

# CLOSING THE DESIGN VS AS-BUILT PERFORMANCE GAP

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Richard Partington  
January 2014

Nearer to  
**zero**

Planning for zero carbon  
homes from 201



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# Introduction to the Zero Carbon Hub

## PURPOSE AND STRATEGIC OBJECTIVES

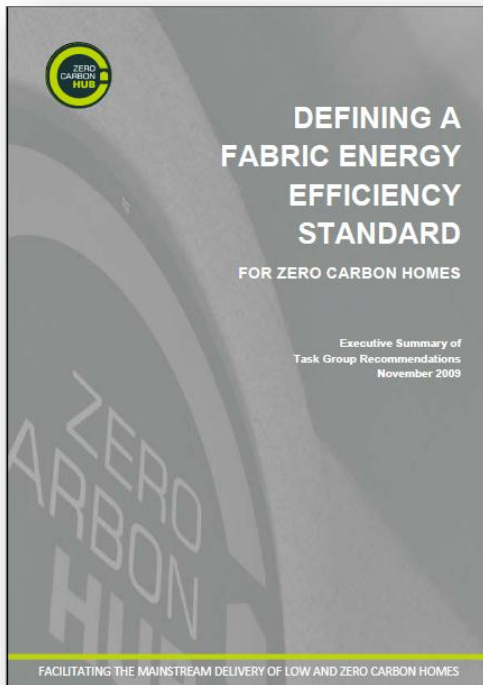
*Supporting the delivery of low and zero carbon homes*

- Providing leadership and creating confidence
- Reducing risk and clearing obstacles
- Disseminating information

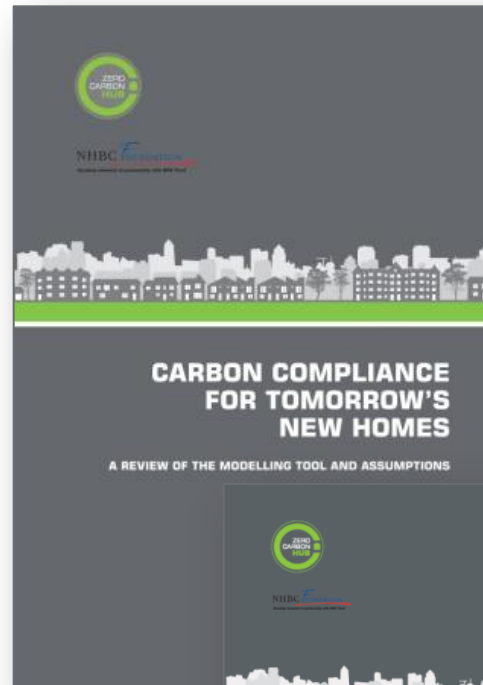
<b>New Homes</b>	<b>New Non-Residential</b>
<b>Existing Homes</b>	<b>Existing Non-Residential</b>

# The Hub's Journey so far .....

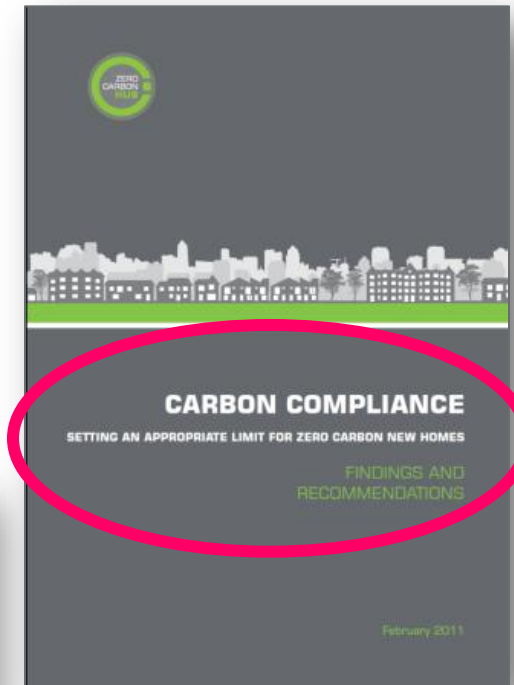
Nov 2009



Aug 2010



Feb 2011



# Background & Evidence

EVALUATING THE IMPACT OF AN ENHANCED ENERGY PERFORMANCE STANDARD ON LOAD-BEARING MASONRY DOMESTIC CONSTRUCTION

Partners in Innovation Project: CI 393/663  
Report Number 8 – Final Report - Executive Summary

Lessons from Stamford Brook  
Bridging the Gap between Designed and Real Performance

Centre for the Built Environment, Leeds Metropolitan University  
Centre for the Built Environment, Leeds Metropolitan University  
Sherraton, Centre for the Built Environment, Leeds Metropolitan University  
School of Health & Human Sciences, Leeds Metropolitan University  
Bartlett School of Graduate Studies, University College London



leeds metropolitan university

## Low carbon housing

### Lessons from Elm Tree Mews

November 2010

Malcolm Bell,  
Jon Wingfield,  
Dominic Miles-Shenton,  
Janey Seavers

This report sets out the findings from a low carbon housing trial at Elm Tree Mews, and discusses the technical and policy issues that...

The Government has set an ambitious target to be zero carbon by 2016. With the appropriate insulation, improved efficiency and renewable energy target is theoretically possible. However, a concern that, in practice, even existing buildings are not being sustained and that this puts the potential to undermine zero carbon. This report seeks to address these concerns through an evaluation of a low carbon development.

The report:

- evaluates the energy/carbon performance of dwellings prior to occupation and...



Final Report:  
In-situ monitoring of efficiencies of condensing boilers and use of secondary heating



Prepared by:

GAS TEC at CRE Ltd  
ACCUM  
EA Technology

Prepared for:

The Energy Saving Trust

Contract Number:

GaC3563

June 2009

## GHA Monitoring Programme 2009-11: Technical Report

Results from Phase 1: Post-construction testing of a sample of highly sustainable new homes



CARBON TRUST  
Micro-CHP Accelerator  
Phase Report - March 2011



## Getting warmer: a field trial of heat pumps

The Energy Saving Trust



## Here comes the sun: a field trial of solar water heating systems

The Energy Saving Trust



ZERO CARBON  
NHBC  
SETTING AN APPROPRIATE LIMIT FOR ZERO CARBON NEW HOMES  
FINDINGS AND RECOMMENDATIONS  
February 2011

ZERO CARBON  
NHBC  
CARBON COMPLIANCE FOR TOMORROW'S NEW HOMES  
MODELLING TOOL AND ASSUMPTIONS  
OVERVIEW OF FINDINGS AND RECOMMENDATIONS  
July 2010

ZERO CARBON  
NHBC  
CARBON COMPLIANCE FOR TOMORROW'S NEW HOMES  
A REVIEW OF THE MODELLING TOOL AND ASSUMPTIONS  
TOPIC 4  
CLOSING THE GAP BETWEEN DESIGNED AND BUILT PERFORMANCE  
August 2010

4 & 09  
JRHT  
Low and zero carbon homes: understanding the performance challenge  
Technology Strategy Board  
Using Innovation  
Building performance evaluation  
COMPETITION FOR FUNDING  
MAY 2010 - 2012  
LOW IMPACT BUILDING INNOVATION PLATFORM  
3RD EDITION



# Evidence assembled for CC4TNH

## Measured v Predicted whole-house fabric performance

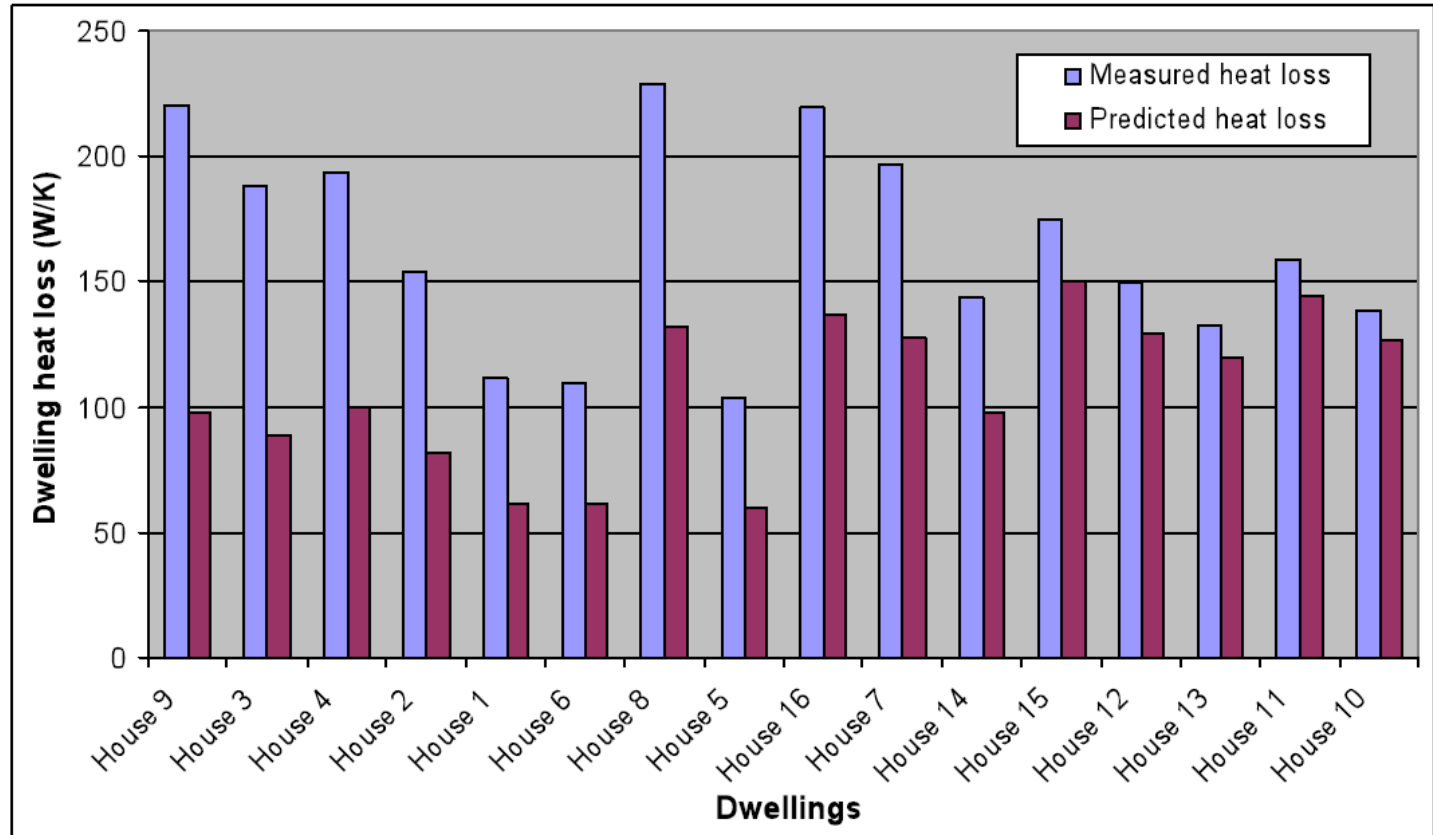


Figure 1 Measured v Predicted whole house heat loss for 16 dwellings<sup>4</sup>

# Closing the performance gap

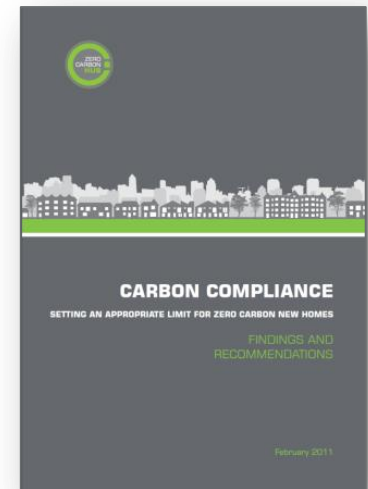
- Carbon Compliance report, Recommendation 4a:

*From 2020 the test results distribution should demonstrate that at least 90% of all dwellings would meet or perform better than the designed energy / carbon performance.*

*Feb 2011*

- The journey:

- 2013 -> 2016 -> 2020



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## Why it's important to industry

- Improving quality throughout the process
- Improving occupant satisfaction
- Levelling the 'playing field'
- Improving links between parts of industry to reduce overall costs
- An alternative to Regulation

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# The current project

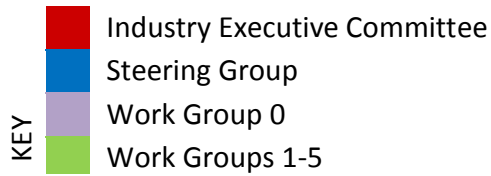
## Main aim:

- To improve the as-built performance of new homes and enable the 2020 ambition to be met
- The group to be seen as *the* place which will, collaboratively, bring together and help to develop all strands of work in this area.

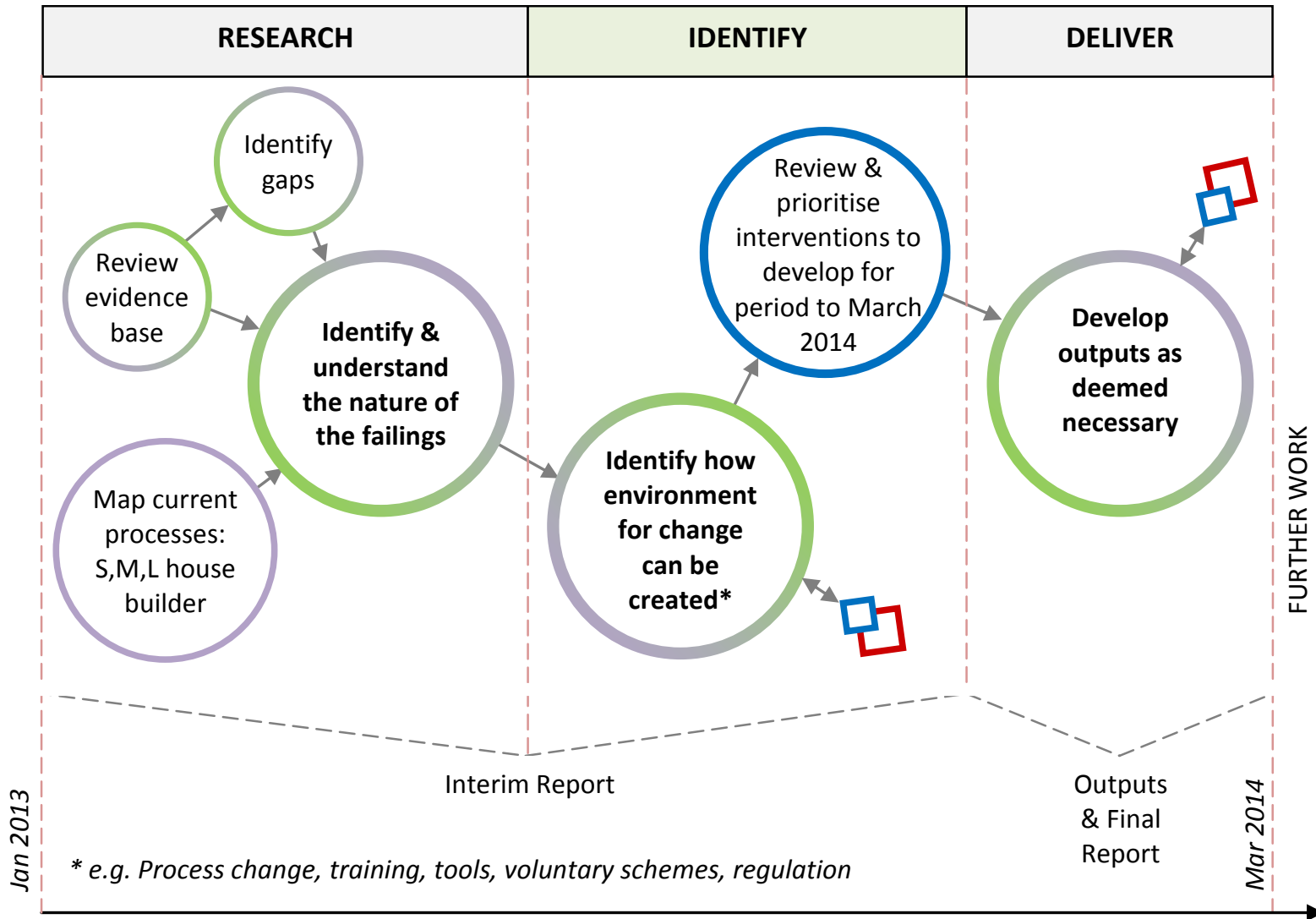
## What are we trying to do?

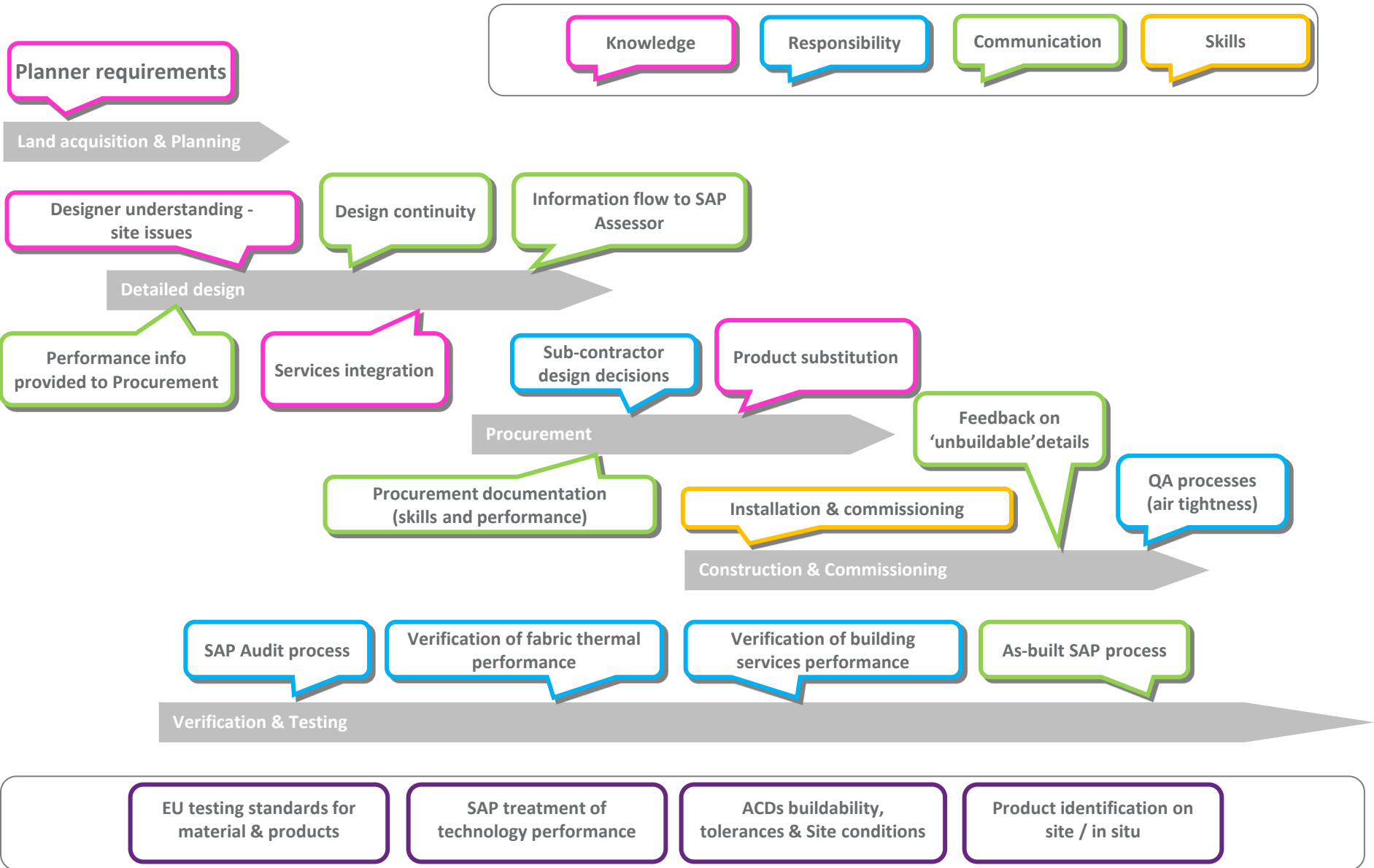
- Find solutions that suit industry & government
- Preferably at no extra cost





# Work stages





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- **Literature reviews**

- Academic and industry research papers
- Laboratory testing
- Field trials

- **Development site reviews**

- Interview process – Concept design to construction
- Site walk through – Design specification versus site
- SAP Audits – Design stage versus site observations

- **SAP Process Analysis**

- Survey of assessors
- Sensitivity of common input issues



# DEVELOPING COMMERCIALY VIABLE PROCESS CONTROL TOWARDS 2020

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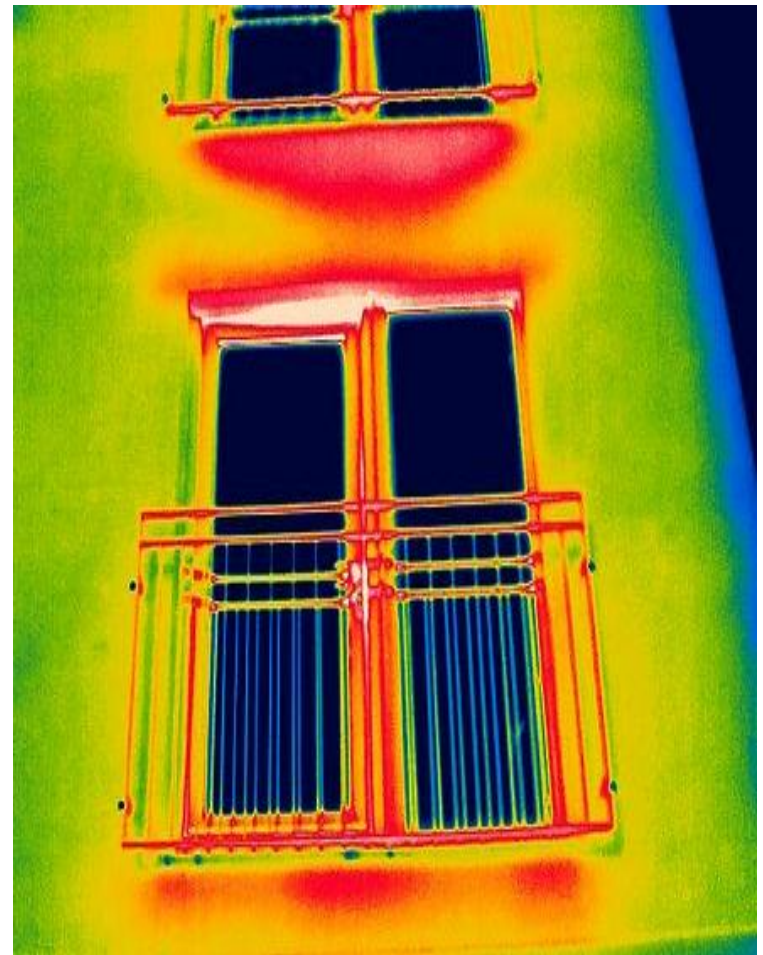
# Thermographic imaging

## Method

- Internal & external images of the building fabric taken during the co-heating testing
- Carried out early in the morning to minimise distortion to surface temperatures

## Observations

- Thermographic images reveal weaknesses in the build and design
- Analysis must be carried out by an experienced person



# In-situ U-value measurement

## Method

- Heat flux testing carried out during co-heating test in one flat in each block
- Heat loss measured across north-facing external walls and also party walls

## Observations

- The difference in measured and calculated U-values is similar to tests of this nature
- A party wall bypass was noted in both blocks



# Co-heating test

## Observations on implementation

- Test carried out in April, at very end of what is considered the suitable period
- Active site, so difficult to maintain controlled temperature in adjacent units

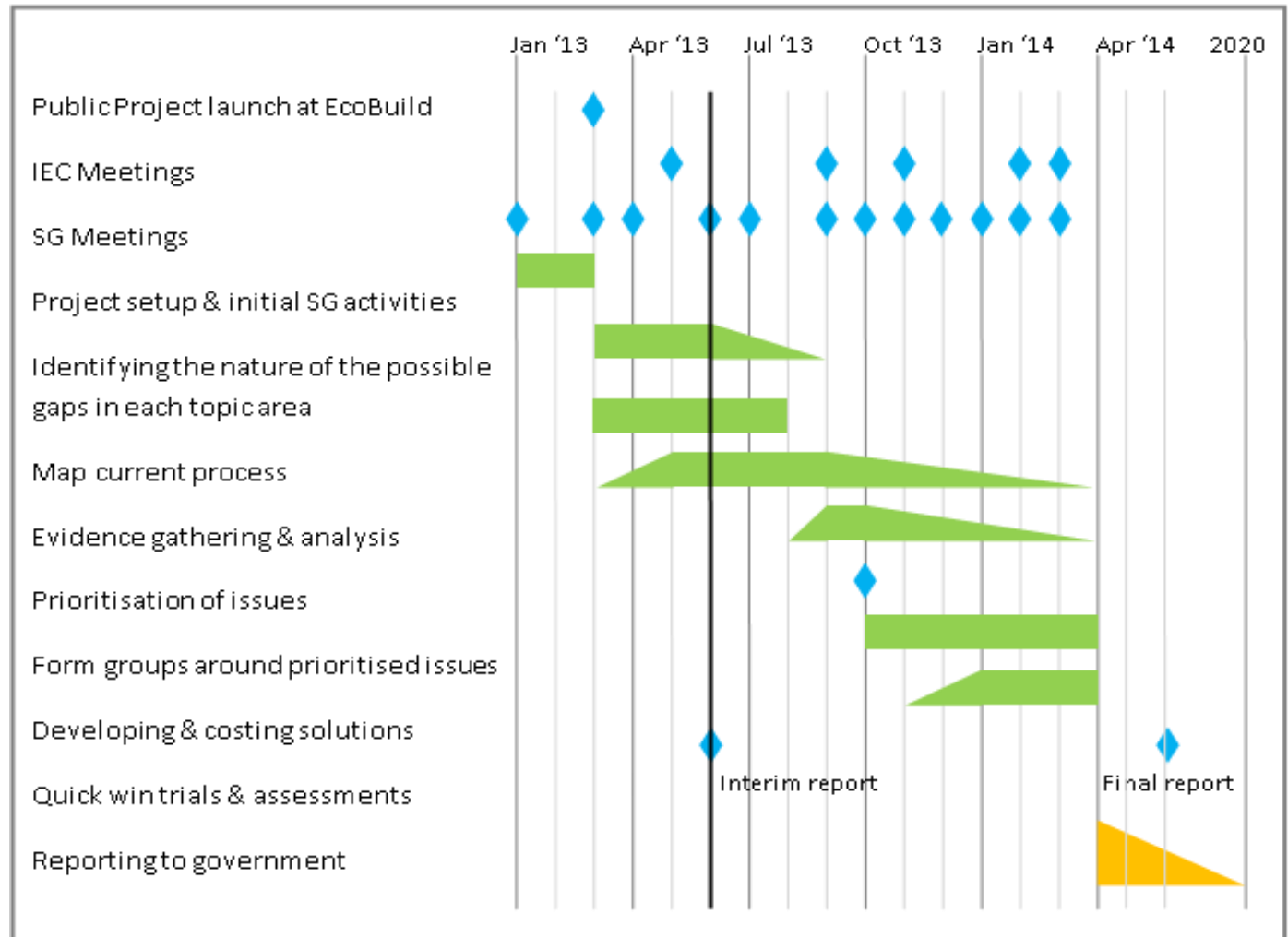
## Observations on results

- Measured heat loss was greater than calculated heat loss
- Result at higher end of scale of published test results



**We need 'inline' and 'end of line' techniques**

# Project next steps



On-going activities (not yet funded)



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# A reminder why it's important

- Improving quality throughout the process (not just end of line)
- Improving occupant satisfaction
- Levelling the 'playing field' (especially amongst product manufacturers)
- Improving links between parts of industry to reduce overall costs
- An alternative to Regulation

# THANK YOU

Richard Partington, Zero Carbon Hub

