Simulating the consequences of an emissions levy at the city and neighbourhood scale

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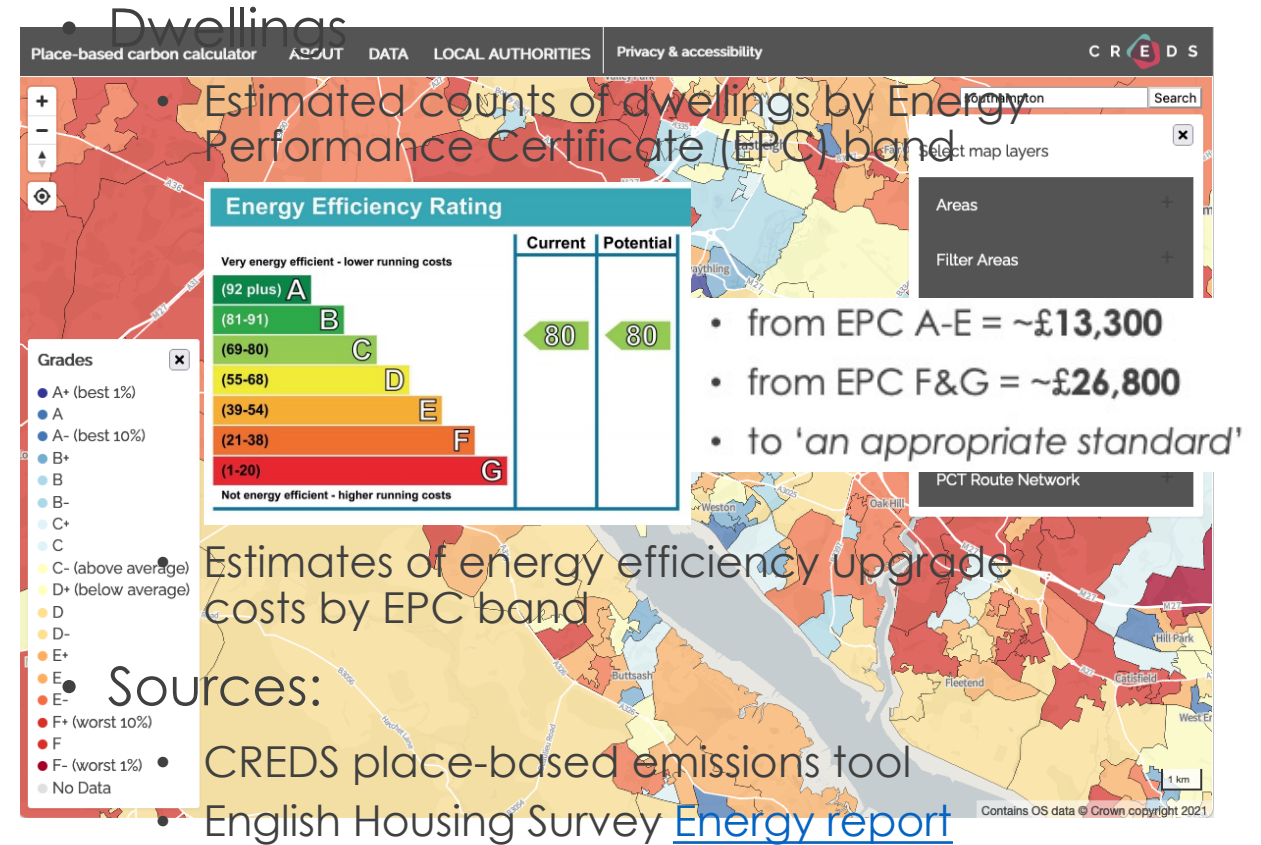
Contents

- What's the problem?
  - CO2e emissions are 'bad'
  - Emissions reductions cost ££
- What to do?
  - Polluter pays?
  - Re-invest in emissions reduction?
- Questions
  - Who pays/receives most?
  - Who pays/receives least?
  - Could it add up?
  - Could it be local?
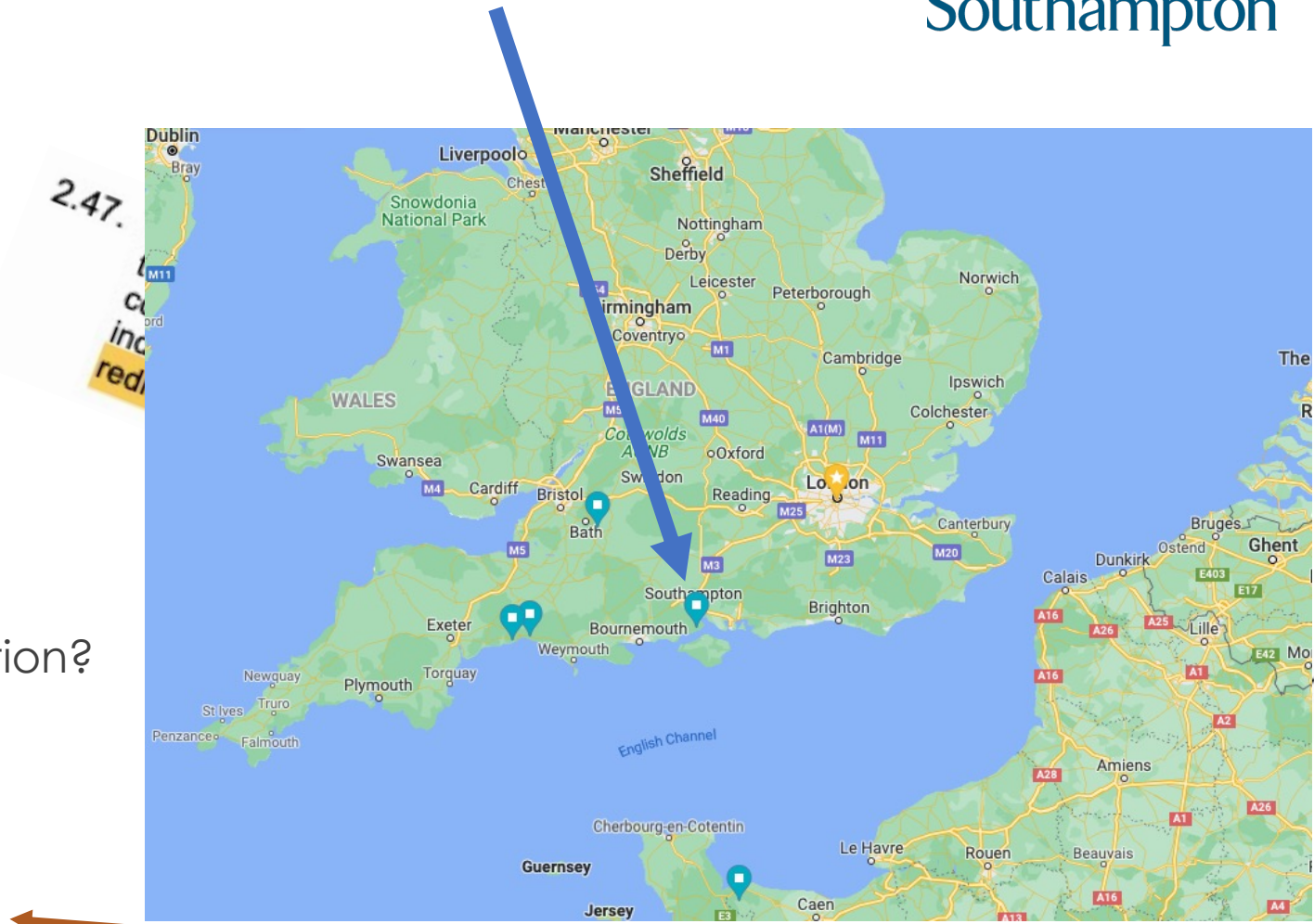
Case study: Energy efficiency retrofits for Southampton?
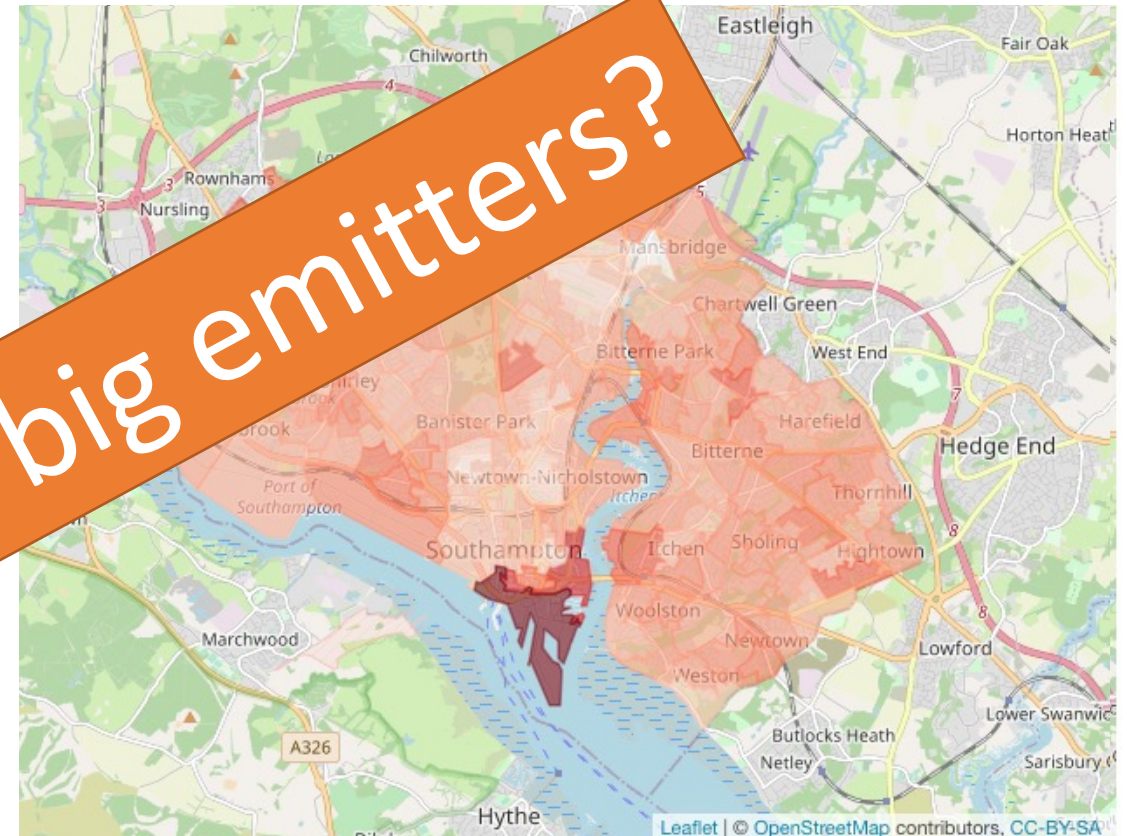
Data sources

- Southampton **residential** emissions:
  - <u>All consumption-based</u> emissions
    - Energy use, purchase of goods & services, diet, all transport, flights etc
  - <u>Gas</u> emissions
    - gas carbon intensity * kWh
  - <u>Electricity</u> emissions
    - grid carbon intensity * kWh
  - <u>Energy</u> emissions
    - Gas + electricity
- Source:
  - Centre for Energy Demand Solutions (CREDS) place-based emissions calculator
  - At Census LSOA level
    - ~ 1,500 households in each

- Dwellings
  - Estimated counts of dwellings by Energy Performance Certificate (EPC) band

  - from EPC A-E = ~**£13,300**
  - from EPC F&G = ~**£26,800**
  - to 'an appropriate standard'

- Estimates of energy efficiency upgrade costs by EPC band
- Sources:
  - CREDS place-based emissions tool
  - English Housing Survey Energy report
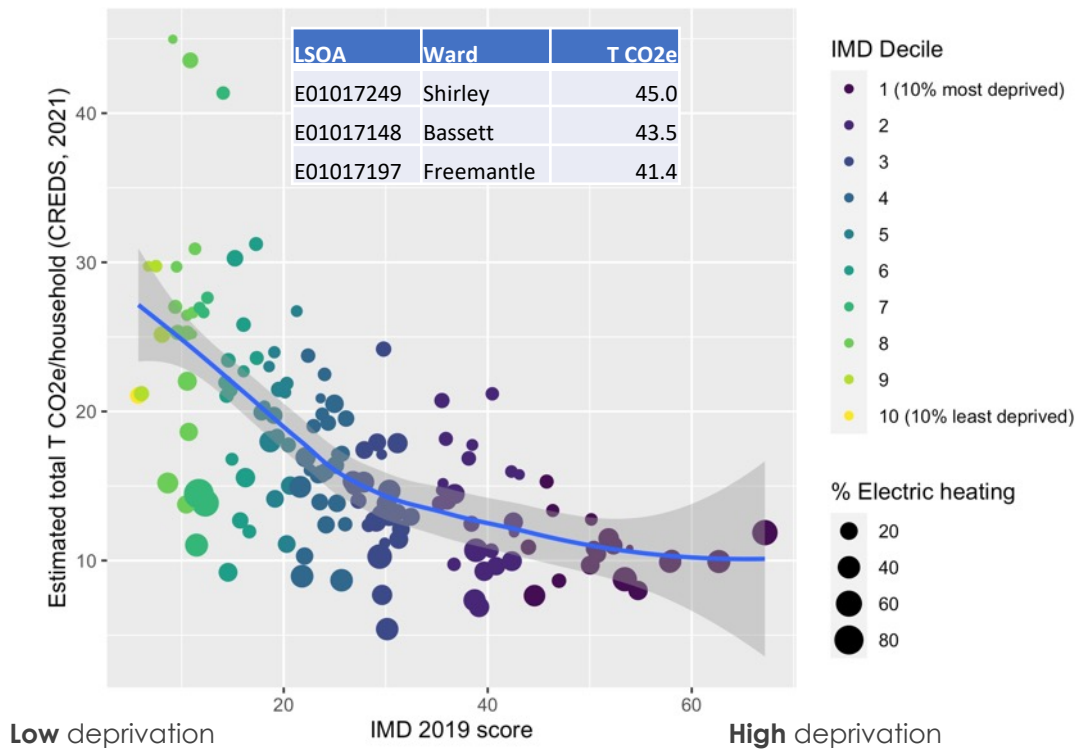
What's the (local) problem?

- Southampton **residential** <u>consumption-based</u> emissions
  - Mean: ~**17.1** T CO2e/dwelling (range: 5 – 45 T)
- Southampton **residential** <u>gas</u> emissions
  - Mean: ~**1.8** T CO2e/dwelling
- Southampton **residential** <u>elec</u> emissions
  - Mean: ~**1.0** T CO2

So who are the big emitters?
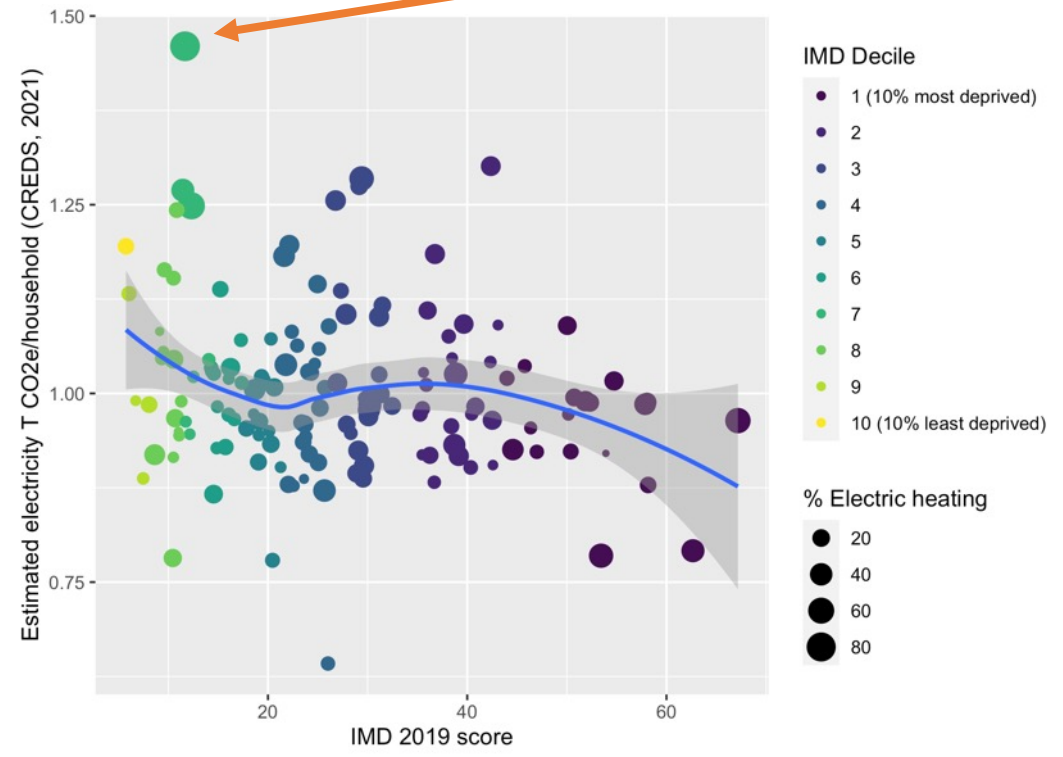
Data source: **All Southampton LSOAs (~1,500 households each**), CREDS place-based emissions tool (https://carbon.place), BEIS electricity meter counts

Who are the big emitters?

Do emissions correlate with deprivation?

LSOA	Ward	T CO2e
E01017249	Shirley	45.0
E01017148	Bassett	43.5
E01017197	Freemantle	41.4

All emissions per household
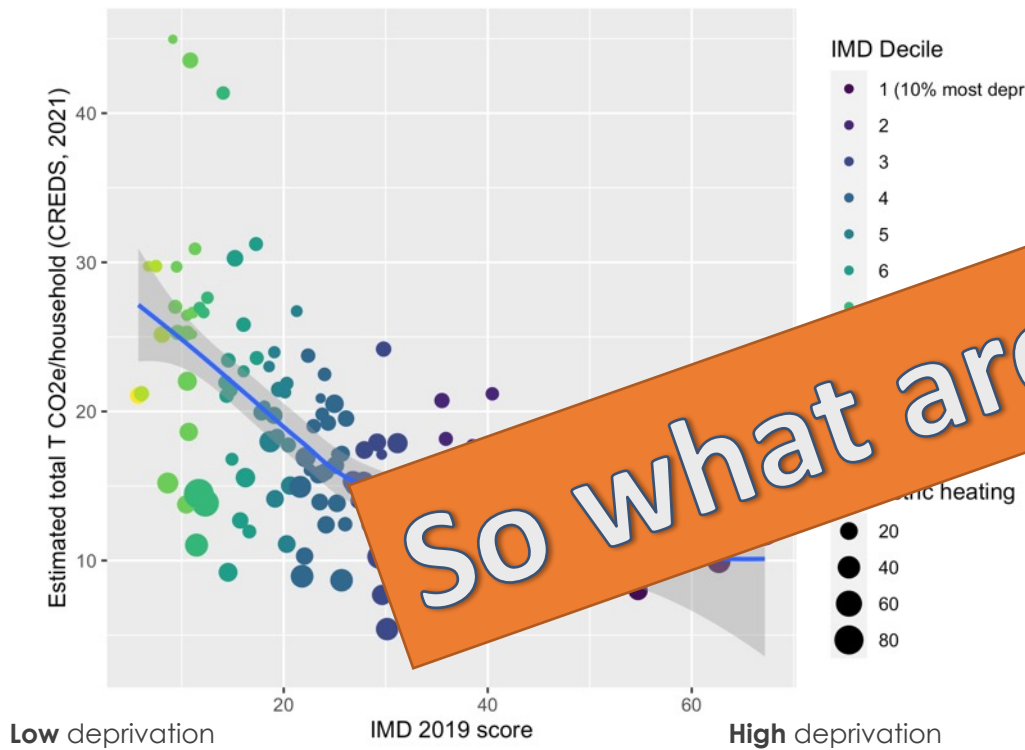Correlation: -0.63 (95% CI: -0.72 - -0.53)

Emissions per household due to **electricity** use
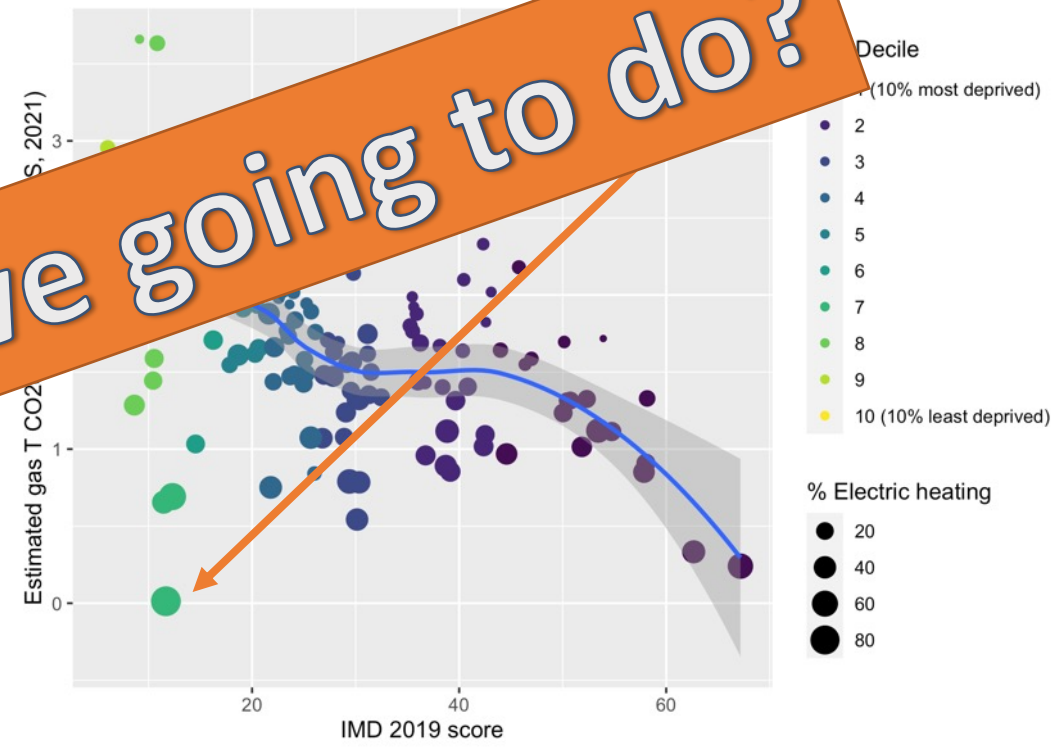Correlation: -0.18 (95% CI: -0.33 - -0.02)

Data source: **All Southampton LSOAs (~1,500 households each**), CREDS place-based emissions tool (https://carbon.place)
BEIS electricity meter counts, 2019 Index of Multiple Deprivation (IMD)

Who are the big emitters?

University of Southampton

Do emissions correlate with deprivation?

So what are we going to do?

All emissions per household
Correlation: -0.63 (95% CI: -0.72 - -0.53)

Emissions per household due to **gas** use
Correlation: -0.54 (95% CI: -0.65 - -0.41)

Data source: **All Southampton LSOAs (~1,500 households each**), CREDS place-based emissions tool (https://carbon.place)
BEIS electricity meter counts, 2019 Index of Multiple Deprivation (IMD)

6

Emissions Levy: What if?

- Case studies:
  - Annual emissions levy
  - [Half-hourly (real time) levy]
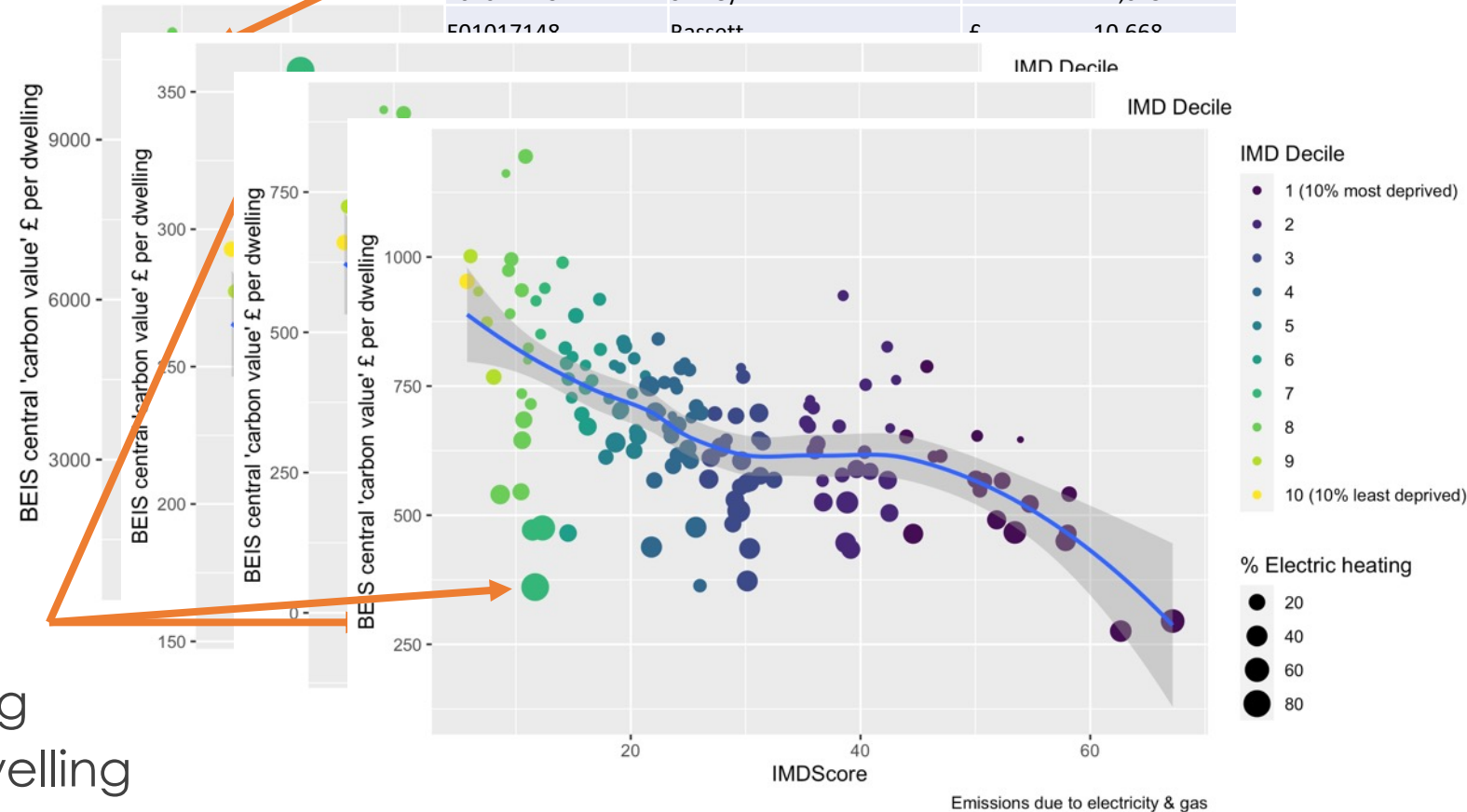
- EU carbon 'price'
  - September 2021: €60 (£51)

- BEIS Carbon 'Value'
  - based on a Marginal Abatement Cost (MAC)
  - 2021:
    - Low: £122/T
    - **Central: £245/T**
    - High: £367/T

Who pays what?

Is it 'enough'?

Could it be circular?
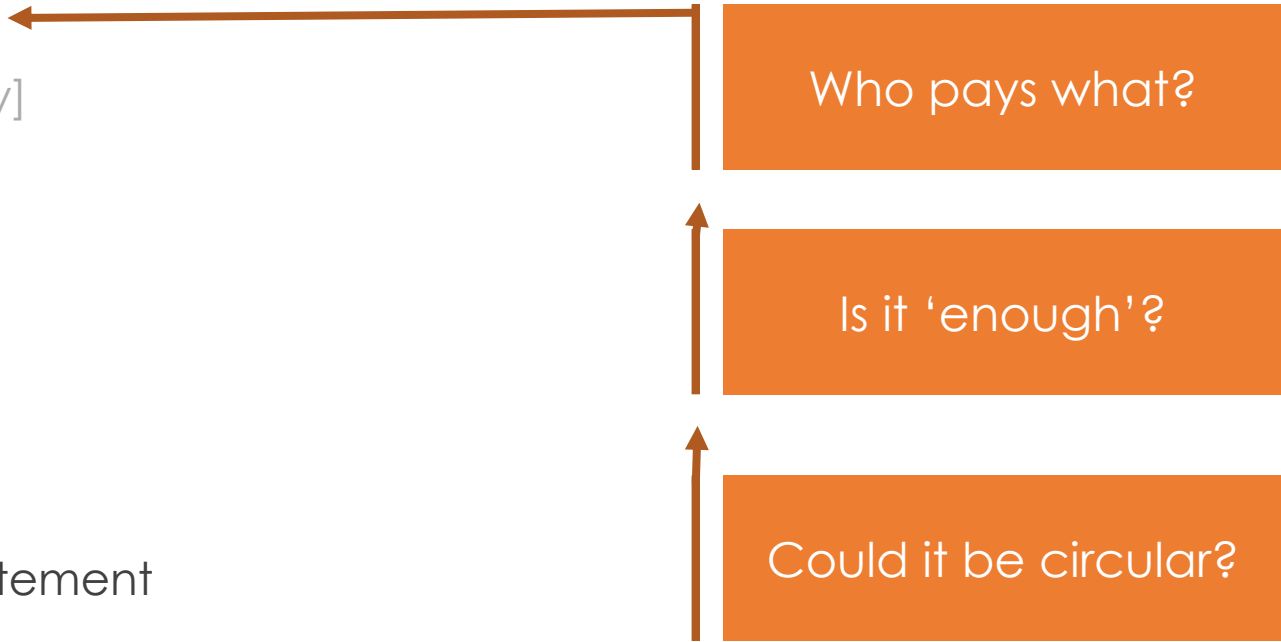
Annual: Who pays what?

- *No personal allowance*

- Carbon:
  - Low: £122/T
  - **Central**: **£245/T**
  - High: £367/T

- Scenarios:
  - **All** emissions: ~£3.7k/dwelling
  - **Electricity** emissions: ~£241/dwelling
  - **Gas** emissions: ~£422/dwelling
  - '*Energy*' emissions: ~£672/dwelling

LSOA	Ward	£ per dwelling
E01017249	Shirley	£ 11,015
E01017148	Bassett	£ 10,668

Emissions due to electricity & gas

Data source: **All Southampton LSOAs (~1,500 households each**), CREDS place-based emissions tool (https://carbon.place)
2019 Index of Multiple Deprivation (IMD). English Housing Survey, own calculations

8

Southampton: Annual levy total

- Y1 Total (**Central**: £245/T)
  - All emissions: £435,336,506
  - Gas: £44,778,840
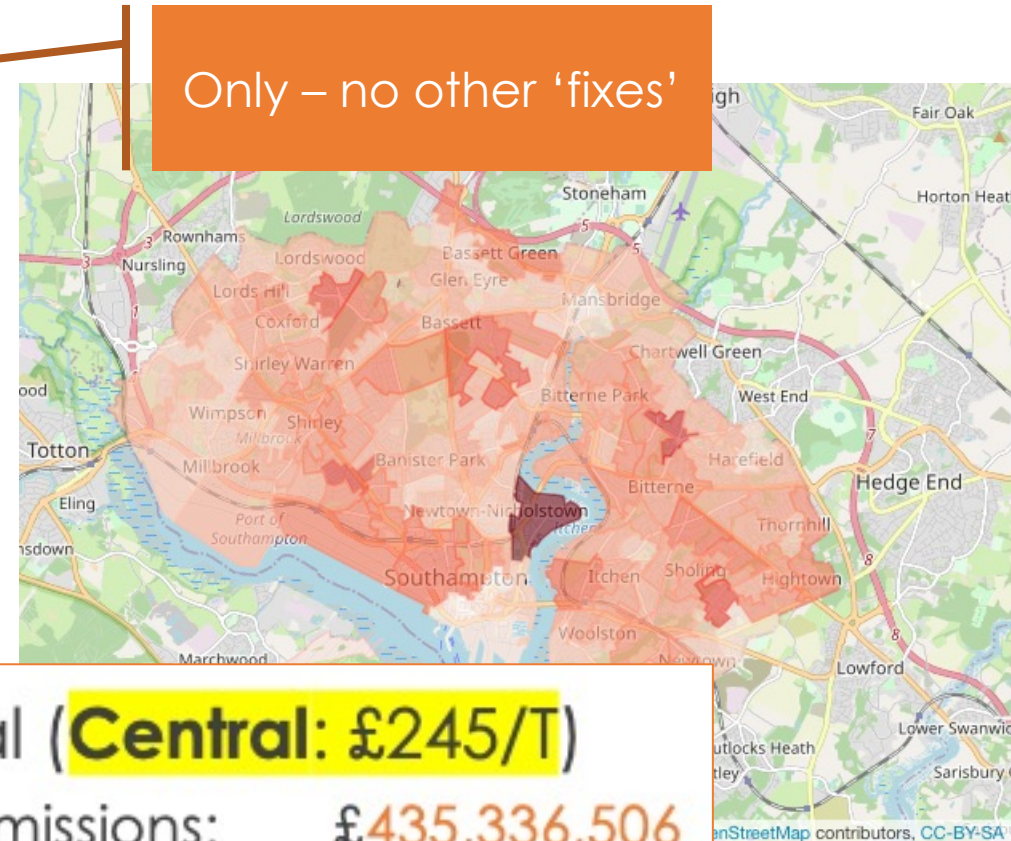 - Electricity: £26,660,724

What could this fund?
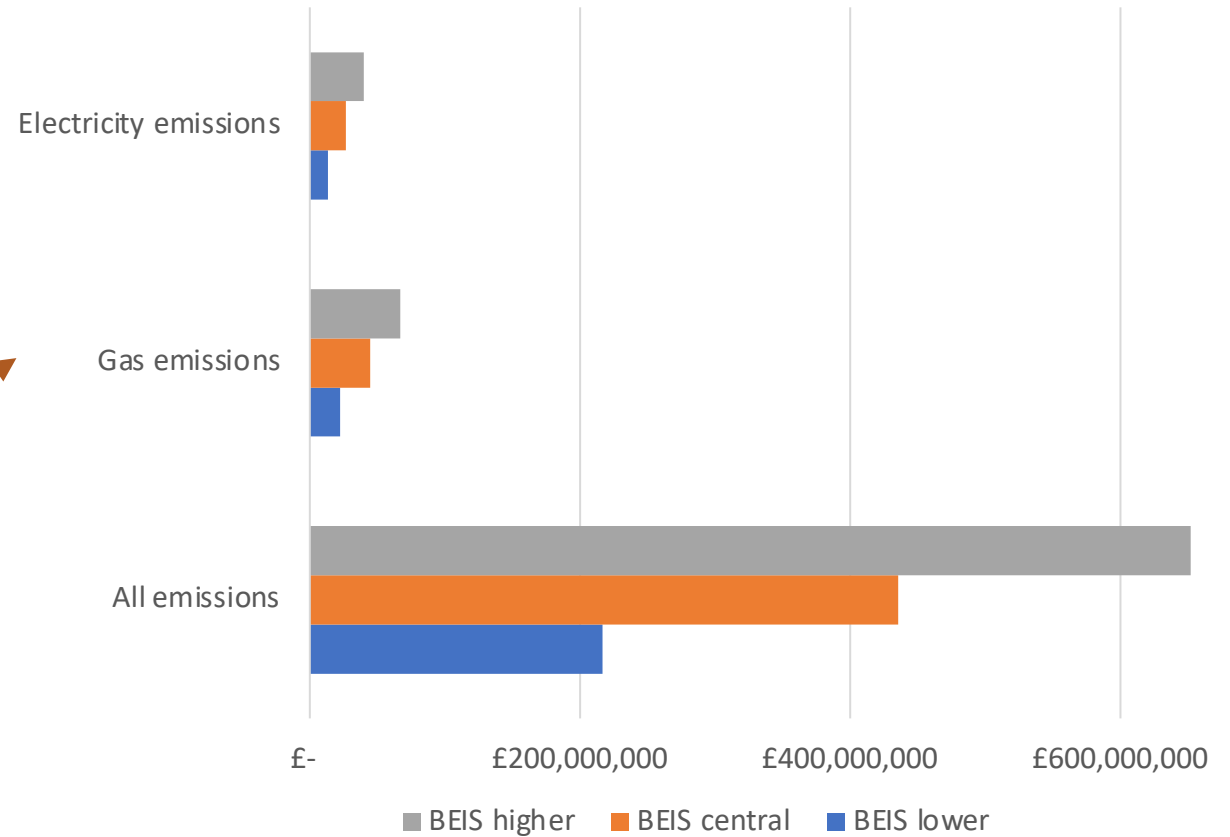
Southampton: cost to 'fix'?

- Energy efficiency upgrades:
  - from EPC A-E = ~£**13,300**
  - from EPC F&G = ~£**26,800**
  - to '*an appropriate standard*'

- Southampton:
  - from D-E: £762,913,993 (57,400)
  - from F-G: £146,809,448 (5,500)
  - In total: £**909,723,441**
 - Or a mean of
    - £14,417 per D-G dwelling

Only – no other 'fixes'

Is the levy 'enough'??

- Y1 Total (**Central: £245/T**)
  - All emissions: £435,336,506
  - Gas: £44,778,840
  - Electricity: £26,660,724

Years to pay back: if LSOAs re-invest

All emissions levy

Energy emissions levy

Because emissions are so high

Because emissions are so low

Clearly: We need to redistribute…

Median 21.5 years

IMD Decile
1 (10% most deprived)
2
3
4
5
6
7
8
9
10 (10% least deprived)
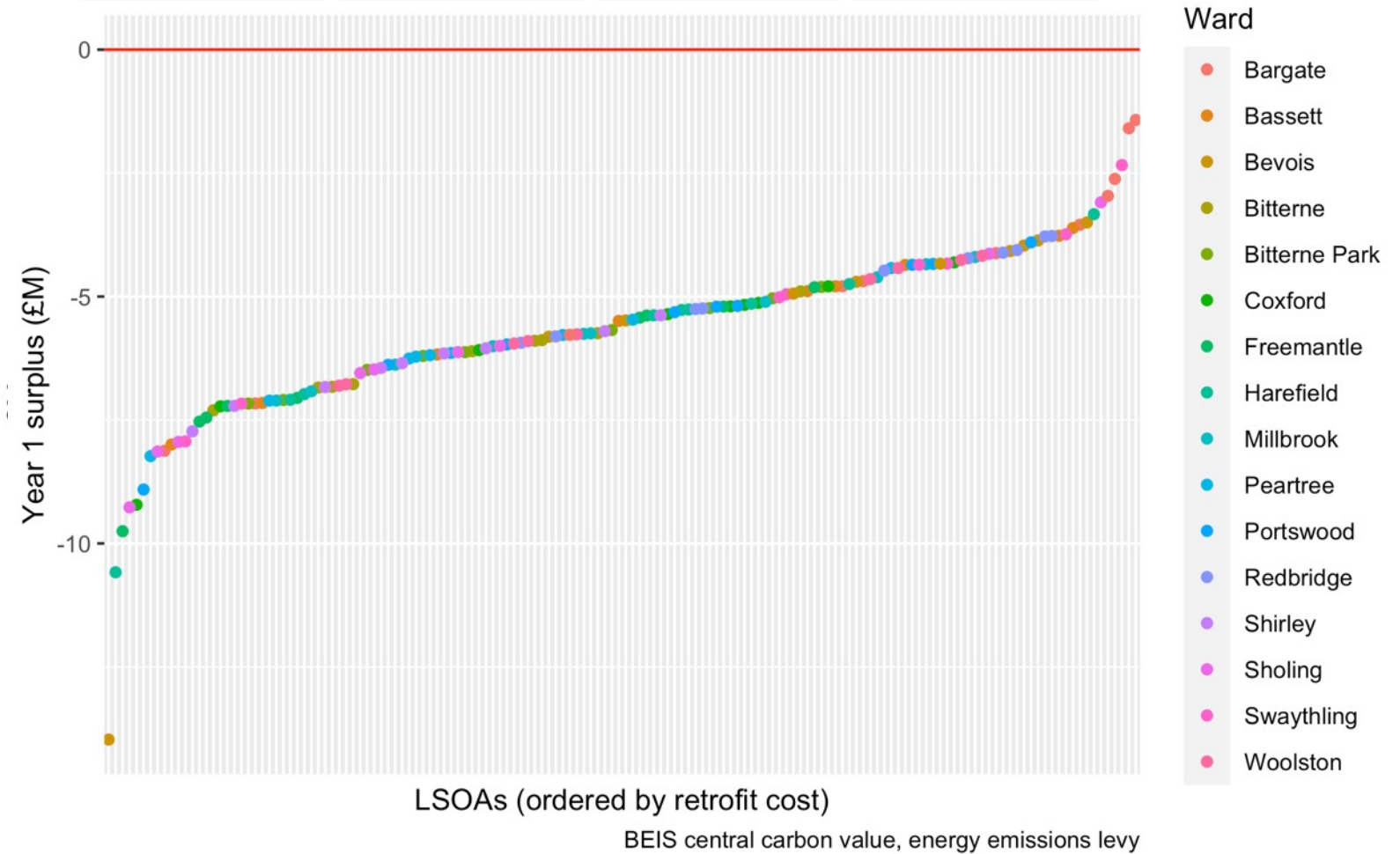
% Electric heating
20
40
60
80

11

Year 1: All emissions levy

- Equal share of levy
  - 3 in surplus
  - Transfer £?
- What happens in Year 2?
  - Depends on rate of retrofits and emissions impacts

BEIS central carbon value, all emissions levy
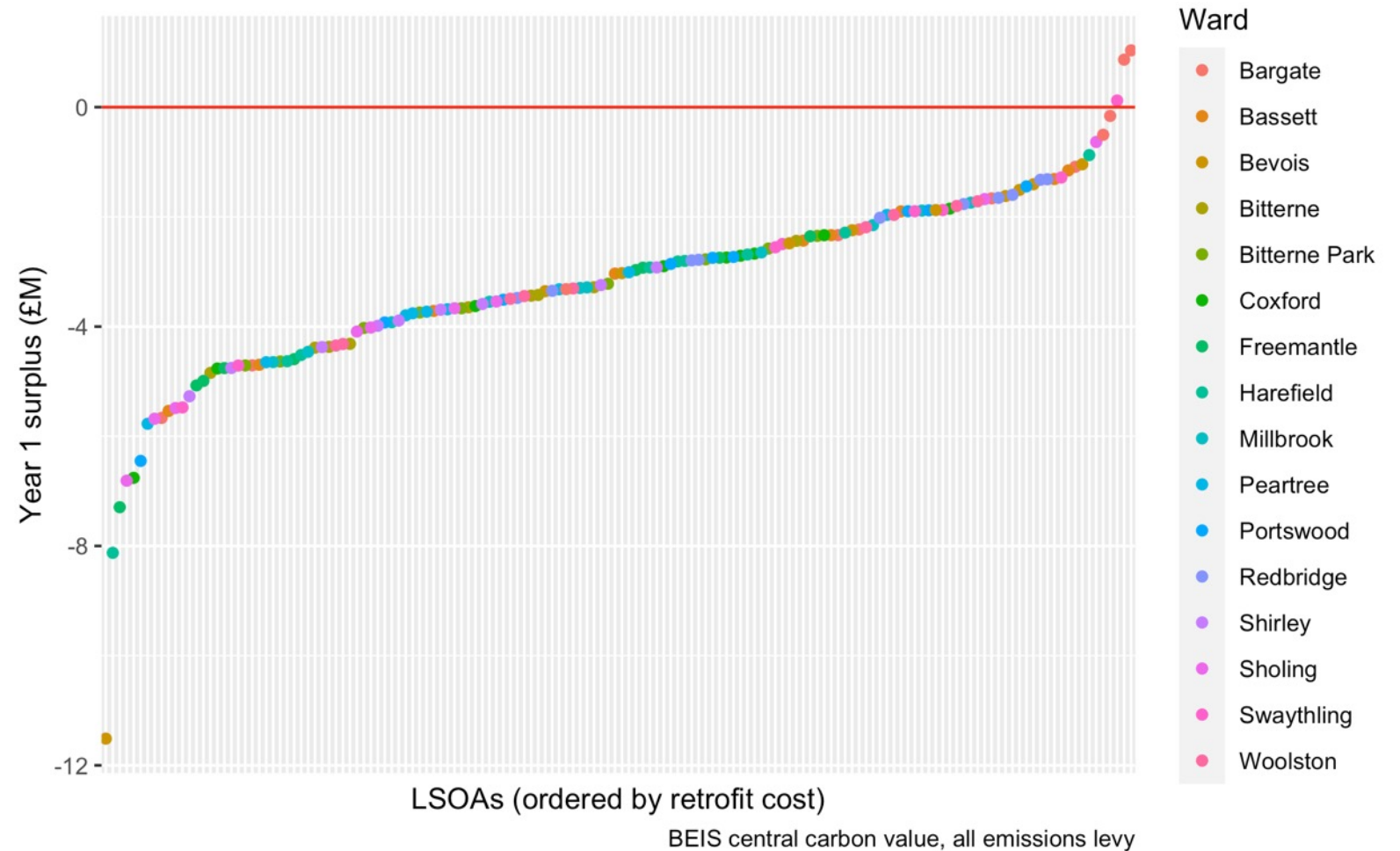
Year 1: Energy emissions levy

- Equal share of levy
  - 0 in surplus

- What happens in Year 2?
  - Depends on rate of retrofits and emissions impacts

Data source: **All Southampton LSOAs (~1,500 households each**), CREDS place-based emissions tool (https://carbon.place) 2019 Index of Multiple Deprivation (IMD). English Housing Survey, own calculations

13

Questions (not answers!)

- What to 'levy'?
  - All emissions?
  - Energy?
  - Energy as a proxy for all emissions?

- Payback?
  - Low carbon value (£122/T) – **½ as fast**
  - Central carbon value (£245/T)
  - High carbon value (£367/T) – **1.5* as fast**

- Progressive?
  - High polluters pay proportionately more?

- (Some of) the problems?
  - High emitters reducing quickly – less ££
  - Tenants vs landlords vs owner-occupiers
  - *Nearly zero* emissions 'Green' tariffs?
  - EPC data out of date?
  - (**Area-based analysis – dwelling level distributional effects unknown**)

Faster payback but how to measure?

Slower payback but easier to measure?

Correlates with all emissions (for now)

But what to do about carbon intensity trends?

Questions?

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