



Creating the conditions for large scale retrofit to drive down CO₂ emissions

14th March 2012

Chris Jofeh



Key messages of this talk

- To achieve 3% year on year reductions in GHG emissions from Welsh buildings requires work at very large scale
- Procurement at very large scale can produce significant economies
- We can learn from the experience of cities around the world in governance, financing and procurement
- It is an essential component of the strategy that energy-efficient buildings become worth more than energy-inefficient ones.



Structure of this talk

- UK pathway to 2050
- Wales's progress so far
- World Economic Forum
- World cities
- UK cities
- Economies of scale
- Wales domestic retrofit
- Small Welsh towns







UK – big picture

National target – 80% reduction in greenhouse gas emissions by 2050 (1990 baseline)

Incremental Savings CO₂/year

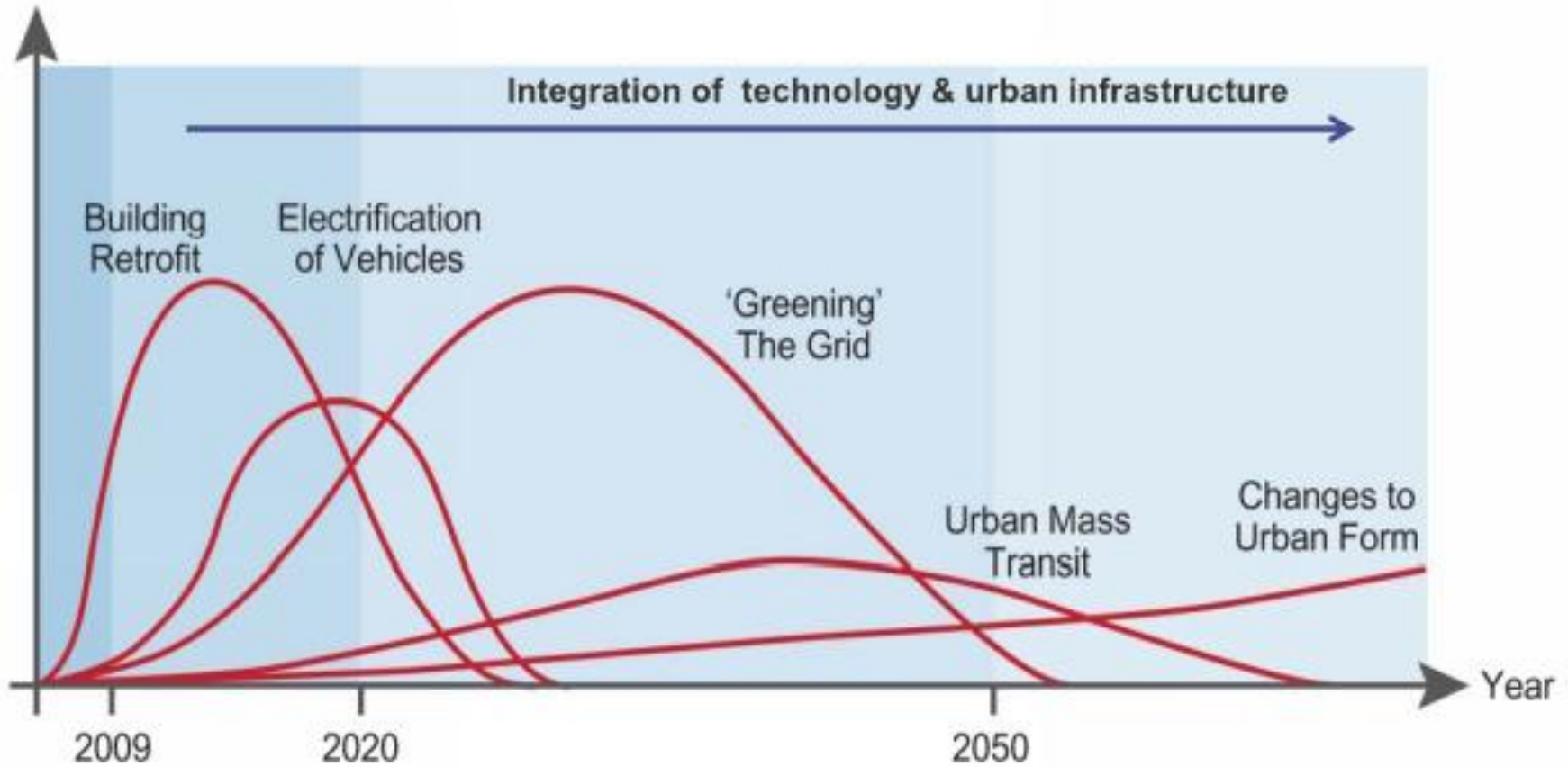


Illustration of scale of land and sea use in 2050 (positions are arbitrary)

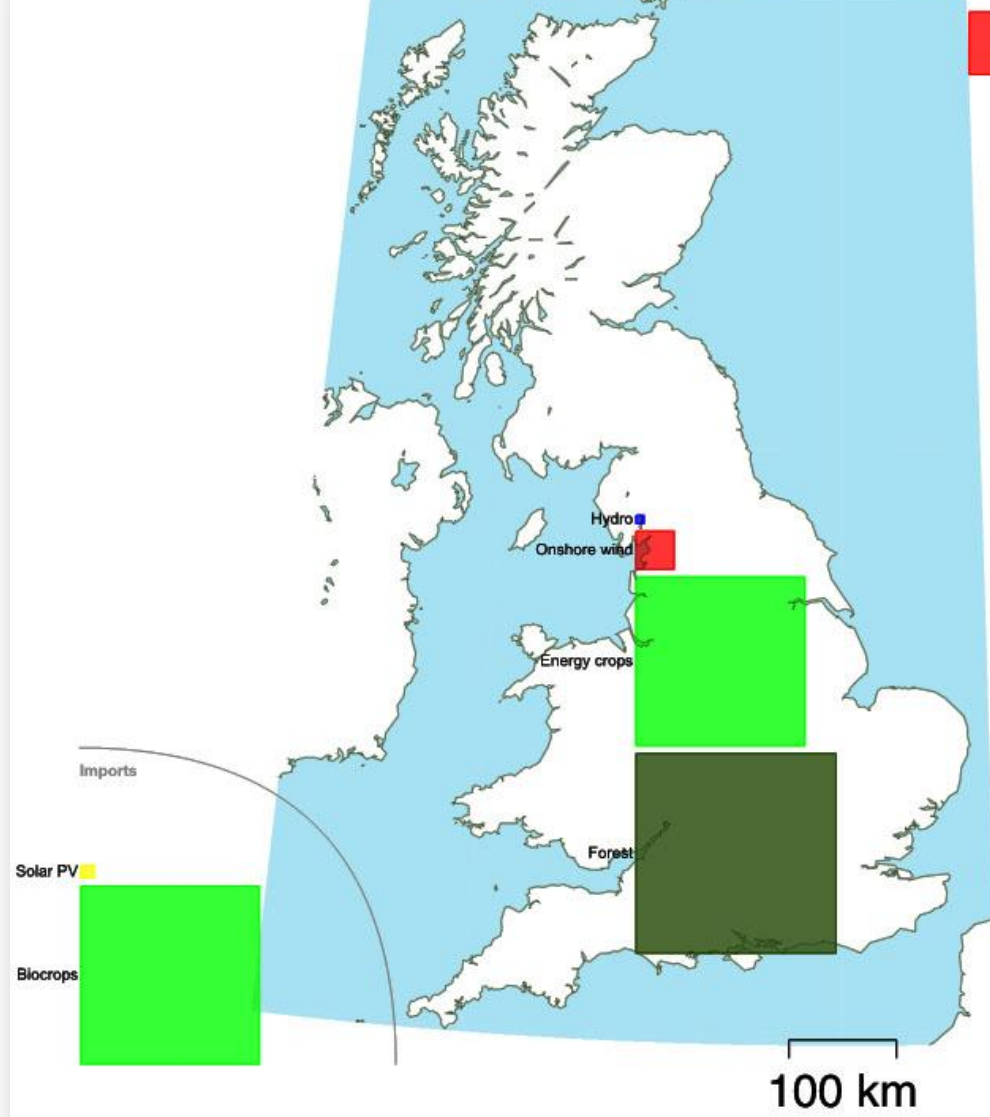
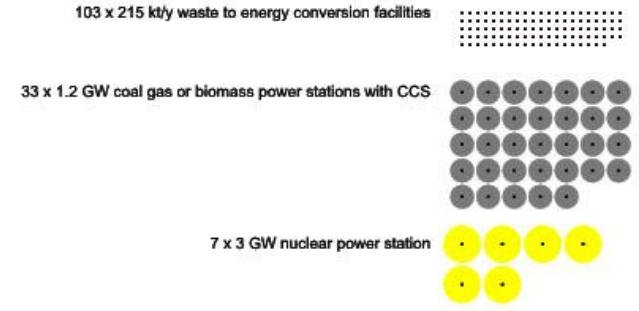
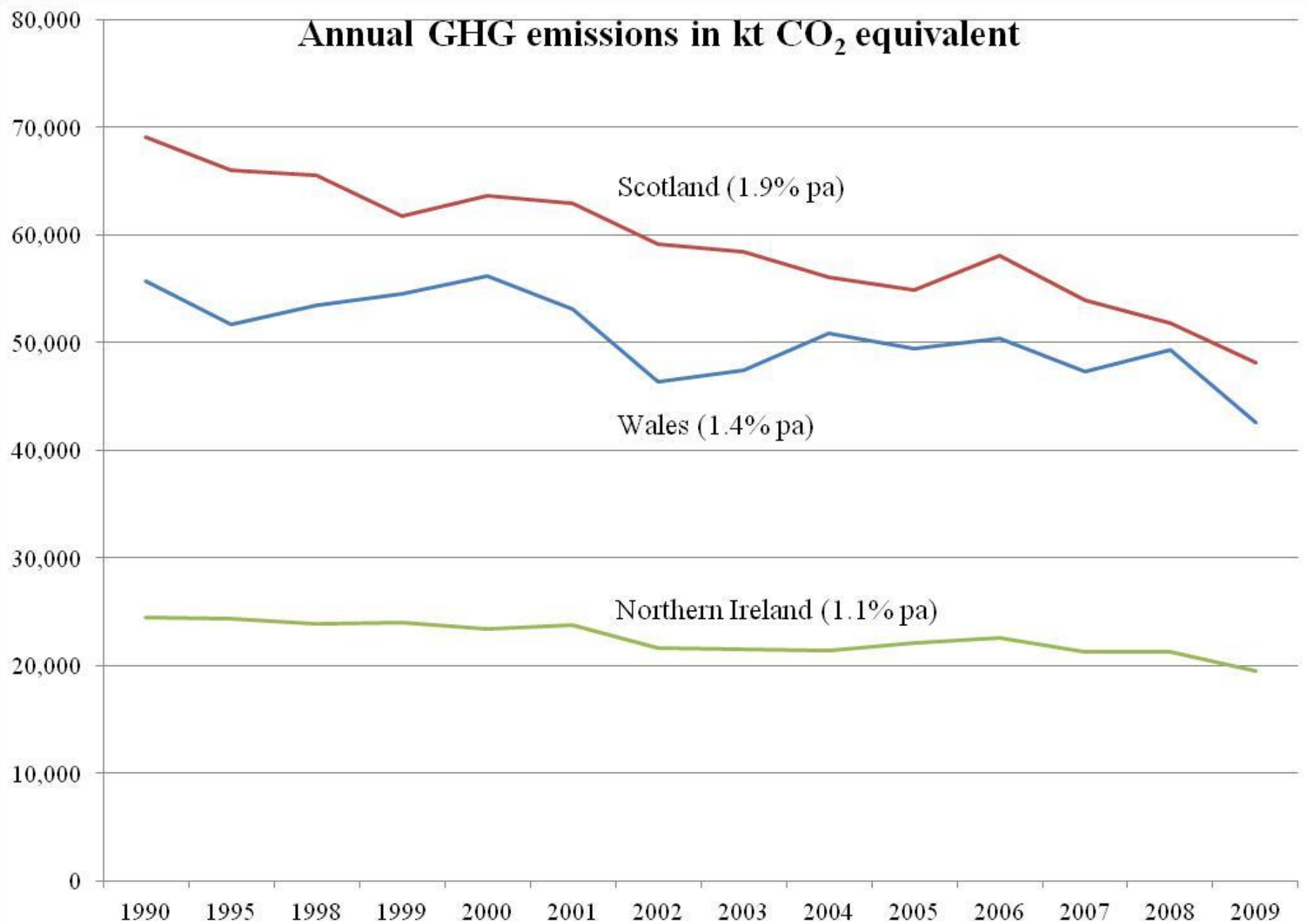


Illustration of the number of thermal power stations in 2050 (scales and positions are arbitrary)



Annual GHG emissions in kt CO₂ equivalent





World Economic Forum

Retrofit Finance & Investing Project



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IMPROVING THE STATE
OF THE WORLD

**A Profitable and Resource Efficient Future:
Catalysing Retrofit Finance and Investing
in Commercial Real Estate**



A Multistakeholder Position
October 2011



Help make building retrofits a scalable endeavour

- Research in Germany, China, Japan, US, UK, and Australia
- Recommendations for policy-makers to stimulate energy efficiency investments in existing commercial buildings

Project Chair

Initial Project Concept and Presentation in Davos, Switzerland

Colin Dyer, Jones Lang LaSalle

Steering Board

Overall project direction and decision-making

Allianz	Jones Lang LaSalle
Arup	Marsh McLennan
BASF	Siemens
Citi	Skanska
Deutsche Bank	Urban Land Institute
GE	US Department of Energy
Greenprint Foundation	US Green Building Council
Hirco	UNEP Finance Initiative

**A Profitable and Resource Efficient Future:
Catalysing Retrofit Finance and Investing
in Commercial Real Estate**



A Multistakeholder Position
October 2011



Key observations:

- Retrofit markets for commercial buildings are in their infancy with indications of growing demand.
- Building owners will rarely make retrofitting a priority unless government makes it a priority and businesses see it as providing a clear return on investment.
- Government holds power as the single greatest catalyst to spark demand and provide structure for all stakeholders to participate.

A Profitable and Resource Efficient Future: Catalysing Retrofit Finance and Investing in Commercial Real Estate



A Multistakeholder Position
October 2011



Foundational Recommendations to Enable a Market

- Establish a centralized database
- Require mandatory disclosure of utility consumption
- Establish a standard asset efficiency rating system



World cities

City of Melbourne – 1200 Buildings



1200 Buildings – Home - Windows Internet Explorer
 http://www.melbourne.vic.gov.au/1200buildings/Pages/Home.aspx

Other City Of Melbourne websites City of Melbourne 1200 Buildings SEARCH

2 February 2012, 4:36am Contact us Site map A+

1200 BUILDINGS

Home

- Retrofitting is good for business
- Current signatories
- Case studies
- How to join
- About 1200 Buildings
- What is a building retrofit?
- Getting started – funding
- Building permits and approvals
- Policies and strategies
- Useful links and resources
- Consultants – register your interest
- Contact us

What is a building retrofit?

What exactly is a retrofit, and how does it differ from a renovation or a tune-up? There are a variety of terms used in the building sector and many of them overlap.

About 1200 Buildings

Encouraging and supporting the improvement of energy / water efficiency and reducing waste to landfill of Melbourne's commercial buildings.

Public Art Commission Exhibition

The 1200 Buildings Public Art Commission Exhibition features eleven proposals received for a sustainability-themed public art work.

1200 Buildings Program

Tony Arnel
 Commissioner, Building & Plumbing Industry Commission
 Chairman, World Green Building Council

I want to...

- Find a consultant
- Join 1200 Buildings

Get informed

- Find a consultant
- How does your building perform?
- Policies and strategies
- Useful links
- Cool roofs

From Council

- Media release: Two new EUAs for 1200 Buildings
- Media release: World's first EUA
- Environment: What Council is doing
- Sustainable Melbourne Fund

More information

How to join

If you are interested in the 1200 Buildings program, please provide us with your details so we can supply you

Funding a retrofit

The City of Melbourne can now help building owners obtain finance for retrofit works to reduce energy use

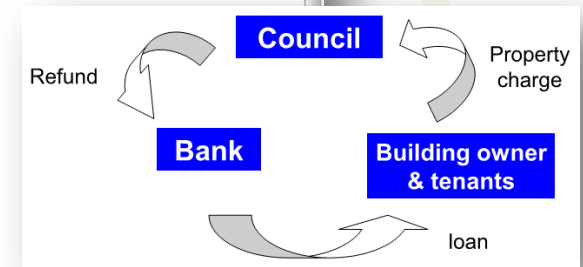
Advice sheets

Thinking about retrofitting your building? Wondering where to start? Our advice sheets cover all aspects of

Case studies

View details of a selection of signatories to the 1200 Buildings Program, including videos capturing

CITY OF MELBOURNE



Wilshire Center Business Improvement District, Los Angeles, California - 1100 buildings



Report a problem

Mayor's Tower Renewal Project, Toronto – over 1000 buildings

The screenshot shows a Windows Internet Explorer browser window displaying the Toronto Tower Renewal website. The address bar shows the URL http://www.toronto.ca/tower_renewal/. The website features the City of Toronto logo and navigation tabs for 'LIVING IN TORONTO', 'DOING BUSINESS', 'VISITING TORONTO', and 'ACCESSING CITY HALL'. The main content area is titled 'Tower Renewal' and includes a sidebar with links to 'About', 'Pilot Sites', 'Media', 'STEP', 'Reports', and 'Contact us'. The main text describes the program's goal to drive environmental, social, economic, and cultural change by improving Toronto's concrete apartment towers and surrounding neighborhoods. It mentions that the region contains North America's second highest concentration of these buildings. A 'What's new' section highlights the 'Toronto Directory of Green Building Products and Services' and the 'Tower Renewal- Implementation Book - Final version'. A 'Findings' section is also visible. On the right side, there are links to 'The Implementation Book', 'Tower Renewal Brochure', 'Tower Renewal Industries', and 'The STEP Program Toolkit'. A 'Highlights' section lists 'The Green Building & Services Directory', 'The Thousandth Tower', and 'Tower Renewal posters'. The browser's status bar at the bottom shows 'Internet | Protected Mode: Off' and a zoom level of 100%.



Commercial property – the link between sustainability and value

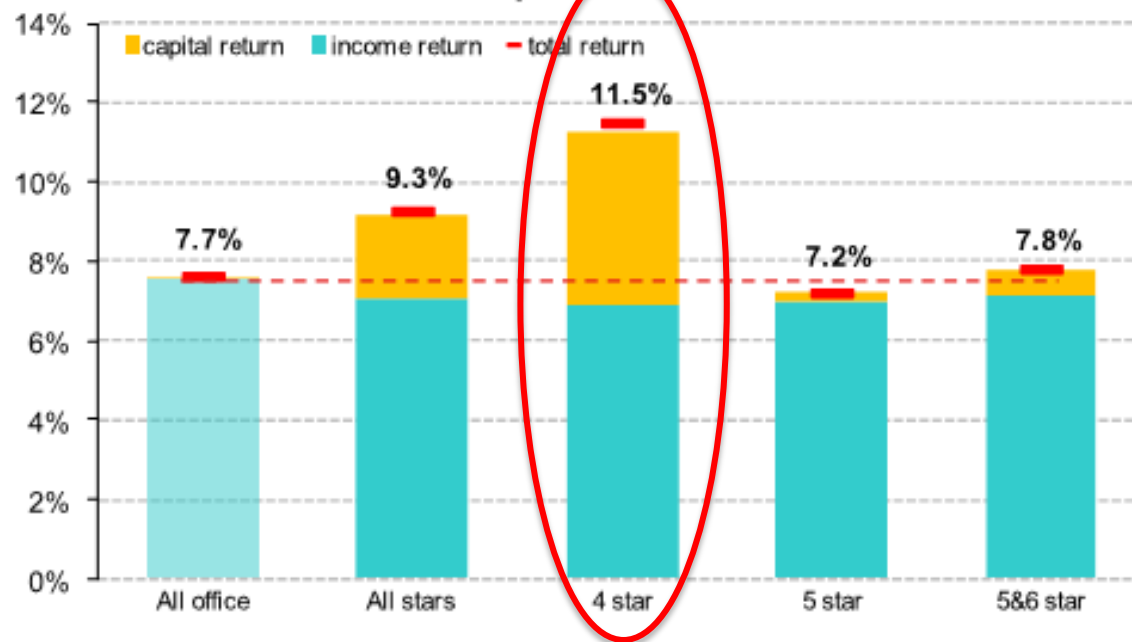
Returns for Green Star rated buildings

Green Star rated buildings deliver higher returns than non-rated buildings

On the pulse of
the property world



Green Star: returns for office market
annualised 2 year returns to June 2011



Source: GBCA & IPD Research.

- The return spread between Green Star rated and all office buildings is c160bps.
- The outperformance of 4 Star rated buildings to 5 & 6 Star may reflect: a) a lower construction cost; hence its payback profile will be shorter; or b) a more robust tenancy profile especially when market conditions are sluggish.



Portfolio Greenness and the Financial Performance of REITs

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October 2011

There is an increasing body of evidence on the financial performance of "green" commercial properties, but not much is known about the implications of investments in such buildings for property companies. This paper investigates the effects of the energy efficiency and sustainability of commercial properties on the operating and stock performance of a sample of US REITs, providing insight into the net benefits of "green" buildings. We match data on LEED and Energy Star certified buildings with detailed information on REIT portfolios and calculate the share of "green" properties for each REIT over the 2000-2011 period. In order to control for the endogeneity between environmental and financial performance, we use two instrumental variables – locational greenness and local environmental government policies. We estimate a two-stage regression model and document that the greenness of REITs is positively related to three measures of operating performance – return on assets, return on equity and the ratio of funds from operations to total revenue. We also document that there is no significant relationship between the greenness of property portfolios and abnormal stock returns, suggesting that stock prices already reflect the higher cash flows deriving from investments in more efficient properties. However, REITs with a higher fraction of "green" properties display lower market betas, which may be related to their reduced exposure to shocks in energy prices and environmental legislation.

JEL Codes: G51, M14, D92

Keywords: Energy Efficiency, Real Estate, REITs, LEED, Energy Star, Financial Performance

Financial support for this research was provided by ECCE, the European Centre for Corporate Engagement, and METEOR, the graduate school of Maastricht University's School of Business and Economics. Kok is supported by a VENI grant from the Dutch Science Foundation (NWO).

Portfolio
'greenness'
→ Improved
operating
performance
→ Reduced risk





UK cities

National target – 80% reduction in greenhouse gas emissions by 2050 (1990 baseline)

Birmingham Energy Savers



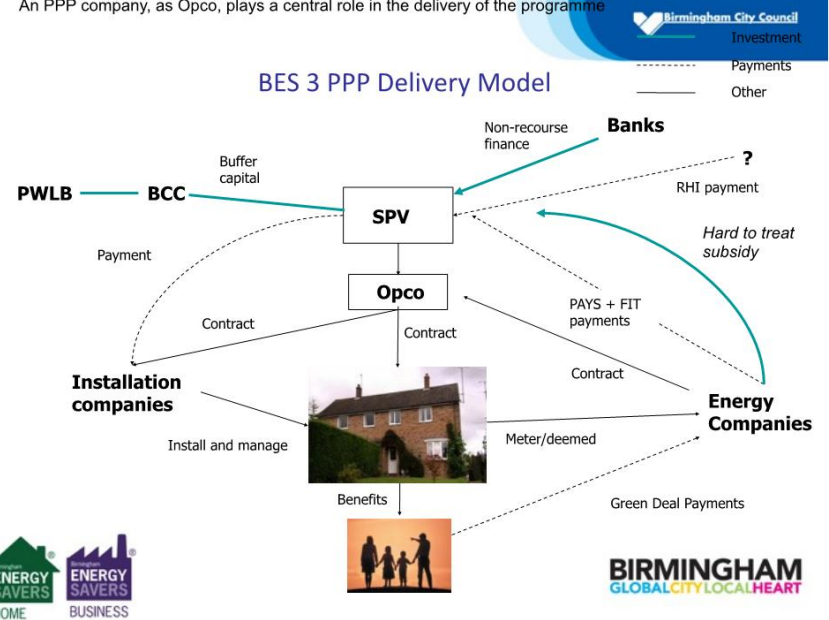
Birmingham Energy Savers is a non-profit organisation launched by Birmingham City Council. The scheme is to create around 270 new jobs and help reduce carbon dioxide emissions by 60 per cent by 2025.

Global City Local Heart
 Telephone: 0800 512 012
 email: bee@birminghamenergysavers.org.uk
 Birmingham Energy Savers © Copyright 2011

investing in your future
 European Regional Development Fund
 European Union

ENERGY SAVERS HOME
 Birmingham Energy Savers
 Birmingham City Council

An PPP company, as Opco, plays a central role in the delivery of the programme

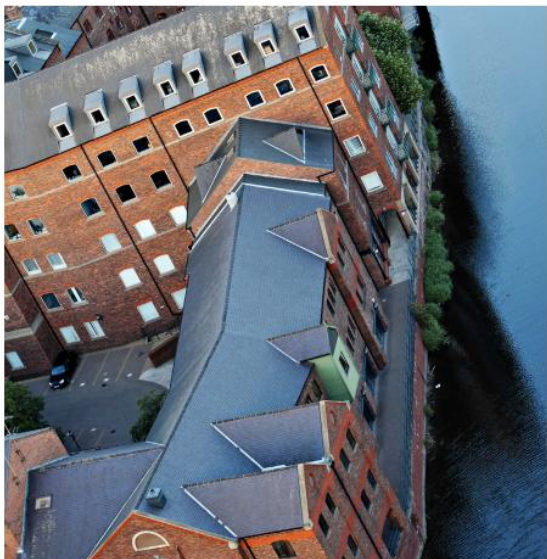


Leeds City Region



Leeds City Region Local Carbon Framework | May 2011

Supporting Carbon Reduction in Commercial Properties Research Summary



ARUP

The Economics of Low Carbon Cities

A Mini-Stern Review for the Leeds City Region

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



Centre for
Low Carbon Futures



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Leeds City Region 46 domestic interventions



Main Findings The Domestic Sector

Cost effective opportunities

- There are £1.1 billion worth of cost-effective, energy efficient and low carbon investment opportunities available in the domestic sector in the Leeds City Region.
- Exploiting these would generate annual savings of £400 million a year.
- At commercial rates, these investments would pay for themselves in under 3 years, whilst generating annual savings for the lifetime of the measures.
- If exploited, these investments would reduce Leeds City Region carbon emissions by 3.8% by 2022, compared to 1990.

Cost neutral opportunities

- There are £3.6 billion of cost-neutral, energy efficient and low carbon investment opportunities available in the domestic sector in the Leeds City Region.
- Exploiting these would generate annual savings of £556 million a year.
- At commercial rates, these investments would pay for themselves in 6.4 years, whilst generating annual savings for the lifetime of the measures.
- These investments would reduce Leeds City Region carbon emissions by 5.3% by 2022, compared to 1990.

Table 7: League Table of the Most Cost Effective Measures for the Domestic Sector

Central business case	£/TCO2
1	Mini wind turbines (skW) with FIT -457
2	Biomass boilers with RHI -325
3	Electronic products -245
4	Information and communication technology products -244
5	Integrated digital TVs -228
6	Reduced standby consumption -228
7	Reduce heating for washing machines -209
8	A++ rated cold appliances -180
9	A rated ovens -175
10	Biomass district heating with RHI -155

11	Efficient lighting -153
12	A-rated condensing boiler -145
13	Insulate primary pipework -132
14	Glazing – old double to new double -123
15	Uninsulated cylinder to high performance -122
16	Glazing – single to new -120
17	Insulated doors -118
18	Reduce household heating by 1°C -111
19	Induction hobs -110
20	Loft insulation 0 - 270mm -79
21	Pre*76 cavity wall insulation -73
22	Improve airtightness -71

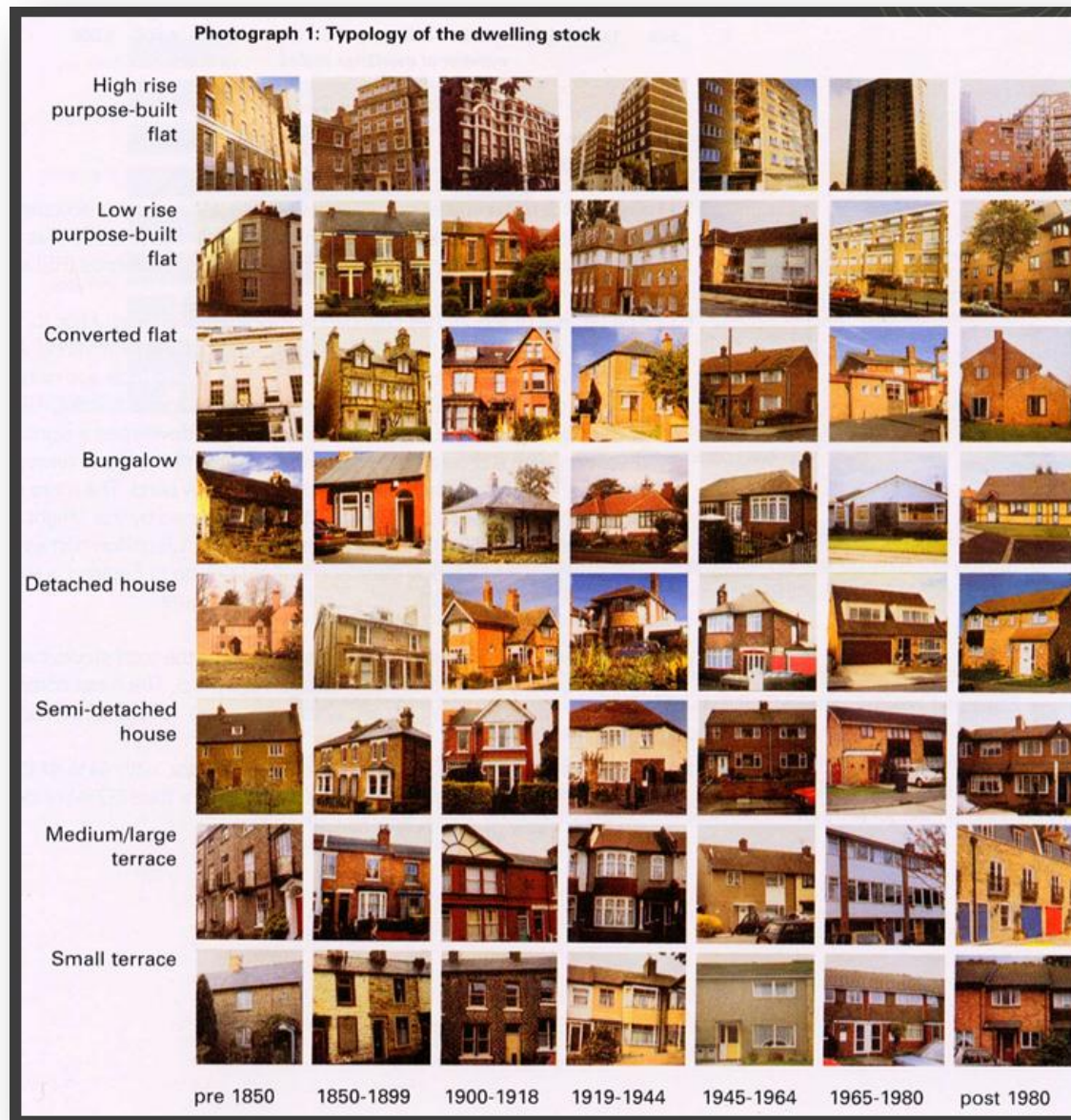
FIT = Feed in Tariff; RHI = Renewable Heat Incentive. Correct as at 1/1/2012

Discussion

There are numerous opportunities for reducing the energy use and carbon footprints of households within the Leeds City Region. This could be done through investments in the fabric of the built environment (i.e. through loft and wall insulation, double glazing), through investments in more energy efficient appliances (computers, TVs, fridges, freezers etc) or through changes in behaviour (turning off appliances, turning down thermostats etc). The league tables of the most cost and carbon effective measures are included in Table 7.

■ Cost effective
■ Cost neutral

23	DIY floor insulation (susp timber floors)	-70	35	Solid wall insulation	9
24	Loft insulation 25 - 270mm	-69	36	Loft insulation 125 - 270mm	11
25	Loft insulation 50 - 270mm	-59	37	Loft insulation 150 - 270mm	59
26	76-83 cavity wall insulation	-56	38	Room thermostat to control heating	59
27	A+ rated wet appliances	-54	39	Paper type solid wall insulation	76
28	Loft insulation 75 - 270mm	-52	40	Modestly insulated cylinder to high performance	90
29	Post*83 cavity wall insulation	-30	41	Thermostatic radiator valves	135
30	Turn unnecessary lighting off	-28	42	Photovoltaic generation with FIT	180
31	Installed floor insulation (susp timber frames)	-25	43	Air source heat pump with RHI	340
32	Loft insulation 100 - 270mm	-8	44	Micro wind turbines (1kW) with FIT	639
33	Glazing (to best practice)	-4	45	Hot water cylinder 'stat	671
34	Ground source heat pump with RHI	2	46	Solar water heating with RHI	1173



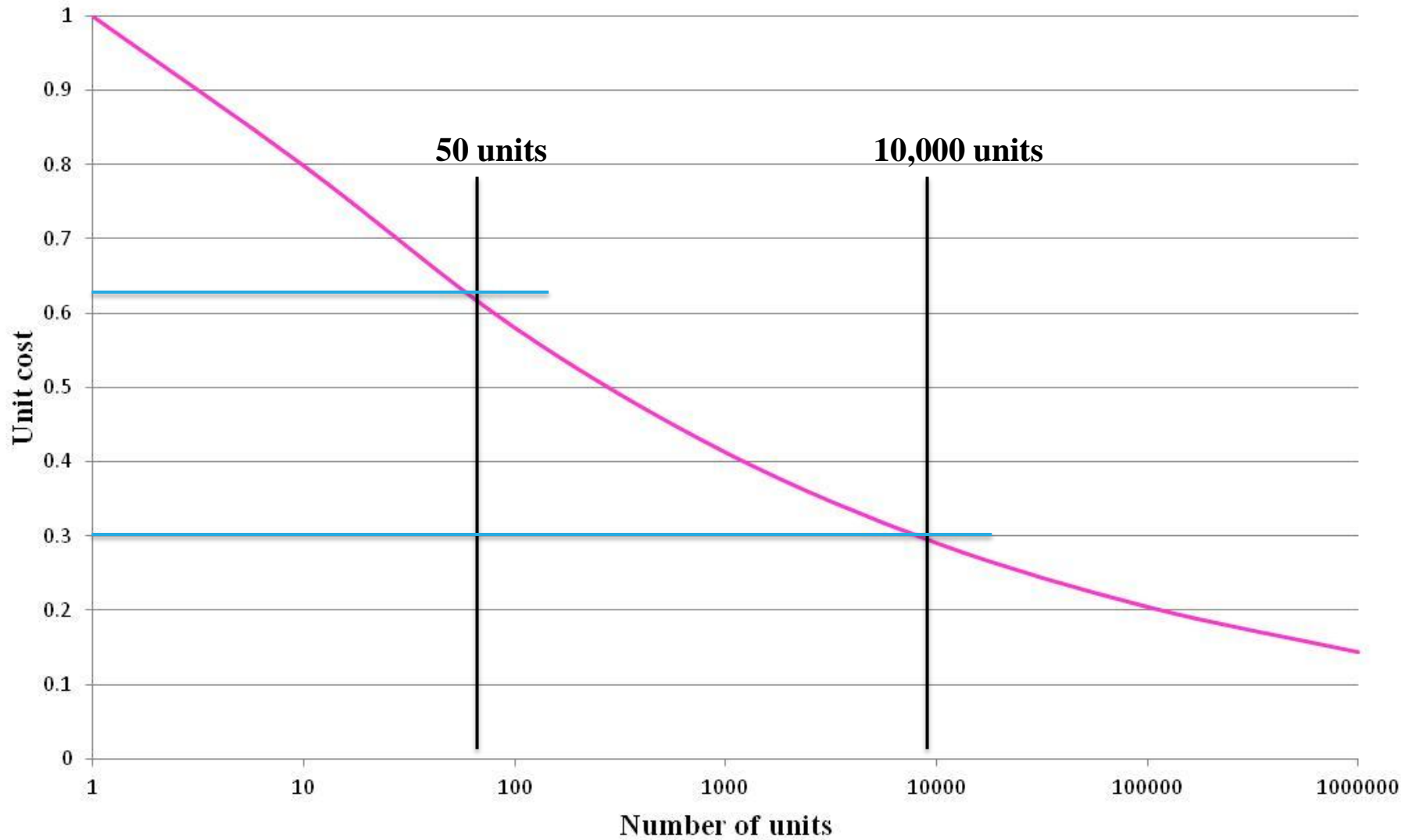


Pick and Mix



Gok Wan

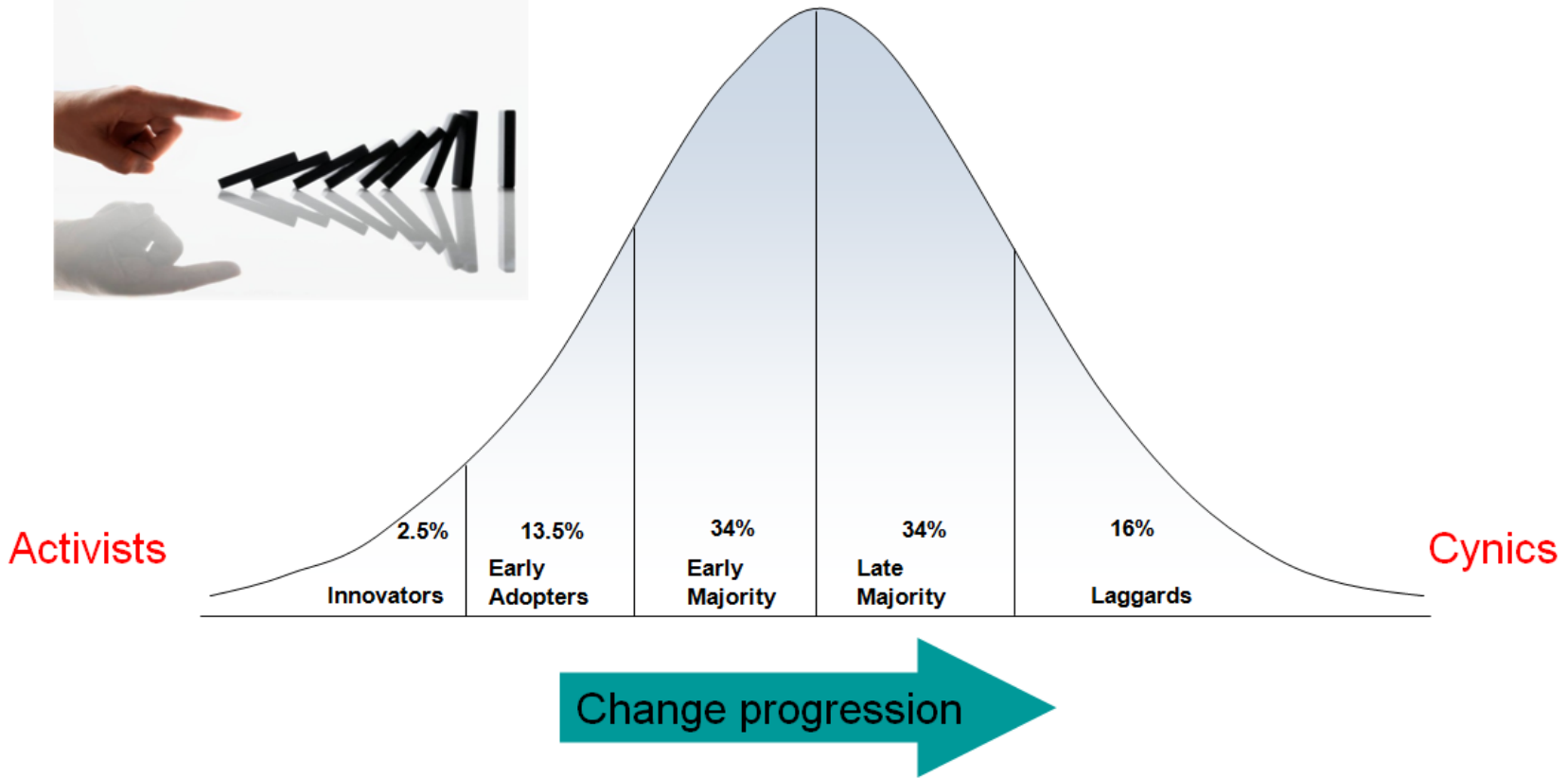
Effect of scale on unit costs (90% experience curve)





Reducing the GHG emissions from 1.25 million dwellings in Wales

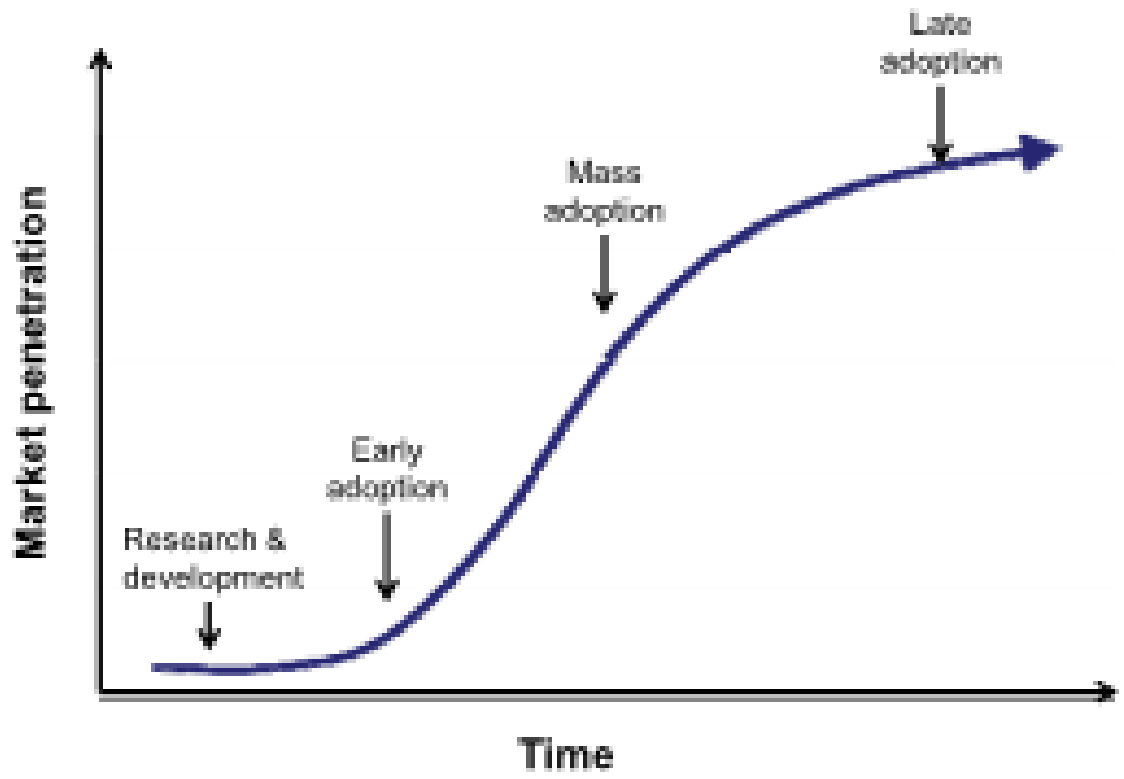
CO₂ CO₂ CO₂



CO₂ CO₂ CO₂



Stages of technology / market development

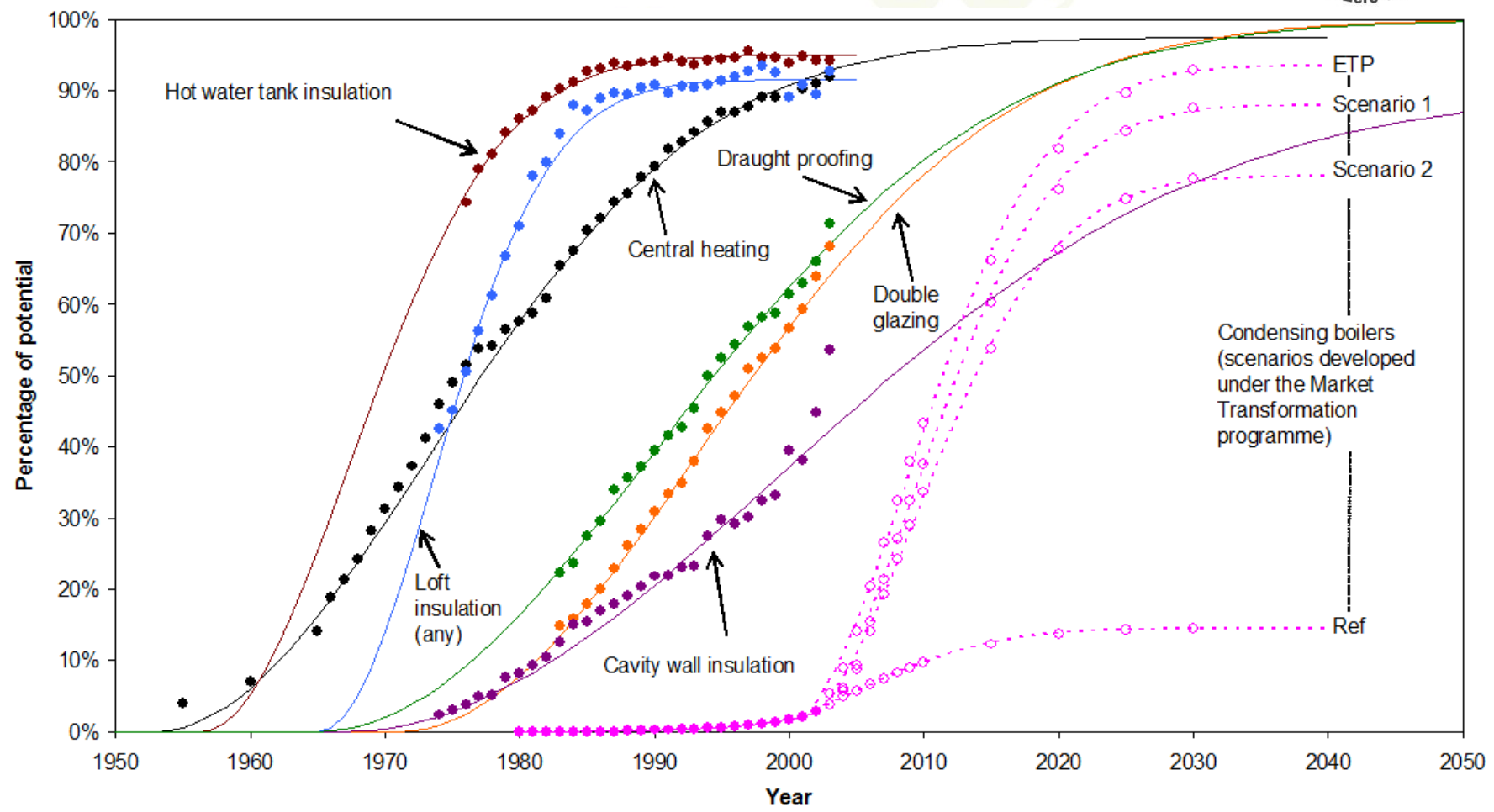


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CO₂ CO₂ CO₂





Wales domestic retrofit

- 1.25million dwellings
- Procure at scale over 20 years
- 62,500 dwellings per year
- £5k/dwelling to upgrade, repayable over 20 years
- £6.25 billion cost
- 20 years → £313million/year
- ~0.7% of Wales's GVA

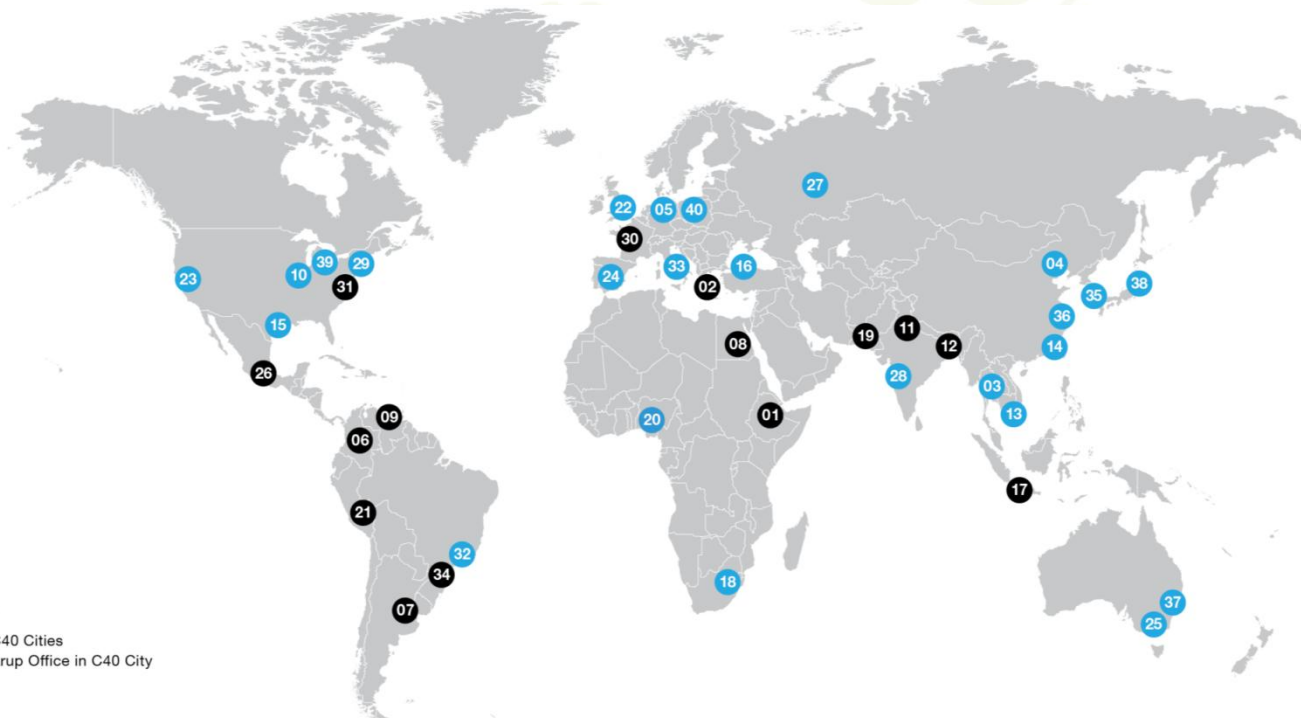


C40 Cities



CLINTON
CLIMATE
INITIATIVE

40 cities | 297 million residents | 4,734 climate actions



Key

- C40 Cities
- Arup Office in C40 City

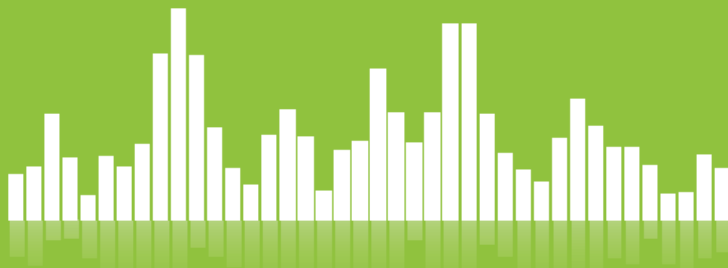
C40 Cities

- | | | | |
|-----------------|---------------------|----------------|-------------------|
| 01 Addis Ababa | 11 Delhi NCT | 21 Lima | 31 Philadelphia |
| 02 Athens | 12 Dhaka | 22 London | 32 Rio De Janeiro |
| 03 Bangkok | 13 Ho Chi Minh City | 23 Los Angeles | 33 Rome |
| 04 Beijing | 14 Hong Kong | 24 Madrid | 34 São Paulo |
| 05 Berlin | 15 Houston | 25 Melbourne | 35 Seoul |
| 06 Bogota | 16 Istanbul | 26 Mexico City | 36 Shanghai |
| 07 Buenos Aires | 17 Jakarta | 27 Moscow | 37 Sydney |
| 08 Cairo | 18 Johannesburg | 28 Mumbai | 38 Tokyo |
| 09 Caracas | 19 Karachi | 29 New York | 39 Toronto |
| 10 Chicago | 20 Lagos | 30 Paris | 40 Warsaw |

Climate Action in Megacities:

C40 Cities Baseline and Opportunities

Version 1.0 June 2011



40 cities
297 million residents
4,734 climate actions

ARUP

C40
CITIES
CLIMATE LEADERSHIP GROUP

EXISTING BUILDINGS

On average, energy used in buildings accounts for 45% of C40 cities' carbon emissions.

Mayoral powers in the building sector are strong among the C40 cities. Twenty-seven city governments own and operate (either in full or partially) municipal office and other buildings and 22 own and operate municipal housing. Seventeen cities reported powers to set policies and enforce regulation over private sector residential and the same number hold regulatory powers commercial buildings. C40 cities have implemented 1,343 actions to reduce carbon emissions from existing buildings.

Key actions



WASTE MANAGEMENT

Globally, waste accounts for around 3% of greenhouse gas emissions.

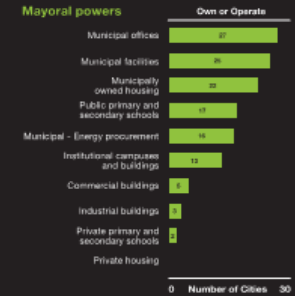
On average, C40 mayors exercise strong powers over the waste sector, especially over residential and municipal building waste collection, and street cleaning where 20 cities own and operate these functions.

C40 cities have implemented 783 actions to reduce carbon emissions from waste.

Key actions



Mayoral powers



Mayoral powers



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Güssing, Austria

Rhuddlan, Denbighshire

Cowbridge, Vale of Glamorgan

History



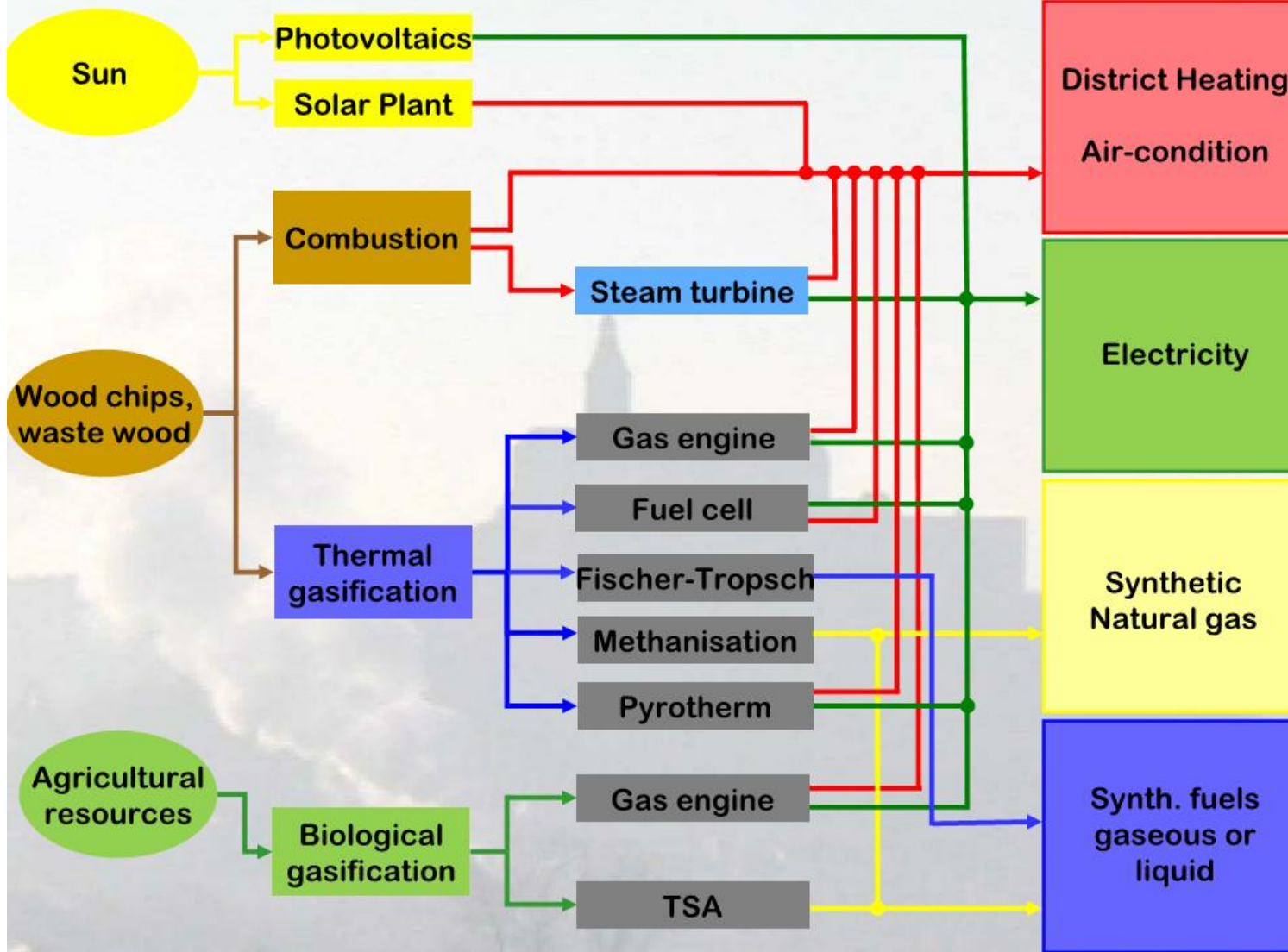
- **50 years alongside the iron curtain to Hungary**
- **no industry**
- **high rate of unemployment**
- **70% commuters**
- **high rate of migration**
- **small structured agriculture**
- **bad traffic infrastructure**

Güssing

20. November 2009



Resources **Conversion technologies** **Forms of energy**



The added value



for the town of Güssing

- More than **50** new companies
- More than 1.100 new jobs netting € 9 Mio. a year
- Total sales volume of energy € 13 Mio. a year
- Total wood consumption 44.000 tons a year

for the district of Güssing

- 45% self sufficiency netting **18 Mio. EURO**
- Potential in case of 100% self sufficiency **37 Mio. EURO**

Güssing

20. November 2009

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- The general power of competence for local authorities
- The community right to build



achieving zero
delivering future-friendly buildings

Brenda Boardman

Environmental Change Institute



	Property owner	Occupant
	Theoretical energy use: mainly gas	Actual energy use: includes all electricity
Residential	Minimum standards based on EPC 82% of all energy in 2009	Personal carbon allowances 100% of all energy
Business	Minimum standards based on EPC 69% of all energy in 2009	Display energy certificates 100% of all energy

It is an essential component of the strategy that energy-efficient buildings become worth more than energy-inefficient ones.



Thank you.
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