

InSmart way to Nottingham's Energy Future



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Barriers to Energy Efficiency Action Plans?

1. Data
2. Data
3. Data
4. What to invest in

What is InSmart

“InSMART project aims to develop in integrative approach to the modelling and analysis of urban energy use”

- Energy Maps
- Domestic Energy Use Modelling
- Transport (Trips & Energy) Modelling
- Energy Systems
- Scenario Building
- Action Plans

Why did Nottingham get involved

- Lack of robust accurate data
- Covenant of Mayors signatory
- Sustainable Energy Action Plan
- City Energy Strategy
- Firm evidence base for future energy investments and infrastructure
- Systemic view, integrating all the energy consuming sectors offers a holistic approach for city planning



GIS Maps

- To support City Planners
- Energy demand
 - Building stock
 - Transportation & Mobility
- Energy systems & networks

Introduction

Layers

Key / Legend

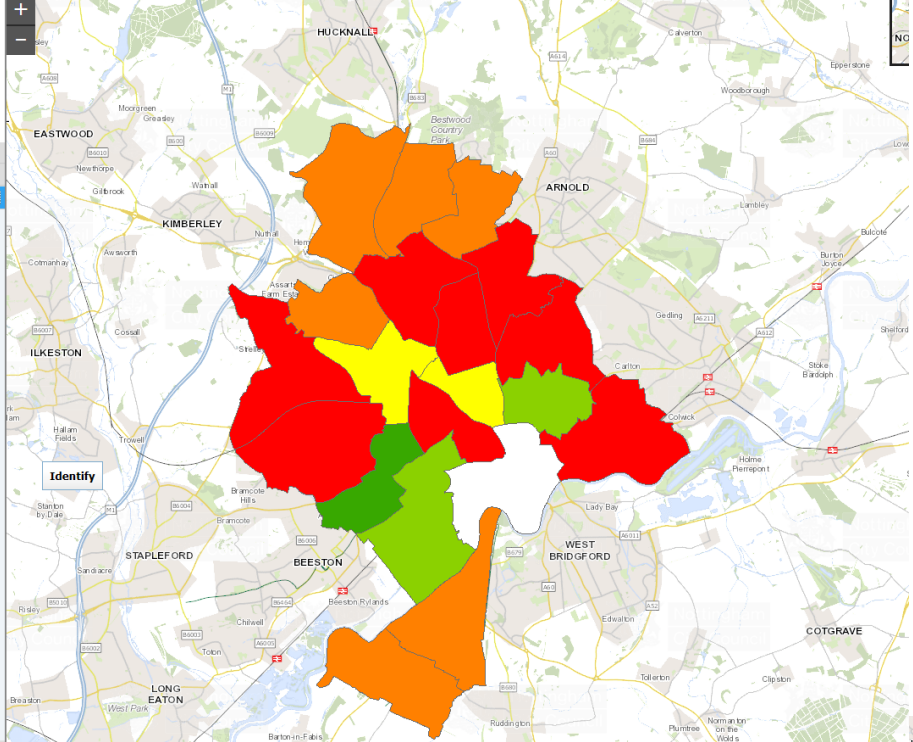
insmart

InSmart Project Data

DECC Estimated Total Energy Use

DECC Estimated Total Energy Use - Ward (2011)

- < 50,000
- 50,001 - 70,000
- 70,001 - 90,000
- 90,001 - 110,000
- 110,001 - 130,000



Introduction

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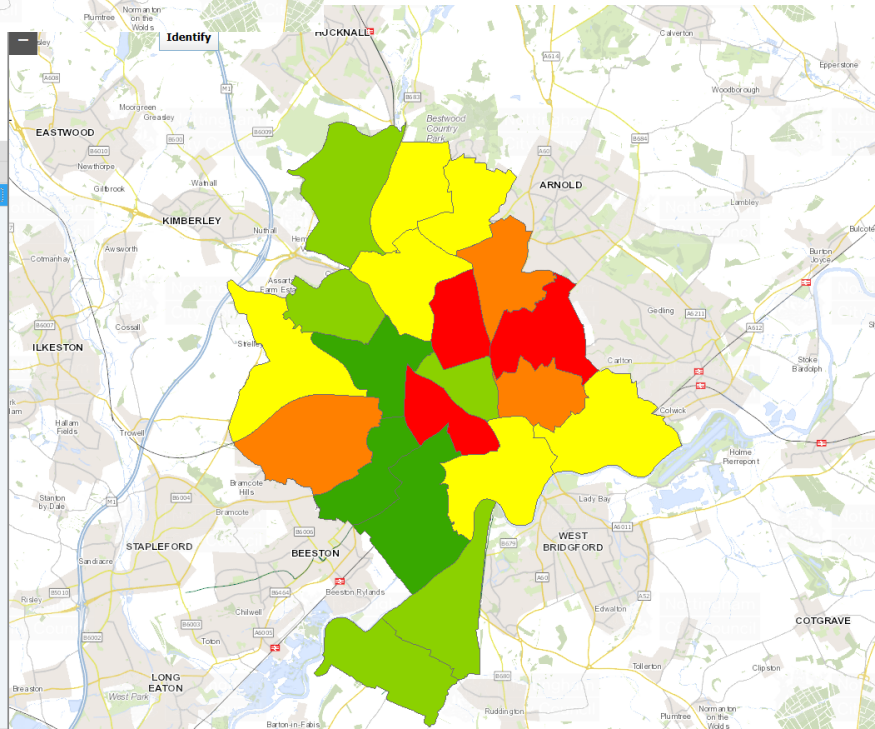
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InSmart Project Data

Simulated Annual Domestic Energy Use

Simulated Annual Domestic Total Energy Use - Ward

- < 65,128
- 65,129 - 89,776
- 89,777 - 103,536
- 103,537 - 117,335
- 117,336 - 134,308



Introduction

Layers

Key / Legend

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InSmart Project Data

Transport simulation results

InSmart Transport Zones

InSmart Transport Zones

Base Year Results (2014)

Transport Demand

Transport Demand (Total trips)

- 57729 - 65203
- 65204 - 131105
- 131106 - 174551
- 174552 - 344869
- 344870 - 563593

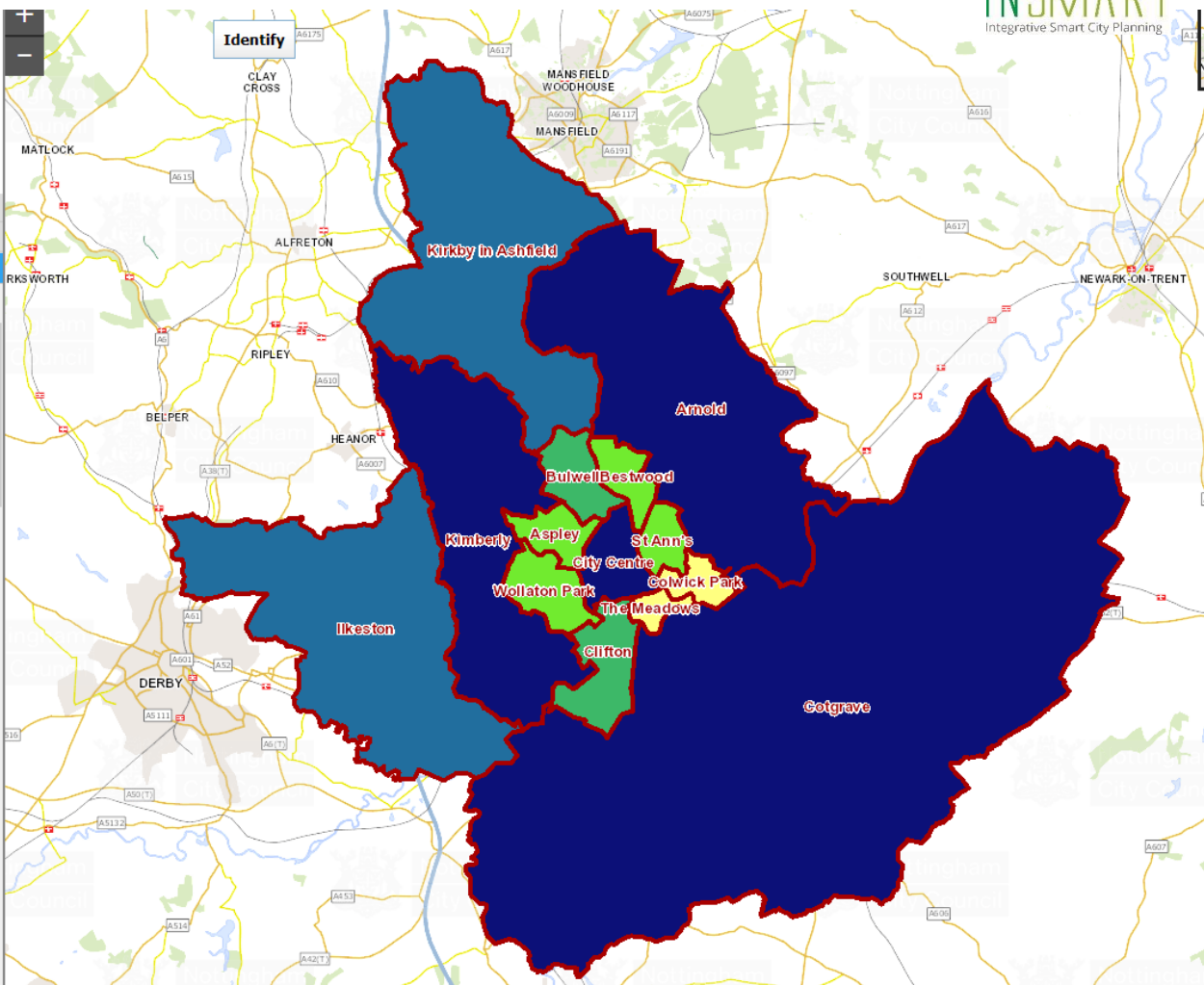
Energy Use

Total Energy use (MJ)

- 999243 - 1376038
- 1376039 - 2659583
- 2659584 - 3828119
- 3828120 - 19546630
- 19546631 - 29916173

Energy/Person (MJ)

- 651 - 1343



City Building Stock

- 600 residential properties surveyed
- 16 typologies identified
- Energy Building Simulation Models (Energy Plus)
- T5 most common
- Show results in next few pages

Table 1: Nottingham's residential building typologies and their frequency

Typology	Description	Number of properties	% of total residential properties	Estimated total Floor Area (m2)
T1	Victorian apartment	7,777	6.06	816,960
T2	Victorian terrace	12,844	10.01	1,244,589
T3	Victorian semi-detached	5,389	4.20	649,086
T4	Victorian detached	1,096	0.85	195,592
T5	Inter-war semi/terrace	22,738	17.72	1,941,031
T6	Inter-war detached	4,456	3.47	647,532
T7	Post-war semi/terrace	15,304	11.91	1,414,077
T8	Post-war detached	3,797	2.96	428,878
T9	60s/70s apartment	12,007	9.36	800,191
T10	60s/70s terrace	11,820	9.21	1,114,015
T11	60s/70s semi-detached	4,338	3.38	402,223
T12	60s/70s detached	4,409	3.44	564,763
T13	Modern apartment	12,406	9.67	1,176,622
T14	Modern terrace	3,668	2.86	331,365
T15	Modern semi-detached	3,555	2.77	302,593
T16	Modern detached	2,729	2.12	332,041

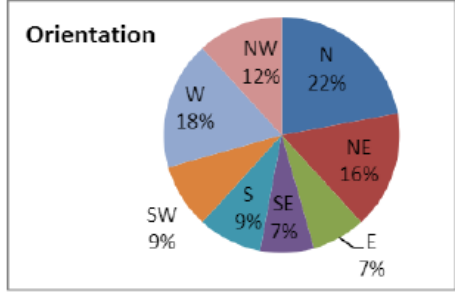
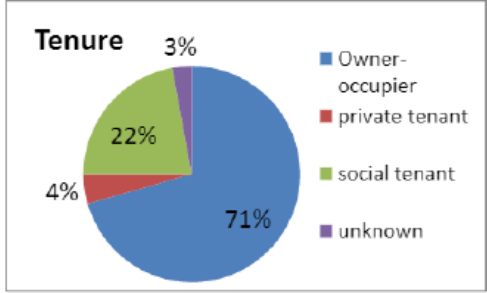


Figure 29: Charts showing [left] tenure and [right] building orientation for surveyed T5 properties

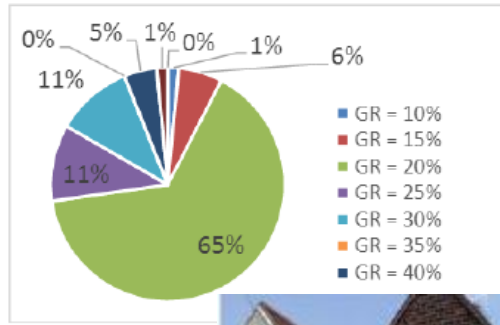
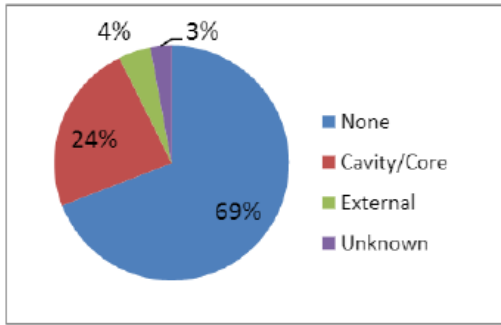
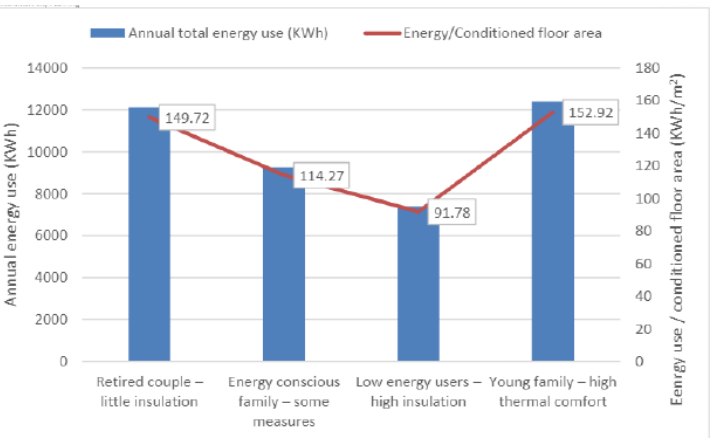
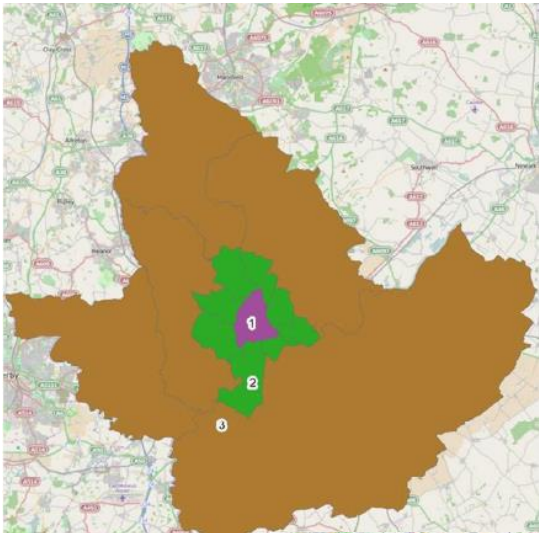


Figure 30: Chart showing wall insulation [left] and glazing ratios for the front façade [right]

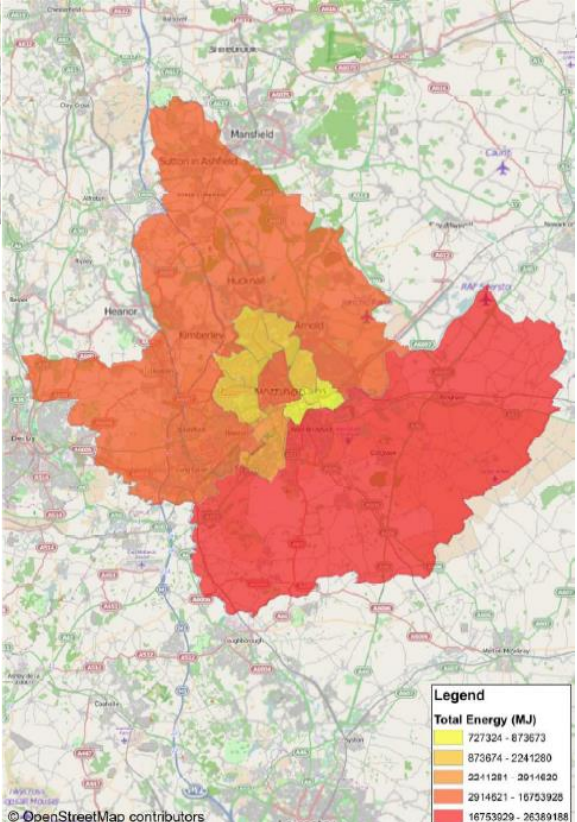
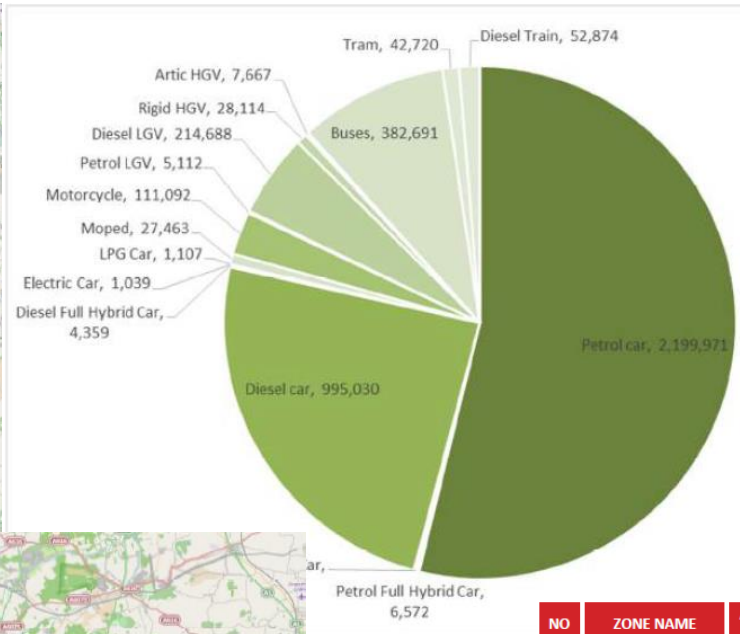


Transport

- Analyse flows of transport by type
- Define scenarios to reduce energy use & emissions without reducing travellers utility
- Identify effective, innovative measures to increase mobility and energy efficiency



Legend
AreaType
 1 City Centre
 2 Edge of City Centre
 3 SubUrban



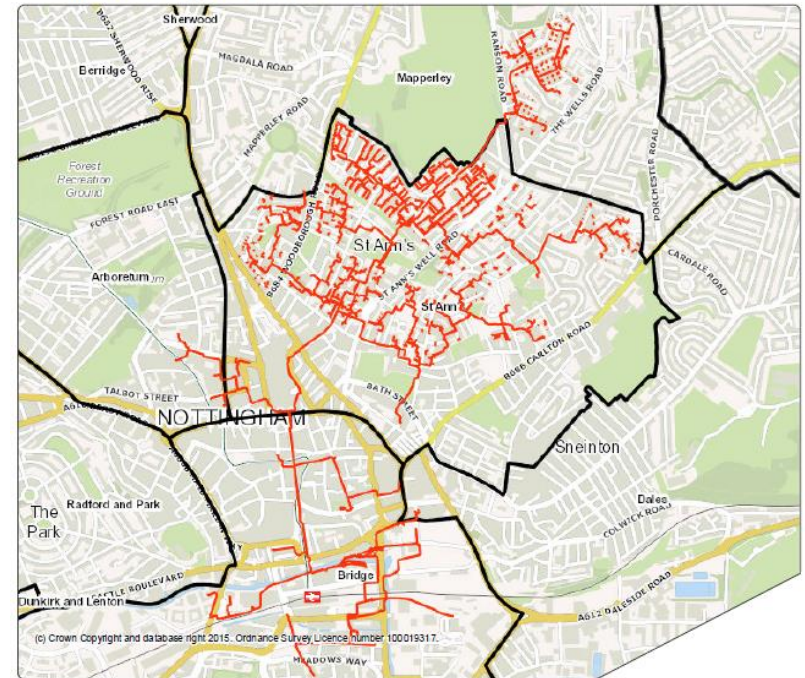
Legend
Total Energy (MJ)
 727324 - 873673
 873674 - 2241260
 2241261 - 20114620
 2914621 - 16753920
 16753920 - 26389188

NO	ZONE NAME	AREA TYPE	POPULATION	DEMAND	ENERGY (MJ)	ENERGY/PERSON	ENERGY/TRIP	
1	City Centre	1	88,948	261,194	7,559,171	85.0	28.9	
2	Clifton	2	39,780	93,448	2,852,132	71.7	30.5	
3	The Meadows	2	16,096	30,639	700,815	43.5	22.9	
4	Colwick Park	2	28,930	27,115	719,743	24.9	26.5	
5	St Ann's	2	41,721	70,260	1,815,026	43.5	25.8	
6	Bestwood	2	45,158	65,396	1,716,763	38.0	26.3	
7	Bulwell	2	42,787	78,893	2,192,923	51.3	27.8	
8	Wollaton Park	2	42,671	59,894	1,716,950	40.2	28.7	
9	Aspley	2	40,274	72,285	1,966,148	48.8	27.2	
10	West Bridgford & South	3	128,757	321,816	26,292,832	204.2	81.7	
11	Hucknall & North	3	133,342	219,463	11,385,852	85.4	51.9	
12	Beeston & Kimberley	3	132,658	284,178	13,545,265	102.1	47.7	
13	Ilkeston & Long Eaton	3	129,362	177,484	8,614,555	66.6	48.5	
14	Arnold & East	3	132,553	332,173	16,583,912	125.1	49.9	
15	External	5	-	285,571	30,259,811	-	106.0	
Total (inc External)				-	4,759,618	255,843,799	-	53.8
Total (exl External)				1,043,037	2,379,809	127,921,899	122.6	53.8

Energy Systems

- Analysed the status of city urban energy systems
- Local authority energy
- Energy networks

District Heating Network



Scenario's

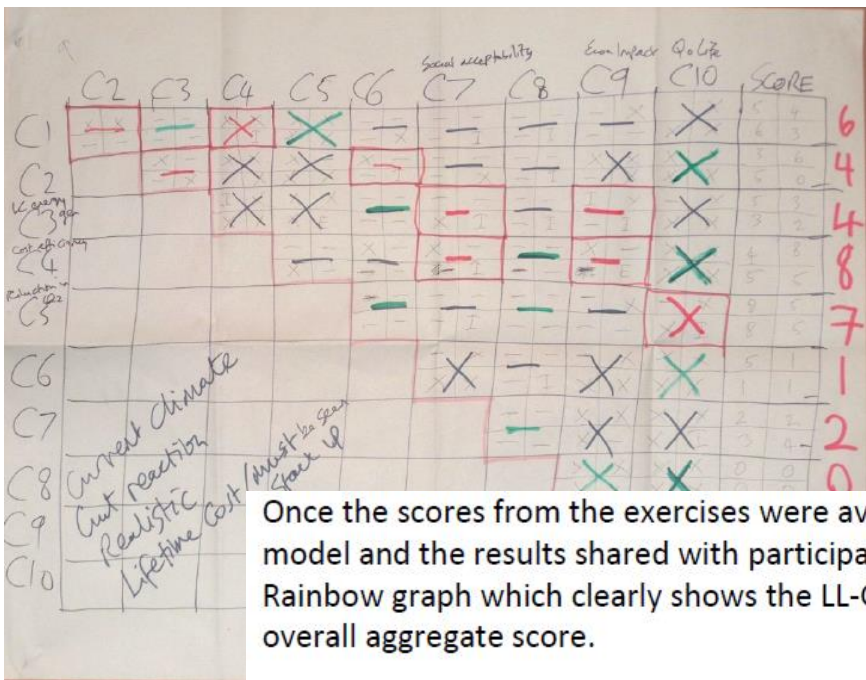
- Develop city specific energy model systems
- Define and analyse sustainability scenarios in order to identify the economical optimum mix of measures
- Implement multi-criteria decision process in order to identify the city optimum sustainability path

The Scenario's

- Reference
- No investment
- Local Leadership
- Green governance
- Green Growth



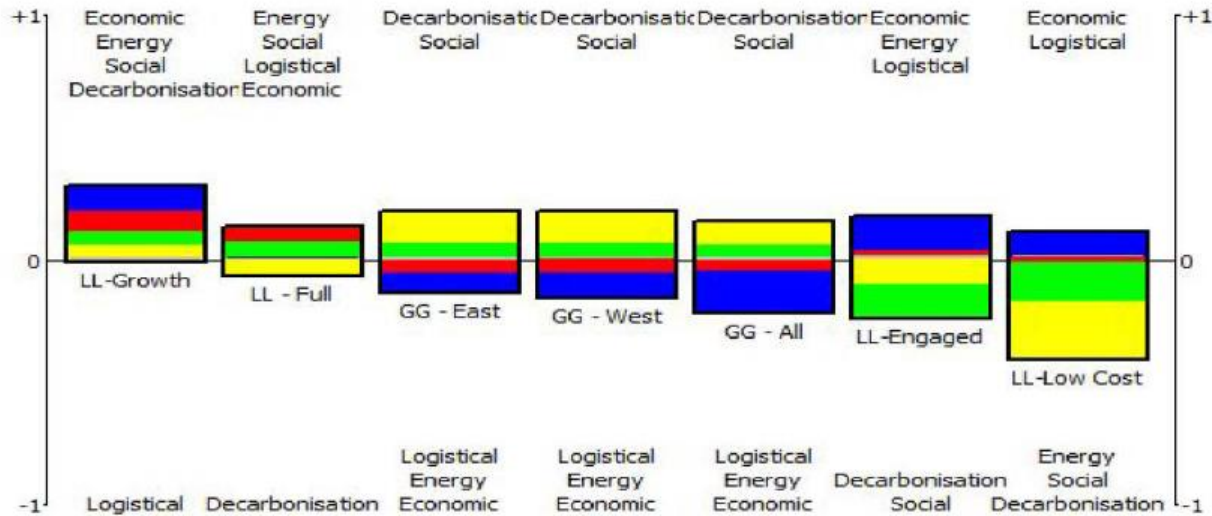
	Working from home & cycling	Domestic PV & Solar Thermal	Residential Retro Fits	Electric buses & southern corridor	Solid Wall Insulation	District Heating	Go Ultra Low	Community Scale Biomass CHP	NET Phase 3 Kimberley	Carbon Tax	NET Phase 3 Gedling	NET Phase 3 All	Anaerobic Digestion	PV at Park & Ride	New Low Carbon Housing	Increased Diffusion Of Electric Vehicles	Subsidies for low carbon heating
LL Low Cost	X	X	X														
LL Engaged	X	X	X	X	X	X											
LL Full	X	X	X	X	X	X	X	X									
LL Growth	X	X	X	X	X	X	X	X						X	X	X	
GG West	X	X	X	X	X	X	X	X	X	X							X
GG East	X	X	X	X	X	X	X	X		X	X						X
GG All	X	X	X	X	X	X	X	X		X		X	X				X



EVALUATIONS	Technical Constraints	Social Acceptability	Legal Issues	Economic Impact	Quality of Life Issues
LL Low Cost	5	5	5	2	2
LL Engaged	5	4	4	3	3
LL Full	4	3	3	3	4
LL Growth	3	3	3	3	4
GG - West	3	3	2	3	4

Handwritten note at bottom right: (Economic winter deaths highest amongst LL - SW cost high)

Once the scores from the exercises were available, these were fed through the PROMETHEE model and the results shared with participants. The most visual representation is this Rainbow graph which clearly shows the LL-Growth scenario on the left with the highest overall aggregate score.



Local Leadership - Growth

- Housing Stock
 - Insulate all cavity walls. InSmart surveys estimate 40% of the non social housing stock still requires insulation
 - Basic draught proofing, significant savings could be achieved through this
 - Ensure that remaining 12% of uninsulated lofts are insulated
- Low Carbon Energy
 - Expansion of District Heating Network. Addition of line 3 from the heat station for new build sites, and development areas around the City Centre
 - Community Biomass CHP. Introduction of low carbon energy for new development sites in the out laying areas of the city. Estimated of 100GWh by 2020, and 140GWh by 2030
 - Implementation of plant scale PV at council operational sites
- Transport
 - Major increase in cycling, estimating a 10% reduction in private transport journeys
 - Significant increase in electric vehicles by 2030. Supported by go ultra low programme



What's Next

- Development of action plan
- Final Conference – Brussels 15th March
- Further info
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