;-1%</b>	<b>-1%</b>					
7. Grid decarbonisation in line with UK carbon budgets. High penetration of renewables and nuclear, doubling capacity by 2030	<b>-34%</b>	<b>-2%</b>	<b>-4%</b>					
8. Green gas in national supply increasing significantly from 2030, contributing 13% of gas supply by 2050	<b>-2%</b>		<b>-4%</b>					
9. Increase London's green area from 47% to >50% by 2050	<b>&lt;-1%</b>	<b>&lt;-1%</b>	<b>&lt;-1%</b>				<b>&lt;-1 °C</b>	
10. London will be a zero waste city	<b>-2%</b>							

# London results: health (mortality)

Policy	GHG emissions	Ambient air pollution	Indoor air pollution and housing risks				Transport-related physical activity	Total
	CO <sub>2</sub> e	PM <sub>2.5</sub>	Indoor source PM <sub>2.5</sub>	Radon	Winter temperatures (absolute change)	Overheating (absolute change)	MET-hrs/week	
<b>Current deaths</b>		<b>3,000</b>	<b>1,400</b>	<b>70</b>	<b>2,600</b>	<b>170</b>	<b>2,500</b>	<b>9,700</b>
1. London's entire transport system to be zero emission by 2050	-19%	121						121
2. 8/10 trips made on foot, by cycle or by public transport (from 6/10 today) by 2041	-7%	142					1,627	1,769
3. Up to 50% of buildings upgraded by 2025, 100% upgraded by 2050	-11%	93	-178	-37	54	-13		-81
4. Up to two million heat pumps installed across London by 2050	-13%	28						28
5. Tenfold increase in heat networks by 2025, connecting up to 650,000 homes to waste and environmental heat sources by 2050	-3%	11						11
6. Up to 100,000 photovoltaic installations across London by 2025, increasing to 25% of all viable buildings by 2050	<-1%	4						4
7. Grid decarbonisation in line with UK carbon budgets. High penetration of renewables and nuclear, doubling capacity by 2030	-34%	70						70
8. Green gas in national supply increasing significantly from 2030, contributing 13% of gas supply by 2050	-2%	<1						<1
9. Increase London's green area from 47% to >50% by 2050	<-1%	1			<1			1
10. London will be a zero waste city	-2%	<1						<1



- These environmental hazards are responsible for **~20% of premature deaths** in London each year
- Implementing these ten policy objectives could **reduce London's environmental disease burden by about 20%** (1,900 deaths in one year)...
- ...and reduce London's **GHG emissions by 90%**
- Health benefits are not automatic and, for some policies, are relatively **modest**
- There is also potential for **unintended adverse consequences**
- Actions that achieve the most substantial benefits are those that **affect the whole population** and lead to **substitution of fossil fuels** for all main activities in a given sector

- This is an **initial analysis** to demonstrate the use of the CRAFT tool
- Inclusion of wider health impacts (e.g. morbidity, wellbeing)
- Application of CRAFT to other CUSSH cities
  - initial version developed for Rennes
  - preparatory work for Chinese and Kenyan cities
- Ongoing engagement with policy makers in partner cities
- **Understanding the use of CRAFT to support decision-making**

- CRAFT is a rapid assessment tool for understanding the effects that city policies can make to **reducing greenhouse gas emissions, decreasing environmental health hazards and improving public health**
- The selected policies for London have the potential to produce **important health benefits** for people living and working in London, but there are differences in the scales of those benefits
- The tool remains **under development**
- Interested in understanding the **use of CRAFT in decision-making**

- **CUSSH project team**, in particular:
  - UCL: Mike Davies (PI), Phil Symonds, Jonathon Taylor, Jo Hale, Nici Zimmermann, Helen Pineo, Aarathi Prasad
  - LSHTM: Paul Wilkinson, Simon Lloyd
  - BuroHappold: Lawrie Robertson, Juliette Aplin
  - University of Wisconsin: Sam Younkin, Henry Fremont
  
- Funded by the **Wellcome Trust** 'Our Planet, Our Health' initiative