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A decorative graphic consisting of several overlapping, wavy, semi-transparent layers in shades of gray, creating a sense of depth and movement across the middle of the page.

Ricardo-AEA

RHI Auditing

- Presentation to Ofgem RHI team
- November 2013

- Mahmoud Abu-ebid and Oliver Edberg

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Agenda

- Introduction from Rob Reid (5 mins)
- Overview of audit programme to date (5 mins)
- Key audit statistics and trends (10 mins)
- Case studies (20 mins)
- Grey areas and Policy recommendations (25 mins)
- Next steps (5 mins)
- Questions- wider discussion time (20 mins)

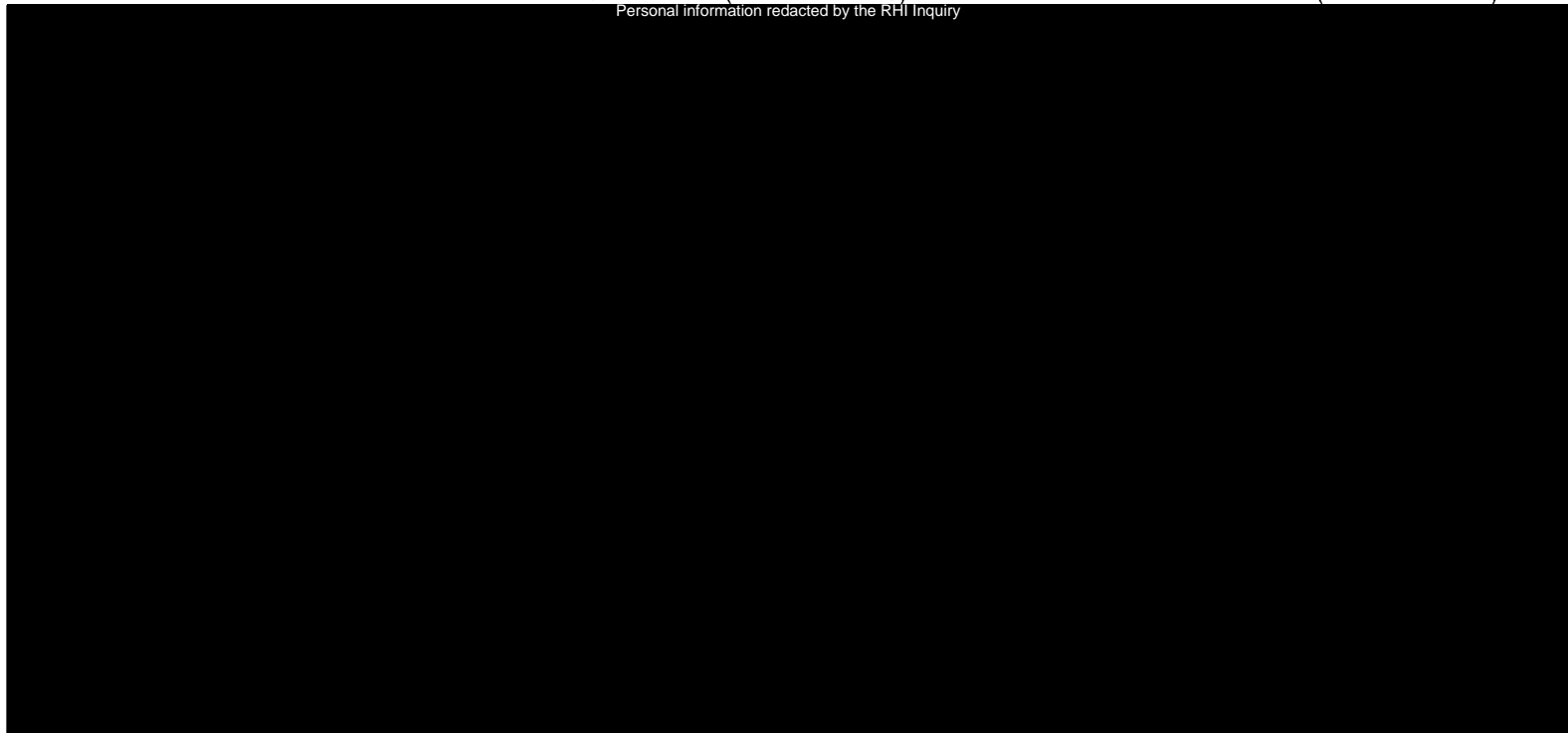


Overview of audit programme to date

Audited a wide range of different installations covered by RHI | RICARDO-AEA

- 75kWth Biomass boiler (RHI0000000936)
- 7kWth WSHP (RHI0000000408)
- 11kWth Solar thermal (RHI0000000814)

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Biomass boiler house

Wood pellet fuel storage silos

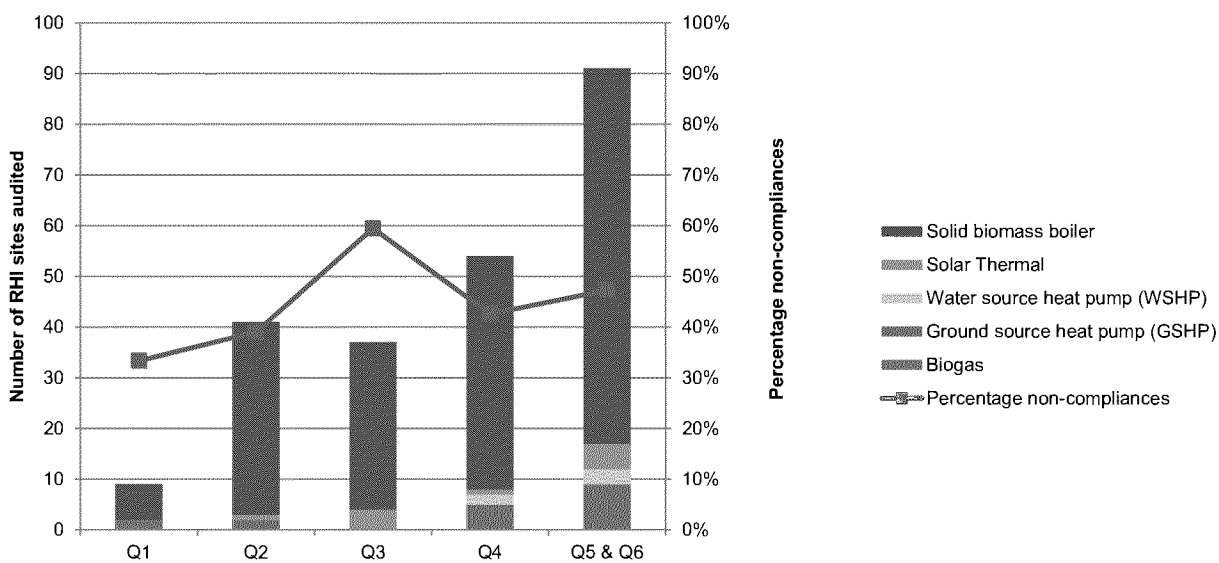
21 bar steam line to process

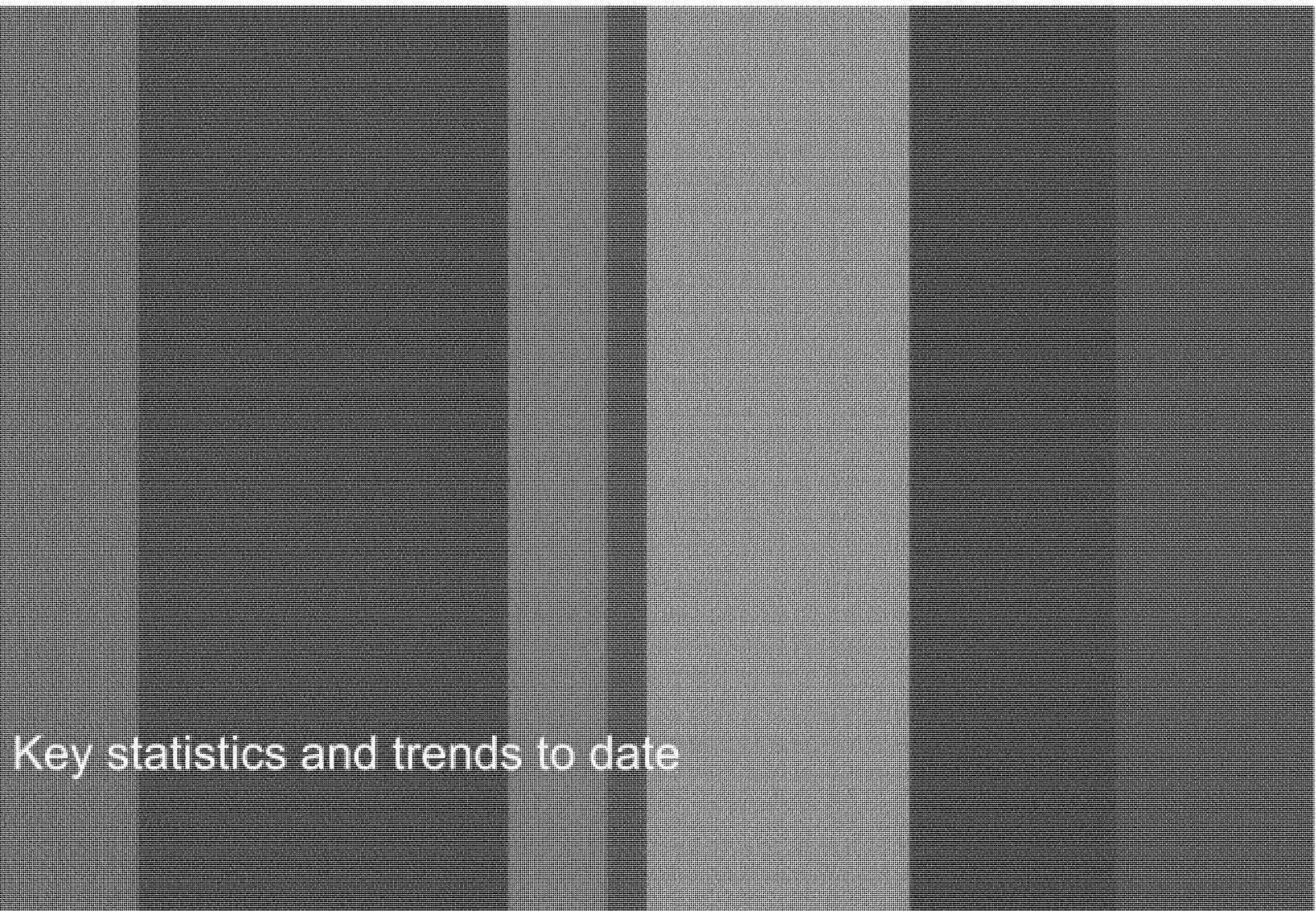
21 bar steam line to process

Steam line to towards oil boiler house

Overview of audit programme to date

- Audit programme started April 2012.
- 232 audits carried out (April 2012- September 2013)
- 85% of sites audited are solid biomass
- 107 out of 232 sites were non-compliant (47% non-compliance rate)

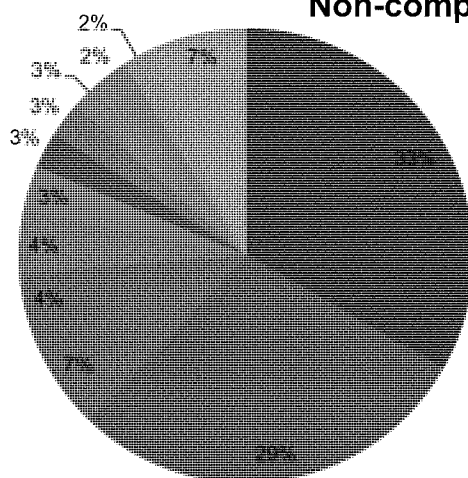




Key statistics and trends to date

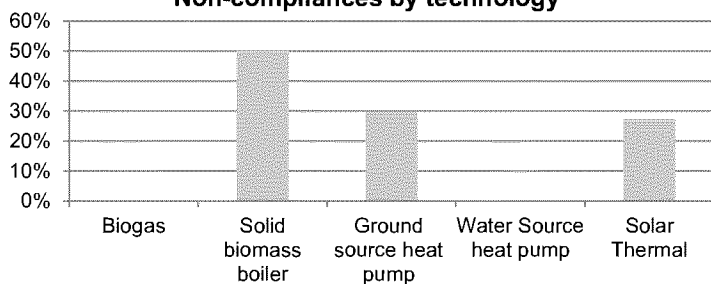
Non-compliance statistics

Non-compliances Q1-Q6



- Lack of biomass fuel records
- Heat Meter installed incorrectly
- Accredited as simple when it should have been complex
- Boiler output higher than rating
- Meter not calibrated (glycol)
- Significant schematic discrepancy
- Building not fully enclosed
- Flow meter reading incorrectly
- Ineligible heat use
- Meter reading anomalies
- Temperature probes installed incorrectly
- Other

Non-compliances by technology



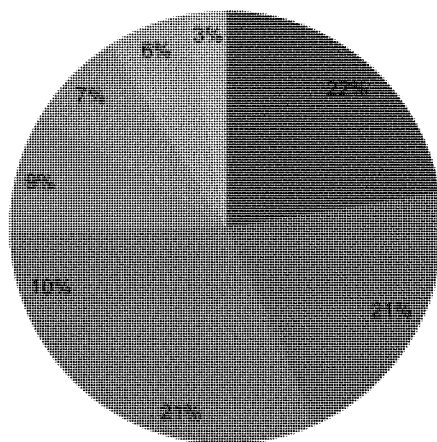
Key messages:

- Lack of biomass fuel records a significant issue for self suppliers
- In Q5/6 53% of non-compliant sites failed to maintain fuel records (due to multiple non-compliances on the same site it is a lower percentage of total NCs).
- We have not seen much of a drop in non-compliance pre and post RHI go-live (53% vs 43%)

Observations

The majority of audits have at least one observation identified

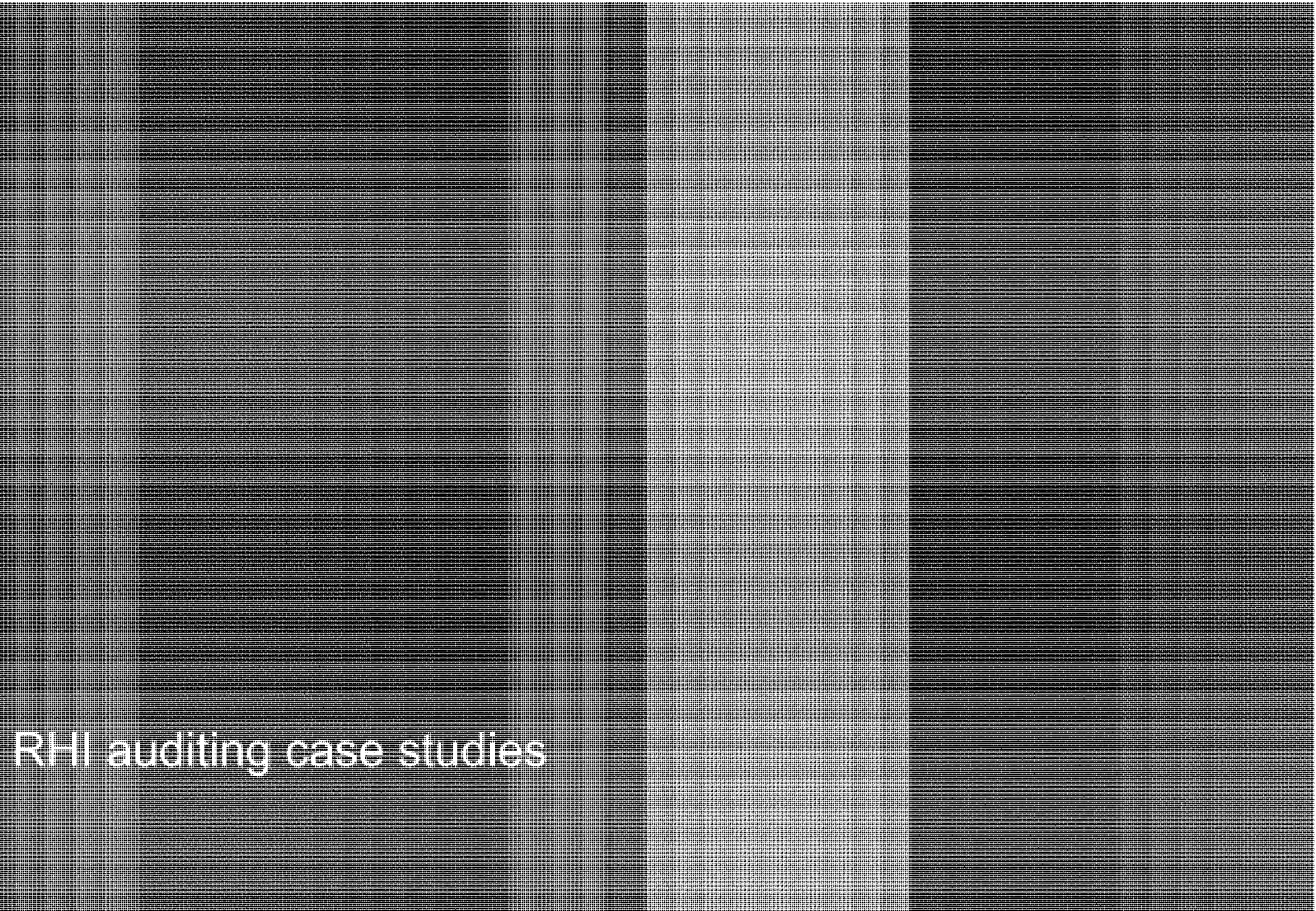
Q4 observations



- IRMA does not accurately reflect the situation on site
- Lack of awareness regarding maintenance requirement for heat meters
- Minor schematic discrepancy that does not affect payments
- Serial number discrepancy
- Small amount of inhibitors in system but there are no details of effect they might have on heat meters and accuracy
- Minor (<10kW) capacity discrepancy
- Lack of commissioning certificate/ commissioning certificate discrepancy
- Periodic data submission errors previously notified to Ofgem

Key observation messages

- Three main observations consistently are identified
- Opportunities for Ofgem E-Serve to focus communication messages to reduce levels of observations identified
- Opportunities to improve process checks to clarify application data i.e. minor capacity discrepancies.

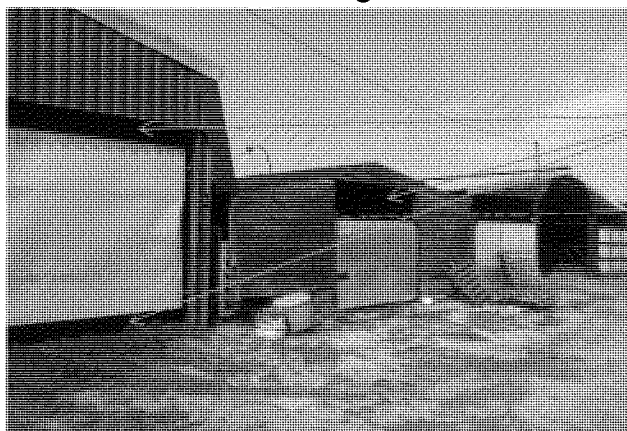


RHI auditing case studies

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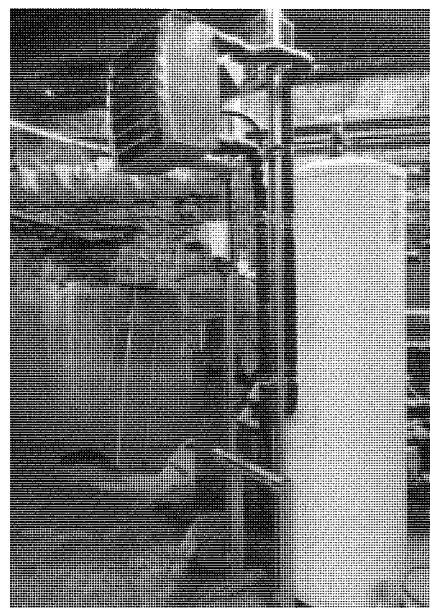
Case studies- milking parlour

Unenclosed farm buildings

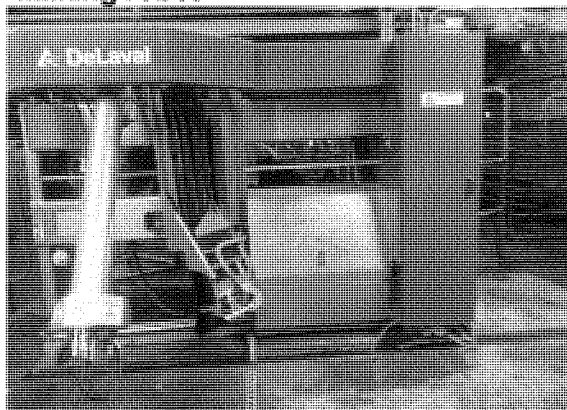


Open spaces

Convection heater



Milking robot



Example highlights a range of issues

- Buildings not being fully enclosed
- Metering arrangement inappropriate
- Wider policy issues surrounding definition of useful heat.

Case studies- fully enclosed buildings

- Definition of a fully enclosed building has caused challenges to auditors and F&C



Roller shutter door

Plastic drapes to minimise heat loss

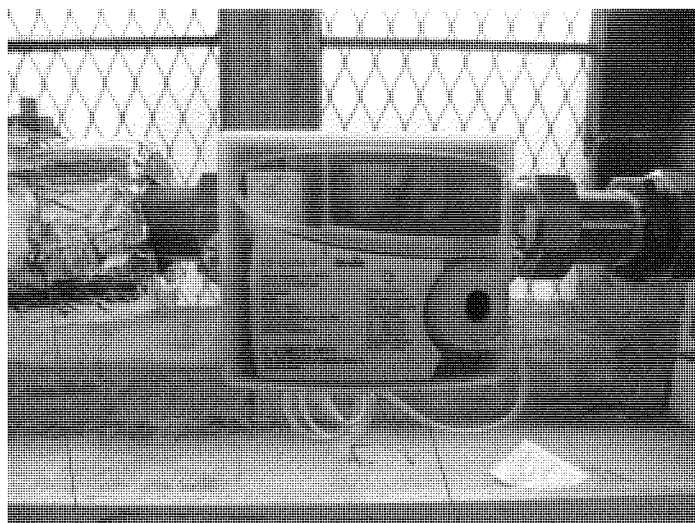
Cases of good and bad practice observed. Similar installation audited on the same day for a warehouse application had a motion sensor fitted.

Should doors that are open most of the time but can be closed be allowed under the RHI?

Case studies- church

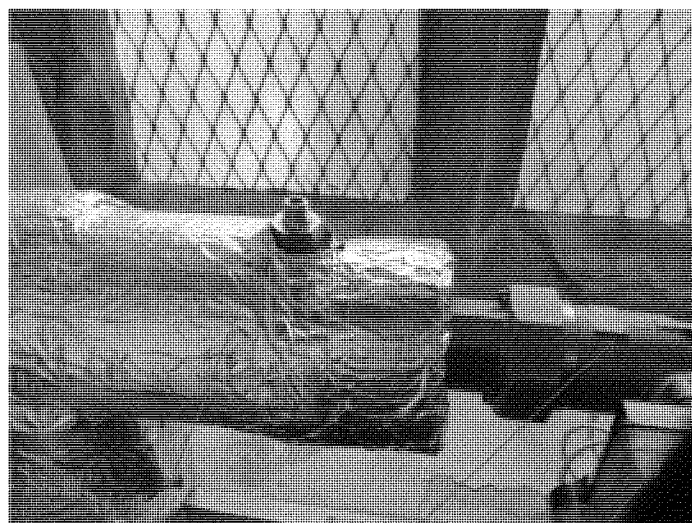
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A challenge facing Ofgem and Ricardo-AEA is the technical understanding of participants. Important to realise that in many cases participants have very little understanding of renewable heating technologies.



Temperature sensor connection

Heat meter calculator



Temperature sensor connection point

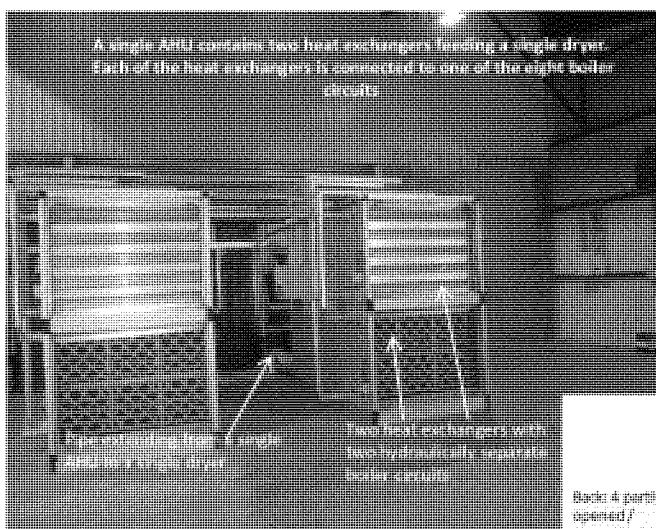
Flow meter

Heat meter calculator

Challenging audits-

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Issues identified:

- Participant has hydraulically separated heating system
- Multiple boilers heating same space
- External heat losses (classed as simple)
- Participant's own records indicate a higher heat output than stated on boiler nameplate
- Authorised signatory is also system designer

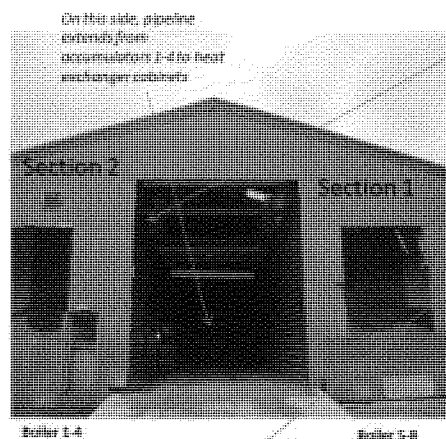
Wider implications:

- Example of a participant reading the guidance documentation and identifying loopholes
- Policy development, this installation is an example of a system designed to maximise RHI benefits, would not have been designed this way without RHI.

Back: 4 partly-opened / uncovered dryers

Middle: 4 accumulators (1-4)

Front: 4 boilers (boilers 1-4)



This space is open (permanently) and could result in escape of heat from pipeline extended along the side walls)

Back: 4 cabinets with 2 heat exchangers each and 4 air handling units / blowers

Middle: 4 accumulators (5-8)

Front: 4 boilers (boilers 5-8)

Permanent louvres on outer wall of Section 1

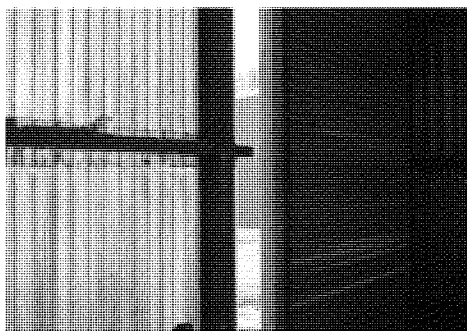
Challenging audits- agricultural site

- Highest number of issues to date from one audit:
 - 7 non-compliances (incl meter installation issues, major schematic discrepancies)
 - 7 observations

Potato grading shed being heated



Gap in wall 1.5m high



Undisclosed fan coil units



Straw bales waiting to be burnt



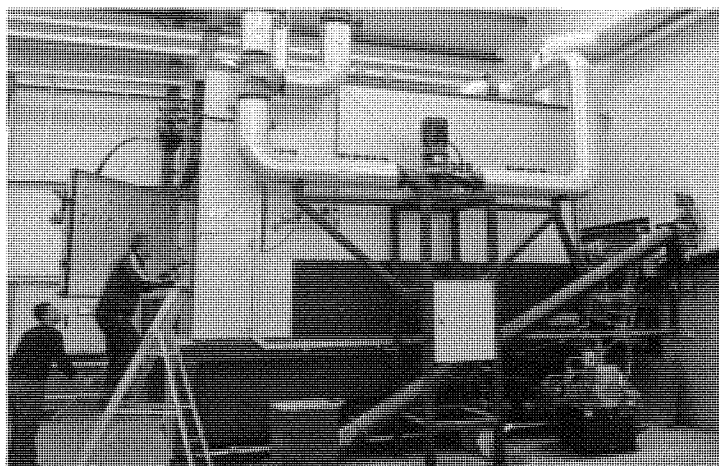
Farmhouse heat meter located 50 m away from farmhouse



The auditor also encountered a dispute between the IRMA author (also the installer) and participant. Difficult to know who was correct.

Plenty of good practice examples exist

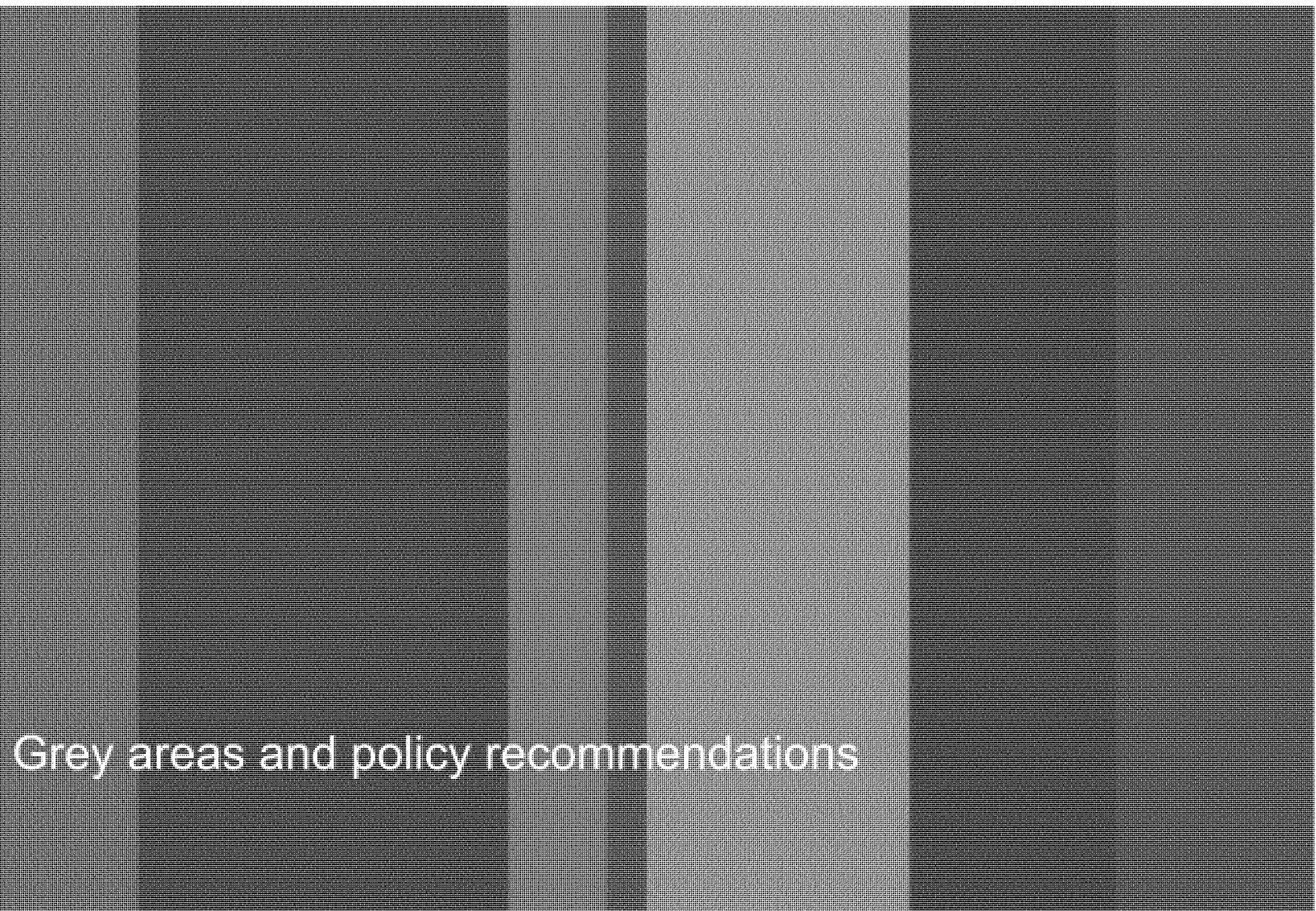
- Many sites represent good practice across range of scales. One example, Glen Avon Growers, audit identified no observations or non-compliances.
- Heat provision to greenhouses for cultivation of salads
- Site also had large gas boiler, coal fired boiler and gas fired CHP



Boiler configuration, biomass boiler 2.8MWth



Oil seed rape straw bales being loaded into boiler



Grey areas and policy recommendations

Grey area: Discrimination of useful heat

- Current regulations have a broad definition on ineligible heat use, for example outdoor swimming pools and heating outdoor spaces. No definition of useful heat.

Solar thermal installation at Personal information redacted by the RHI Inquiry

Personal information redacted by the RHI Inquiry

- Audit identified that solar thermal installation was connected to underfloor heating system (not shown on schematic).
- The participant had used this during wet summer of 2012.
- Regulations do not prohibit internal heating of properties providing they are an eligible heat use
- Creating heat demand which would otherwise not exist.

Wood fuel awaiting chipping at Personal information redacted by the RHI Inquiry

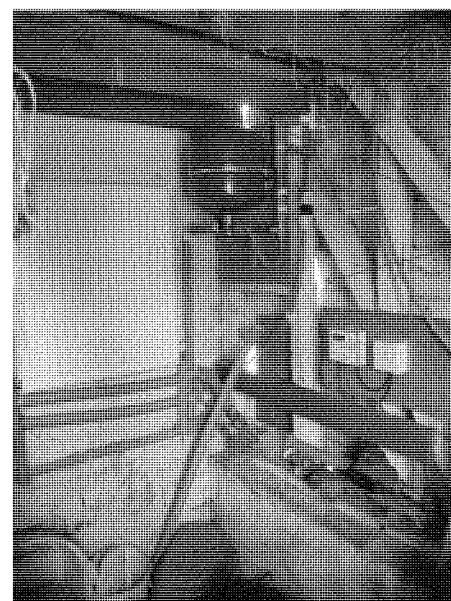
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audits

- Participant is chipping and drying biomass (alongside other drying functions i.e. grain)
- In this case selling heat used for drying to customers
- Several examples where participants are drying biomass to be used in RHI installations and claiming RHI on the heat used for drying.

Policy recommendation useful heat

- The RHI policy development should consider whether a definition of useful heat should be introduced. Examples which are (probably) allowed under current regulations:
 - Heating an eligible installation over the summer (i.e. underfloor heating user solar thermal)
 - Heating a agricultural building housing livestock
 - Heating a milking parlour
 - Drying biomass feedstock to be used in RHI installation
- Ricardo-AEA has experience of defining useful heat from CHPQA. Definition below is taken from the EU Energy Efficiency Directive (2012/27/EU) as follows:
 - *'useful heat' means heat produced in a cogeneration process to satisfy economically justifiable demand for heating or cooling (Article 2, Paragraph 32)*



Gaps in building fabric

Outhouse used for rearing animals

Equally “economically justifiable demand” is defined as follows:

- *'economically justifiable demand' means demand that does not exceed the needs for heating or cooling and which would otherwise be satisfied at market conditions by energy generation processes other than cogeneration (Article 2, Paragraph 31)*

Ricardo-AEA recommendations to reduce number of observations and low risk non-compliances

Accreditation checks

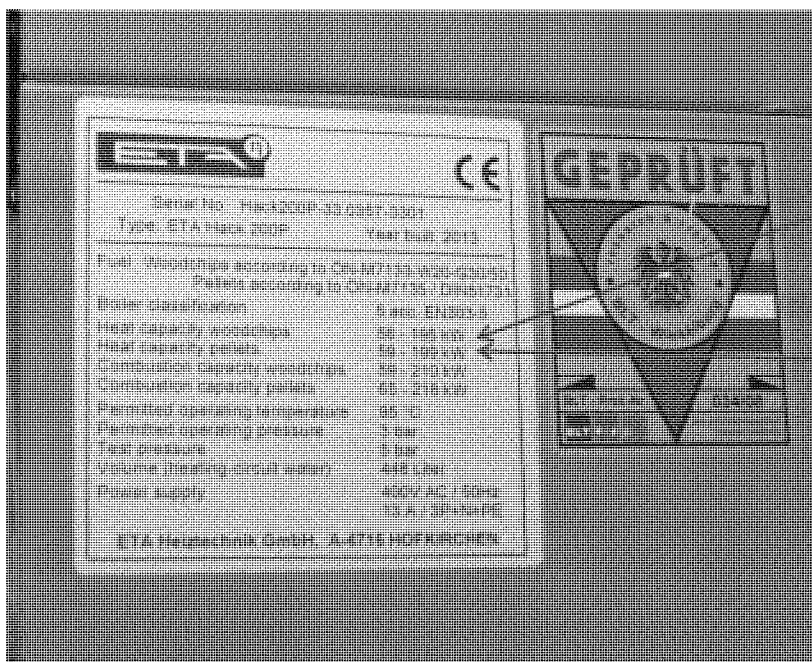
- Small biomass heating capacity discrepancies can be checked through referring to fuel type to be used
- Referring to the milking parlour example for some agricultural properties it could be worth requesting photographs of buildings that will be heated
- Do these buildings have an eligible heat load?

Communication with accredited participants

- Generic finding is that Volume II of the Ofgem E-Serve guidance has not been read by participants.
- Most scheme are relatively simple so key points from Volume II are:
 - Lack of biomass fuel records
 - Lack of awareness surrounding heat meter maintenance
 - Unaware of frost corrosion inhibitors
- Opportunity to make target guidance i.e. by technology to be issued as part of accreditation

Minor capacity discrepancies

- Opportunity to remove minor errors in capacities where participants are stating the incorrect capacity figure on application form
- Issue impacts payments through Tier 1 threshold for biomass boilers normally in applicants favour



Capacity when running on wood chips

Capacity when running on wood pellets

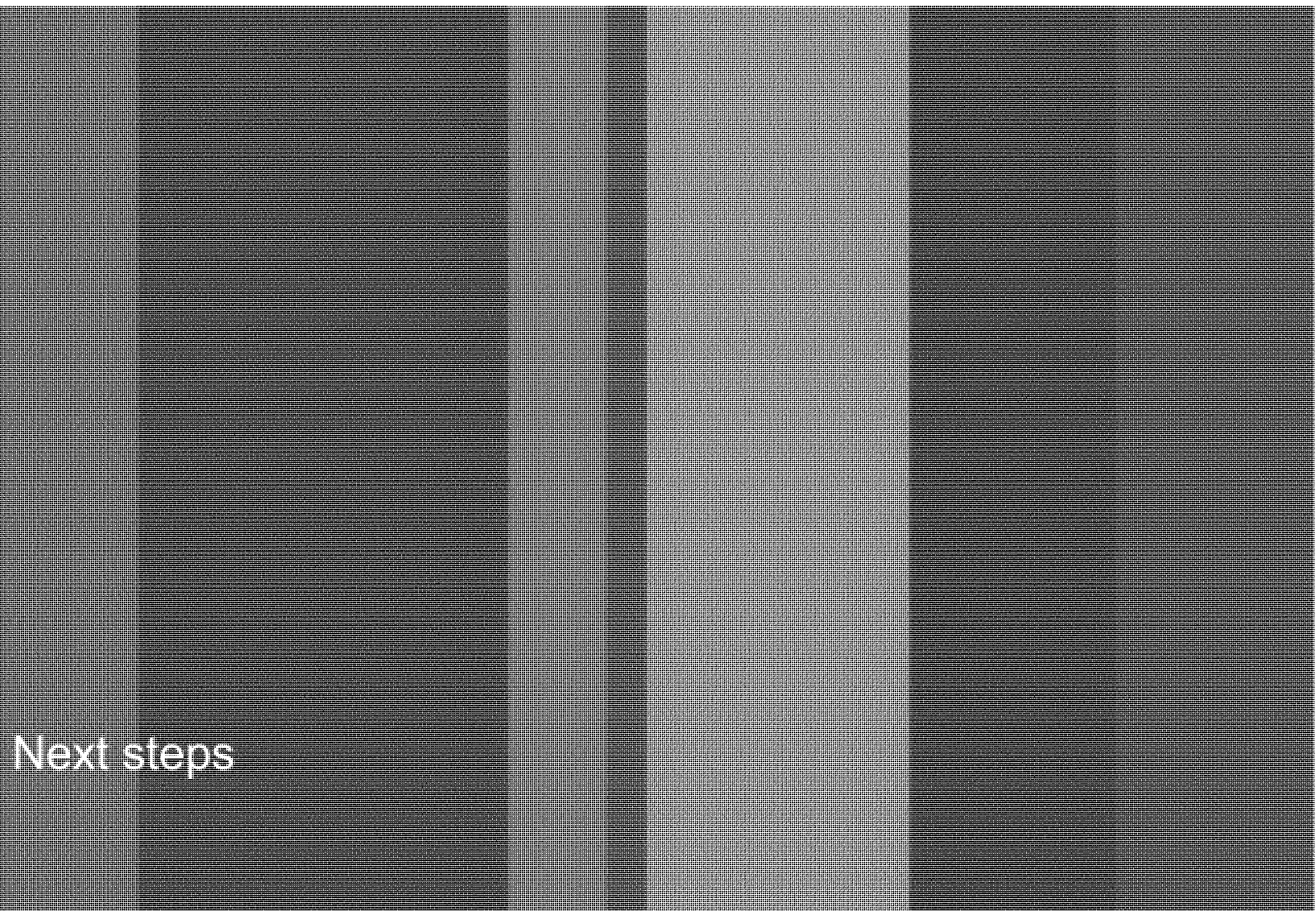
Opportunity for Ofgem E-serve to introduce cross check against fuel participant intends to use

Policy: Multiple installations

- A number of unintended developments have been encountered through RHI audits
 - Multiple <200kWth systems are being installed on the same site to maximise RHI payments i.e. poultry sheds
 - System design is geared towards decentralised heating systems
 - Example of heating system being hydraulically separated but feeding same heating unit
- These above issues represent a significant financial cost to the programme in terms of RHI payments. Also represent burden (increased costs) to Ofgem administration.
- **Ricardo-AEA recommendations**
 - The definition of site boundary should be changed. Multiple installations on one site/property should be regarded as a single RHI installation. Applicant retains flexibility for multiple or individual boiler, total capacity of boilers sets tariff payment levels.
 - Defining site boundary would negate the need to define a heating system in further detail i.e. to amend regulations for hydraulically separated systems in Hereford case. This would be regarded as one installation as it is on the same site.

General experiences from RHI auditing

- Most installations are less than 500kW_{th}. Participants generically have very little understanding of technology or heating system.
- Very few cases of suspected intentional fraud (less than 5 examples)
- Most non-compliances arise from a lack of understanding by the participant, installer or IRMA author.
- Dealing with non-compliances should ensure consideration of this lack of technical understanding. Can direct correspondence with participants be introduced to speed up issue resolution?

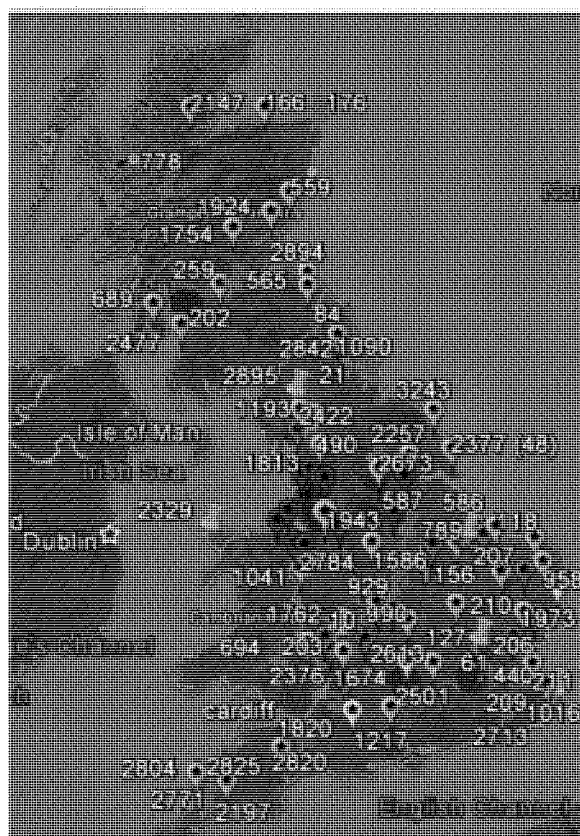


Next steps

Next steps for audit programme

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- Ricardo-AEA are carrying out 122 audits over the period October 2013 to March 2014
- Looking to implement Ofgem E-Serve Technical Audit Assurance Categories to audit findings
- Ofgem E-Serve Audit team planning to select more pre-accredited sites for audit in place of some accredited sites
- Extending checks being covered to include
 - Additional metering questions
 - Vents
 - Pipework
 - Biomass Air Quality



Questions and wider discussion

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Notes Summary:

Slide 8: 'Q5/6 had a slightly wider range of observations so picture is less representative of key themes from observations, i.e. more unique site specific issues during Q5/6 which means a higher number of observations classed under 'other'. Q4 is useful as it shows clearly the top three observations over the first year of the audit programme clearly.'

Slide 10: Irrelevant information redacted by the RHI Inquiry

Slide 11:

Slide 14:

Slide 17:

Slide 18: