Place-based Social Impacts of Climate Action

The UK Co-Benefits Atlas

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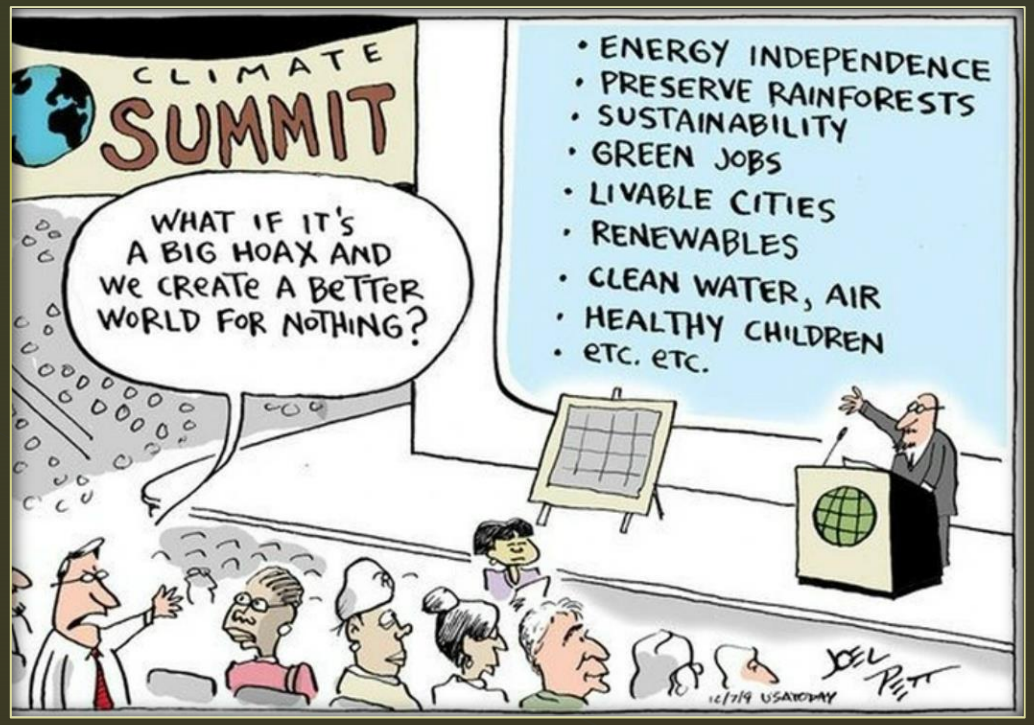
What are co-benefits and why are they important?

- As climate actions shifts from energy production to homes, offices and lifestyles the wider consequence of actions (the co-benefits) are becoming larger and more visible.
- Overwhelming these co-benefits are positive
- Highlighting the scale of these benefits, giving simple and specific examples, and highlighting success stories are key to communicating the co-benefits of climate action



What co-benefits do we analyse?

- Co-benefits include all wider socio-economic impacts, but for the purposes of this analysis, we have analysed 11 robust co-benefits types:


Physical activity


Congestion reduction


Dampness reduction


Air quality


Road repairs


Excess cold


Noise reduction


Road safety

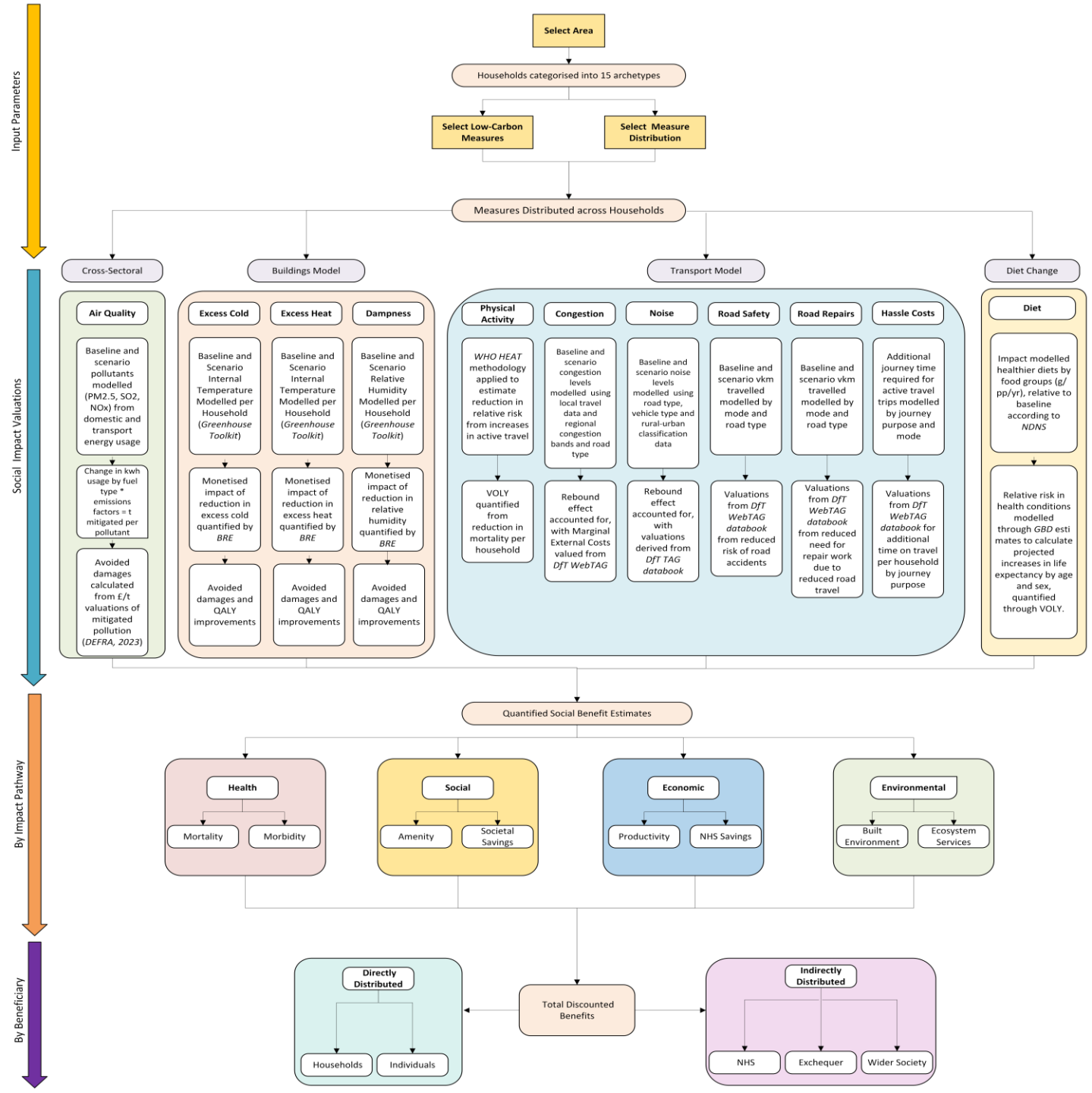

Excess heat


Hassle costs


Dietary change

Methodology –

- High-level process for estimating social benefits for specific interventions, in specific areas.
- Estimates co-benefits according to local characteristics, across demographic, economic and geographical variables.



Example Methodology - *Noise*

The reduction of noise co-benefit is a result of decreased levels of noise pollution, which lead to the negative effects on the health and well-being of society and ecosystems.

Environmental noise pollution is the second-greatest environmental risk in Europe[13], leading to declines in quality of life, reduced amenity, sleep disturbances, and increased health risks.

The co-benefit is quantified by estimating baseline noise in the local area, through mapping noise levels by road type and rural-urban classification, using estimates from the Department for Transport[14].

The change in noise pollution is modelled by using the relationship between vehicle type and noise[11], to estimate the marginal changes in decibels per vehicular kilometre travelled (either by reduction in vkmt or shifting vkmt to EVs). The benefits are valued using the DfT's TAG noise assessment databook[15], and distributed to populations based on the rural-urban classification in which the reduction in noise occurs, so that avoided damages can be weighted appropriately. This is broken down into distinct damage pathways, like increased amenity and reduced sleep disturbance.

$$
\begin{aligned}
&\text{Baseline distance travelled by vehicle type and powertrain (vkm)} \\
&\times \text{ Share of vkm by road type and rural-urban classification} \\
&\times \text{ Typical noise pollution by vehicle and road type } \left(\frac{\text{dB}}{\text{vkm}}\right) \\
&\times (\text{Baseline modelled noise (dB)} - \text{Net change in modelled noise pollution}) \\
&\times \text{ Share of population affected} \\
&\times \text{ Avoided marginal external costs of noise pollution } (£) \\
&\times \text{ Share of impact pathway} \\
&= \text{Total value of avoided noise pollution relative to baseline } (£)
\end{aligned}
$$

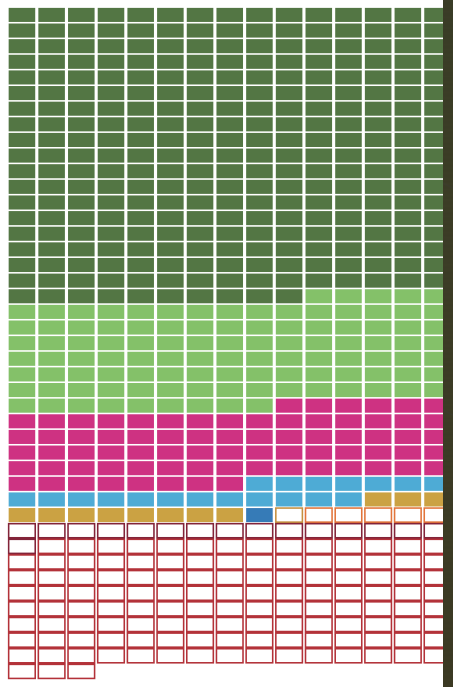
13. https://www.eea.europa.eu/articles/noise-pollution-is-a-major#:~:text=In%20fact%2C%20according%20to%20some,air%20pollution%20(particulate%20matter).
14. https://www.bradford.gov.uk/Documents/Hard%20Ings%20Road%20improvement%20scheme/2b%20Compulsory%20Purchase%20Order%20and%20Side%20Road%20Order/5%20Supporting%20documents/Calculation%20of%20Road%20Traffic%20Noise%201988.pdf
15. https://www.gov.uk/government/publications/tag-environmental-impacts-worksheets

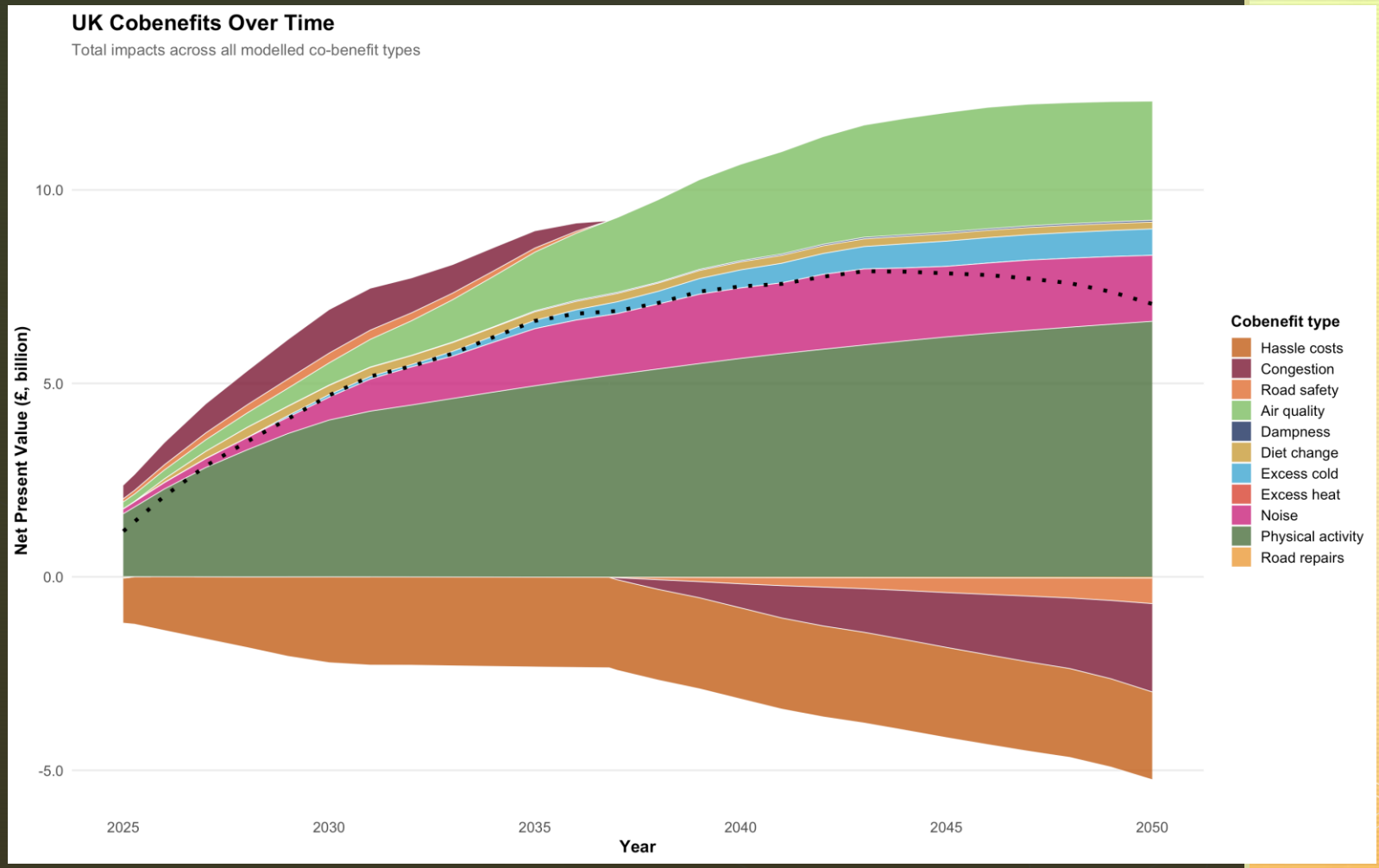
What is the high-level story?

Total Co-Benefits

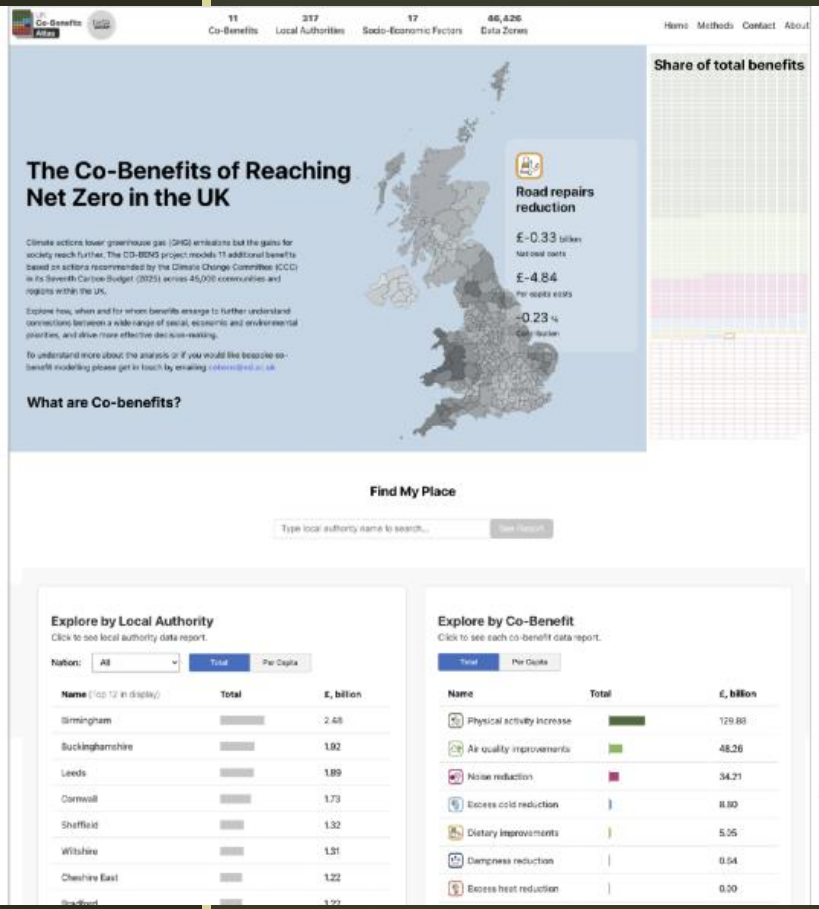
£159.79 billion
National benefits

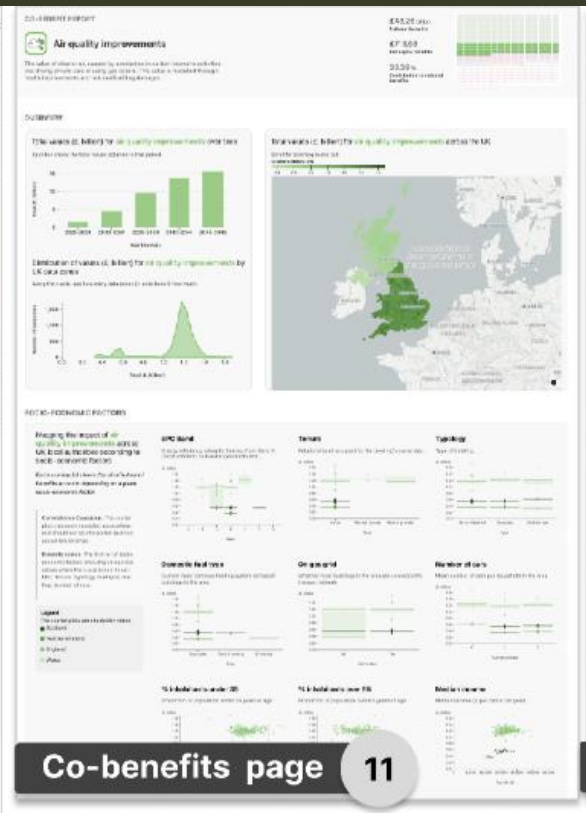
£2363.05
Per capita benefits

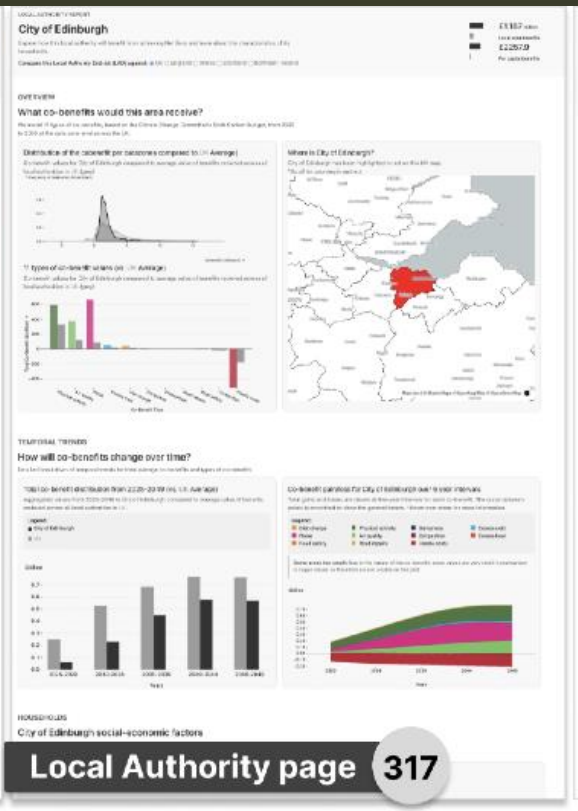


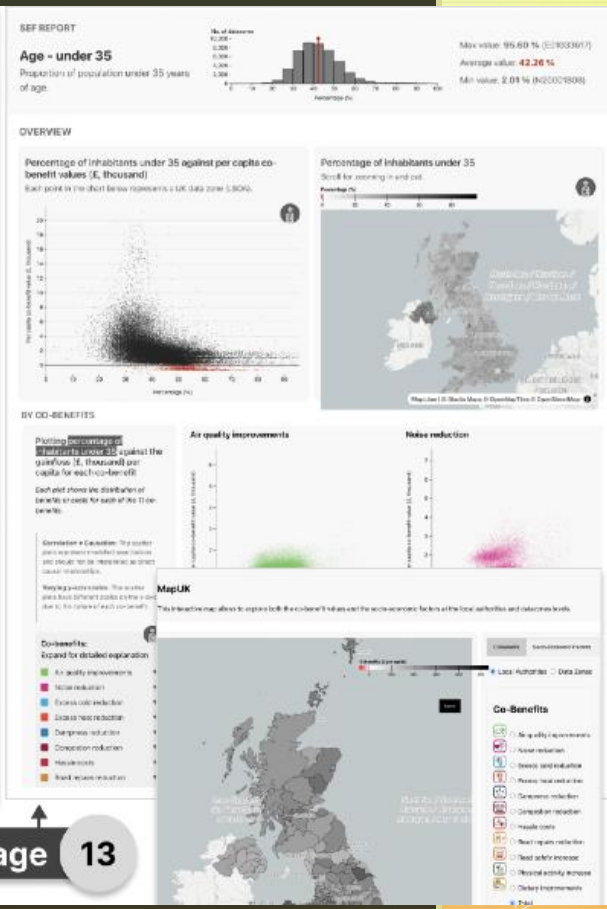


The challenge is now about communication









UK Co-Benefits Atlas beta version

11 Co-Benefits | 382 Local Authorities | 17 Socio-Economic Factors | 46,426 Data Zones

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Derbyshire Dales (Total: £0.142 billion) **>> Overview**

OVERVIEW

What co-benefits would this area receive?

We model 11 types of co-benefits, based on the Climate Change Committee's Seventh Carbon Budget, from 2025

Derbyshire Dales (Total: £0.142 billion) **>> Temporal trends**

TEMPORAL TRENDS

Derbyshire Dales (Total: £0.142 billion) **>> Household benefits**

HOUSEHOLDS

Derbyshire Dales (Total: £0.142 billion) **>> Household benefits**

Comparing the Socio-Economic factors distributions of Derbyshire Dales and UK, and their correlation with co-benefits.

Legend:
- Derbyshire Dales
- UK

Interpreting the charts:

Barchart: Each bar represents the normalized frequency of datazones linked to a given social economic factor value.

Scatterplot: Each dot represents a datazone inside Derbyshire Dales. The cloud shows the distribution for UK.

Correlation ≠ Causation: The scatter plots represent modelled associations and should not be interpreted as direct causal relationships.

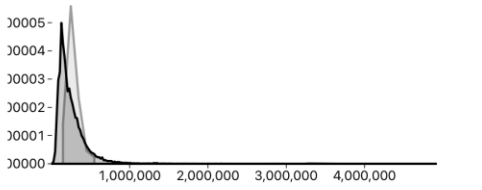
Discrete scales: The first set of socio-economic factors are using categorical values where the x-axis is non-linear: EPC, Tenure, Typology, Fuel type, Gas flag, Number of cars.

House value

Median value of household per area.

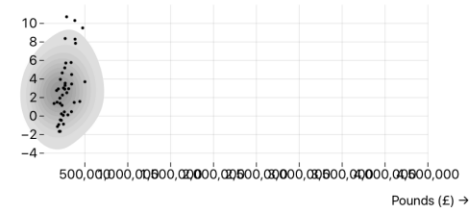
Data zones distribution (vs. UK average)

The histogram shows the number of data zones distributed across different household social economic factors.



Co-benefits received by data zones across House value values

Density plot refers to UK distribution while the scattered points refer to data zones in Derbyshire Dales.

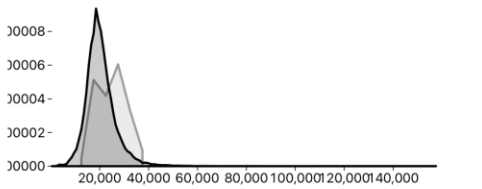


Annual fuel consumption

Annual mean energy consumption per household.

Data zones distribution (vs. UK average)

The histogram shows the number of data zones distributed across different household social economic factors.



Co-benefits received by data zones across Annual fuel consumption values

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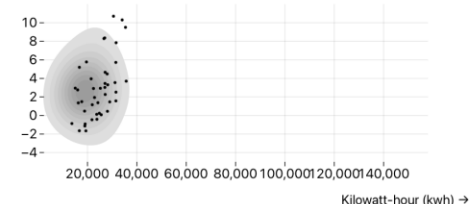

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11 Co-Benefits | 382 Local Authorities | 17 Socio-Economic Factors | 46,426 Data Zones

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Lambeth (Total: £0.235 billion) **>> Overview**

What co-benefits would this area receive?

We model 11 types of co-benefits, based on the Climate Change Committee's Seventh Carbon Budget, from 2025 to 2050 at the data zone level across the UK.

Distribution of

Co-benefit values

authorities in UK

Distribution of data

0.6 0.5 0.4 0.3 0.2 0.1 0.0 −15

11 types of co-

Co-benefit values

authorities in UK

300 200 100 0 −100 −200 −300

Total Co-Benefit (£million)

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Lambeth (Total: £0.235 billion) **>> Temporal trends**

TEMPORAL TRENDS

How will co-benefi

Detailed breakdown of temporal

Total co-benefit distribu

Aggregated values from 2025

across all local authorities in

Legend:

Lambeth

UK

£billion

0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0

2025-2029

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Lambeth (Total: £0.235 billion) **>> Household benefits**

Comparing the Socio-Economic factors distributions of Lambeth and UK, and their correlation with co-benefit

EPC Band

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Lambeth (Total: £0.235 billion) **>> Household benefits**

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Lambeth

UK

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Discrete scales: The first set of socio-economic factors are using categorical values where the x-axis is non-linear: EPC, Tenure, Typology, Fuel type, Gas flag, Number of cars.

Percentage of inhabitants under 35

Proportion of population under 35 years of age.

Data zones distribution (vs. UK average)

The histogram shows the number of data zones distributed across different household social economic factors.

0.07 0.06 0.05 0.04 0.03 0.02 0.01 0.00

20 40 60 80

Percentage (%) →

Co-benefits received by data zones across Percentage of inhabitants under 35 values

Density plot refers to UK distribution while the scattered points refer to data zones in Lambeth.

↑ Datazone Co-Benefit (£)

10 8 6 4 2 0 −2 −4

10 20 30 40 50 60 70 80 90

Percentage (%) →

Percentage of inhabitants over 65

Proportion of population over 65 years of age.

Data zones distribution (vs. UK average)

The histogram shows the number of data zones distributed across different household social economic factors.

0.14 0.12 0.10 0.08 0.06 0.04 0.02 0.00

10 20 30 40 50 60 70

Percentage (%) →

Co-benefits received by data zones across Percentage of inhabitants over 65 values

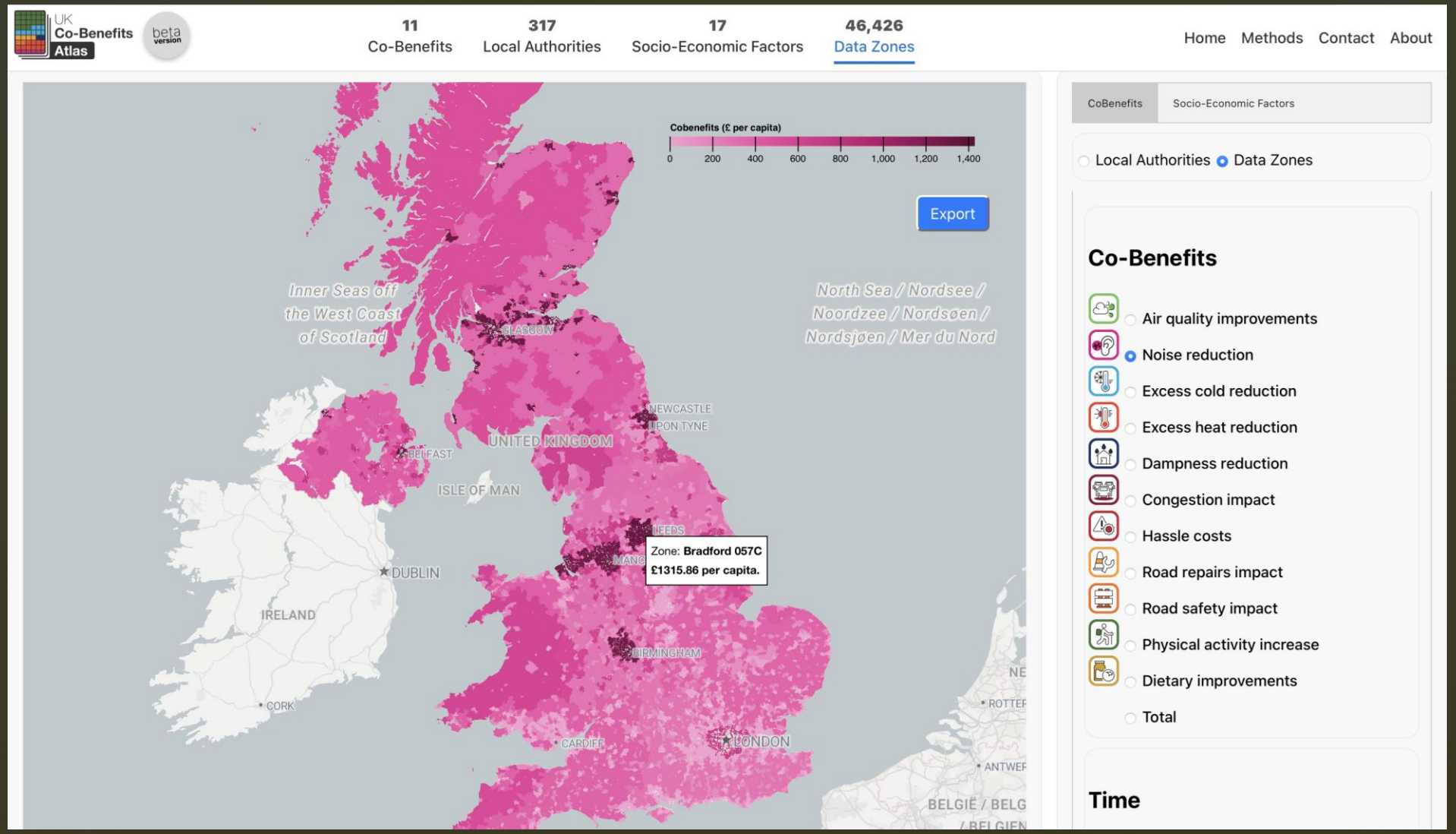
Density plot refers to UK distribution while the scattered points refer to data zones in Lambeth.

↑ Datazone Co-Benefit (£)

10 8 6 4 2 0 −2 −4

10 20 30 40 50 60 70

We can also use the Atlas to think about climate action across the UK



Use Cases

- Cost-benefit analyses – often the only way to certain climate interventions (e.g. heat pumps) affordable is to include co-benefits.
- Public perception and uptake – highlighting the co-benefits can help allay concerns about net-zero (economic, behavioural, etc.).
- Informing policymaking – the public benefits (to individuals, public bodies like the NHS, avoided governmental spending, etc.) can improve policy delivery and efficacy.
- Contribute to evidence base – The distributional implications of co-benefits on wider society, and knock-on effects, are currently under-researched in academic and policy areas.

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