Examining the Performance of Urban Interventions in the Far Future
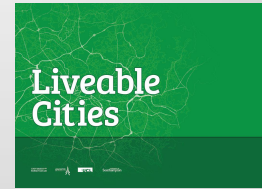
Professor Chris Rogers
University of Birmingham
9th January 2014

EPSRC
Pioneering research and skills

Liveable Cities

ibuild

Urban Futures

Resilience Through Innovation
Critical Local Transport and Utility Infrastructure

What is the Purpose of Cities?

A place to trade (especially food)
A place of safety
   ... with a source of clean water

An agglomeration of people
   ... a place to live, work and play
   ... an amalgam of residential, commercial, retail, industry, leisure, transport and open spaces, green spaces
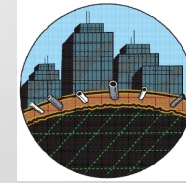   *... a place of business, busyness and peaceful solitude*
   ... dynamic 24 hour city living
   ... a place for biodiversity to flourish – trees, birds, bats

We all have different visions of, and aspirations for, a city.

How must it be supported?

Servicing our Cities

Engineers need to provide

... a source of clean water

... energy (gas, electricity ... even fuel)

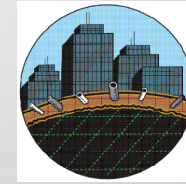*... telecommunications*

... removal of wastewater (sewage)
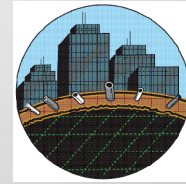
... removal of storm water (drainage)
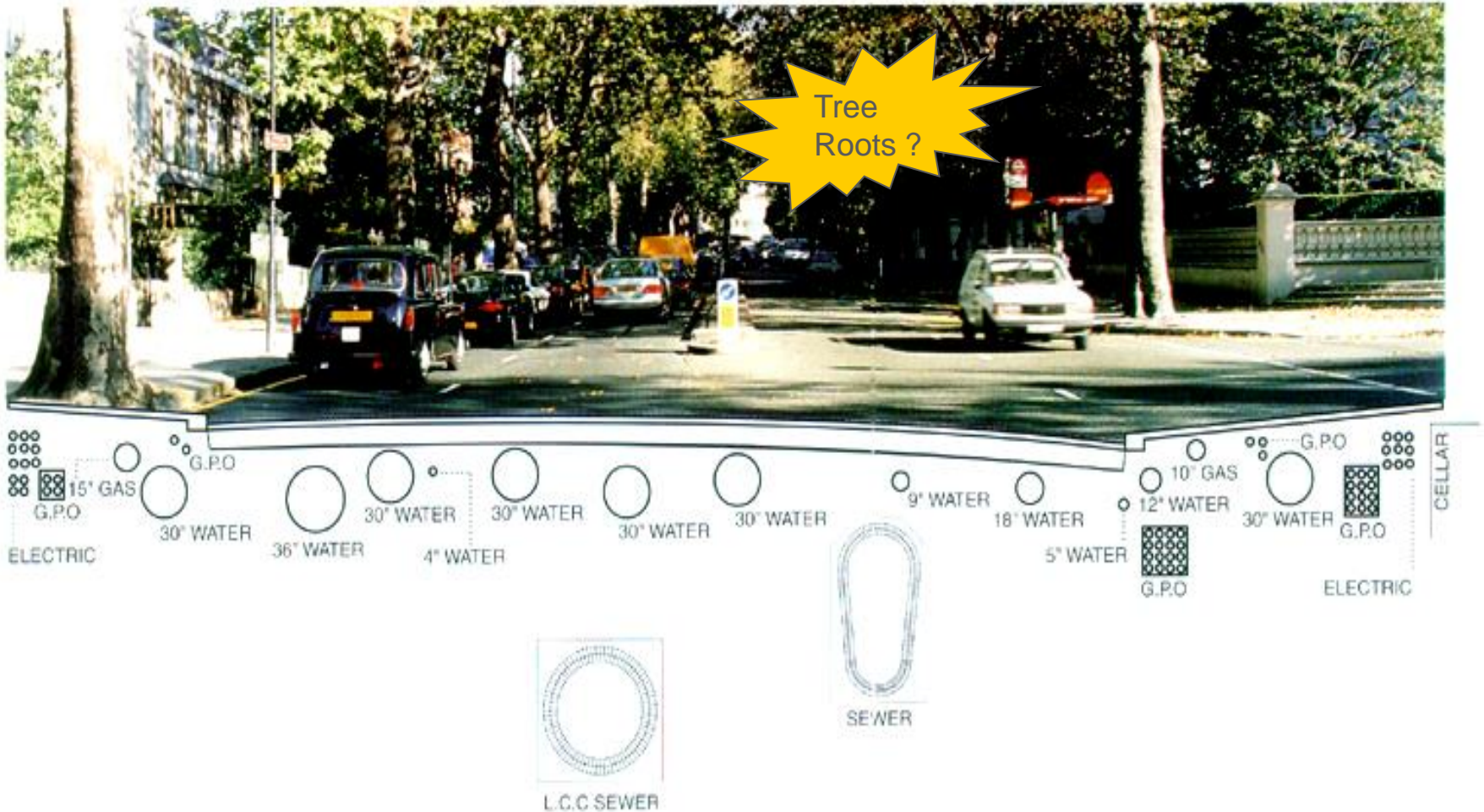
... removal of solid waste

... street lighting

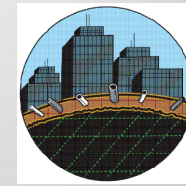*... a variety of means to move around (walking, cycling, cars, trams, buses, trains, rollerblades, pushchairs)*

... and a means to control the interfaces (traffic lights, traffic control, CCTV)

Contested Space in Cities
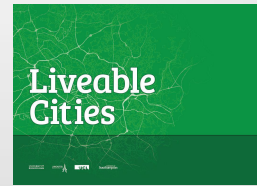
Alternative Underground Thinking

Near surface placement under tramway in Geneva (1972)

Near surface placement in pathway in Barcelona (1992)

Alternative Underground Thinking
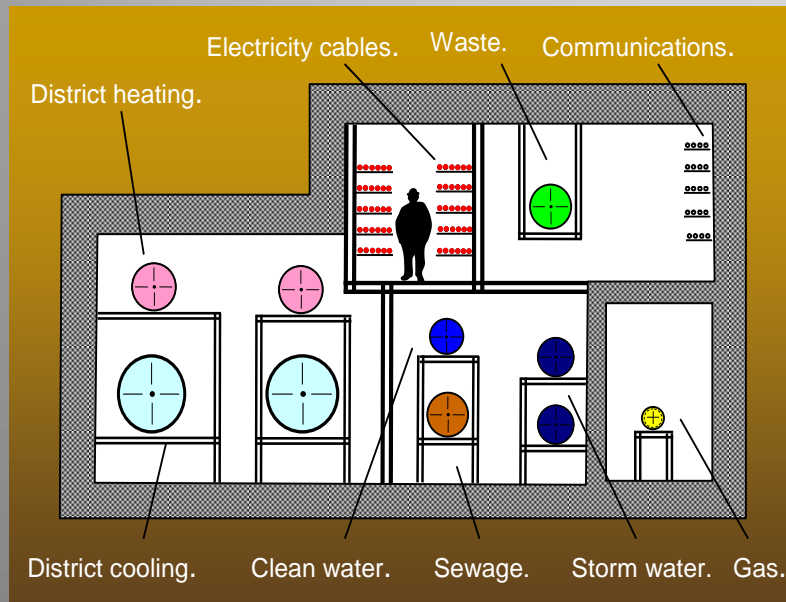
'cut and cover' in Japan (2002)
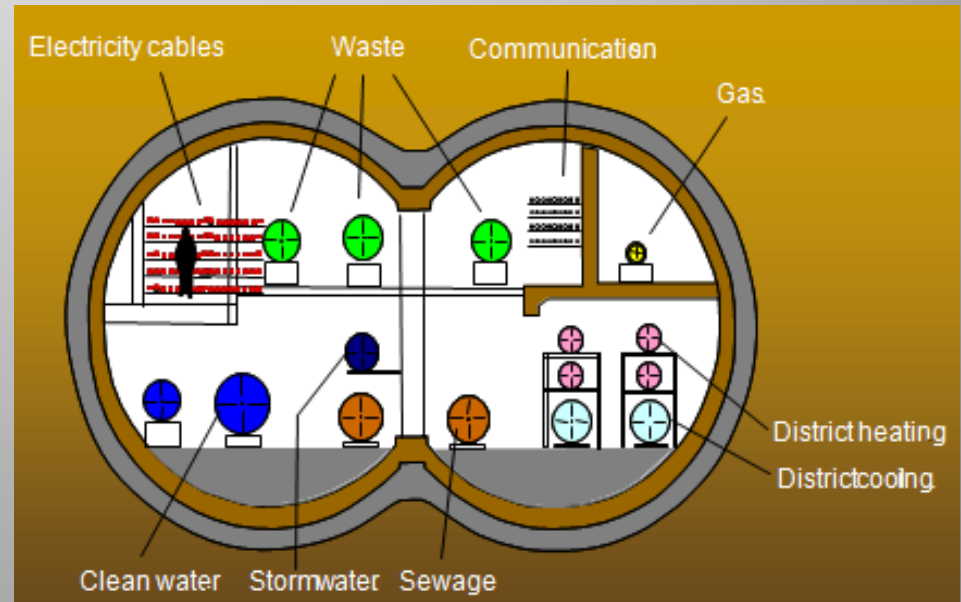
'DOT tunnelling' in Japan (2002)

Urban Futures

How do we plan, design and construct for the future?
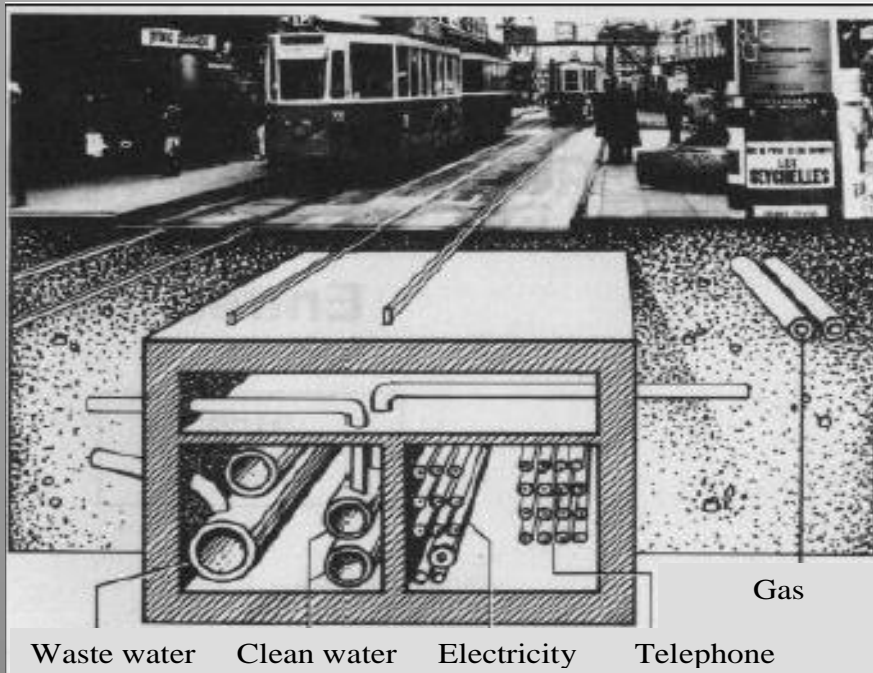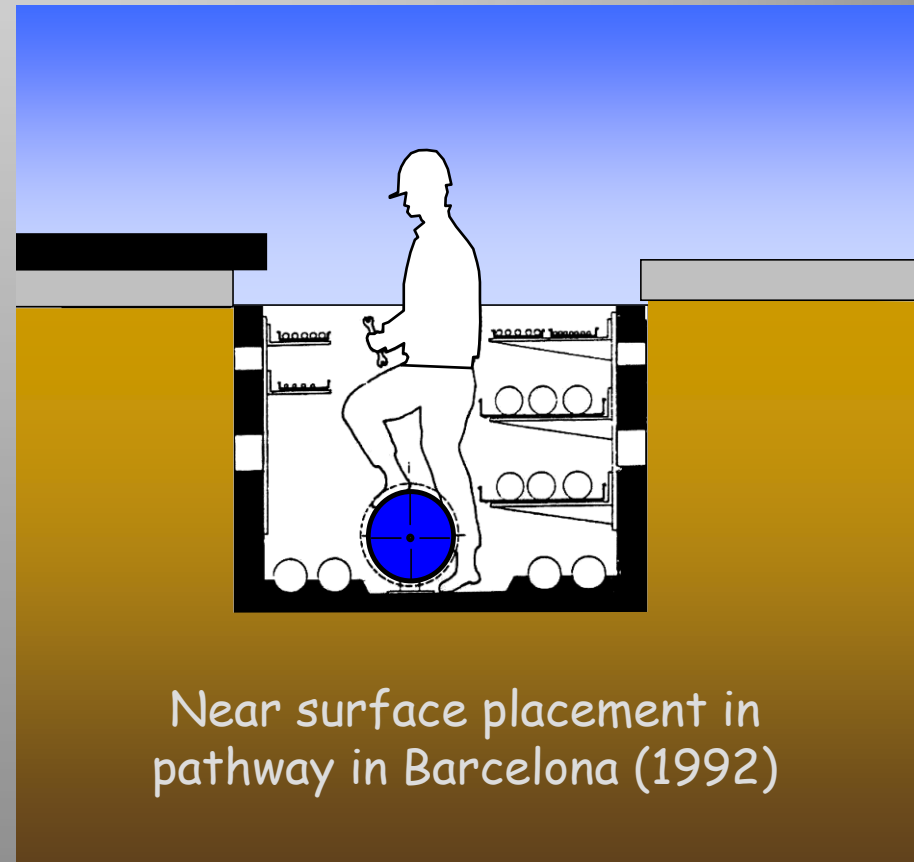... the big debate is about *sustainability*, or *resilience*

Sustainability is about putting in place now solutions that will yield a positive rather than negative future legacy
... and we are investing our limited resources today
... we want to make sure they are good investments

The essential underlying question is:

"how sustainable are these engineering solutions?"

while the answer inevitably is:

"it depends on how the future develops"

Resilience is about maintenance of function or service in the face of change ... or bouncebackability in the face of shocks

Vision

Vision:

— To test the resilience of actions being taken today (today's 'solutions') in the name of sustainability

Method:

— Identifies a sustainability solution and its intended benefit(s)

— Identifies the necessary conditions for each benefit to be delivered …

… and ensures that they are in place today

— Assesses the necessary conditions in four futures:

… will the necessary conditions remain in place?

Dimensions
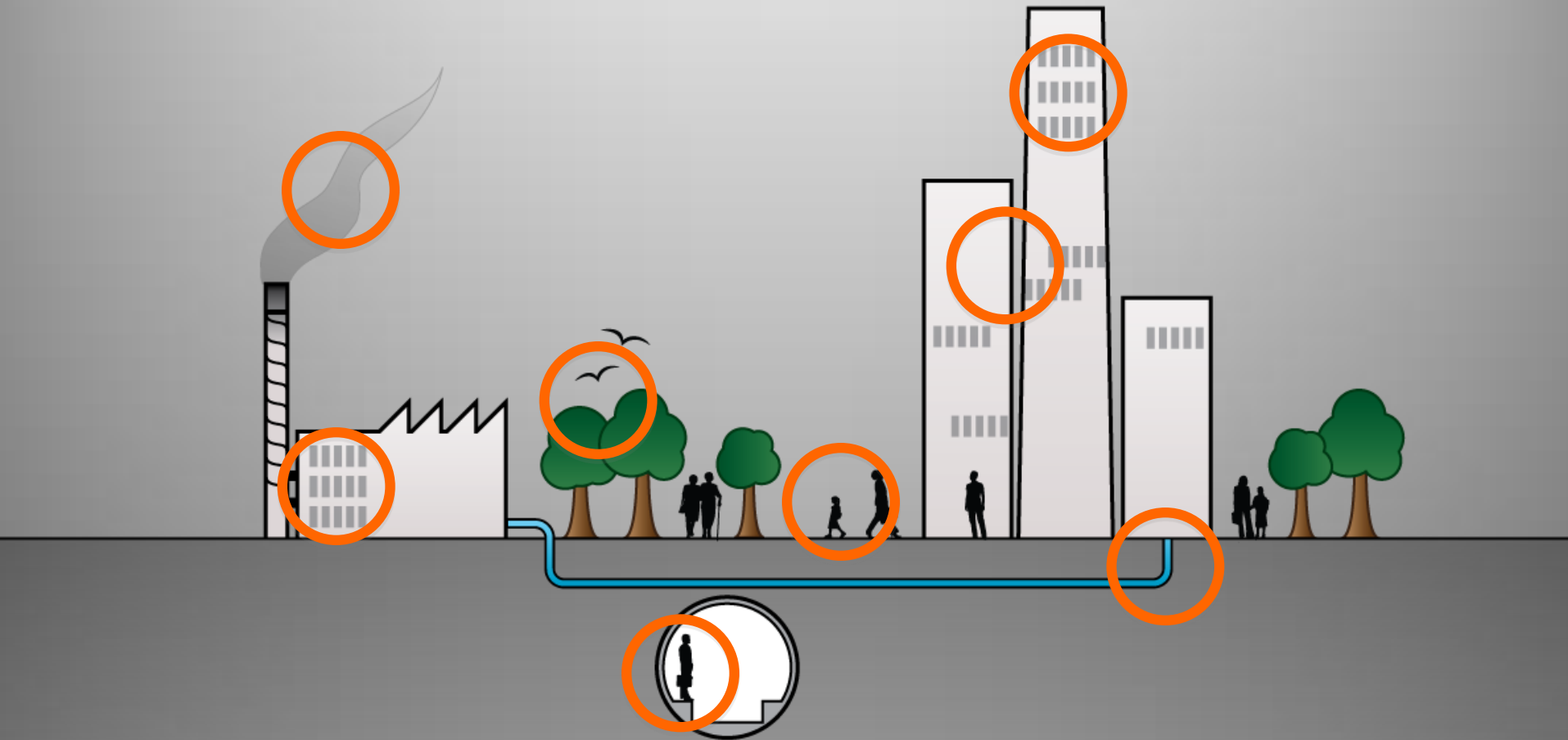
Fortress World

- In this scenario, powerful actors organise themselves into alliances in an effort to safeguard their own interests

- The UK divides into two groups: an authoritarian elite who live in interconnected, protected enclaves ('gated communities') controlling access to resources, and an impoverished majority outside

Market Forces

— In this scenario, current demographic, economic, environmental, and technological trends unfold without major surprise, with convergence toward today's structures

— Competitive, open markets drive UK development. The self-correcting logic of the market is expected to cope with problems as they arise

— Sustainability issues are addressed more through rhetoric than action

— Materialism and individualism spread as core human values, whereas social and environmental concerns are secondary

Photo by lyzadanger, via Flickr

Policy Reform

— In this scenario, co-ordinated government action is initiated to reduce poverty and social conflict while enhancing environmental sustainability

— Strong government policies and some changes in consumer behaviour emerge to support environmental and social consciousness. Such policies help to negate trends toward high distributional inequity.

— Tensions still exist between the continued dominance of conventional ideologies and values and key sustainability goals

New Sustainability Paradigm

— In this scenario, new socio-economic arrangements and fundamental alterations in societal values result in changes to the character of UK urban civilisation

— The notion of progress evolves and a deeper basis for human happiness and fulfilment is sought

— An ethos of 'one planet living' pervades, facilitating a shared vision for a more sustained quality of life, now and in the future

The Urban Futures Method

Solution, intended benefit

Fortress World

Market Forces

Policy Reform

New Sustainability Paradigm

The Urban Futures Method

Urban Futures

Solution, intended benefit

Necessary Conditions

- Fortress World
- Market Forces
- Policy Reform
- New Sustainability Paradigm

The Urban Futures Method

Solution, intended benefit

Necessary Conditions

Fortress World	Market Forces	Policy Reform	New Sustainability Paradigm
Better	No change	Worse	Better
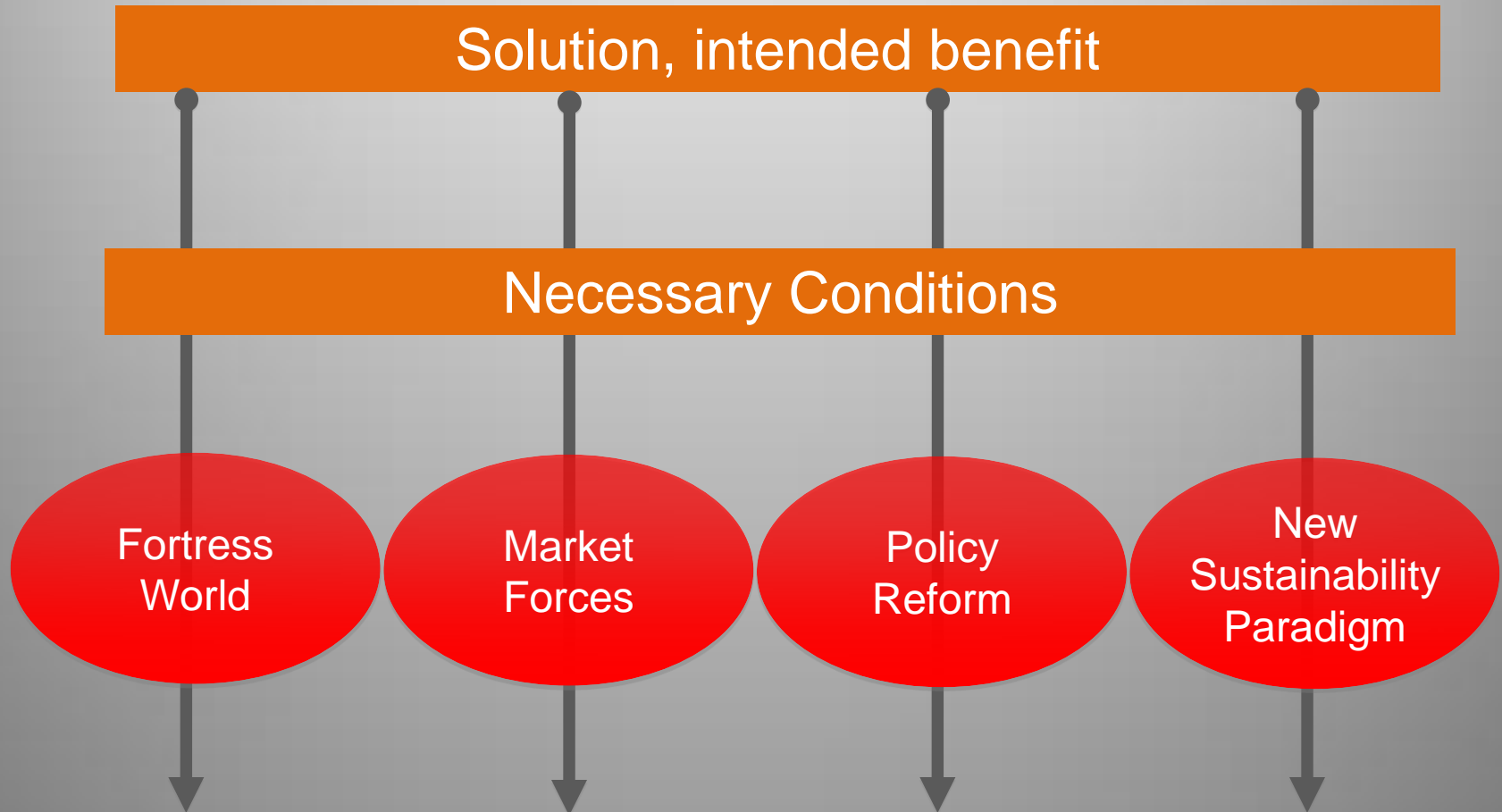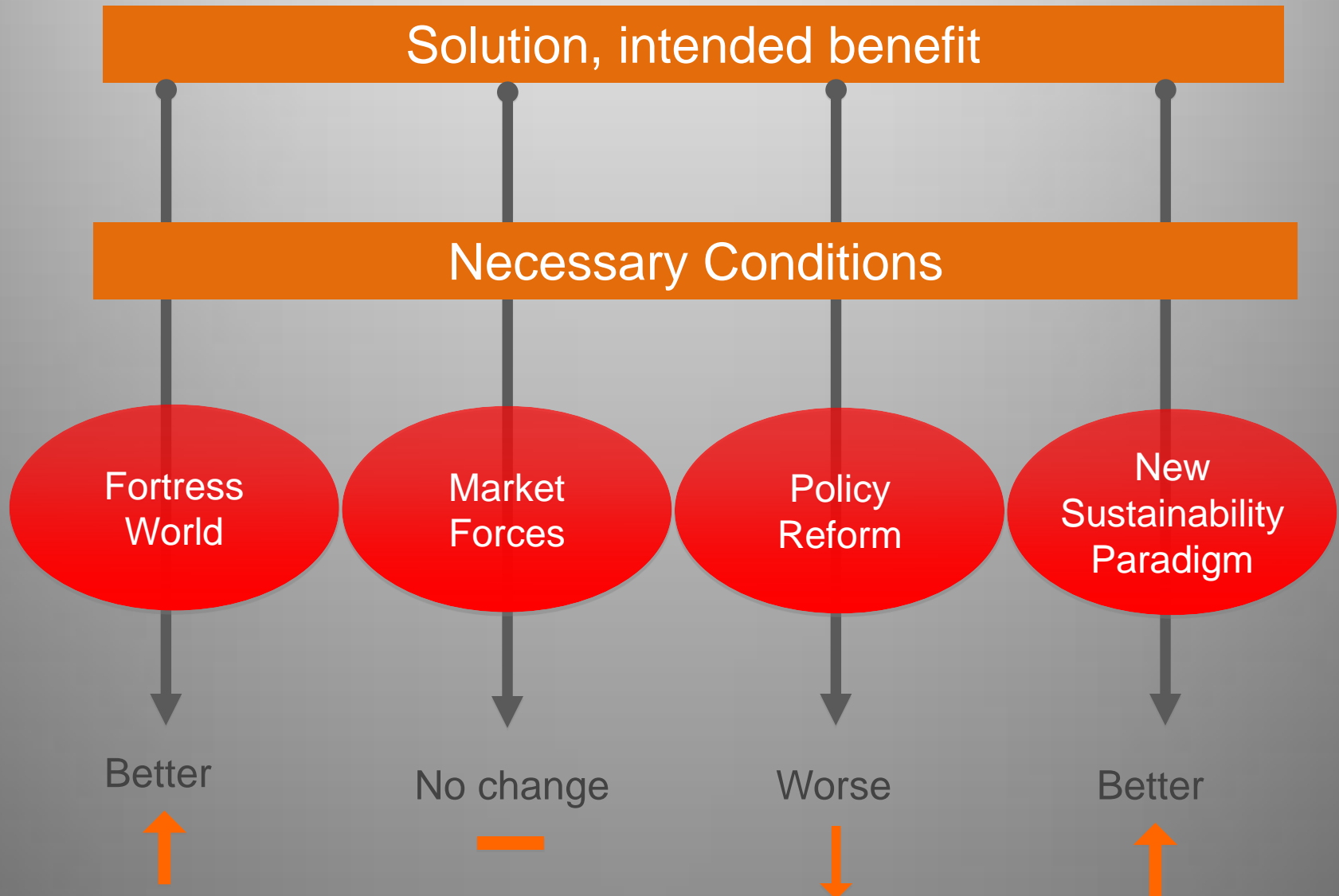
Analysis Methodology

Urban Futures

Solutions and Intended Benefits → **Necessary Conditions** → **Analysis in Four Scenarios** → **Implement Robust Solutions**

Implement Vulnerable Solutions

Adapt Solutions

Urban Futures

DESIGNING RESILIENT CITIES
A guide to good practice

DR Lombardi, JM Leach, CDF Rogers and the Urban Futures Team

So we have some answer to: "how sustainable are these engineering solutions?" and its blocking answer: "it depends on how the future develops"

Yet the greatest value is in *thinking about the intended benefits* of our engineering solutions and the conditions necessary for their delivery

Birmingham aims to create a leading green city for a better life

Economic	Social	Environmental

prosperous,	Birmingham is more: healthier, fairer and	resource-efficient

Green Roadmap Themes

Outcomes

Improved: education, skills, innovation and knowledge, leading to new supply chains and services for a low-carbon, green economy	Significantly reduced levels of fuel poverty Better quality of life Increased average life-expectancy	Low carbon energy generation Reduced carbon emissions	**Carbon Roadmap, Energy Plan, Birmingham Energy Savers**
A Smart City Able to operate and succeed in a world of increasingly scarce and expensive resources Energy security & resilience	Lower energy costs More efficient, well-insulated buildings Fuel security	Increased decentralised energy, low carbon energy generation and supply Reduced energy demand Alternative energy and fuel sources	**Smart Energy Systems**
Industrial symbiosis	Significantly better air quality	Better management of city waste: improved reuse, recycling, and conversion into fuel/energy	**Resource Efficiency**
Low-carbon transport infrastructure	More efficient, affordable transport		**Birmingham Mobility Action Plan**
	Better public transport options		
	Better cycling and walking options		
	Improved natural environment		**Green Living Spaces Plan**
	Resilient, sustainable communities	Effectively planned and managed ecosystem service	
Improved use of land and green space for an attractive city	Adaptation to extreme weather and future climate impacts		**Climate Change Adaptation Action Plan**

Planning Framework and Policy

Sustainable Energy & CO$_2$ Emissions Reduction

Green Economy

Enabling smarter and greener citizens

Birmingham aims to create a leading green city for a better life

Economic | **Social** | **Environmental**

Birmingham is more:

prosperous, | healthier, fairer and | resource-efficient

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A Smart City — Able to operate and succeed in a world of increasingly scarce and expensive resources / Energy security & resilience	Lower energy costs / More efficient, well-insulated buildings / Fuel security	Alternative energy and fuel sources
Industrial symbiosis	Significantly better air quality	Better management of city waste: improved reuse, recycling, and conversion into fuel/energy
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	Better public transport options	
	Better cycling and walking options	
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Sustainable Energy & CO$_2$ Emissions Reduction

Resource Efficiency

Birmingham Mobility Action Plan

Green Living Spaces Plan

Climate Change Adaptation Action Plan

Planning Framework and P...

Sustainable Energy & CO$_2$ Emissions Reduction

Green Economy

Enabling smarter and greener citizens

Mini-Stern Review

Mini Stern Review of Birmingham

Centre for Low-Carbon Futures

How might Birmingham reach its ambitious carbon reduction targets – 60% reduction (from 1990 levels) by 2027 – effectively?

What are the options?

How will they be received?

The UK's carbon targets:
  - ➢ 34% reduction by 2022
  - ➢ 50% reduction by 2027
  - ➢ 80% reduction by 2050

The Economics of Low Carbon Cities

A Mini-Stern Review for Birmingham and the Wider Urban Area

Andy Gouldson, Niall Kerr, Corrado Topi,
Ellie Dawkins, Johan Kuylenstierna, Richard Pearce.

CO_2

Centre for Low Carbon Futures

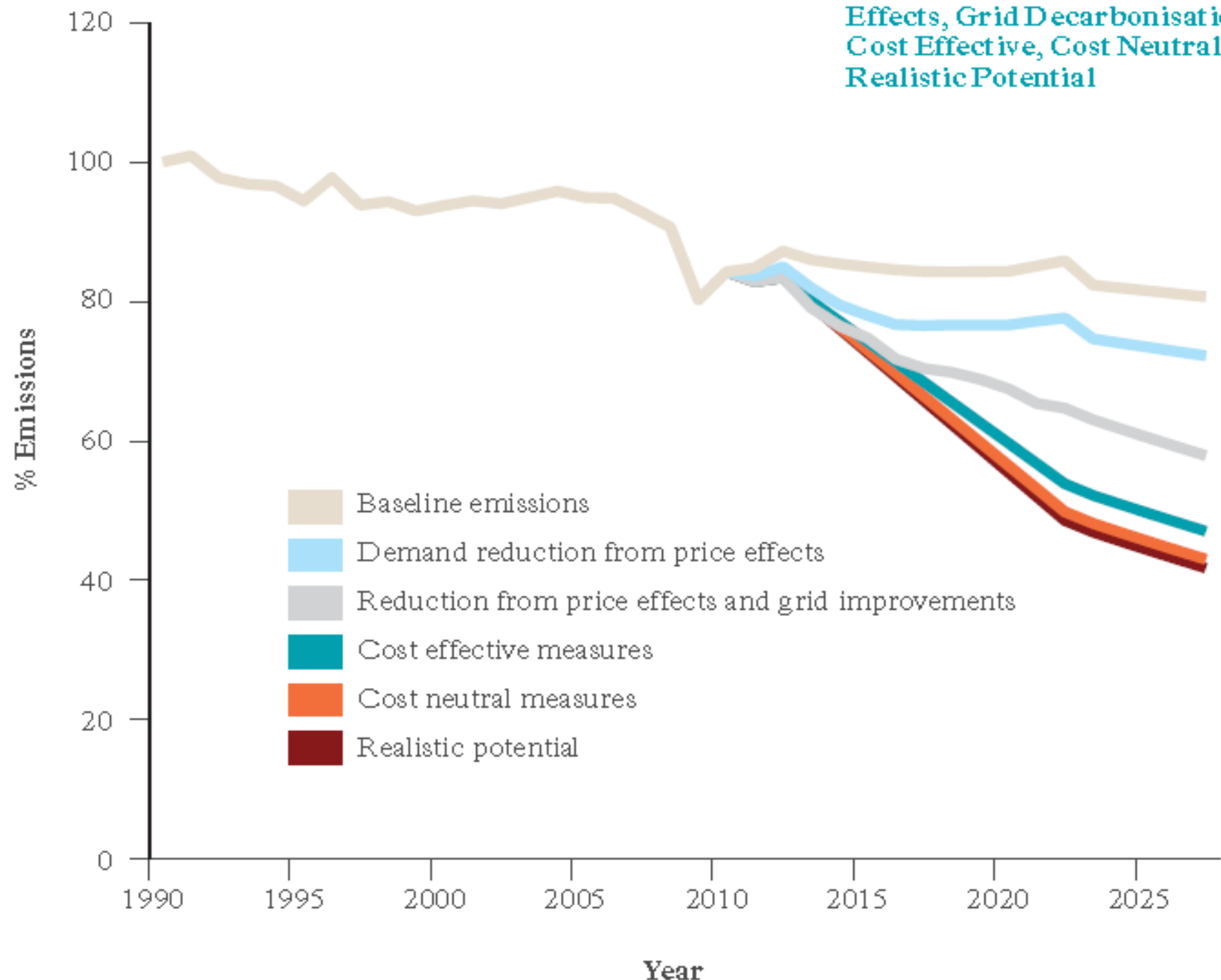Centre for Climate Change Economics and Policy · UNIVERSITY OF LEEDS · THE UNIVERSITY of York · SEI STOCKHOLM ENVIRONMENT INSTITUTE · UNIVERSITY OF BIRMINGHAM

Figure 1: Baselines and Analysis of Price Effects, Grid Decarbonisation and Cost Effective, Cost Neutral and Realistic Potential

Mini-Stern Review

Top 10 Measures – Domestic

Cost Effective

- Mini wind turbines (5kW) with FIT
- Reduced heating for washing machines
- Electronic products
- ICT products
- Integrated digital TVs
- Reduced standby consumption
- Reduce household heating by 1 C
- A++ rated cold appliances
- A rated ovens
- Efficient lighting

Carbon Effective

- Reduce household heating by 1 C
- Solid wall insulation
- Pre-1976 house cavity wall insulation
- Electronic products
- Ground Source Heat Pump with Renewable Heat Incentives (RHI)
- Air source heat pumps
- ICT products
- Efficient lighting
- Solar water heating with RHI
- Glazing – single to new

Cost effective – Cost neutral

Liveable
Cities

Liveable Cities Vision

To identify and test radical engineering interventions that will lead to *low carbon*, *resource secure* future cities in which *societal wellbeing* is prioritised.

This will be achieved by

- *envisioning 80%-reduced-carbon resource-secure cities,*

- *working back from there to explore what's stopping us getting there,*

- *creating the necessary engineering solutions*, and

- *proving the concept of a viable and socially acceptable alternative future*.

Liveable Cities

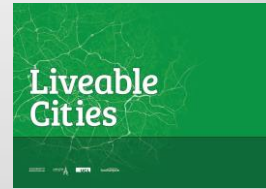Once we know what we should be doing in terms of radical engineering, it is necessary …

… *to form an engineering strategy* and

… *provide a pathway to implementation*

This means aligning finance, policy, regulation and governance

… *it allows us to work out how we could make it happen*
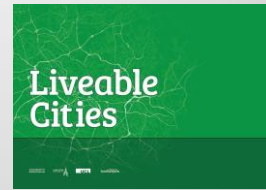
Infrastructure Interdependencies

Some 4 million road structures are damaged each year

The defining issue is *"Who pays? Who benefits?"*

Infrastructure Interdependencies

Some 4 million road structures are damaged each year

ibuild

The defining issue is *"Who pays? Who benefits?"*

We need to explore *values*, not *costs*.

So, now taking water as example, what if …

- *Water is considered a human right*
  … everyone is allocated 50 litres/day

- *(Responsible) water usage beyond that is charged as today*
  … so between 50 and 150 litres/day

- *(Irresponsible) water usage beyond that is charged at ten times the rate that is charged today*
  … so more than 150 litres/day

The model delivers *equity, resource security, behaviour change, energy and CO_2 reduction, profits* …
… and we would change our perception of the value of water
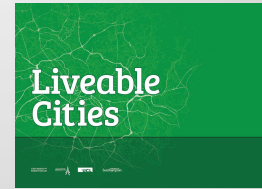
"When dealing with the far future, predictions (or projections, or forecasts) *will be wrong – the question is: how wrong?"*

Scenarios avoid this problem, in one of two ways:

- *Extreme-yet-plausible scenarios define the boundaries of the space occupied by possible future worlds*
    – gives confidence that we will end up somewhere between where we are now and these extremes
    … the Urban Futures approach

- *Aspirational scenarios in which we achieve certain goals*
    – e.g. carbon reduction, resource security, wellbeing
    … the Liveable Cities approach

Implementation requires policy, governance, regulations, and (reconceived) business models to align