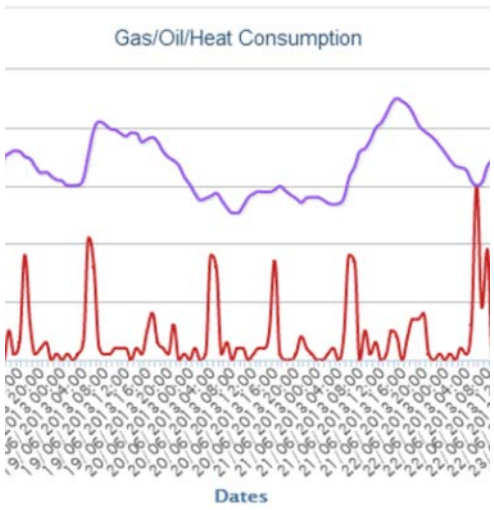
Mapping low carbon communities

Understanding the energy and carbon performance in your community and household



EVALOC carbon mapping, Kirklees Council

16 July 2014

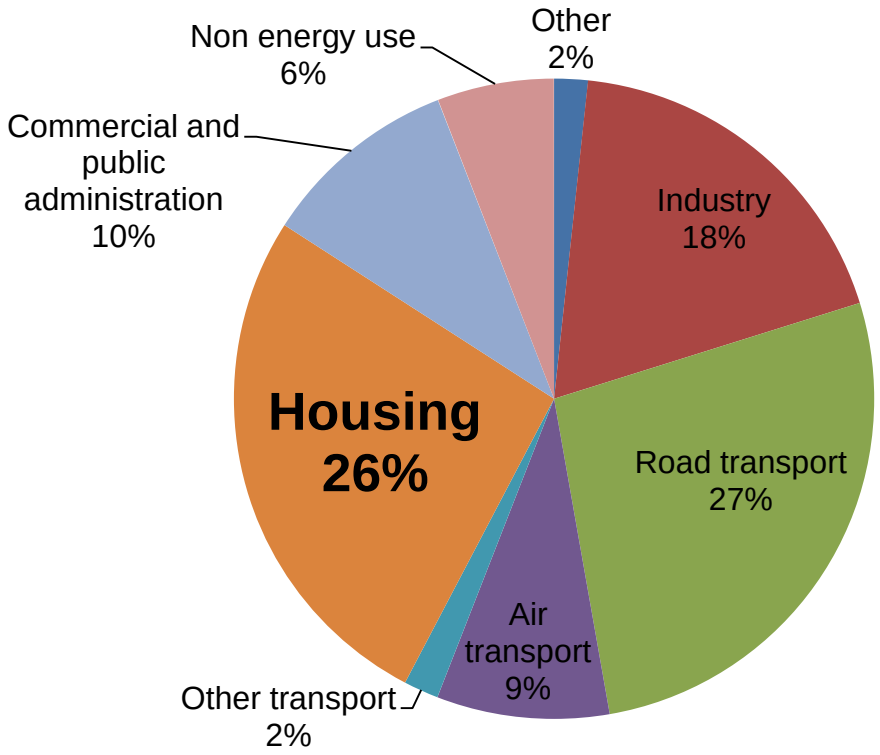
Professor Rajat Gupta, Laura Barnfield and **Matt Gregg**
OISD Low Carbon Building Group, Oxford Brookes University, UK
rgupta@brookes.ac.uk

What is the context?

"It will be impossible to meet the 2050 objective without changing emissions from homes"
(UK Housing Energy Fact File, DECC 2012)

- Climate Change Act 2008: UK committed to an **80% reduction** in carbon emissions by 2050 (from 1990 levels)
- Household energy use accounts for **26%** of the total UK final consumption
- In 2050, **majority** of **existing homes** will still be occupied

Total UK energy consumption 2011
(UK housing energy fact file, 2012)



How do we change carbon emissions from homes?

- **Building fabric**: walls, floor, roof and windows
- New heating and electricity **generating technologies**
- Changing **energy behaviours** and practices

What is EVALOC?

- Three year research project to **Evaluate six selected low carbon communities** funded under the DECC's **Low Carbon Communities Challenge** (LCCC)

- In terms of their:
  - **IMPACTS** (on changing individual and community energy behaviours)
  - **EFFECTIVENESS** (on achieving real-savings in energy use CO_2 emissions)

    DECoRuM carbon mapping
  - **SUCCESS** (in bringing about sustained and systemic change).

EVALOC
EVALUATING LOW CARBON COMMUNITIES

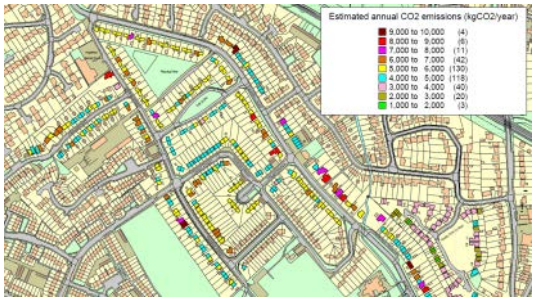
What is carbon mapping?

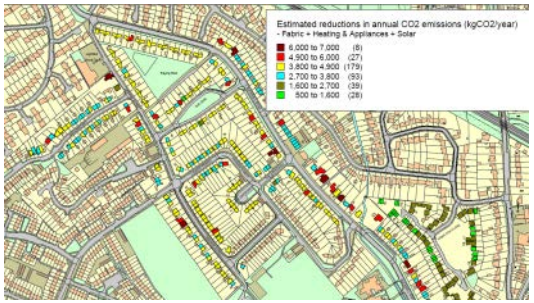
- **Baseline carbon map on a house-by-house level**
  EVALOC: Pre-2010 --> 2012

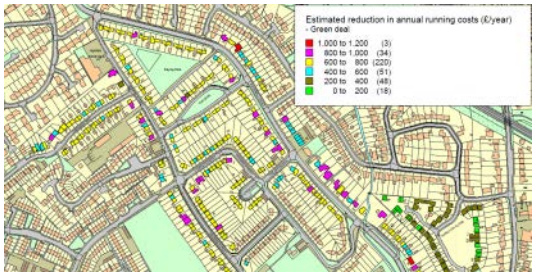
- **Evaluating potential energy and CO_2 reductions:** best practice energy efficiency measures, low carbon systems and renewable energy technologies

- **Assess cost-effectiveness:** Identify the most cost-effective measures for reducing CO_2 emissions

- **Visualisation and communication:** Visualise and communicate the anticipated energy and CO_2 savings through DECoRuM to residents.

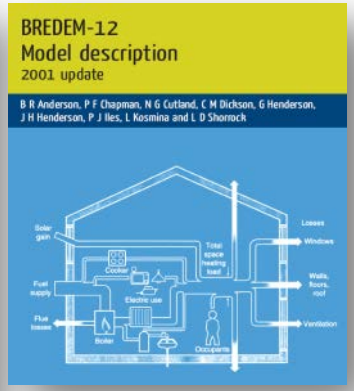






Where does DECoRuM get its input data?

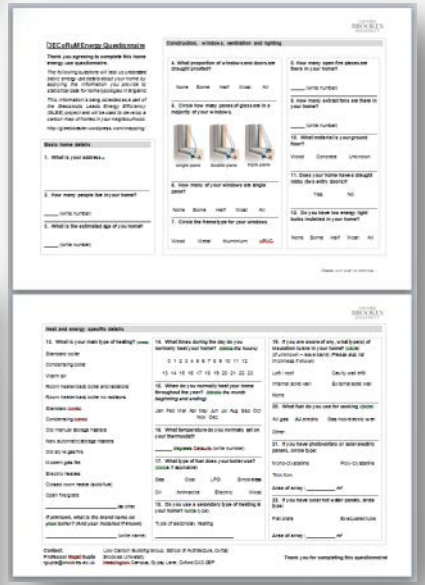
DECoRuM gathers data from a wide array of sources to develop a robust estimation of energy use and resultant CO_2 emissions at a local scale.

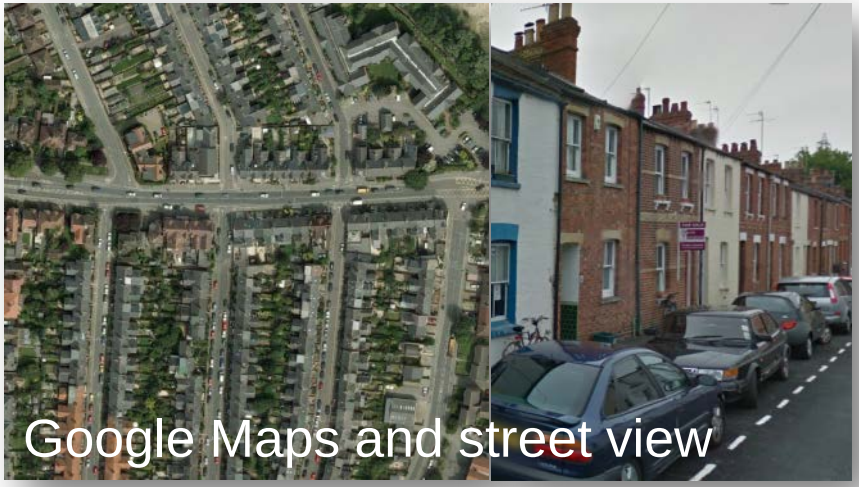


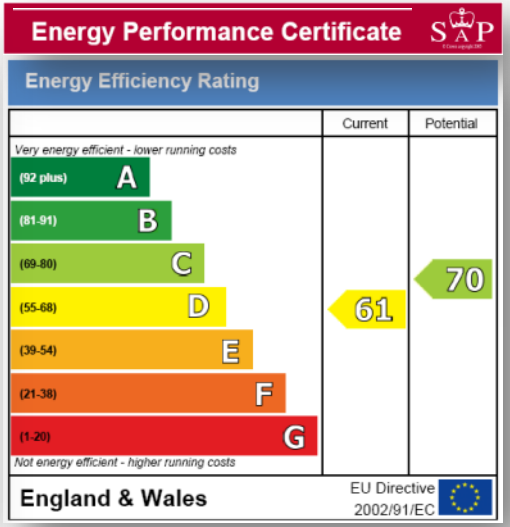
Communities and Local Government

English House Condition Survey

Energy questionnaires



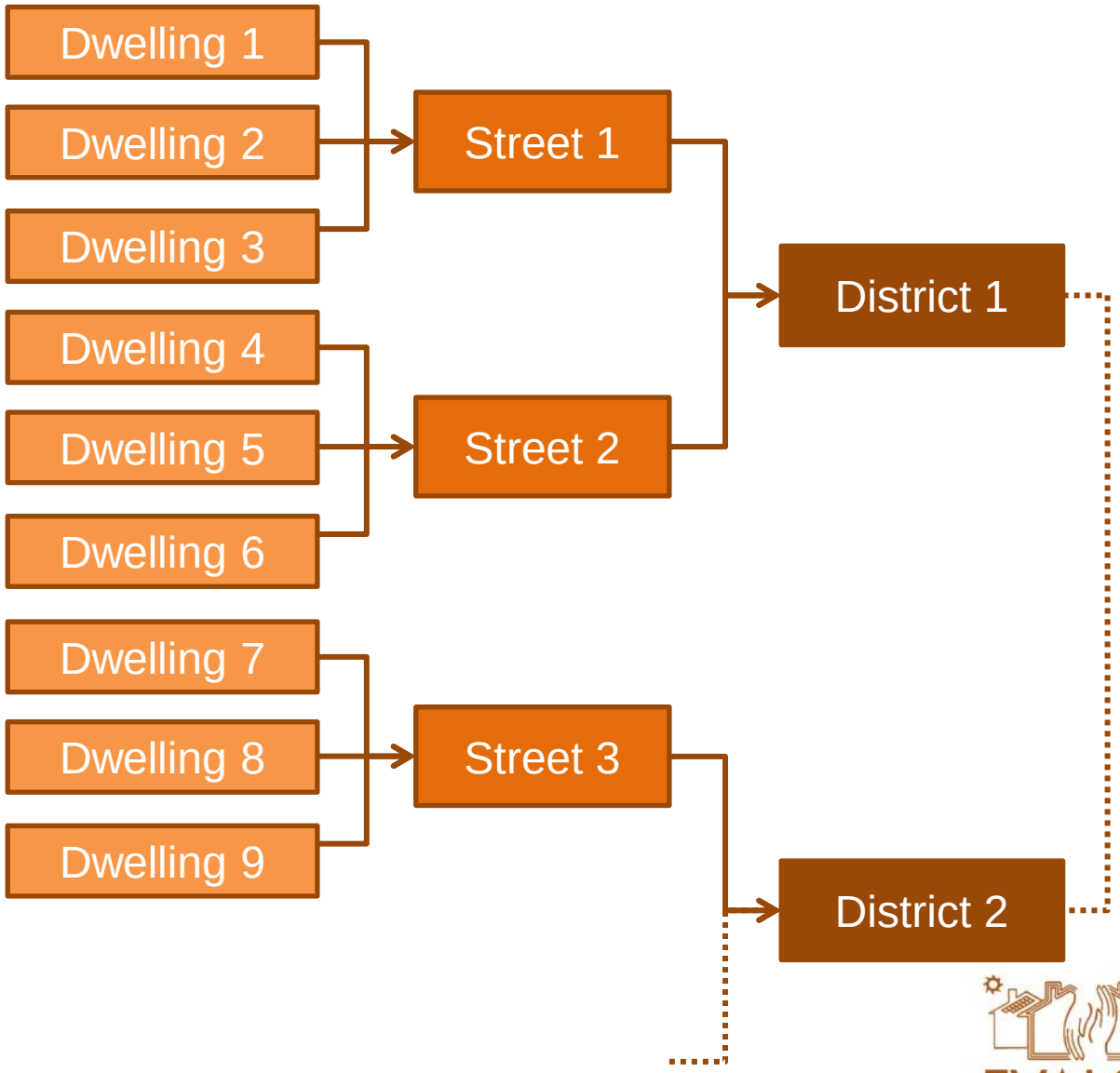




EVALOC
EVALUATING LOW CARBON COMMUNITIES

How is it done?

DECoRuM baseline energy model **estimates energy consumption** and **CO_2 emissions of individual dwellings** as the basic component for calculation, and then aggregates these to an **urban scale**.



EVALOC
EVALUATING LOW CARBON COMMUNITIES

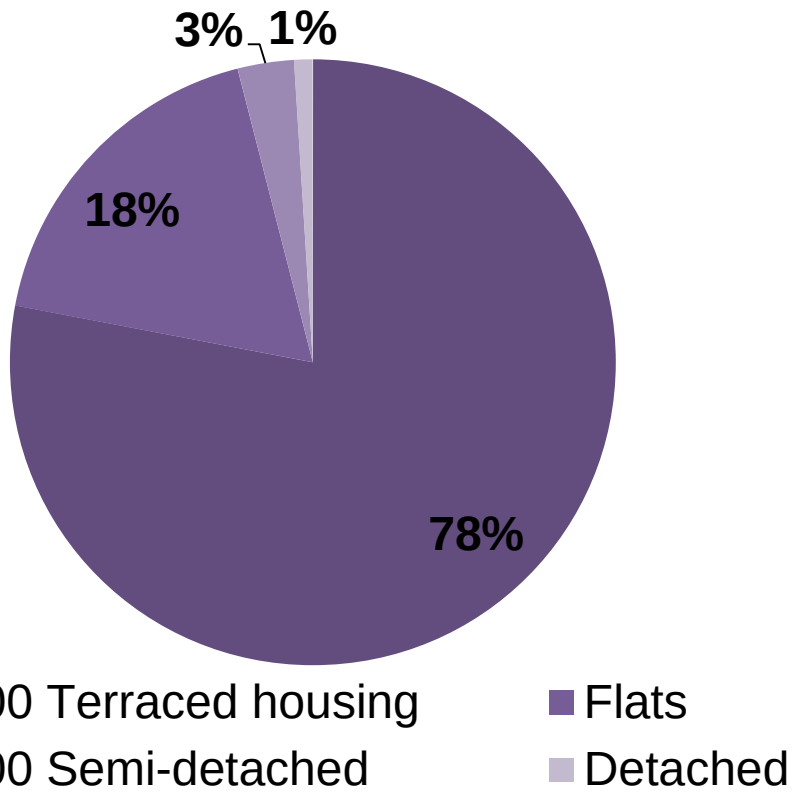
Carbon mapping Hillhouse

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Context: Hillhouse

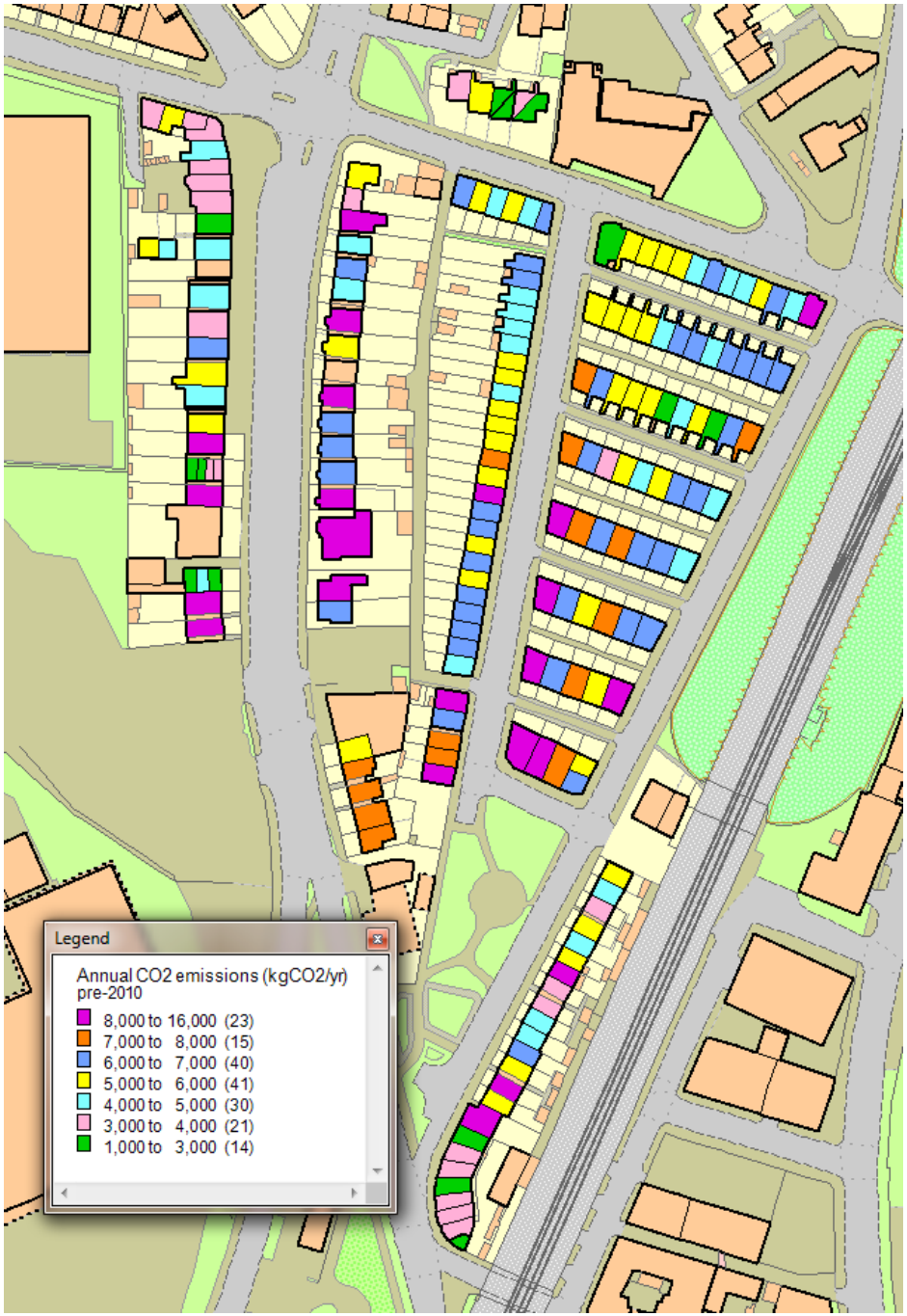
- **Hillhouse mapped area:**
  184 dwellings

- Dominant build form:
  Pre-1900 terraced housing



EVALOC
EVALUATING LOW CARBON COMMUNITIES

Findings: Pre 2010

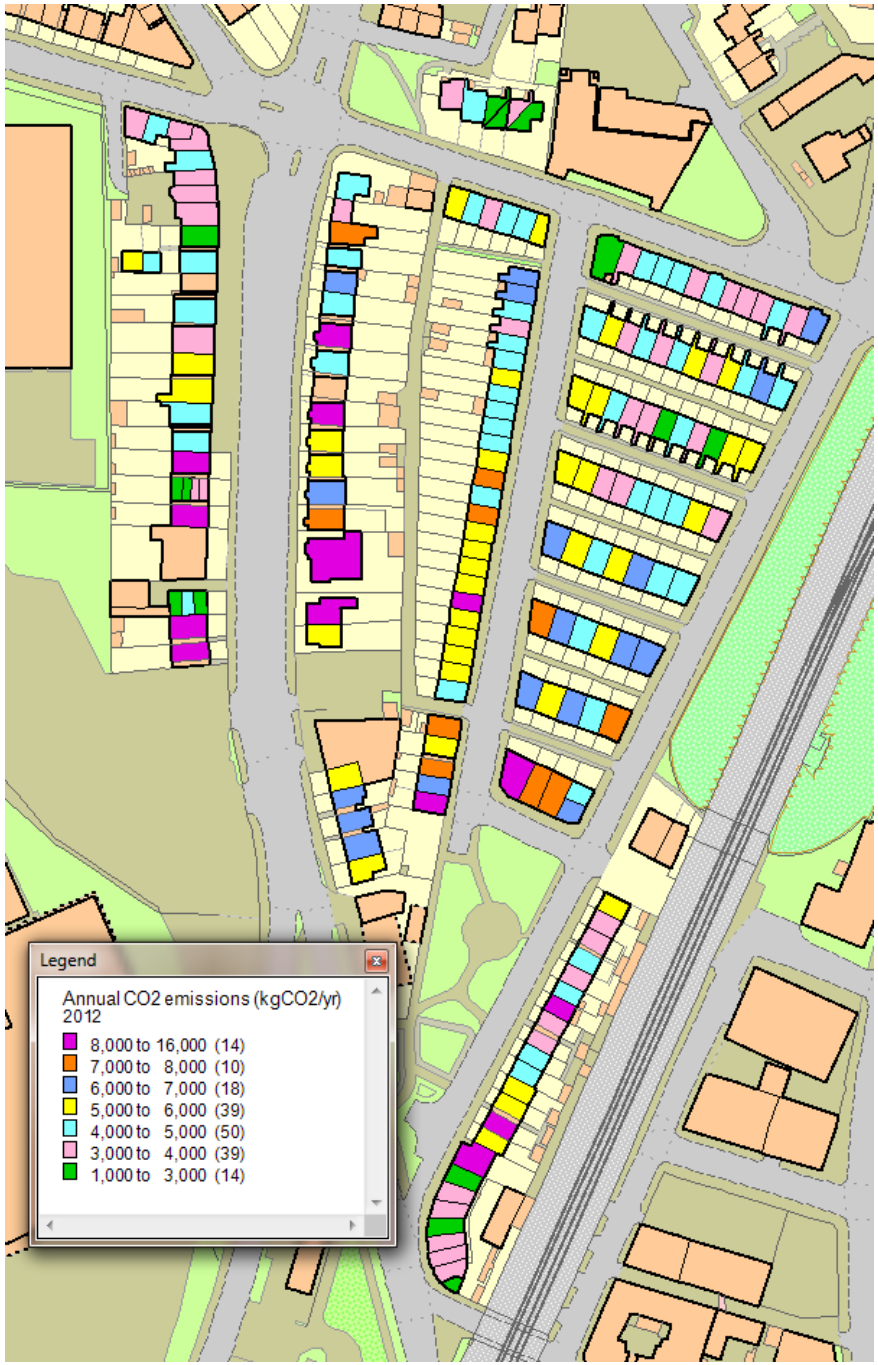


Average annual CO_2 emissions for ***mapped area***: **5,624 $kgCO_2/yr$**

Average annual energy costs for ***mapped area***: **£1,341**

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Findings: 2012



Average annual CO_2 emissions for ***mapped area***: **4,870 $kgCO_2/yr$**

13% reduction

How?

Photovoltaic systems
Loft insulation
Double glazing
Knowledge

Average annual energy costs for ***mapped area***: **£1,170**

EVALOC
EVALUATING LOW CARBON COMMUNITIES

What can be done in your home to save energy?

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Fabric improvement

184 homes could install **external wall insulation** for an average **16% reduction** in CO_2 emissions

82 homes could install or top-up **loft insulation** for an average **2% reduction** in CO_2 emissions

184 homes could install **internal wall insulation** for an average **16% reduction** in CO_2 emissions

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Number of homes approximate

Fabric improvement

148 homes could install **ground floor insulation** for an average **11% reduction** in CO_2 emissions

182 homes could **draught proof** windows, doors, loft hatch and chimneys for an average **2.5% reduction** in CO_2 emissions

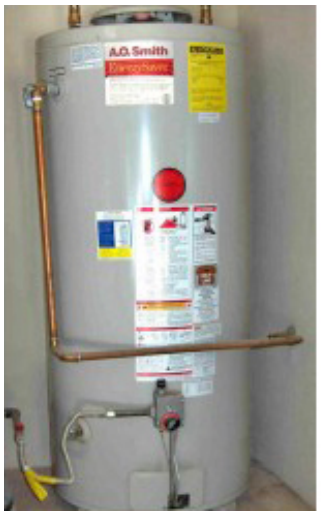
37 homes could install **double glazing** for an average **7% reduction** in CO_2 emissions

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Number of homes approximate

Upgrade heating system

153 homes could install a **condensing boiler** or replace existing boiler, insulate hot water cylinder and insulate pipework for an average **16% reduction** in CO_2 emissions



Number of homes approximate

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Energy efficient lighting and turn down thermostat

Individual measures:
Energy efficient lighting
Turn down thermostat

132 homes could install **100% energy efficient lighting (LED)** for an average **2% reduction** in CO_2 emissions

Turning down your thermostat from **21º to 19º** could provide a **10% reduction** in CO_2 emissions

Number of homes approximate

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Solar energy systems

Individual measures: Solar energy systems

98 homes could install **photovoltaic panels** for an average **8% reduction** in CO_2 emissions

167 homes could install **solar hot water system** for an average **9% reduction** in CO_2 emissions

Number of homes approximate

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Adopting a package approach

Fabric improvement Package

- Wall insulation (cavity or solid)
- Loft insulation
- Floor insulation
- Double glazing
- Draught proofing

Fabric and heating upgrade Package

Fabric improvement package +

- New condensing boiler
- Hot water tank insulation
- Pipework insulation
- Heating controls

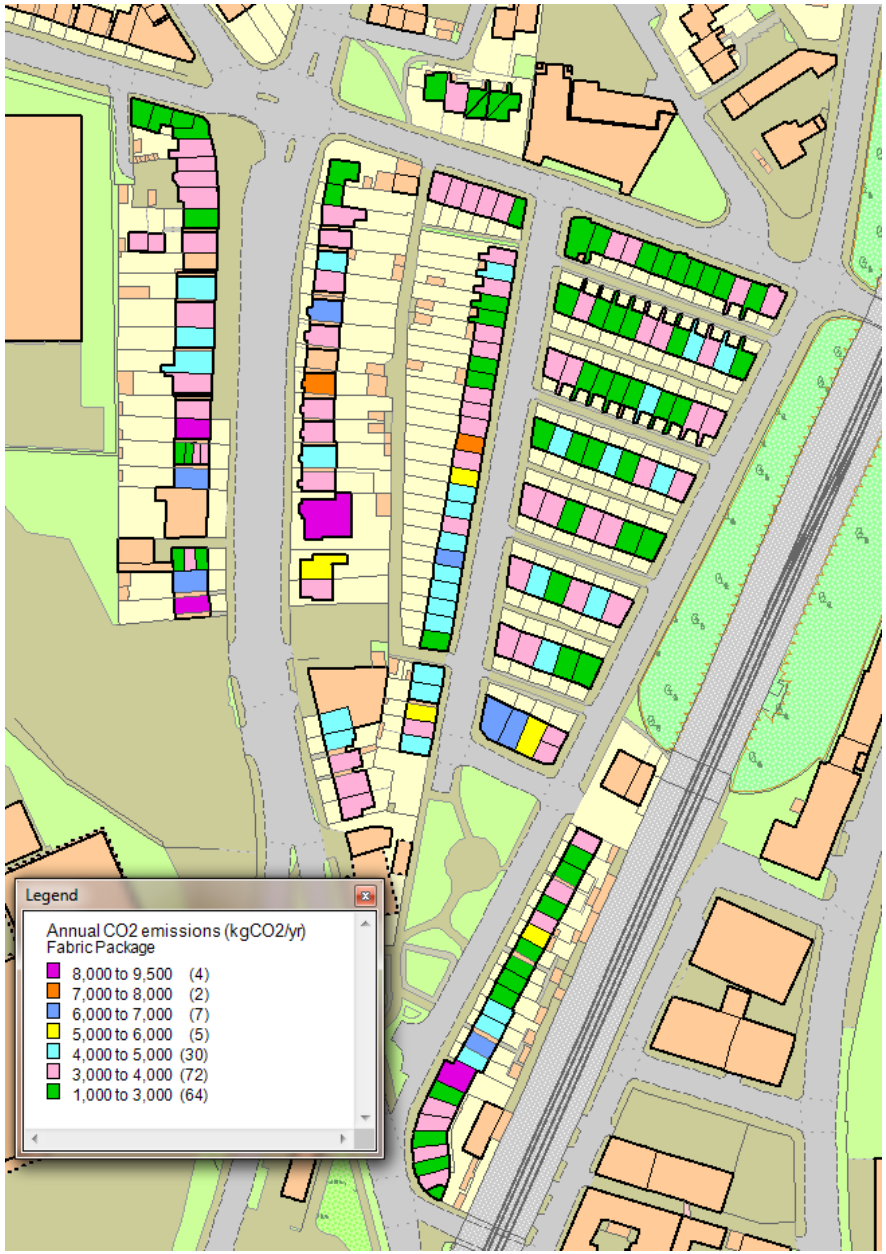
Deep renovation

Fabric and heating upgrade package +

- Photovoltaic solar system
- Solar hot water system

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Fabric improvement package

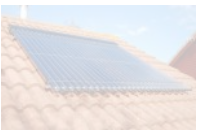


Total reduction in CO_2 emissions after package:

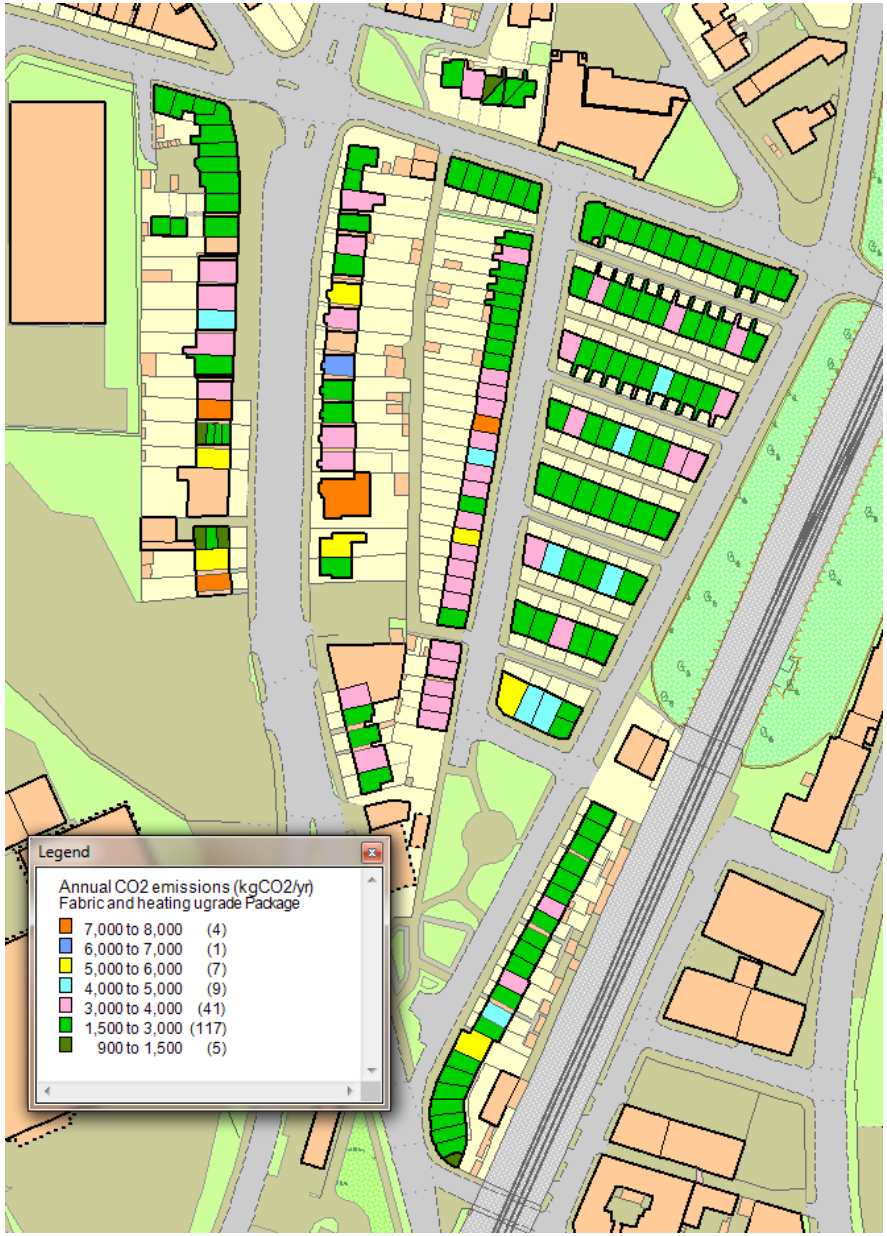
Reduction from 2012 (baseline)

- **29%** for Solid wall homes

Average energy cost reduction: **-£388.25**



Fabric and heating upgrade package

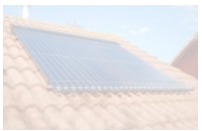


Total reduction in CO_2 emissions after package:

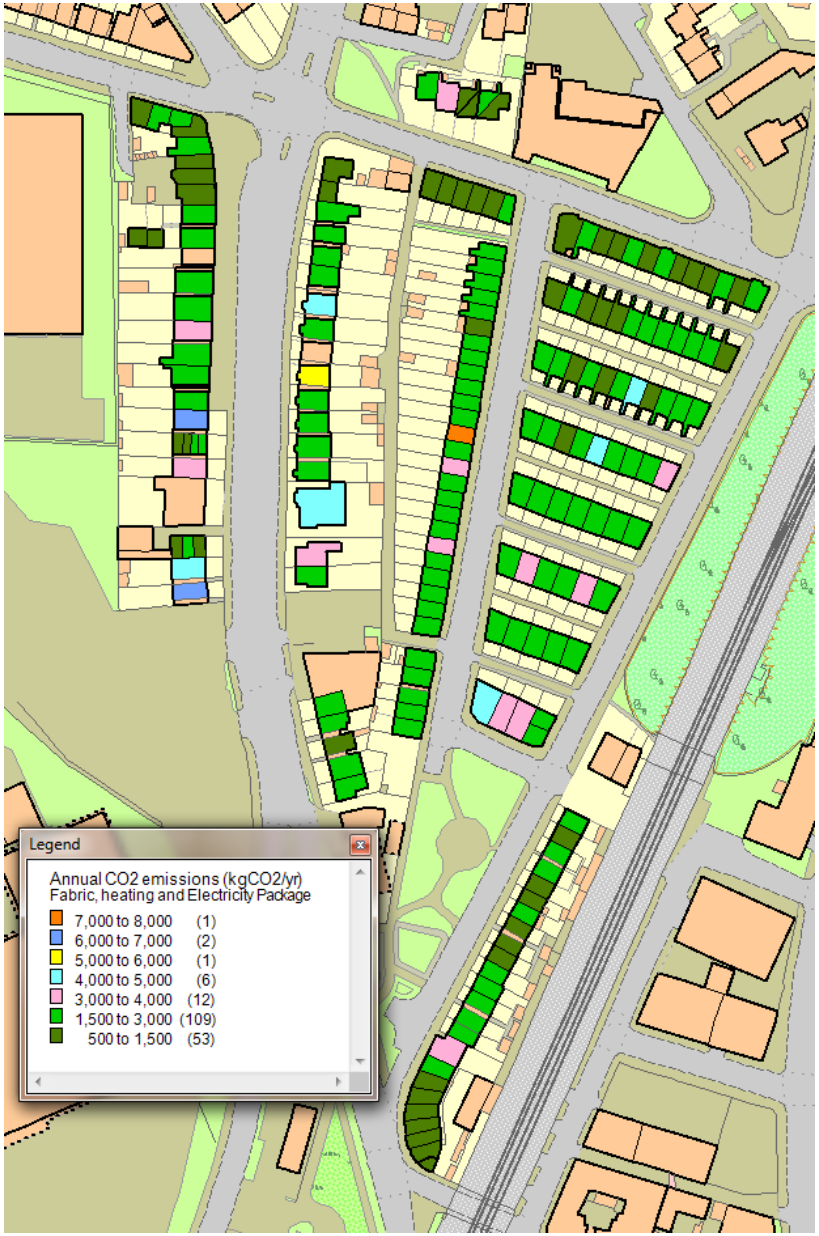
Reduction from 2012 (baseline)

- **44%** for Solid wall homes

Average energy cost reduction: **-£591.09**



Deep renovation



Total reduction in CO_2 emissions after package:

Reduction from 2012 (baseline)

- **59%** for Solid wall homes

Average energy cost reduction: **-£941.01***

**Running cost reductions include FIT and RHI payments for solar systems*

Thermal imaging

EVALOC
EVALUATING LOW CARBON COMMUNITIES

What can thermal imaging show us?

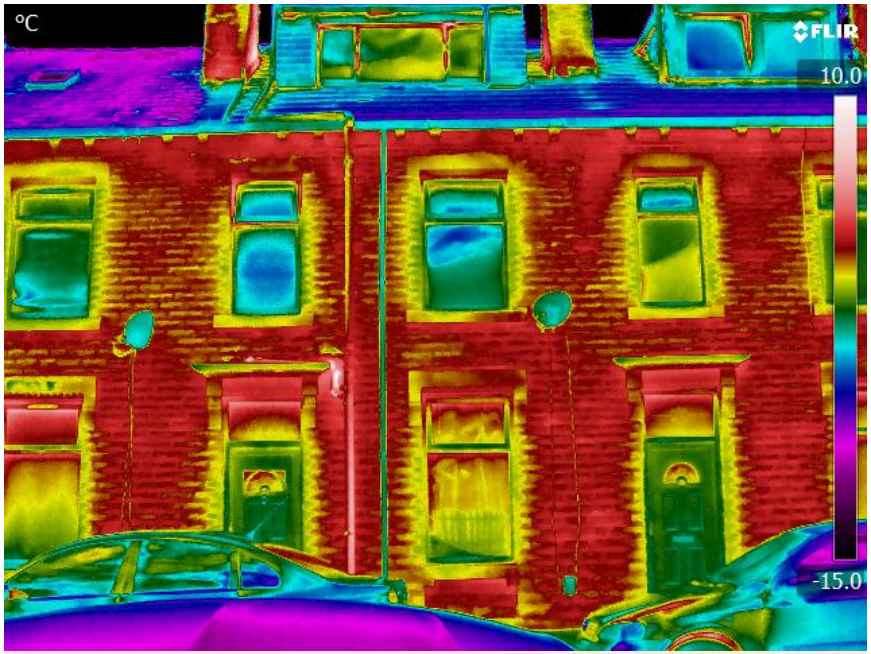
Visualise changes in temperature across an object revealing **potential heat losses from building fabric**.

This helps:

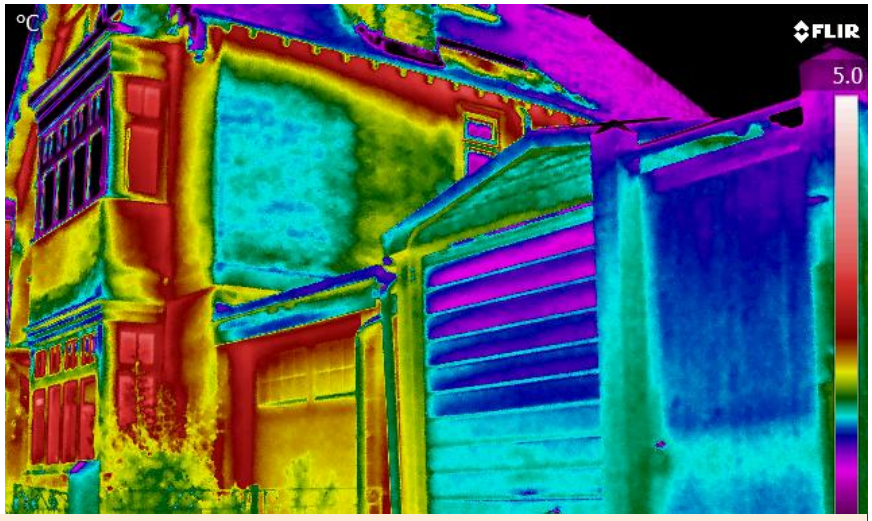
- **Identify** potential areas for energy efficient improvements
- **Evaluate or verify** the completion of fabric improvements
- **Makes energy visible**

EVALOC
EVALUATING LOW CARBON COMMUNITIES

Thermal imaging survey

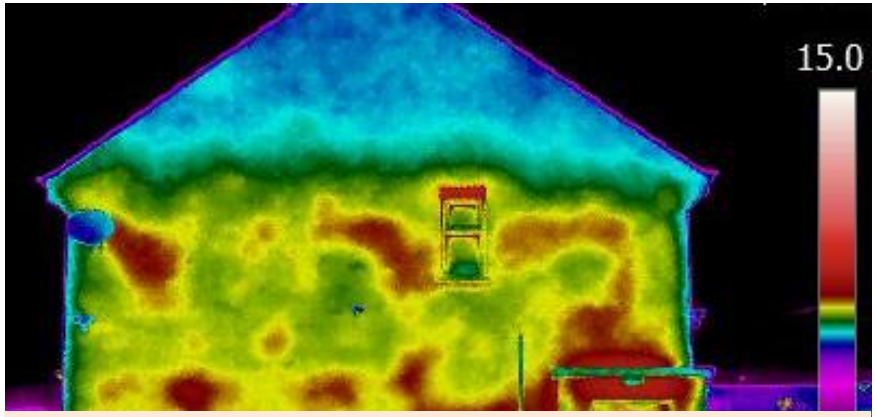


Heat loss in un-insulated solid walls



Improvements offered by solid (and cavity) wall insulation

Personal feedback available:
Please speak to an EVALOC researcher following this event to discuss the thermal imaging survey of your home



Contrast in loft insulation & cavity wall insulation

Final thoughts

Carbon mapping

- Makes energy use visible for homeowner in a useful way -influencing energy literacy
- Assists in prioritising action and change to home or community
- Helps communities understand local housing stock and local impact
- Potential to increase take-up of reduction measures
- Comparison of current and future performance potential

Thermal imaging

- Helps substantiate findings with carbon maps
- Assists in visual identification of specific areas for improvement

OXFORD BROOKES UNIVERSITY

Research Councils UK Energy For a Low Carbon Future

Thank you!

www.evaloc.org.uk

EVALOC
EVALUATING LOW CARBON COMMUNITIES