Co-heating Tests

- what and how?

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Overview

- What is a co-heating test?
- Leeds Met Protocol
- Additional tests
- Other protocol

Background

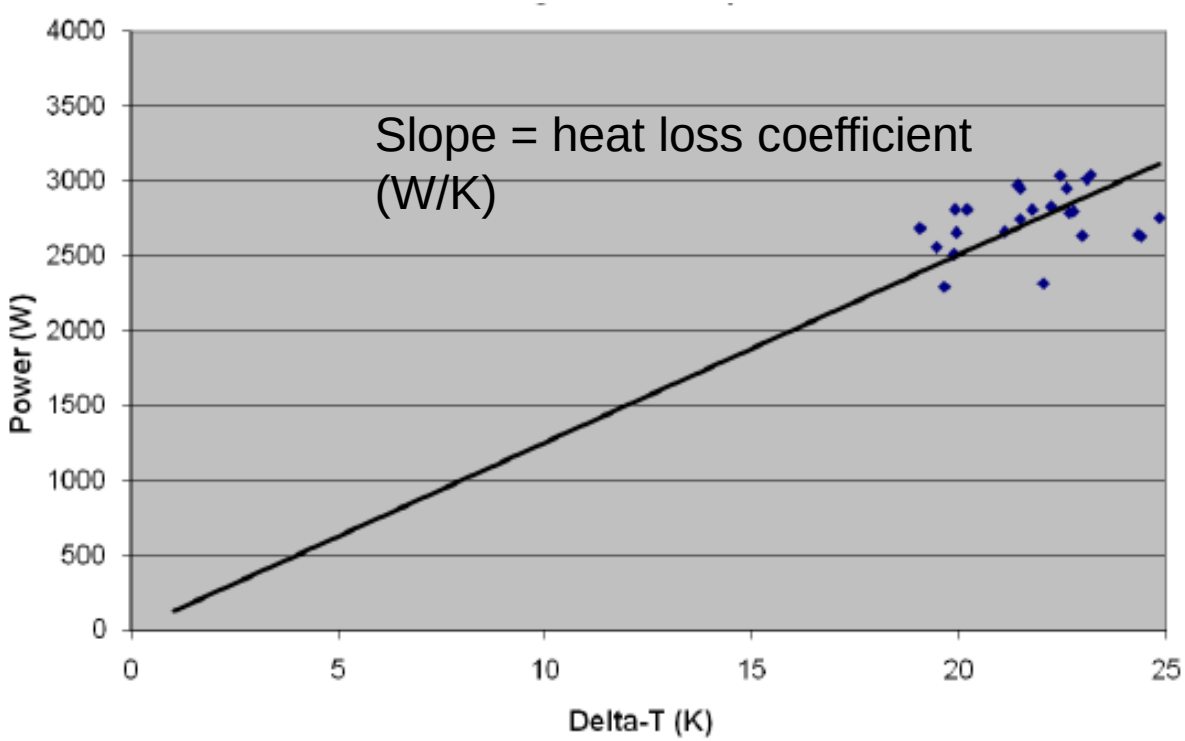
- Buildings currently account for ~ 50% of total CO_2 in the UK
- 60% domestic vs. 40% non-domestic
- Targets to reduce CO_2 emissions
- From 2016 all new domestic buildings zero carbon
- However, it is actual performance that counts not just design predictions!

What is the co-heating test?

- Post construction performance test for domestic properties
- A measure of the whole house heat loss (W/K) in an unoccupied dwelling
  - Fabric heat loss + background ventilation loss
  - Electric heaters
  - Maintain internal temperature at 25°C
  - 1 to 3 weeks
- Discrepancies between the expected and measured performance
- Identifies issues in build process

A little more detail…..

- Daily heat input required to maintain the internal temperature is determined from measuring electrical energy consumed
- Internal and external temperatures also measured
- Heat loss coefficient calculated by plotting the daily heat input vs. daily ΔT



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Internal equipment

- Number of zones
- Temperature and relative humidity sensors
- Fan heaters
- Circulation fans
- Thermostats
- kWh meters
- Data logger
- Extension leads

Conditions required

- Need to maximise the ΔT value (10K or more)
  - Usually carried out during winter months
- Even temperature profile throughout the dwelling – circulation fans
- Restricted access during the test
- 5 minute logging intervals

Pre-test

- Pressurisation test before and after test
  - Estimate the background ventilation rate
  - Another way is to use tracer gas decay

- CO_2 decay measurement

Co-heating test procedure

1. Ventilation system vents and openings must be sealed / closed off
2. All water traps must be filled and electrical and heating systems must be switched off
3. Internal doors wedged open
4. Set up equipment, thermostats to 25°C, switch on all heater fans and circulation fans
5. CO_2 gas dispensing system
6. Activate data loggers
7. Observe for first couple of days and adjust if necessary
8. Once uniform mean temp is achieved monitor for 1-3 weeks

Additional equipment

- External weather data is required
- Weather station
- Measurements of external temperature and relative humidity, vertical south facing pyranometer (solar radiation) and wind speed.

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Adjacent dwellings

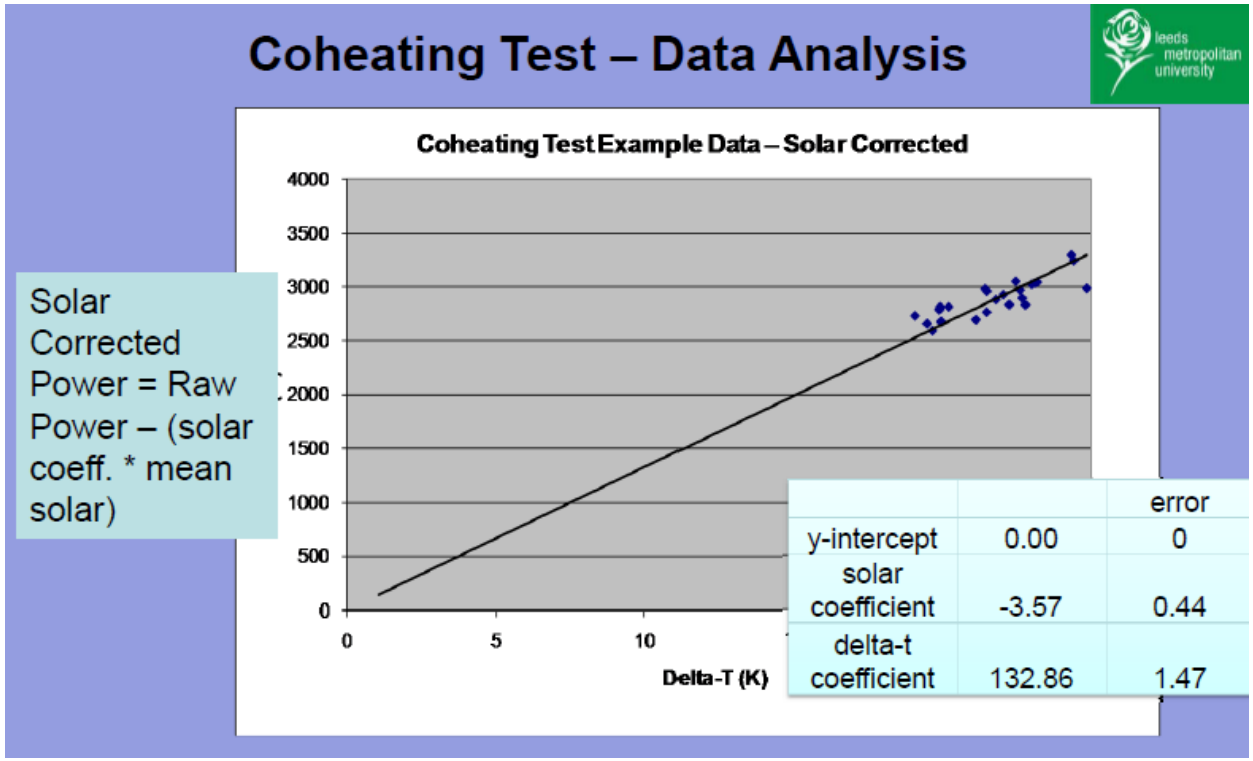
- Any heat loss through any construction elements that are shared with adjacent dwellings must be considered

- If access to adjacent dwellings is permitted
  - Same mean internal temperature as the test dwelling
  - Heat loss to/from adjacent spaces will be eliminated

- If access to adjacent dwellings is not permitted
  - Install heat flux sensors on the internal surface of the test dwelling
  - Measure the heat flux through construction elements

Stages of data analysis

1. Raw data with standard regression
2. Linear regression – forced through the origin
3. Multiple regression analysis using solar corrected data



Ref: research results from Leeds Metropolitan University

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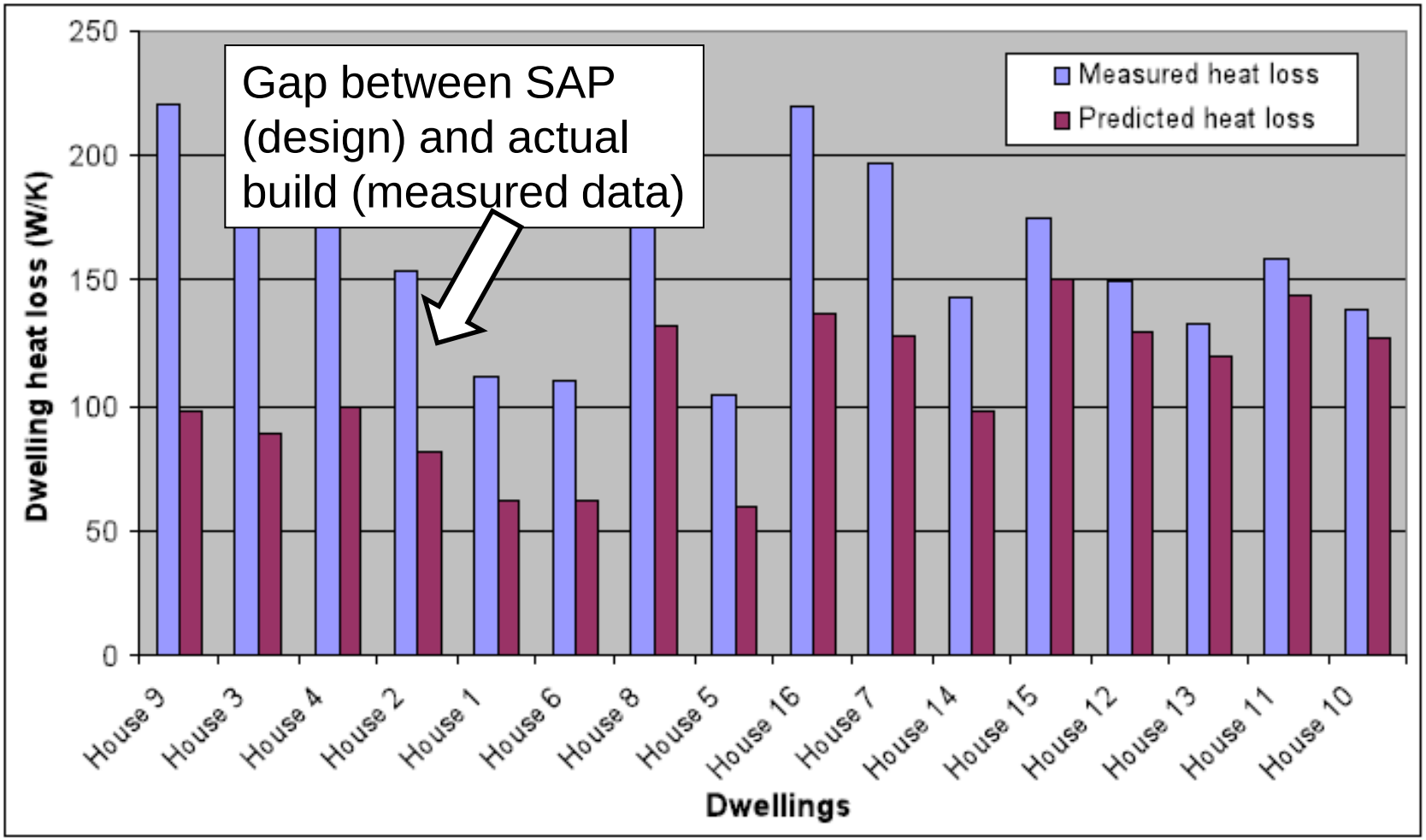
Performance gap



Ref: findings from research study by Leeds Metropolitan University

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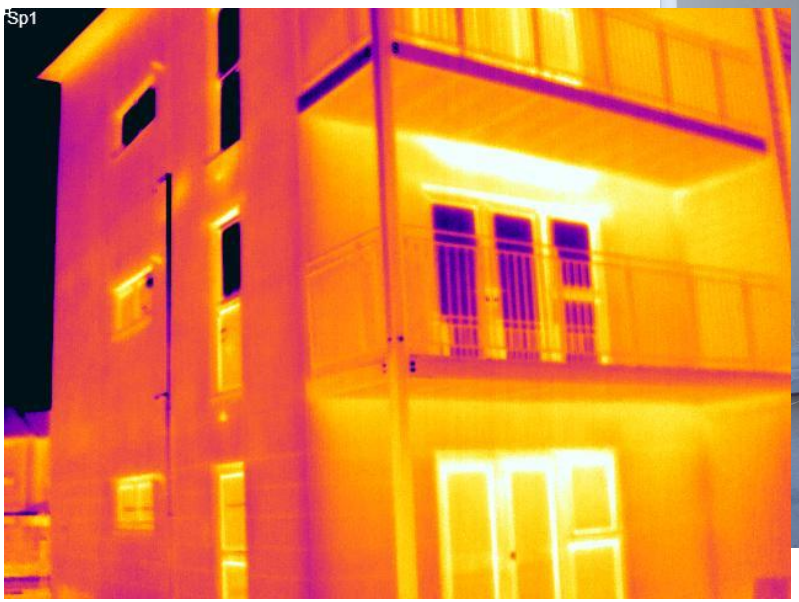
Other tests

- **Results from other tests can help explain this gap**
- **How do they compare to design?**
  - **U-value**
  - **Thermal imaging**
  - **CO_2 decay results**
  - **Air pressure tests**



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Test protocol

- Currently most of us use the Leeds Met Protocol
- Not widely performed- unoccupied for a period of at least 2 weeks!
- Error and uncertainty -tests not completely understood
- Recently removed as a mandatory element in TSB's BPE programme
- Improved understanding - results to be stated with greater certainty

Alternative protocol

- PStar test
- Same approach but uses heating and cooling
- PStar - only 72 hours of co-heating
- PStar ‘Comparison Project’
- Differences found

Thank you

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