Department for
Business, Energy
& Industrial Strategy

EVALUATION OF THE REFORMED RHI

Synthesis report: ‘interim applicant’ research

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Executive Summary

Introduction

This report presents findings from the evaluation of the reformed Renewable Heat Incentive (RHI). This theory-based evaluation is being undertaken for the Department for Business, Energy and Industrial Strategy (BEIS) by CAG Consultants, in partnership with Winning Moves, Hatch Regeneris, EREDA Consultants and UCL.

In particular, the focus of this report is on the impact of the Government's announcement in December 2016 of a package of RHI reforms and the subsequent delays to the implementation of these reforms. The evidence presented does not assess whether the reforms achieved their aims, this question will be addressed in future reports from this evaluation.

To understand the impacts during the period between March 2016 and September 2017, this report synthesised findings from fieldwork which took place in late 2017 and early 2018:

- Quantitative surveys of pre-reform RHI applicants applying before September 2017 (separate surveys for domestic, non-domestic, and biomethane and biogas)
- Qualitative research with pre-reform domestic heat pump applicants and non-domestic medium-scale biomass applicants
- The evaluation's initial sustainable markets assessment (involving desk-based analysis of market data combined with stakeholder consultations)
- Desk-based analysis of RHI application data.

Policy background

There are two parts to the RHI scheme (domestic and non-domestic), created to encourage uptake of renewable heat technologies amongst householders and businesses through financial incentives. The Government consulted on changes to the RHI schemes in March 2016 intended to reform the scheme to ensure it focusses on long-term decarbonisation, promotes technologies with a credible role to play in that transition, and offers better value for money. It subsequently published its proposals in December 2016, with an expectation that the reforms would come into force in Spring 2017. However, the implementation of these reforms was subsequently delayed as a result of interrupted Parliamentary legislative timetables[1]. A first package of reforms – involving changes to tariff levels, domestic technology heat demand limits and the removal of tariff bands for non-domestic biomass – then came into force on 20 September 2017.

The Government reported to us that it recognised that applications to the RHI scheme have a historical trend which suggests the market can react quickly to proposed changes in the scheme or tariff levels (e.g. tariff degressions). As a result, in addition to the reforms targeting

[1] The reforms were delayed as a result of a General Election, called in April 2017 and held in June 2017. This interrupted Parliamentary legislative timetables, meaning that necessary legislation and regulations could not be introduced in the Spring, as originally intended.

long-term changes in RHI applications, short-term changes were likely in the period between the announcement of scheme reforms and the implementation of the reforms themselves. In recognition of these potential short-term impacts, the policy implementation approach intended to encourage consumers to continue installing renewable heating systems between the date of publication and the date the changes came into force, avoiding a hiatus in investment and consequential impacts on the supply chain.

Application trends during the interim period

During the period between the initial consultation on the reforms in March 2016 and the introduction of the first tranche of the reforms in September 2017, there were a number of spikes in applications to the domestic and non-domestic schemes. For the domestic scheme, there was variability in the number of heat pump applications in particular, with spikes in applications in March 2016, March 2017 and September 2017. Application numbers for biomass and solar thermal were relatively low and stable during this period.

In the non-domestic scheme, biomass applications per month fluctuated during this period, with the largest spikes occurring in March and June 2017 for medium biomass, whilst variability in applications for other technologies eligible under the non-domestic scheme was less pronounced. Biomethane applications dropped to their lowest levels since the scheme's start.

These spikes align with those technologies where the reforms potentially reduce RHI payments for some applicants, namely domestic heat pump applicants affected by heat demand limits and non-domestic medium-sized biomass applicants affected by merging of the biomass tariffs and other changes to scheme eligibility.

The following sections explore how the reform announcements and delays influenced applicants.

Extent to which reform proposals and delays affected these trends

Influence of the reforms

For the domestic scheme, the majority of applicants (61%) to the scheme during the April 2016 to September 2017 'interim' period reported being unaware of the March 2016 consultation on the draft reforms or the December 2016 proposed reforms. Among those who said they were influenced by the reforms (17%), the majority reported that the timing of their applications or installations had been brought forward as a result. This is supported by the application numbers which show a substantial increase in heat pump installations that would have been impacted by the introduction of the proposed heat demand limits in 2017. A small increase in domestic biomass applications was also received at this time, however this was less pronounced.

For the non-domestic scheme awareness of the reforms was highest among biomethane and biogas applicants, where only 12% were unaware of the reforms. Among the remainder of the non-domestic applicants, 31% were unaware of the reforms. Among those biomass applicants who reported being influenced (19%), 48% reported that it was the size of the installation that

had been influenced. This is consistent with introduction of reforms that removed tariff banding based on the capacity of the biomass installation.

For the large-scale non-domestic technologies (e.g. biomethane and large-scale CHP), the evidence suggested a hiatus in investment decisions resulted from an anticipation of the introduction of tariff guarantees and uplifted tariffs for biomethane/biogas installations. Installer evidence also suggested that the reform delays had prevented the installation of shared ground loops (as a result of the delays to deemed metering), however, social housing providers were reported to be more willing to proceed with these installations despite the uncertainty.

Influence of the reform implementation delays

The available evidence does not support conclusions to be made as to the impacts specifically resulting from the delays to the implementation of the reforms, however, the evidence suggests that the delays may have contributed to the overall sense of uncertainty around the RHI scheme.

General uncertainty about the future of the RHI, as well as the expectation of tariff degressions, was reported by participants in this research. This uncertainty was a driver that contributed to applicants applying or installing earlier than they otherwise would have. It is likely that the reform proposals and subsequent delays may have contributed to this general market uncertainty. Non-domestic biomass applications in particular seem to have been driven by the expectation of tariff degressions being triggered (particularly for the June 2017 spike in applications).

More broadly, evidence from RHI applicants suggested that general uncertainty about how long the RHI might continue (for example in reference to the budget cap), under what conditions and at what levels of subsidy, also appeared to have an influence on them. This uncertainty about the scheme created an opportunity for some installers to encourage installations to be undertaken during this period. Indeed, qualitative and quantitative evidence highlighted that installers and other third parties played a pivotal role in some customer decisions about technology choices and timing.

Conclusions

The findings highlight that the RHI reform announcements and their subsequent delays played a significant role in influencing a minority within the renewable heat market. Less than a fifth of applicants to the domestic and non-domestic schemes reported being influenced by the reforms or delays, however, two thirds of biogas and biomethane applicants reported being influenced.

The evidence indicates that the reform proposals and their delays had three distinct effects:

- Speeding up some applications and installations that stood to lose out when the reforms came into force. This was the case in particular for domestic heat pump applicants;
- Influencing applicant decisions about the size of their installation where applicants stood to lose out when the reforms came into force. This was the case in particular for non-domestic biomass applicants; and

- Delaying or slowing down applications for large scale non-domestic technologies that stood to benefit from the reforms (particularly from tariff guarantees), such as biogas, biomethane and shared ground loops.

The general uncertainty about the future of the RHI, as well as the expectation of tariff degressions, also contributed to applicants applying or installing sooner than they otherwise would have. It is likely that the reform proposals and subsequent delays may have contributed to this general market uncertainty. The scheme reforms were designed to create a longer-term platform for investment, and included measures to reduce uncertainty, however, delays caused by external factors may have added to customer confusion in the short-term.

The extent of the impact of the reform announcements and delays on applicants was largely determined by a number of key factors:

- Customer awareness of the reforms proposals and perceptions about how the proposals would impact on them;
- The financial sensitivity of the installation (i.e. the extent to which changes in RHI subsidies would affect the viability of a renewable heat technology being installed); and
- Customers' ability to alter the timing of their installation.

For installers, the extent of the impact of reforms was largely determined by:

- The technology involved and the extent to which the reforms impacted on it;
- The ability of the installer to diversify into other areas (or the extent to which they had already diversified);
- The nature of the customer base, such as the extent to which their customer base was driven by the RHI subsidy;
- The nature of the installer's offer, such as their ability or willingness to respond to customer demands; and
- The lead-in times of the supply chain used by the installer.

Contents

1. Introduction

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In particular, the focus of this report is on the impact of the Government's announcement in December 2016 of a package of RHI reforms and the subsequent delays to the implementation of these reforms. To understand this impact, this report synthesised findings from fieldwork which took place in late 2017 and early 2018. The evidence presented in this report does not assess whether the reforms achieved their aims. This question will be addressed in future reports from this evaluation.

Policy background

There are two parts to the RHI scheme (domestic and non-domestic), created to encourage uptake of renewable heat technologies amongst householders and businesses through financial incentives. The Government consulted on reforms to the RHI schemes in March 2016[2]. It subsequently published its proposals in December 2016, with an expectation that the reforms would come into force in Spring 2017. However, the implementation of these reforms was subsequently delayed. A first package of reforms – involving changes to tariff levels, domestic technology heat demand limits and the removal of tariff bands for non-domestic biomass, then came into force on 20 September 2017.

The scheme reforms

The Government's key proposals – and subsequent amendments - for a reformed RHI scheme are set out below3.

For heat pumps, the reforms were intended to support growth in the size of the market and improvements in the quality of the supply chain. The key changes were increases in support for domestic heat pumps alongside a cap on annual payments received by larger properties, provision of support for ground source heat pump systems supplying multiple properties through a shared ground loop and a requirement that all new domestic heat pumps have electricity meters installed.

For biogas and biomethane, the reforms intended to vastly improve the carbon cost-effectiveness of further support. New feedstock requirements, requiring new plant to produce at least half their biogas and biomethane from waste-based feedstocks to receive support for all their production, were accompanied by small uplifts in the biomethane tariff and maintenance of the biogas tariff.

[2] Department of Energy and Climate Change (2016), The Renewable Heat Incentive: A reformed and refocused scheme, 3 March 2016. Available at: https://www.gov.uk/government/consultations/the-renewable-heat-incentive-a-reformed-and-refocused-scheme [accessed: 24 May 2018]

[3] Taken from: Department for Business, Energy and Industrial Strategy (2016), *The Renewable Heat Incentive: A reformed scheme – Government response to consultation,* 16 December 2016. Available at: https://www.gov.uk/government/consultations/the-renewable-heat-incentive-a-reformed-and-refocused-scheme [accessed: 24 May 2018]

For biomass, the reforms were intended to support further deployment where the technology offers best value for money and is likely to have a long-term role, such as in high-temperature industrial processes. The reforms introduced one level of support for all new non-domestic biomass boiler deployment. The reforms also introduced a cap to the annual payments for new domestic biomass systems installed in larger properties alongside a slight increase to the tariff for new domestic biomass systems to allow the technology to continue to deploy.

The reforms were also intended to provide improved certainty for investors in larger projects through the introduction of "tariff guarantees"4. These were designed to help address the current dominance of RHI spending on smaller scale systems by providing certainty to investors regarding the tariff they will receive earlier in the project lifecycle. Without this reform, the Government was concerned that large-scale projects would continue to be relatively rare or would require significantly higher tariffs.

Additional reforms were proposed, including the introduction of 'assignment of rights' to allow the development of third-party financing arrangements in the domestic RHI scheme, while eligible heat uses under the non-domestic scheme were amended to remove such uses as wood drying. These proposals are not explicitly covered by this research report.

To avoid a hiatus in investment and consequential impacts for the supply chain, the Government included measures within the reforms to encourage consumers to continue to install renewable heating systems between the date of reform publications and the date the changes came into force. This included making all applicants eligible for tariff uplifts from the date the reforms were announced (payable from the date they came into force), as well as providing flexibility to biogas and biomethane applicants applying during the interim period to choose the scheme rules under which they would operate5.

The December 2016 Government consultation stated that the reforms would come into force in Spring 2017, however, the implementation of these reforms was subsequently delayed as a result of interrupted Parliamentary legislative timetables6. To maximise certainty in the market, those reforms which could be brought into force without active approval of Parliament were introduced in September 20177. The remainder of the central package of reforms came into force in May 2018.

[4] A tariff guarantee allows applicants to the non-domestic RHI to secure a tariff rate before their installation is commissioned and fully accredited on the RHI.
[5] See pages 19 and 34 of Department for Business, Energy and Industrial Strategy (2016), *The Renewable Heat Incentive: A reformed scheme – Government response to consultation,* 16 December 2016. Available at: https://www.gov.uk/government/consultations/the-renewable-heat-incentive-a-reformed-and-refocused-scheme [accessed: 24 May 2018]
[6] The reforms were delayed as a result of a General Election, called in April 2017 and held in June 2017. This interrupted Parliamentary legislative timetables, meaning that necessary legislation and regulations could not be introduced in the Spring, as originally intended.
[7] A Statutory Instrument laid under the negative procedure becomes law on the day the Minister signs it and automatically remains law unless a motion to reject it is agreed by either House within 40 sitting days. https://www.parliament.uk/site-information/glossary/negative-procedure/ [accessed 24 May 2018]

Study aims and objectives

This synthesis research was designed to understand how and why the announcement of the reforms influenced RHI applications and the wider renewable heat market in the period leading up to those reforms coming into force, and the role that the elongated period of implementation played within this.

There were a number of spikes in applications to the domestic and non-domestic schemes during the 'interim period', the between the announcement of the reforms in December 2016 and the introduction of some of the reforms in September 2017. During 2017 and 2018 this research sought to understand the drivers of these spikes and the contexts in which they were happening in more detail. The research activities focused in particular on those technologies with the largest application spikes, providing a detailed understanding from domestic heat pump and non-domestic biomass applicants.

The evaluation questions which the synthesis process has sought to address were:

- How have the successive reform announcements in 2016 and 2017, and the way that they have been implemented, influenced RHI applications?
- For whom (applicant types, supply chain sectors, technology types) and in what contexts has this influence been most marked and why?

Report outline

Chapter 2 summarises the methodological approach for this research.

Chapter 3 sets out the scheme and wider market trends during the 'interim period' (December 2016 to September 2017), including application and installation trends.

The findings in relation to the influence of the reforms announcements and their implementation on domestic heat pump applications are presented in chapter 4. Their influence on non-domestic biomass applications is summarised in chapter 5, whilst Chapter 6 focuses on their influence on applications for other RHI-eligible technologies.

Chapter 7 outlines the findings regarding the impact of the RHI reform announcements and subsequent delays on installers. The conclusions from the research are then presented in chapter 8.

A series of appendices are included, containing: the overall evaluation plan; theoretical framework; interim applicant theory and an overview of the synthesis process method.

2. Methodology

This chapter sets out the methodological approach for the evaluation as a whole and for the research underpinning this synthesis report. It also outlines the process employed to synthesise the research findings from multiple evaluation workstreams.

Theoretical framework

Overall theoretical framework for the evaluation

The evaluation is theory-based and informed by the principles of realist evaluation[8]. This involves developing, testing and refining 'realist' theory about the reformed RHI as the scheme proceeds. The theoretical framework stems from a high-level 'if, then, because' statement summarising the aims of the RHI reforms, to inform the evaluation as a whole.

If…the Government subsidises renewable heat generation to 2021 through the RHI and introduces demand-side reforms (e.g. assignment of rights, tariff guarantees, metering)…

then…this will encourage people and organisations to invest in renewable heating systems…

because… people and organisations will be motivated by the financial incentives and reduced investment risk.

The reformed RHI is expected to contribute indirectly to a more sustainable market for renewable heat, and associated long-term carbon savings, through a series of linkages and feedback loops in the supply and demand system. These are summarised in the overall policy map in Appendix B.

Within the context of this overall policy map, specific theories were developed about how the extended announcement period for the reforms (and the delays and uncertainties associated with these reforms) may have influenced the supply and demand for renewable heating systems. These 'interim applicant' theories provide the foundation on which the research for this specific report were developed.

[8] R Pawson, R, and Tilley, N. (1997) *Realistic Evaluation*. London: SAGE Publications Ltd; and Pawson, R. (2006) *Evidence-Based Policy*. London: SAGE Publications Ltd.

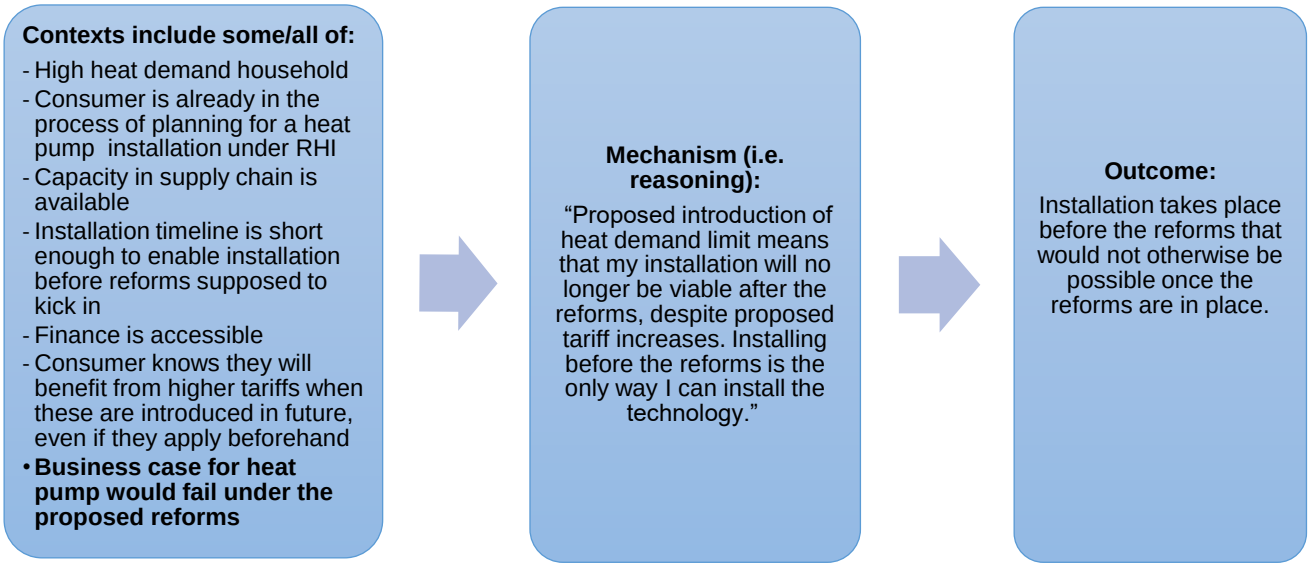
The ‘interim applicant’ theory

For this phase of the evaluation research, specific theories were developed for the policy questions of most concern to BEIS: the effect of the reforms on demand and supply for domestic heat pumps and for medium-scale non-domestic biomass installations.

We took a realist[9] approach to theory development for these two technology groups, focusing on the influence of reform announcements on the reasoning of particular groups of customers and installers. Our theories are set out as ‘Context-Mechanism-Outcome’ (CMO) hypotheses, describing the contexts in which we would expect particular actors to change their reasoning as a result of the reform announcements, resulting in particular outcomes (e.g. advancement, deferral or cancellation of investment decisions). In addition to providing evidence to understand the impact of the reformed RHI scheme, this approach also provided a granular level of detail to support the development of future policies in this area.

For example, **Error! Reference source not found.** below sets out our initial hypothesis about how the announcement of future heat demand limits might affect heat pump investment decisions for customers with high heat demand where the business case is marginal. In this example, the applicants who speed up their installation (the outcome) are found to have a range of contexts in place, with the most important one being that the business case for their installation would not hold up after the reforms. In these cases the applicants reason that installing before the reforms is the only way they can proceed with their installation.

Figure 1: CMO hypothesis for influence of reforms on heat pump outcome for high heat demand household



[9] Realist evaluators seek to identify ’what works in which circumstances and for whom?’, rather than merely ‘does it work?’. For an overview of realist evaluation, go to: https://www.betterevaluation.org/en/approach/realist_evaluation

A full set our of our ‘candidate’ hypotheses for medium-scale non-domestic biomass and for domestic heat pump technologies are shown in Appendix C.

Whilst the theories were developed specifically for the technologies of most interest to BEIS, they were also used as the basis for our analysis and synthesis of all technologies. An iterative approach of testing technology specific theories, and then collating this level to the level of the overall evaluation, means that over the course of the entire evaluation, the overall theory of how the RHI scheme works will be evidenced, refined and tested.

We reviewed our candidate theories in the light of the evidence presented in this report and have prepared revised theories for the two technology groups. These are presented in Appendix D.

Evidence sources

This report synthesises findings from three evaluation workstreams: detailed applicant monitoring; qualitative research; and sustainable markets assessment[10]. The principal methods of data collection utilised in each of these workstreams are summarised in Table 1**Error! Reference source not found.** below.

It should be noted that no evidence collection was conducted with applicants who applied after the reforms came into force. These applicants will be the subject of future evaluation reports.

Table 1: Principal methods of data collection used in the individual workstreams

Detailed applicant monitoring	Domestic (D) applicants	21% of the 11,591 domestic applicants accredited between April 2016 and September 2017 completed a post-application survey. An online survey was completed by 2,334 applicants accredited to the scheme for one installation[11]. A telephone survey was completed by 80 applicants accredited to the scheme for more than one installation (responsible for 162 applications). Both datasets coded and merged prior to analysis. Data weighted to the population of successful applications

[10] The remaining four workstreams had not begun evidence gathering at the time of this synthesis report.
[11] Note that the surveys included applicants who made their applications prior to the December 2016 reform announcements. All who applied post-March 2016 were asked about their awareness of the reforms. Those who applied in 2016 were asked about awareness of the reform consultation and those who applied in 2017 were asked about awareness of the formal proposals. For analysis purposes, these were then amalgamated so as to assume that anyone aware of either was ‘aware of the reforms’. Influence responses (i.e. applicants responding to say they were influenced by the reforms) were only counted as valid if the respondent indicated that they were aware of the reforms.

		based upon (a) technology and (b) single vs multiple applicants. Set of calibration weights then applied to ensure weighted sample representative of the population.
	Non-domestic (ND) applicants for every technology except bio-gas/ bio-methane	13% of the 4,661 non-domestic applicants (excluding biogas and biomethane) accredited between January 2015 and September 2017 completed a post-application survey. An online survey was completed by 483 applicants accredited to the scheme for one installation. A telephone survey was completed by 100 applicants accredited to the scheme for more than one installation. A telephone survey was completed by 24 solar thermal & WSHP accredited applicants to account for low incidence of these technologies in the population. Datasets coded and merged prior to analysis. Data weighted as described above.
	ND bio-gas and bio-methane applicants	25% of the 398 biogas and biomethane applicants accredited between January 2015 and September 2017 completed a post-application survey. A telephone survey was completed by 100 applicants, responsible for 189 applications, accredited during this period. Data weighted as described above.
Qualitative research	D heat pump applicants	In-depth telephone interviews with five applicants who submitted applications during the spike in applications in March 2017 (see section 3 for more information about application spikes). In-depth telephone interviews with five applicants who submitted applications during the spike in applications in September 2017. All interviewees submitted applications for systems for which heat demand was significantly above the proposed heat demand limits (HDL), in order to explore the impacts of the introduction of these HDL.
	ND medium-	In-depth telephone interviews with 12 applicants who submitted applications during either the March or June

	scale biomass applicants	2017 spikes in applications, six at the low end of the medium-scale and six at the high end.
	Installers	In-depth telephone interviews with 10 installers of domestic heat pumps and medium-scale non-domestic biomass technologies.
Sustainable markets assessment	All	Literature review & consultation to define desired end-state for renewable heat market. Statistical analysis to support sustainable markets indicator framework. Desk-based review and stakeholder consultations to collate wider market insights on progress toward sustainable markets[12].

The data tables from detailed applicant monitoring surveys can be found in Appendix E. The working paper from the qualitative research is provided in Appendix F.

Data analysis was carried out within the individual workstreams prior to the synthesis process.

For the qualitative research, data was coded and mapped against the contexts, mechanisms and outcomes (C-M-Os) for the interim applicant theory and wider demand theory. We analysed the extent of support for different CMOs in the framework and for potential refined or new CMOs.

Statistical analysis of the data from the detailed applicant monitoring was conducted, with the different datasets for each scheme (domestic and non-domestic) being coded and merged prior to the analysis taking place. For each survey an initial weight was applied to interviews based upon (a) technology and (b) single vs multiple applicants. The latter weight was applied to account for the different chance of single or multiple applicants being sampled, as they were included in either the online or phone survey. A set of calibration weights were then applied – based upon the approach used in previous monitoring – to ensure the weighted sample was representative of the population.

Within the sustainable markets assessment workstream, data was analysed against the sustainable markets indicator framework, with wider market insights also being collated and fed into the synthesis process described below.

Analysis was also carried out on the application data from the domestic and non-domestic schemes, with the findings feeding into the synthesis process.

[12] Stakeholders included Renewable Energy Association, Sector bodies and manufacturers, Renewable Energy Finance Forum, BSRIA, Anaerobic Digestion & Bioresources Association, WRAP

Synthesis approach and process

The synthesis process was led by CAG Consultants, with inputs from Winning Moves and Hatch Regeneris.

A realist synthesis applies realist philosophy to the synthesis of findings that have a bearing on a single research question or set of questions[13]. This program theory – in this case the interim applicant theory - sets out how and why a class of intervention is thought to 'work' to generate the outcome(s). The suitability and value of element of theory is then tested using relevant evidence from different sources. The ideas within a program theory are then re-cast and conceptualised in realist terms. As Wong et al describe:

“Synthesis consists of comparing 'how the programme was supposed to operate' to the 'empirical evidence on the actuality in different situations' - all along C-M-O lines. Analytic purchase comes from the ability to describe and understand the many contingencies that affect the likelihood of such interventions generating their intended outcomes.”[14]

The purpose of the synthesis process was therefore to understand the influence of the RHI reform proposals in different settings and for different participants.

For this research, the CMO hypotheses in the interim applicant theory formed the main structure for the realist synthesis process. There was a particular focus on the non-domestic biomass and domestic heat pump sectors (applicants and supply chain), as these were identified as priority issues by BEIS and were therefore the focus of the qualitative fieldwork. Wider evidence from the other workstreams highlighted above was also used, to help understand impacts and reasoning across the renewable heat market.

Key steps in the realist synthesis process were:

- Step 1. Relevant data from across the three workstreams was mapped against the interim applicant theory and other key elements of the theoretical framework (particularly the demand theory). A CMO template was created in Excel, setting out the evidence from the three workstreams against the interim applicant theory for each technology.
- Step 2. Additional analysis. The initial mapping and organisation process helped identify additional analytical opportunities for generating a deeper understanding of the interim applicant theory. This involved additional analysis of the retrospective applicant survey data by Winning Moves (workstream 1), as well as some updates to analysis of statistical data by Hatch Regeneris (workstream 4).
- Step 3. Assessment of evidence. The evaluation evidence was assessed to establish the extent to which it supported the existence of outcomes, mechanisms

[13] Wong G, Greenhalgh T., Westhorp G., Buckingham J, and Pawson R. (2013), *RAMESES publication standards: realist syntheses,* BMC Med. 2013; 11: 21. Published online 2013 Jan 29. doi: 10.1186/1741-7015-11-21. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3558331/ [Accessed: 13 June 2018]
The CMO hypotheses in the interim applicant theory formed the main structure for our realist synthesis. [14] ibid

and contexts in the interim applicant theory, for each scheme (domestic and non-domestic) and for each RHI-eligible technology.

- Step 4. Refinement of theory. The assessment was then used to confirm, refine or revise the CMO configurations for the interim applicant theory.

Appendix G sets out the methodology for the synthesis process in greater detail.

Limitations

The reader should note a number of limitations to the research design. The remaining years of this evaluation will seek to address these challenges, where feasible, and strengthen the overall evidence base.

Lack of qualitative data across RHI technologies

In line with BEIS's priorities, the qualitative research focused only on domestic heat pump and non-domestic biomass applicants and installers. As such, the synthesis process did not generate in-depth insights into why, for whom and under what circumstances the reform proposals impact on other technology sectors. To help mitigate this, applicant survey data was used, as far as possible, to generate limited 'why, for whom and under what circumstances' insights.

Lack of data about non-applicants

No evidence was gathered from non-RHI applicants. It was therefore not possible to gather in-depth insights from consumers themselves about why some potential renewable heat customers decided not to install an RHI-supported renewable heat technology. Data from installer qualitative interviews provided only limited number of insights into consumer decisions not to install as a result of the reform proposals. This resulted in only very limited testing of elements of the interim applicant theory relating to decisions not to install a renewable heat technology as a result of the reform proposals.

Limited sample sizes

The qualitative research involved a relatively small sample of applicants and installers. Large samples are not required to confirm the existence of CMO configurations or applicant types. However, the sample was not sufficiently diverse to get an in-depth understanding of the whole of the interim applicant theory, meaning that not every CMO could be tested thoroughly. For example, some mechanisms in the theory were neither refuted or confirmed in our sample, meaning we did not have sufficient evidence from this round of research to discount them. Where relevant, we may be able to use evidence from future evaluation findings to undertake a more comprehensive testing of the theory.

For the quantitative applicant surveys, there were robust sample sizes for the overall data on the impact of the reforms. However, analysis of the data at a sub-sample level (e.g. for individual technologies during certain time periods), samples were smaller and less robust. For these findings, therefore, there is a large potential margin of error. Where this is the case, figures have been reported as broad proportions (e.g. 'around a half') rather the precise percentages.

Self-selection bias

In the qualitative research, there is likely to have been a degree of self-selection bias in the sample. Due to low response rates for non-domestic biomass applicants, invitations had to be sent out to relatively large numbers of potential interviewees in order to meet the sampling criteria. This may have introduced some bias to the sample. This affected any conclusions for the overall population but was not an issue in terms of the internal validity of cases as a means of testing the CMO configurations.

A particular gap in the sample was in relation to installers who entered the British market during the interim period. No reliable sample frame was secured for this group, and this impacted on our ability to explore some aspects of the theory relating to installers. Issues in obtaining installer responses during recruitment also meant that a degree of self-selection bias occurred. For example, installers who are less reputable or whose outputs have lower quality are less likely to have agreed to be interviewed. We have highlighted in the installer findings chapter where our ability to test the theory was limited in this regard.

Respondent recall

In the qualitative research, some applicants were interviewed 12 months after their installation had taken place and some of the interview questions were about decisions and actions which had taken place much earlier than the installation. In a small number of cases, this impacted on the applicant's ability to recall some of the details being requested in the interviews. Similarly, in the installer interviews, some confusion was apparent regarding the timing and nature of the reforms and their relationship to tariff degressions. It should be noted, however, that this was not simply an issue of recall but also reflected a lack of understanding on the part of some installers of the reform timelines and the distinctions between the reforms and the degressions. This confusion may also have affected responses in retrospective applicant survey about the impact of the reform proposals.

Self-reported additionality statistics

The survey included questions that asked applicants what they would have done if the RHI scheme had not been in place. These questions were included to get an insight into the impact the scheme had on applicants and the potential counterfactual actions. Self-reporting of additionality, however, is subject to biases resulting from respondent recall and distortions in perception. With this in mind, these figures are most valuable in assessing the changes in motivations or counterfactual installations over time, or between groups, rather than providing an absolute assessment of the impact of the scheme on each applicant.

3. ‘Interim period’: application and installation trends

This section summarises high-level trends for RHI applications, and the renewable heat industry, during the ‘interim period’ between the announcement of reforms in December 2016 and implementation of the first wave of reforms in September 2017.

While our research focuses particularly on the interim period, the charts in this chapter include data before and after the interim period for context. The trends presented here allow us to assess progress on the objectives of the RHI scheme. We first present statistics on RHI applications, which are indicative of the RHI’s progress in stimulating demand for renewable heat technologies during the interim period. We then present statistics on industry-wide installations and on the renewable heat supply chain, which are indicative of the RHI’s progress in supporting supply-chain development during the interim period.

What happened to application numbers during the interim period?

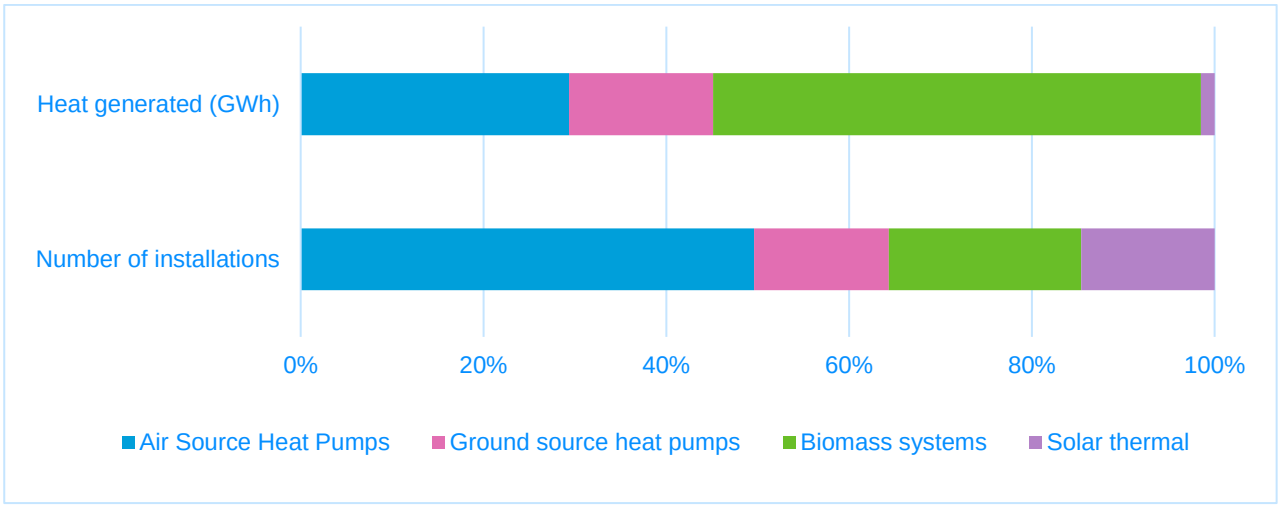
Domestic RHI scheme

Since the start of the domestic RHI scheme in April 201415 and up to March 2018, there were 61,691 accredited domestic applications. Of these, air source heat pumps comprised 51% of accredited applications, with ground source heat pumps representing a further 15%. Biomass systems represented 20% of accredited applications while solar thermal has represented 14%. However, biomass systems generated more than half of the heat generated under the domestic RHI scheme up until that point. The average capacity of air source heat pump applications since April 2014 was 10.2 kW, ground source heat pumps had an average of 14.9kW and biomass applications had the highest average capacity at 27.2 kW16. Figure 2 illustrates scheme outputs by technology type.

Figure 2: Breakdown of domestic scheme outputs by technology (April 2014 to March 2018)

[15] These statistics are derived from the number of accredited applications for new and ‘legacy’ installations from April 2014 to March 2018. ‘Legacy’ refers to systems installed before the launch of the domestic RHI scheme on 9 April 2014 which subsequently applied for domestic RHI. (Source: BEIS, *Non-Domestic RHI and Domestic RHI monthly deployment data*, March 2018).

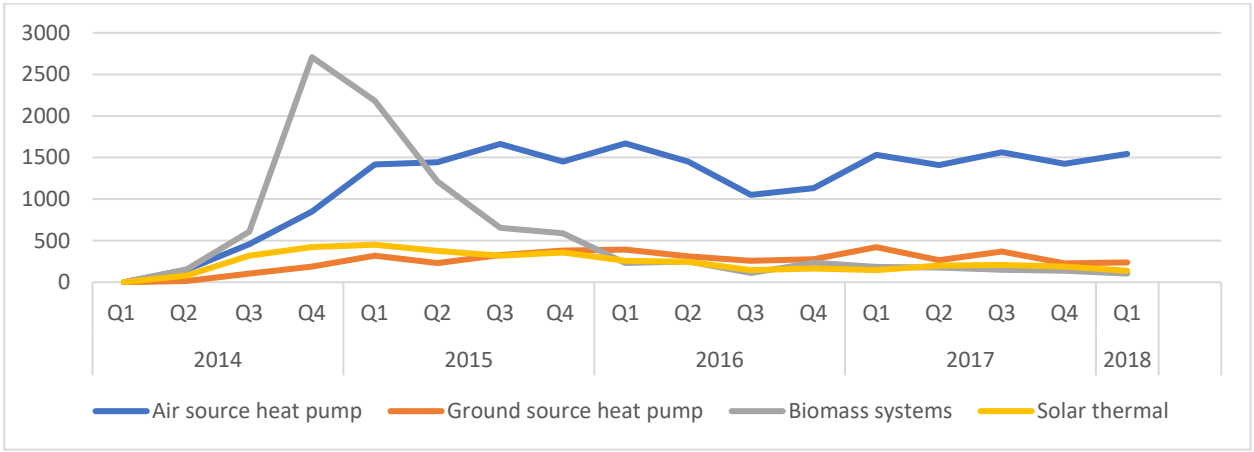
[16] These averages represent the mean capacity for all domestic RHI applications for these technologies, up to end February 2018. Solar thermal is not included as capacity is not an appropriate measure for solar thermal systems. (Source: BEIS, *Non-Domestic RHI and Domestic RHI monthly deployment data*, March 2018).



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

Error! Reference source not found. below shows that domestic biomass applications peaked in 2014 but have since fallen to much lower levels (in line with tariff degressions[17]), while heat pump and solar thermal applications have been more stable.

Figure 3: Applications to domestic RHI scheme by quarter, by date of first application

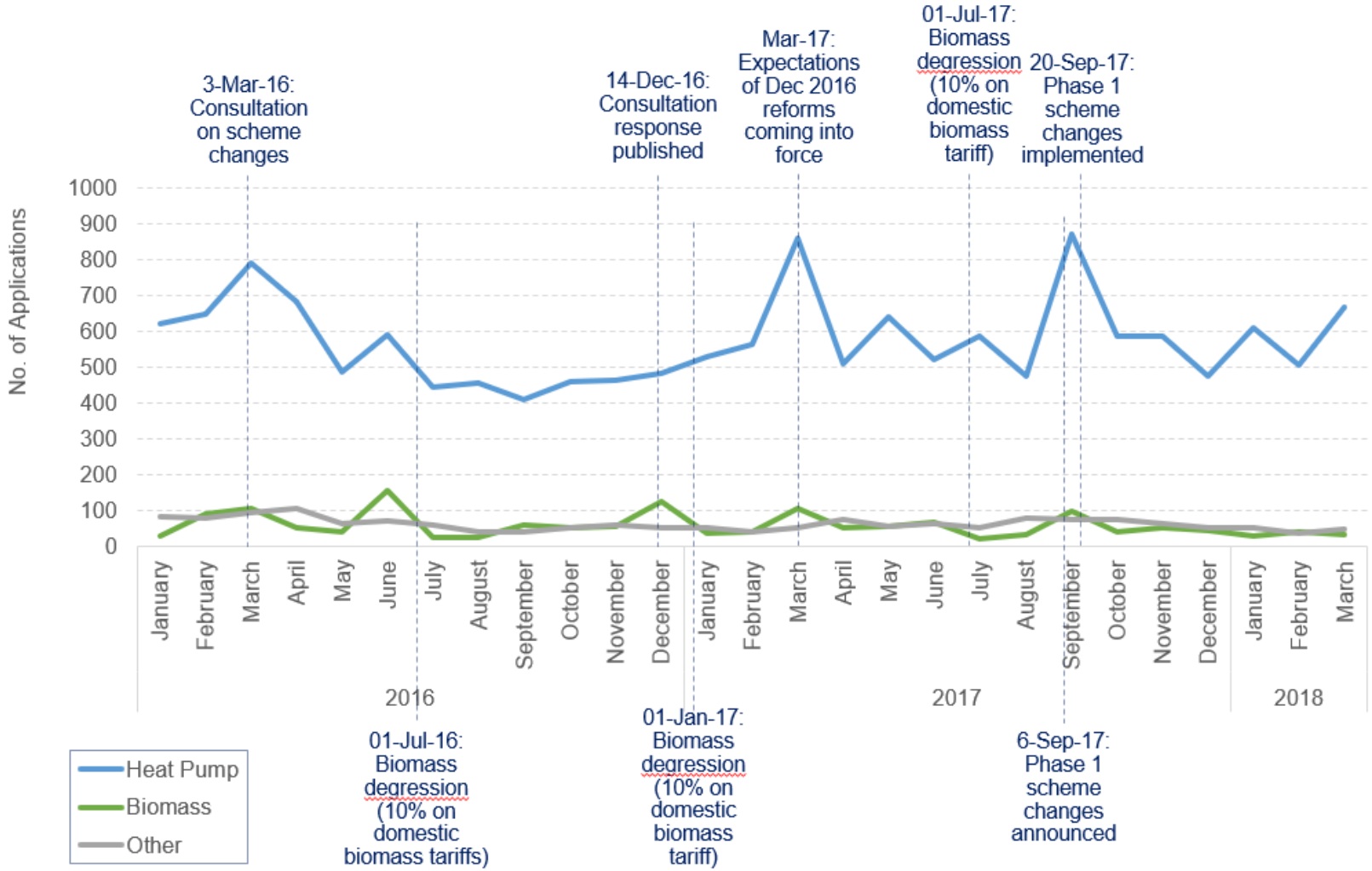


Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

Figure 4 provides more detail on applications up to March 2018. While there was no overall direction to the trend in heat pump applications over 2016 and 2017, there was a spike in heat pump applications around spring 2017, the date when the reforms were expected to come into force. A second spike in applications took place in September 2017, aligned with when the reforms affecting the domestic scheme came into force after a series of delays.

[17] Annual budgets for the RHI are fixed so Government needs to ensure that the scheme stays within budget. The means of controlling the budget for the RHI is through degression, which operates by gradually lowering the tariffs which can be paid to new applicants as more renewable heating systems are installed. Tariffs are only reduced as estimated spend on the scheme reaches certain expenditure thresholds or "triggers". Where required, tariff degressions are applied at the start of a quarter (e.g. 1st January, April, July or October).

Figure 4: Number of applications received for the domestic RHI scheme, and timeline of potential scheme-related influences on domestic RHI applications, by date of first application



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

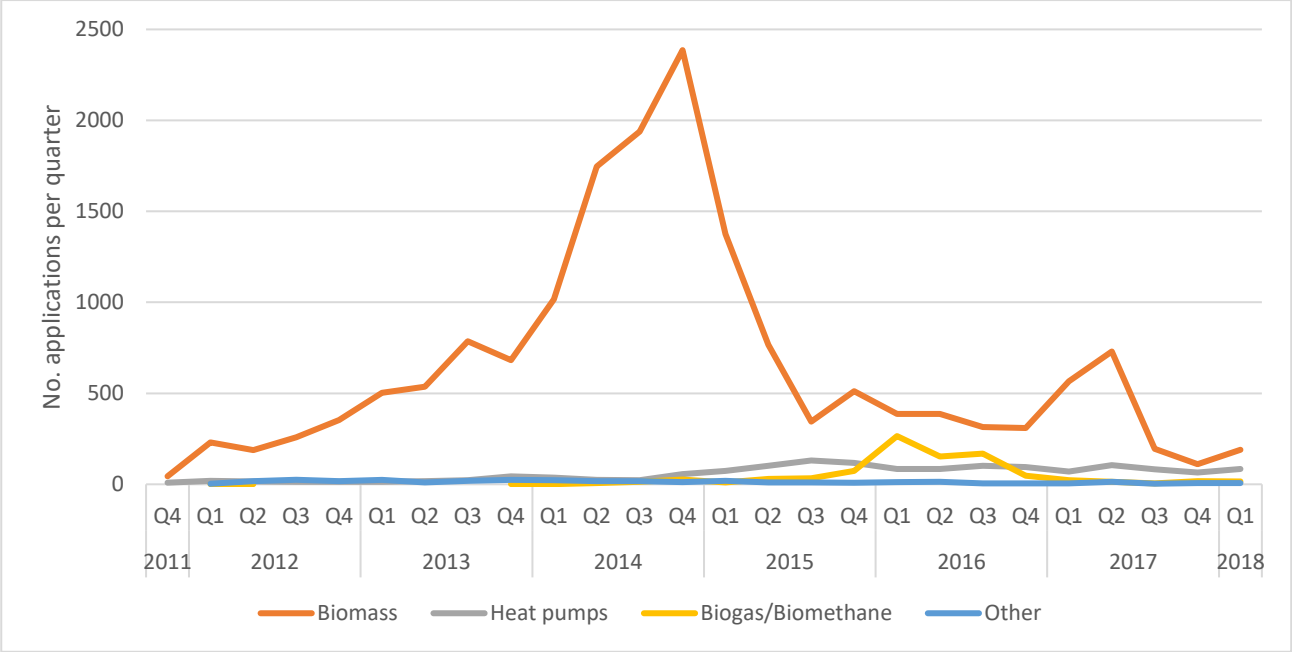
These observed spikes in heat pump applications informed the decision to focus the first wave of evaluation research on understanding the impact of the reforms on domestic heat pump applicants. In chapter 4, we analyse heat pump applications in more detail and explore the extent to which applications during the interim period were influenced by the reform announcements and delays in reform implementation

Within the domestic RHI scheme, applications for biomass boilers and solar thermal installations have continued at a low but stable rate throughout the interim period. **Error! Reference source not found.** shows that there were slight quarterly peaks for biomass boiler applications, but the volatility in biomass boiler applications was lower during 2017 than 2016.

Non-domestic RHI scheme

Since its start in November 2011, biomass applications have dominated the non-domestic RHI scheme, as shown in Figure 5. Applications for small-scale biomass boilers (up to 200 kW) peaked at over 2000 per month at the end of 2014. Extensive tariff degressions then had the effect of reducing small-scale biomass applications to lower levels (e.g. fewer than 40 per month in 2017). Applications for medium-scale biomass boilers (between 200 kW and 1 MW) remained higher (averaging more than 100 per month during 2017), while there were fewer than 5 large-scale biomass boiler applications per month (more than 1 MW) during 2017.

Figure 5: Applications for non-domestic RHI scheme by quarter, by date of first application[18]



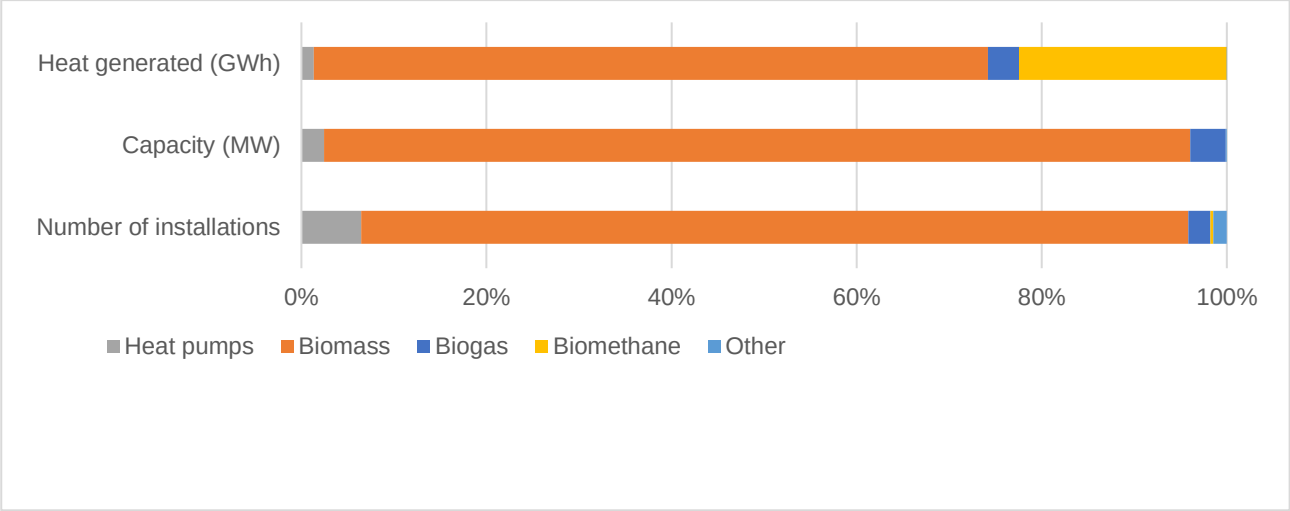
Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

[18] CHP plants are included in the biomass figures. Biomethane and Biogas while the 'Other' category comprises solar thermal and geothermal (although there have been not applications to date for the latter). A small number of installations are undisclosed in published RHI statistics, to avoid disclosure – these are shown as 'undisclosed'.

While low in numbers, individual biogas and biomethane schemes typically involved large-scale investment with a considerable lead-time. These applications peaked in early 2016, prior to degressions affecting their tariffs and the announcement of the reforms. Non-domestic applications for heat pumps (ground source, air source and water source) remained fairly low despite stable or increasing tariffs over time.

Figure 6 shows that biomass installations dominated the number of installations, the capacity installed and the heat generated by the non-domestic scheme since it was introduced in November 2011. In total, 16,593 GWh of heat was generated and paid for by the non-domestic RHI scheme up to March 2018. Included in this total is 4,903 GWh of heat that could have been generated from gas produced by the 56 biomethane plants that have been receiving RHI payments up to March 2018[19].

Figure 6: Breakdown of non-domestic scheme outputs by technology



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

More detailed examination of application numbers over the last two years reveals a pattern of biomass applications that aligns with key reform milestones and tariff degressions, as shown in Figure 7. The largest spikes in the number of biomass applications occurred in March and June 2017, both aligning with the expected spring 2017 introduction of the reforms. The June 2017 spike also aligns with a tariff degression on 1st July. A smaller spike can be observed in September 2017, aligned with the delayed introduction of reforms to remove the 'small-medium-large' bands for biomass, which had the effect of reducing future tariffs for medium-scale biomass plants.

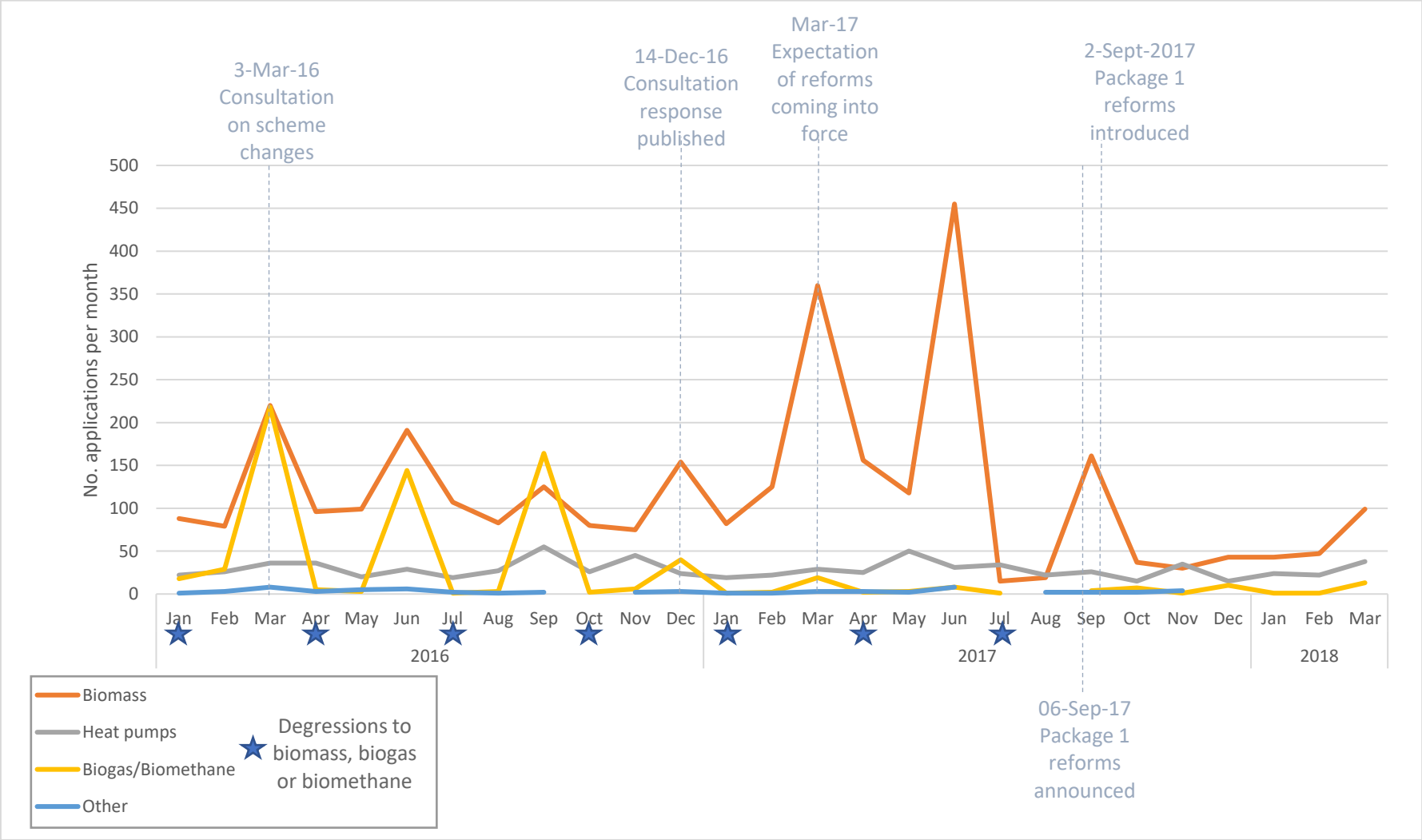
Despite the flexibility built into the changes to the biomethane and biogas tariff (as described on p9), there appeared to be a hiatus in investment decisions for some large-scale technologies (e.g. biomethane and large-scale CHP). Evidence from industry stakeholder consultations suggested applicants in these sectors were holding off investment in anticipation of the introduction of tariff guarantees. Installer evidence also suggested that the reform delays had prevented or delayed the installation of shared ground loops (as a result of the delays to the introduction of deemed metering for shared

[19] Biomethane plants generate gas rather than heat. Their capacity is not included in this chart as it is measured in different units, however, the heat generated from gas produced by these technologies is included in the 'Heat Generated' statistics.

ground loop installations on the non-domestic scheme), however, social housing providers were reported to have been more likely to have continued with installations on the expectation they could apply for the RHI once the deemed payments were introduced.

Chapters 5 and 6 of this report provide additional evidence to explore the extent to which non-domestic applicants were influenced by reform announcements and delays during the interim period. Evidence was strongest for medium-scale non-domestic biomass applications where in-depth interviews were conducted.

Figure 7: Number of full applications (by date of first submission) received for the non-domestic RHI scheme, and timeline of potential scheme-related influences on non-domestic RHI applications



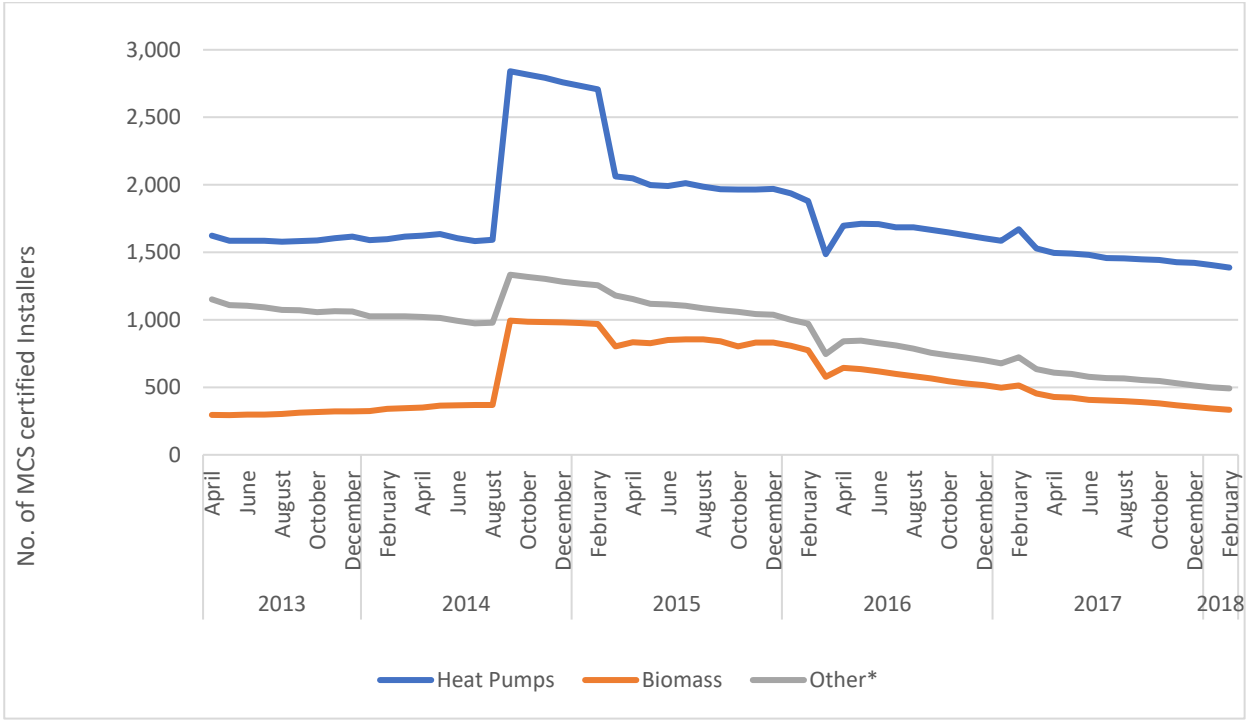
Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

What happened to installation numbers and the renewable heat industry during the interim period?

One indicator of the state of the renewable heat industry is the number of installers registered with the Microgeneration Certification Scheme (MCS). This is the best available indicator of the state of the domestic renewable heat industry as all domestic RHI applications are required to be installed by an MCS registered installer (or equivalent). Any non-domestic installations below 45 kW will also most likely be installed by MCS-registered installers but larger installations are delivered by non-MCS installers.

Figure 8 shows there are more installers registered with MCS to install heat pumps, compared to biomass and solar thermal. Following a peak in 2014/15, there has been a slow but steady decline in the number of installers registered to install renewable heat technologies below 45 kW. Consultation with industry stakeholders suggests that this may be explained by a number of factors including consolidation of smaller installers, ongoing changes in how the MCS scheme is run (including the introduction of higher fees for MCS registration), as well as changes in demand for renewable heat technologies (e.g. as a result of tariff degressions from 2015 onwards) and the influence of reform announcements and delays during the interim period. The influence of reforms on installers is explored further in chapter 7.

Figure 8: Number of MCS registered installers[20]



Source: MCS installer statistics (http://www.microgenerationcertification.org/about-us/statistics)

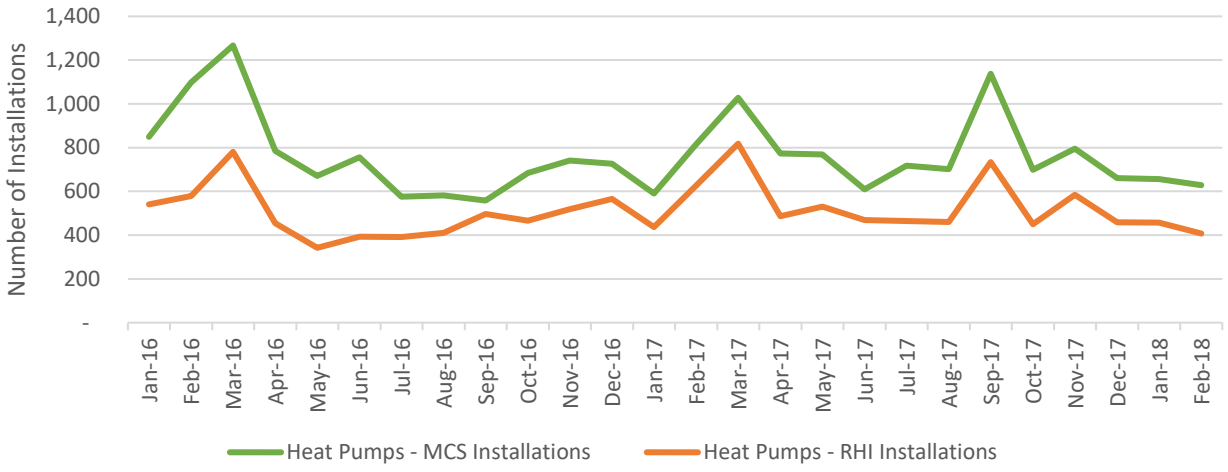
In addition to assessing MCS installer numbers, it is also possible to review the number of individual installations carried out by MCS installers. MCS reports installations for

[20] 'Other' MCS installers represent solar thermal installers, as geothermal is not covered by MCS data.

renewable heat technologies, including installations that were not supported by the RHI scheme and those not eligible for RHI support. The MCS installation figures do not distinguish between domestic and non-domestic installations, but due to the size requirements will predominantly be domestic.

The MCS heat pump installation figures presented in **Error! Reference source not found.** show that installations follow the same expected pattern as RHI applications, with the higher levels of installation than the RHI statistics due to the inclusion of types of heat pumps that are not eligible for RHI (such as air to air heat pumps or installations in new builds). For example, in March 2017, MCS reported 1028 heat pump installations but there were only 802 RHI heat pump installations (787 domestic and 15 non-domestic). The MCS data shows spikes in installations in March 2016, March 2017 and September 2017 being in line with the RHI deployment spikes for heat pumps: the reasons behind the pattern for domestic heat pump installations is explored further in chapter 4.

Figure 9: Heat pump installations by MCS installers (excluding exhaust air heat pumps) and under the RHI scheme (both domestic and non-domestic)[21]

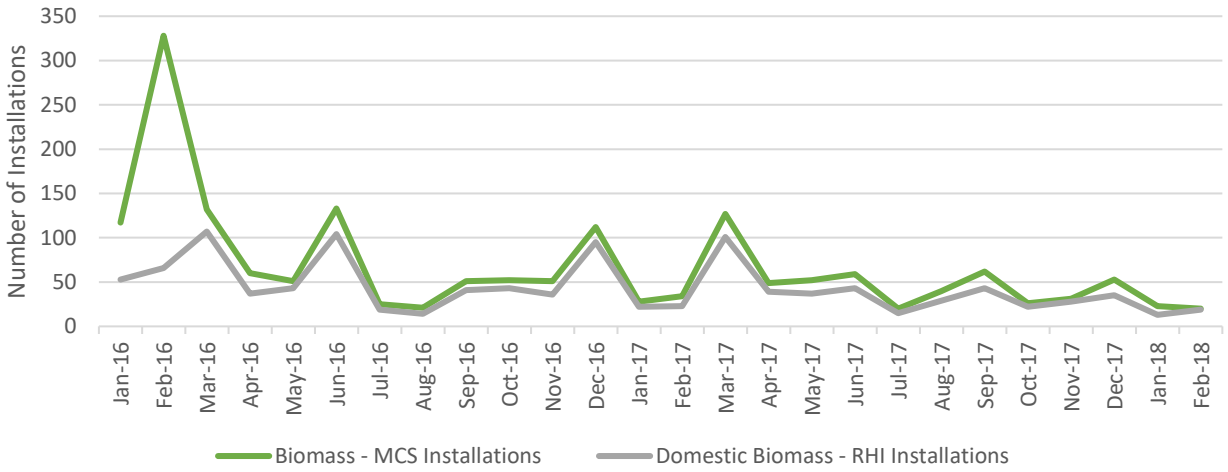


Source: MCS installation data (http://www.microgenerationcertification.org/about-us/statistics); RHI installation data shows cleaned data from Ofgem for accredited applications (not 'applications received' as shown earlier in this section). The latter is not yet available for March 2018.

MCS figures for biomass exclude installations above 45 kW, so they include all domestic but only some small-scale non-domestic biomass installations (as the latter include installations of much larger sizes). As shown in **Error! Reference source not found.**, MCS figures show a large spike in February 2016, preceding one of the degressions for non-domestic small-scale biomass. Beyond that point, MCS installation statistics closely mirror RHI domestic biomass installations because there were much lower volumes of small-scale non-domestic biomass installations. There were modest spikes in both the MCS and domestic biomass series in June and December 2016, and in March and September 2017. Chapter 5 explores the reasons for spikes in non-domestic medium-scale biomass applications to the RHI, which are not shown in this chart.

Figure 10: Biomass installations by MCS installers

[21] MCS heat pump figures include air to air heat pumps which are not eligible for RHI, but exclude



Source: MCS installation data (http://www.microgenerationcertification.org/about-us/statistics); RHI installation data shows cleaned data from Ofgem for accredited applications (not 'applications received' as shown earlier in this section). The latter is not yet available for March 2018.

We have also examined whether customers report difficulties or lack of choice in finding a suitable installer. The applicant survey results suggest that access to suitable installers is not a large problem: the survey of domestic consumers making applications between April 2016 and September 2017 found that 11% of heat pump applications reported problems finding an installer, compared to 15% of biomass applications and 14% of solar thermal applications. Previous applicant surveys collected statistics for the number of applicants that found it easy to find an installer, which showed some variation over time (possibly associated with peaks and troughs in demand). During the interim period, a slightly higher proportion of applicants making non-domestic than domestic applications reported problems finding an installer: 22% of non-domestic heat pump applications, 21% of non-domestic biomass applications and 17% of non-domestic solar thermal applications reported problems. It is not clear why non-domestic applicants found identifying an installer slightly more problematic than domestic applicants.

To what extent were RHI applications influenced by the reform announcements?

The previous sections illustrated application and installation trends during the interim period. The section below explores what influence the RHI reform proposals, and the subsequent delays to their implementation, had on these trends. The influence of the reform proposals is then explored in more depth for each technology in chapters 4, 5 and 6.

Domestic RHI applications

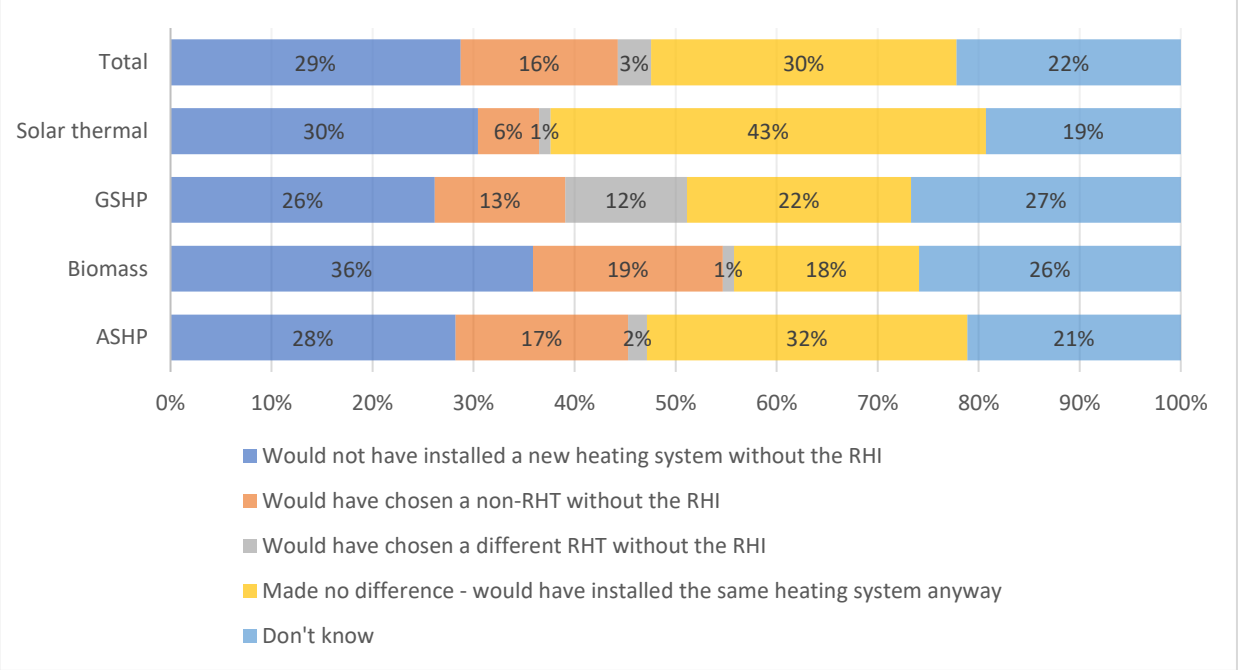
Influence of the RHI in general

Domestic applicant survey results showed that a significant proportion of applicants during the interim period reported that the RHI influenced their installations.

The survey aimed to assess the 'additionality' of the RHI scheme i.e. whether the scheme resulted in 'additional' installations that would not otherwise have taken place. Respondents were asked to report the extent to which the RHI led to renewable heating technology installations that would not have taken place in the absence of the RHI scheme. It should be noted that these are self-reported perceptions from applicants and are subject to potential recall and perception bias. These figures are therefore most valuable for tracking changes over time, or between groups, rather than assessing the absolute impact of the scheme.

As Figure 11 highlights , in terms of 'additionality'; the survey found that for 45% of applications between April 2016 and September 2017, applicants said either they would not have installed a new heating system without the RHI (29%) or would have installed a non-renewable technology without the RHI (16%). Additionality was highest amongst biomass applications (55%), followed by air source heat pumps (45%), ground source heat pumps (39%) and solar thermal (37%).

Figure 11 Domestic applicant's self-reported hypothetical behaviour in the absence of the RHI (April 2016-September 2017), by proportion of applicants per technology



Source: Winning Moves, Domestic applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=2,414)

The survey also found that 33% of applications were 'non-additional': 30% of applicants believed they would have installed the same renewable heating system in the absence of the RHI and 3% would have installed a different renewable heat technology. 22% did not know what they would have done.

The levels of overall self-reported additionality have fluctuated over time. The proportion of applications in which the applicant said they would have installed the same technology

without the RHI were around 23% at the outset of the scheme (April-June 2014[22]), peaking in April-June 2016 at 45% and then steadily decreased to 22% in July-September 2017. Interpreting these figures requires further analysis as the proportion of applications where the applicant says they “Don’t know” has also fluctuated from 14% to 27%.

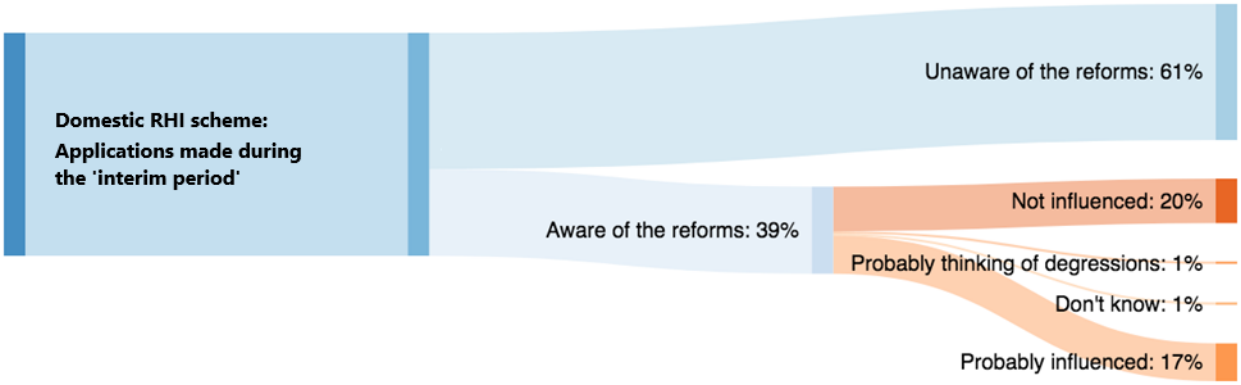
Further research to understand additionality will be conducted in later years of the evaluation. A particular focus of this will be understanding the indirect influence that the RHI has on applicants, particularly the influence that the RHI has had on those in the building trade and how this is influencing the heating system recommendations they give to householders.

Awareness of the RHI reform proposals

The domestic applicant survey found that in 39% of domestic RHI applications between April 2016 and September 2017, applicants were aware that the Government had published proposals to make changes to the RHI's tariffs and eligibility (see Figure 12). There was significantly greater applicant awareness of the reforms for 2017 applications (when there were published proposals) than 2016 applications (when there was only the consultation).

Those applying for biomass were slightly more likely to state that they were aware of the RHI reform announcements. However, the qualitative research suggested that some may have been thinking of general tariff degressions, or the tariff degressions may have made this group more likely to pay attention to or be aware of policy changes.

Figure 12 Proportion of domestic RHI applications (April 2016 – September 2017) for which respondents reported (a) being aware of at least one proposed reform and (b) being influenced by the reform proposals



Source: Winning Moves, Domestic applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=2,414)

Influence of the RHI reform proposals

A fifth of domestic applicants (17%) who applied during the interim period reported being influenced by the reform proposals.

[22] There are small methodological differences between the early and more recent surveys meaning these figures should be treated as indicative only.

Those aware of the reforms and applying in 2017 were much more likely to be influenced by them than those aware and applying in 2016. One reason for this may be that the reforms were only at consultation stage in 2016 and therefore less likely to have influenced decisions.

Domestic applicants who were influenced by the reform proposals were more likely to attribute their renewable heat technology to the RHI than those who were not influenced. This makes sense, in that those applying for installations which were more underpinned by RHI income would be more sensitive to potential changes in that income. For 56% of applications that were influenced by the reforms, the applicant would not have installed a renewable heating system in the absence of the RHI. For applications that were not influenced by the reforms, the figure was 42%.

By far the most common type of influence was on timing, with the majority of respondents who said they had been influenced by the reforms reporting that the timing of their applications or installations had been brought forward as a result. As suggested in chapter 4, this is likely, at least in part, to be a result of applicants with high heat demands seeking to avoid the implementation of the heat demand limits.

In most cases this decision seems to have been led by the applicant, but some respondents also admitted that they had simply been told of the need to apply or install earlier by their installer. Other respondents may have neglected to mention the role the installer or others had in influencing that decision.

Non-domestic RHI applications

Influence of the RHI in general

The non-domestic applicant survey found that self-reported additionality is higher for non-domestic applications than domestic applications. As illustrated in Figure 13 Non-domestic applicant's (excluding biogas and biomethane) self-reported hypothetical behaviour in the absence of the RHI (April 2016-September 2017), by proportion of applicants per technology

, for 62% of non-domestic applications (excluding biomethane and biogas) between January 2015 and September 2017, applicants said either they would not have installed a new heating system without the RHI (24%) or would have installed a non-renewable technology without the RHI (38%). Analysis by technology indicated that additionality was highest for biomass CHP applications (80%) and lowest for air source heat pump applications (30%).

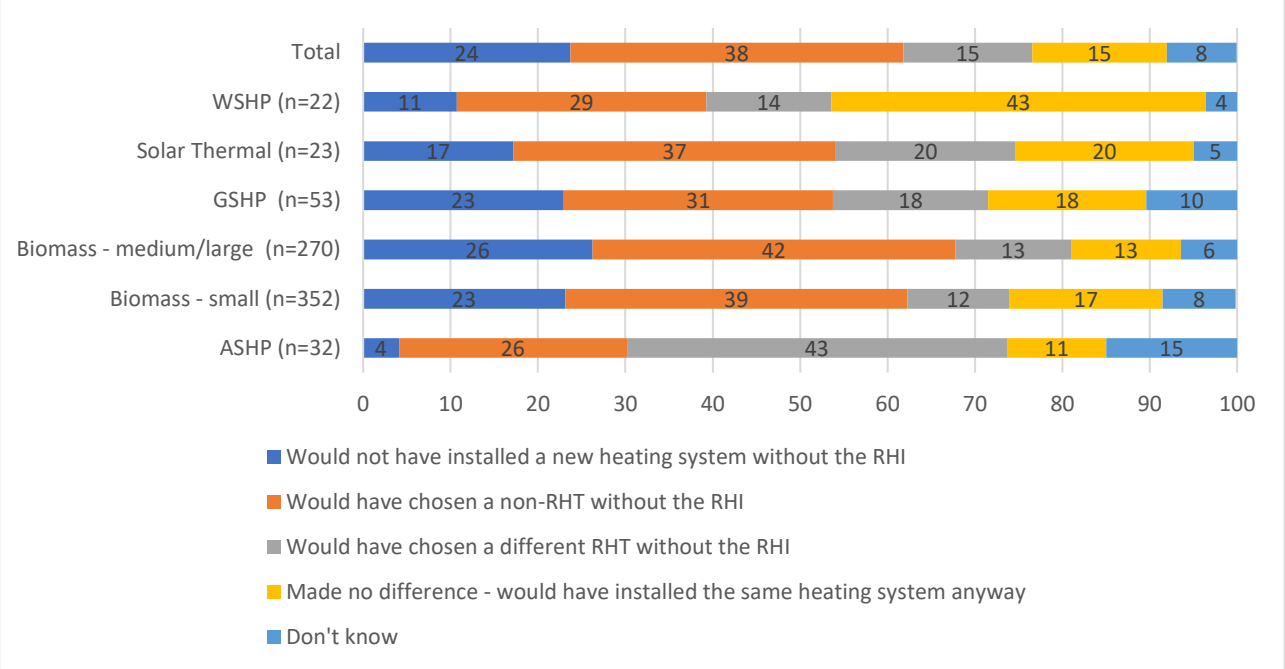
As Figure 13 Non-domestic applicant's (excluding biogas and biomethane) self-reported hypothetical behaviour in the absence of the RHI (April 2016-September 2017), by proportion of applicants per technology

highlights, 15% of applicants responding to the survey believed they would have installed the same renewable heating system in the absence of the RHI, 15% believed they would have installed another renewable technology, while 8% did not know what they would have done.

The impact of the RHI appears to be very different across the technologies. For ASHP applicants, the applicants are more likely to report that the RHI influenced the decision between renewable heating technologies (with 43% saying they would have installed a

different renewable heating technology). However, biomass applicants are more likely to reporting having been influenced to consider renewable heating technologies at all (with 40% saying they would have installed a non-renewable technology, and 20% saying they would not have installed any system).

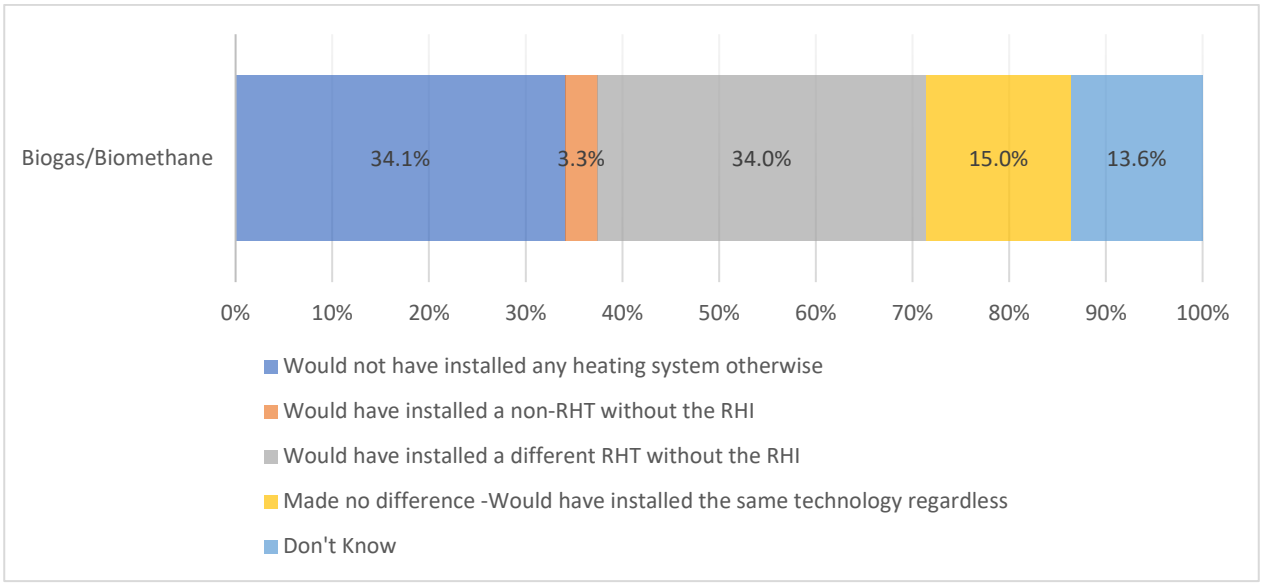
Figure 13 Non-domestic applicant's (excluding biogas and biomethane) self-reported hypothetical behaviour in the absence of the RHI (April 2016-September 2017), by proportion of applicants per technology



Source: Winning Moves, Non-domestic applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=752). Note that for technologies where the response were small, these figures are indicative only.

Biogas and biomethane applicants were surveyed separately and findings from that survey indicated that additionality was lower for applications for these technologies, see Figure 14. Overall additionality was 37%, with 34% of biogas/biomethane applicants stating that in the absence of the RHI they would not have installed a new system at all and 3% stating that they would have installed a non-renewable heat technology (3%). The survey also found that 15% of applicants believed they would have installed the same renewable technology in the absence of the RHI, 34% would have installed another type of renewable technology, while 14% did not know what they would have done.

Figure 14 Biogas and Biomethane applicant's self-reported hypothetical behaviour in the absence of the RHI (April 2016-September 2017)



Source: Winning Moves, Biogas and Biomethane applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=189)

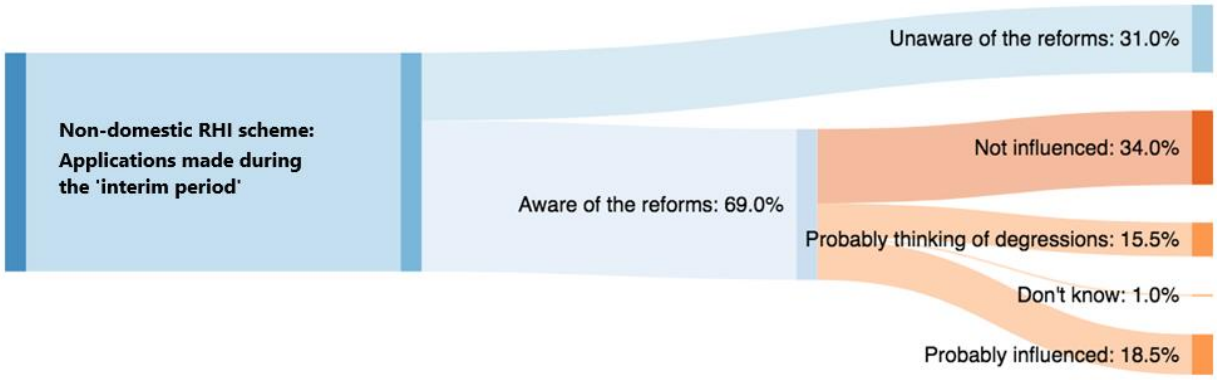
Key trends suggested that applicants who were located on the gas grid were most likely to report that they would have installed the same technology without the RHI (29% vs 7% off the gas grid), suggesting they were most likely to have a business case that operates effectively without the RHI. Additionality for biogas and biomethane applications is discussed further in chapter 6.

Awareness of the reform proposals

For non-domestic applicants applying between April 2016 and September 2017, 69% of survey respondents, excluding biogas and biomethane,[23] reported that they were aware of at least one of the proposed reforms, a much higher awareness rate than for domestic applicants (see Figure 15). Of the specific proposed reforms, awareness was highest for the proposed tariff reductions.

Figure 15 Proportion of non-domestic RHI applications[24] (April 2016 – September 2017) for which respondents reported (a) being aware of at least one proposed reform and (b) being influenced by the reform proposals

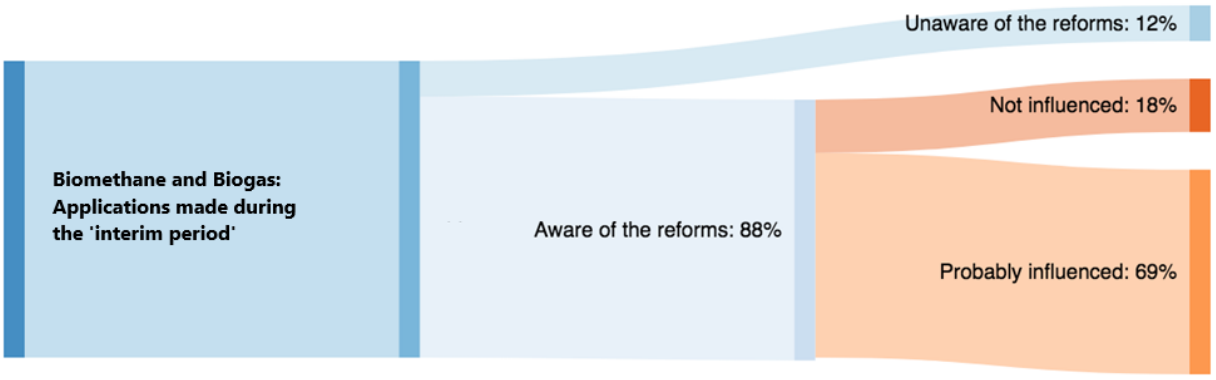
[23] Note that 'non-domestic' survey figures do not include biogas and biomethane applicants, as they were surveyed separately.
[24] ibid.



Source: Winning Moves, Non-domestic applicant monitoring survey (excluding biomethane and biogas) with applicants successful from April 2016 to September 2017; (n=607)

For biogas and biomethane applicants, awareness was even higher, with 88% of survey respondents indicating that they were aware of at least one of the proposed reforms (see Figure 16).

Figure 16 Proportion of biogas and biomethane RHI applications (April 2016 – September 2017) for which respondents reported (a) being aware of at least one proposed reform and (b) being influenced by the reform proposals



Source: Winning Moves, Biogas and biomethane applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=100)

Influence of the reform proposals

Overall, non-domestic applicants were more likely to report being influenced by the reforms than domestic applicants. 18.5% of non-domestic applicants in the interim period reported being influenced by the reform proposals. A further 15.5% reported they were

influenced by the reforms but were probably referring to the tariff degressions[25]. Among the 19% of non-domestic applicants reporting being influenced by the reforms, the majority said that the reforms influenced the timing of their installation or RHI application.

When compared to the domestic scheme, the relationship between reported impact of the reforms and additionality ran in the opposite direction. Non-domestic applicants who reported being influenced by the reforms reported lower additionality (54%) than those who were not influenced by the reforms (63% additionality). This means that applicants who were influenced by the reforms may have been less likely to see the RHI as central to their decision. Those applicants reporting that the reforms influenced their application were less likely to report that they would have chosen the same installation in the absence of the RHI (5% of applications versus 20% of applications where the applicant did not cite the influence of the reforms) but they were more likely to have chosen a different renewable heat technology (40% of applications versus 12% of applications where the applicant did not cite the influence of the reforms).

These findings indicate that for non-domestic applications, the reform announcements played a significant role in the choice between renewable technologies, whereas in the domestic scheme the influence was more in terms of the choice of installing a renewable technology or not. This may be reflective of a greater prevalence of non-financial drivers in non-domestic installations, e.g. wider business motivations for pursuing a renewable heat installation, and is something that will be explored further in the ongoing evaluation.

4. Influence of reform announcements: domestic heat pump applications

This chapter presents the findings in relation to domestic heat pump applications. This group was chosen for in-depth analysis due to the spikes in applications observed during 2016 and 2017. It sets out how and why domestic heat pump applicants were influenced by the reform announcements and the delays, and the circumstances which affected this influence.

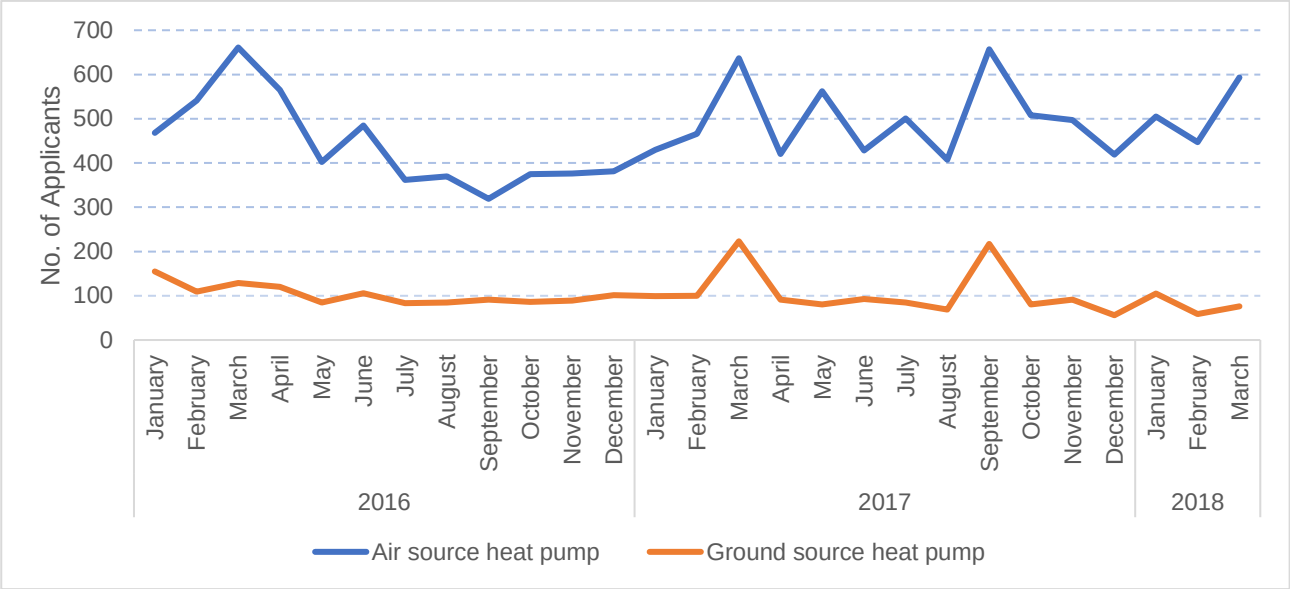
Impact of the reform announcements and delays

Number of applications

The number of domestic heat pump applications per month between January 2016 and March 2018 are shown in Figure 17.

Figure 17 Number of domestic air source heat pump and ground source heat pump applications, January 2016 to March 2018

[25] Judgement based upon (a) their open end response on the influence of the reforms (assuming they provided one / a clear one) and (b) the timing of their application i.e. If their application was near to one of the degressions.



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

The graph highlights that during the 'interim' period (December 2016 to September 2017), there were two main spikes in applications for both heat pump types, in March 2017 and September 2017. There were also smaller spikes during this period for air source heat pumps, in May and July 2017. It is worth noting that for air source heat pumps there were also application spikes in both March 2016 and March 2018, suggesting that the March 2017 spike for air source heat pumps may, in part, be explained by an annual applications pattern, as well as the impact of the reform announcements (as highlighted below).

Influence of the RHI in general

The subsidy provided by the RHI played an important role in incentivising the installation of heat pumps for applicants during the interim period. This is highlighted by the domestic applicant survey, undertaken with successful RHI applicants from April 2016 to September 2017. It found that for 45% of air source heat pump applications and 39% of ground source heat pump applications, applicants reported that, without the RHI, either they would not have otherwise installed a new heating system at all or would otherwise have installed a non-renewable technology. For context, this can be compared to surveys of applicants for these technologies between 2014 and 2016, where the figures were 40% and 46% respectively[26].

It should be noted that for 21% of air source heat pump applications and 27% of ground source heat pump applications in this period, applicants stated that they did not know what they would have done in the absence of the RHI. This can be understood further by the qualitative fieldwork which highlighted that as well as applicants whose heat pump installation was driven by the RHI subsidy, there were also applicants for whom the RHI was one of a mixture of reasons (e.g. environmental motivations, self-sufficiency, heating performance, etc.). In these instances, the RHI subsidy appeared to provide an important

[26] Report from waves 1-24 of the domestic RHI census of accredited applicants. https://www.gov.uk/government/publications/report-from-waves-1-24-of-the-domestic-rhi-census-of-accredited-applicants [Accessed: 4 February 2019]

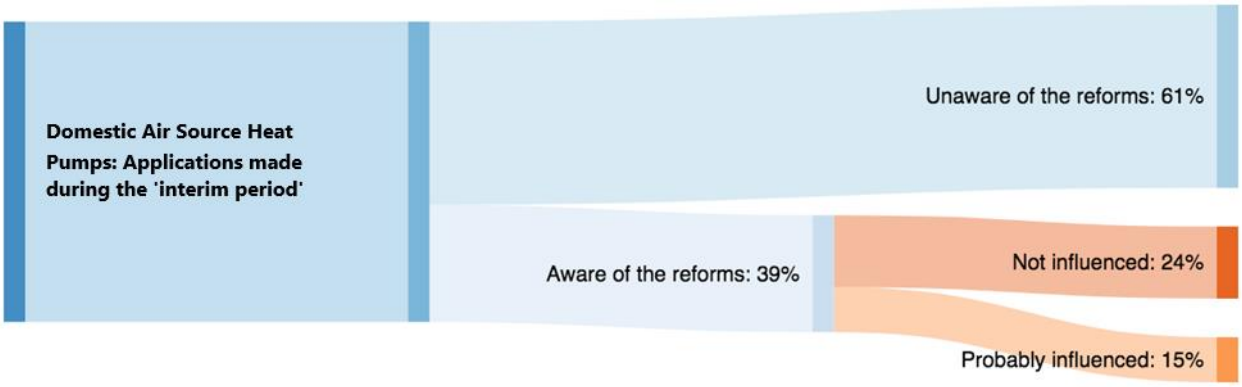
'nudge' in applicants' decision-making processes; it is not certain whether the applicants would have gone ahead with a heat pump installation without the RHI.

Applications influenced by the reform announcements

In 44% of domestic ground source heat pump applications, and 39% of air source heat pump applications, surveyed between April 2016 and September 2017, applicants reported being aware that 'the Government had published proposals to make changes to the RHI's tariffs and eligibility'.

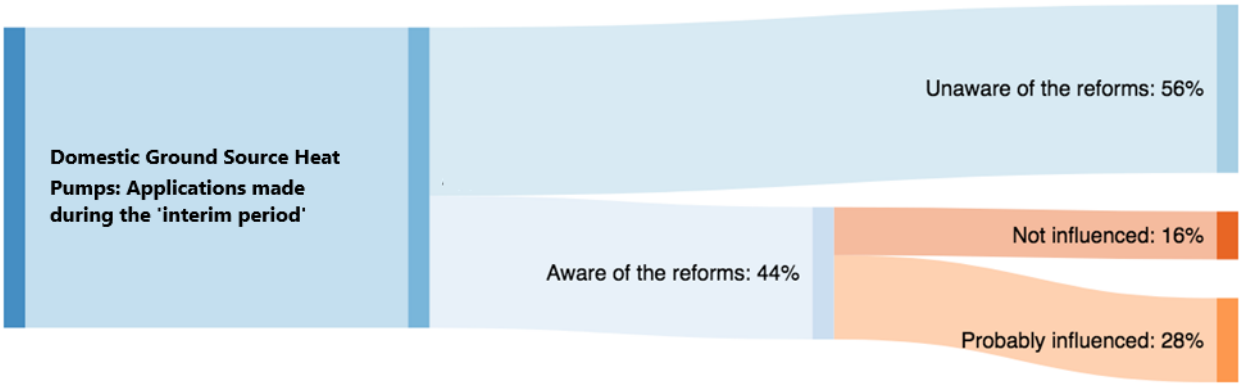
As illustrated in **Error! Reference source not found.** and **Error! Reference source not found.**, ground source heat pump applicants during this period were almost twice as likely to have been influenced by the reforms. 28% of ground source heat pump applicants (65% of those aware of the reforms) and 15% of air source heat pump applicants (38% of those aware of the reforms) said that they were influenced by the reform proposals in some way.

Figure 18 Proportion of domestic air source heat pump RHI applications (April 2016 – September 2017) for which respondents reported (a) being aware of at least one proposed reform and (b) being influenced by the reform proposals



Source: Winning Moves, Domestic heat pump applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=1,492)

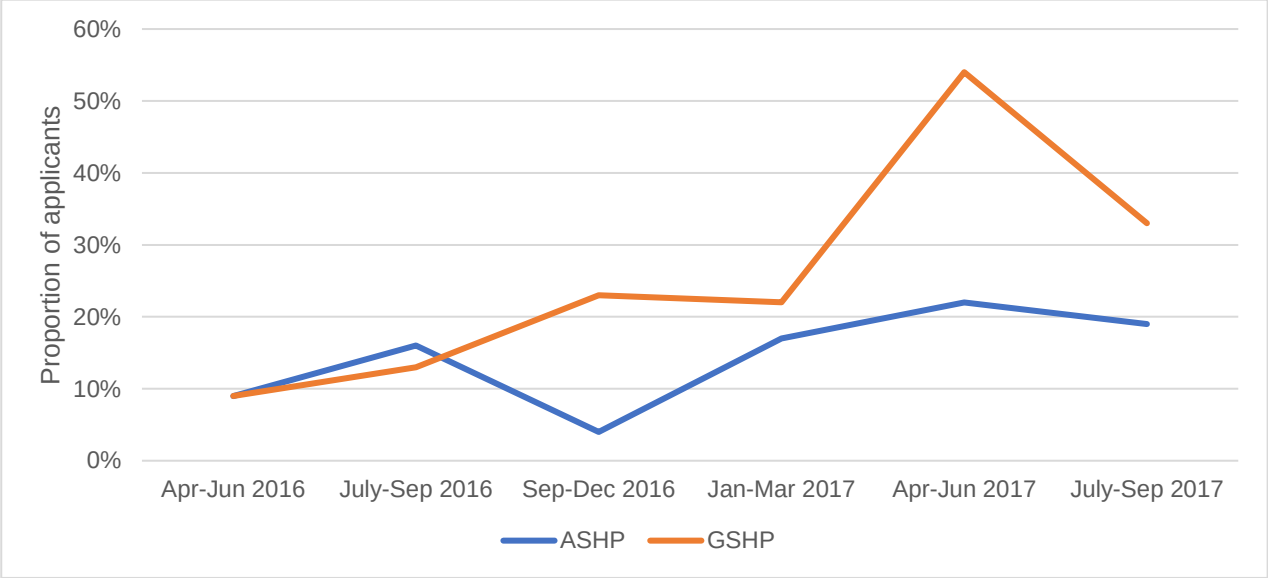
Figure 19 Proportion of domestic ground source heat pump RHI applications (April 2016 – September 2017) for which respondents reported (a) being aware of at least one proposed reform and (b) being influenced by the reform proposals



Source: Winning Moves, Domestic heat pump applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=453)

Error! Reference source not found. illustrates that domestic heat pump applicants who were aware of the reforms and applied during the interim period were more likely to be influenced by them than those who applied before December 2016. This perhaps reflects the fact that the reforms were only at consultation stage between March and December 2016 and therefore less likely to have influenced decisions, although there was no clear evidence to support this.

Figure 20 Proportion of domestic heat pump applicants reporting they were influenced by the Government's proposal to make changes to the RHI's tariffs and eligibility

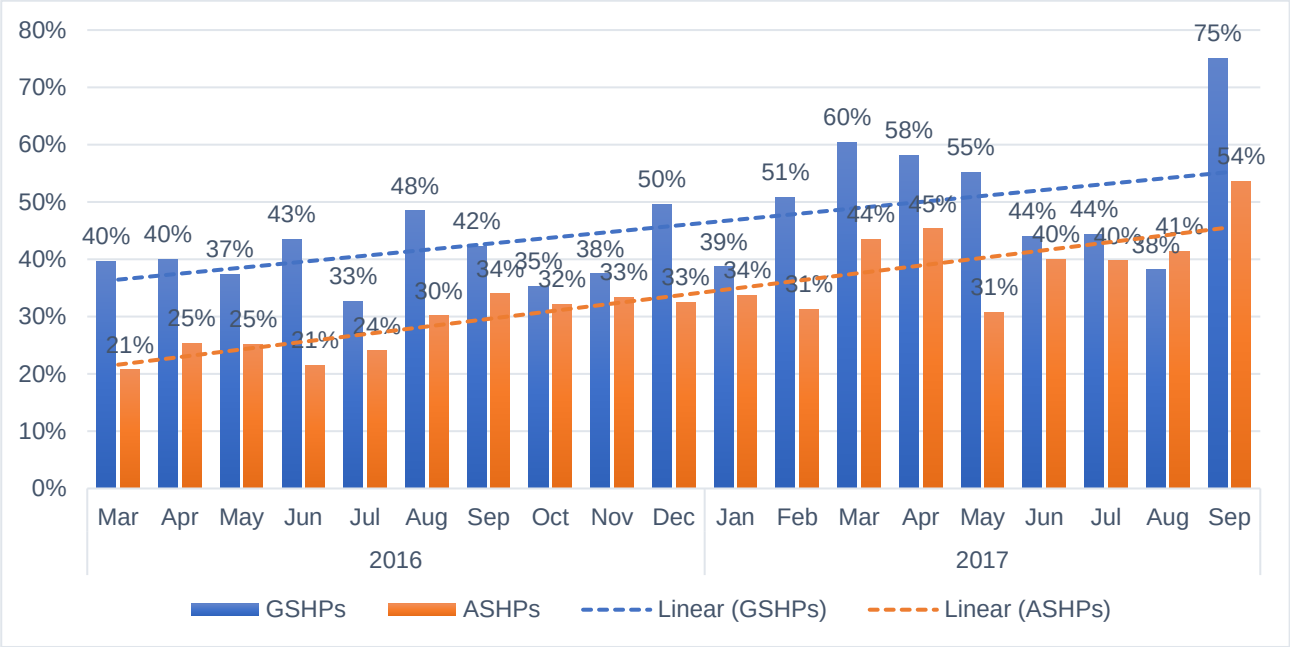


Source: Winning Moves, Domestic applicant monitoring survey with applicants successful from April 2016 to September 2017 (n=472, air source heat pumps; n=193, ground source heat pumps)

Notably, applicants for air source and ground source heat pumps in March and September 2017 were more likely than heat pump applicants at other times to be aware of the reforms (59% to 35%), more likely to state that they had been influenced by them (23% to 16%), and more likely to say the timing of their application had been influenced.

Considering that the September reforms introduced heat demand limits for domestic applicants, it is not surprising that many of the applicants in March and September 2017 had high heat demands. The mean heat demand for respondents in the 'spike' months was 17,969kWh compared to 14,129kWh for heat pumps in other time windows. Similarly, **Error! Reference source not found.**Figure 29 shows that the proportion of applications for installations with heat demand over the heat demand limits rose during this period. The numbers of applications for installations with heat demand over the heat demand limits was particularly high (proportionately and in absolute terms) in the spike months of March and September. These figures suggest that there was a push to submit applications for high heat demand installations before the heat demand limits were introduced.

Figure 21 Proportion of domestic heat pump applications per month that were for installations that exceeded the heat demand limits introduced at the end of September 2017



Source: BEIS, Domestic RHI application data

Data from the survey provide further insight into reform awareness, strengthening the assumption that applicants from larger households were most aware:

- Those making applications for larger properties (150 sq m +) were more likely to report being influenced by the reforms than those in smaller properties; and
- Those making applications for an installation in a detached property were more likely than those in other property types to report being influenced by the reforms.
- Those making multiple applications (for example social housing providers or households installing more than one eligible technology) were more likely than those making single applications to be aware of the reform proposals but less likely to report being influenced by them;

Nature of the influences of the reform announcements

The domestic applicant survey findings show that by far the most common influences were on timing. The majority of respondents who said they were influenced by the reforms reported that the timing of either their application (70% for ground source heat pump applications, 63% for air source heat pump applications) or installation (88% for ground source heat pump applications, 73% for air source heat pump applications) had been affected. The survey responses suggested that in these cases, applicants were bringing forward (as opposed to delaying) their applications and installations.

As explained in section 7, in-depth research with installers revealed that some multiple-property non-domestic RHI applications by social housing providers were held back because of delays to specific reforms for shared ground loop heat pumps, but research

with individual domestic applicants found no evidence of reforms delaying domestic applications.

In terms of other influences, a small proportion of domestic heat pump applicants (between 2% and 8%) said that the reform proposals had influenced their choice, sizing or operation of their heat technology. There was insufficient evidence to explain why these applicants were influenced differently.

How did domestic heat pump applicants react to the reform announcements, why, and under what circumstances?

The section below sets out the different ways in which domestic heat pump applicants responded to the reform proposals, why they responded to the proposals in the way they did, and the circumstances which influenced this.

The evidence below illustrates the types of applicants identified through this research and their experiences. The research methodology means that there may be other types of applicants that have not been captured by our research, but do exist in the population. The full applicant theories, expressed using the realist methodology, can be found in appendix C. A summary of the theory is included in the blue boxes in each of the applicant type descriptions below.

Domestic heat pump applicant types 1-3 were all influenced by the reforms and were therefore in the minority, whilst applicant type 4, who were not influenced by the reforms, made up 83% of the applications during this period. As noted above, we know from the survey data that those making applications for installations in larger and/or detached properties were more likely to be in types 1-3.

Domestic heat pump applicant 1: “RHI had no influence on application timing”

These were applicants for whom the timetable for installation of a heat pump system was unaffected by the proposed changes to the RHI. The domestic applicant survey found that 72% of ground source heat pump applications and 85% of air source heat pump applications during the interim period were unaffected by the reform proposals. These applications may also have included applicants falling into applicant type 4 as it was not clear from the applicant survey responses what proportion of applications fell into this category.

Summary of the theory for applicant type 1

Where… domestic heat pump applicants were unaware of reform proposals, or were aware of the reforms but did not think they would impact their application, or the timing of their application was determined by other factors (e.g. timetable for refurbishment of their home; or the need to fit expenditure within a certain financial year)

then…these applicants installed their technology as planned, without any influence from the reforms

because… applicants had no ability or no need (or no awareness of any need) to speed up their installation and expected to be able to afford the installation irrespective of timing vis a vis the reforms.

Contexts influencing this reasoning were:

- Applicants who did not think the reforms would impact on their installation or application (even if they would) were unaffected by the proposed RHI changes.
- Similarly, applicants who were simply unaware of the reform proposals were also unaffected by the proposed RHI changes.
- Applicants may have been unaware of the reform proposals but may have been influenced by advice from an installer, architect or other supply chain stakeholder to apply by a certain date, for reasons not directly related to the RHI scheme itself.
- The qualitative fieldwork highlighted that there were applicants who were focused on the completion of refurbishment work to their home. This refurbishment timescale was the key determinant of the timing of their installation and subsequent application and they had limited ability to alter this.

> *Never once did I refer to it or it made any difference to - all I cared about was getting my barn finished and heated. And the installation just came along with a timetable, which was driven predominantly by my builder and not anything else.*
>
> Domestic heat pump applicant

Domestic heat pump applicant type 2: “The anticipated reforms sped up my application (perceived reduced benefits post-reforms)”

These were applicants whose installations would have had a heat demand over the heat demand limits and therefore submitted their applications ahead of the reforms to ensure that they avoided the reduction in RHI payments that the reforms would have caused.

> *From what I recall, there was a meaningful shift in the calculation of the amounts... we would have been capped, I think, in the amount that we could have received because we were going for a larger installation. I ran the numbers and it seemed to*

me that we would be significantly better off if we were in the uncapped. So ... I was particularly keen to get over line before that change took place.

Domestic heat pump applicant

Summary of the theory for applicant type 2

Where… domestic heat pump applicants: were aware of the proposed reforms to the RHI; believed that these would reduce the RHI payments they would receive or were told by a supplier to install by a certain date; and had the ability to flex their installation timing

then…these applicants installed their technology and applied to the RHI as soon as possible to guarantee their RHI benefits

because… applicants wanted to avoid a reduction in income.

As highlighted above in the survey findings, the majority of heat pump applicants who were aware of, and were influenced by the reforms proposals, changed the timing of their applications or installations as a result.

A key context for applicants of this type was an awareness of the reforms, combined with a view that the introduction of heat demand limits would negatively impact on their RHI payments.

The ability of an applicant to be flexible in the timing of their installation or application was also important; for example, there were applicants of this type who were carrying out refurbishment works and had sufficient flex in their installation and application timescale to complete their installation and submit an application ahead of when they otherwise would have. In other cases, there were applicants who were retrofitting heat pumps into their heating system for cost reasons and so were not driven by particular building timescales. Qualitative and quantitative evidence also highlighted that installers had an influence through encouraging some applicants to apply or install early.

The survey findings also flagged that applicants in this group (and applicant type 3, below) were also more likely than other groups to attribute their installation to the RHI scheme. As with applicant type 3, the survey also highlighted that these applicants were also more likely to be in larger, detached properties and have a higher annual household income. This is consistent with the idea that these applicants had high heat demands.

Also similar to applicant type 3, both qualitative and quantitative evidence highlighted that installers or other third parties also played a role in encouraging customers to apply or install before the reforms were anticipated to come into force (originally expected in 'Spring' 2017).

I think it was somebody else who just happened to know I was doing it and said, "You do know it's changing at the end of September," or something. And I went, "I didn't know. Best I get it done then."

Domestic heat pump applicant

Domestic heat pump applicant type 3: "The anticipated reforms sped up my application (installation not viable post-reform)"

Another reason why applicants sped up their heat pump applications and installations is likely to be that they either thought, or were told, that their heat pumps would not have been financially viable after the reforms because of the introduction of the heat demand limits[27]. Whilst we did not come across direct examples of this applicant type in the qualitative interviews, however, interviews with installers suggested that this group is likely to have existed.

Summary of the theory for applicant type 3

Where… domestic heat pump applicants: were aware of the proposed reforms to the RHI; believed that these would mean their installation would not be viable post-reforms; and had the ability to flex their installation timing

then…these applicants installed their technology and applied to the RHI as soon as possible to guarantee their RHI benefits

because… applicants would not have been able to afford the installation after the reforms were in place.

Installers interviewed in the qualitative research highlighted that they had advised heat pump customers with heat demand over the heat demand limits to complete installations and applications by 'Spring' 2017 – when they had originally expected the reforms to come into force - because customers' installations would not be financially viable after the implementation of the RHI reform package. Open-end responses in the domestic applicant survey also suggested that installers had an influence in encouraging some applicants to apply or install early in response to the reforms. It is therefore reasonable to expect that a proportion of applicants who sped up their application or installation did so because they thought their installation would not make financial sense after the reforms.

The absence of direct qualitative interview evidence of this applicant type means it is not possible to be confident about the key contexts that would have influenced this view. However, they are likely to be similar to those identified for applicant type 2, given that both types decided to speed up their applications or installations in response to the reform announcements. These are; the applicants being aware of the reform proposals, the heat demand of applicants' homes, applicants' ability to change the timing of their installation or application, and, in at least some cases, the existence of installer (or other third party) advice encouraging applicants to install or apply early.

[27] The December 2016 reform proposals stated that heat demand limits would be set for air source and ground source heat pumps for the Domestic RHI. Heat demand limits cap the financial support that participants can receive for their annual heat use. The cap for air source heat pumps is 20,000kWh per year. For ground source heat pumps it is 30,000kWh per year. The Government introduced these changes to the scheme regulations on 20 September 2017. Heat demand limits now apply to applications after these regulations came into effect.

Domestic heat pump applicant type 4: “General RHI uncertainty sped up application”

For this group, general uncertainty about the future of the RHI, or uncertainty about potential tariff changes (for example due to degressions), motivated applicants to speed up the timing or of their installation or application.

In these cases, applicants believed that there might be forthcoming changes to the RHI - possibly including the reforms - which would negatively impact on their ability to benefit from the RHI. Qualitative interview evidence illustrated that applicants were not always clear what these changes might have been but had either been told of upcoming changes to the RHI (for example by installers) or had their own belief, based on their own research, that there might be changes to the RHI which would reduce their benefits.

Summary of the theory for applicant type 4

Where… domestic heat pump applicants were aware of potential changes to the RHI (including future tariff degressions and general uncertainty about the future of the RHI scheme) and they believed that these would reduce the RHI payments they would receive, or were told by a supplier to install by a certain date, and they had the ability to flex their installation timing

then…these applicants installed their technology and apply to the RHI as soon as possible to guarantee their RHI benefits

because… applicants would face reduced income from the RHI, in some cases potentially resulting in them not being able to afford the installation after the reforms were in place, and in other cases simply reducing the financial motivation for installation

There were two main types of influential contexts for this group of applicants:

Scheme-related influences

General uncertainty about how long RHI tariffs might continue was an influencing factor. Applicants interviewed expressed a fear that the RHI may not continue for long, or that the tariffs might be subject to cuts at short notice. For some applicants, for example, this uncertainty was based on applicant experiences or knowledge of changes to the Feed-in Tariff.

Applicants who thought that end-of-quarter tariff changes might happen, and that these might negatively impact on their RHI payments, were also influenced to complete their applications earlier than would otherwise have been the case. Interviewees were not always clear whether they thought these changes would be end-of-quarter degressions or the reforms themselves, although the way they described them it seemed more likely to be the former.

> *I was aware that they were going to be reviewed, and nobody really knew if they were going to stay the same, go up or go down, but I was aware they were going to be reviewed. So I kept an eye on the Ofgem website. But I was told if we got it up and running, I think it was before April, then that tariff is guaranteed up until a*

certain time. If we got it in before that time then the payments would be guaranteed at that level.

Domestic heat pump applicant

The qualitative interviews suggested that applicants in this group tended to be applicants who would not have gone ahead with their installation without RHI (i.e. RHI payments were critical to their decision to install heat pump). Therefore, ensuring that their application was submitted before any potential changes was very important to their financial business case for installing a heat pump.

Third-party influences

Advice from 'expert' third parties such as installer, architect or other supply chain stakeholder to apply by a certain date (not explicitly reform-related) had an influence on applicants' reasoning. This was an apparently important factor for applicants with low levels of awareness about the RHI the potential reforms.

'Special offers' by sales people or installers to install within a certain timeframe were also an influencing factor. One applicant, for example, reported that a sales advisor told them they would benefit from a special offer if they installed within a certain time as their installer would be undertaking other installations in the area at the same time.

If you did with this particular deal, because they were people that came from Essex, they wanted to get a lot of people around at the same time. All of their installers would be around the place at the same time and not have to keep going backwards and forwards. That's how they actually sold it, that we were actually going to be getting it cheaper because we were on that type of scheme.

Domestic heat pump applicant

5. Influence of reform announcements: non-domestic biomass applications

This chapter presents the findings in relation to non-domestic biomass applications. It sets out how and why non-domestic biomass applicants were influenced by the reform announcements, and the circumstances which affected this influence. This group was chosen for in-depth anlaysis due to the spikes in apolications observed during 2016 and 2017.

To what extent were medium-scale non-domestic biomass applicants influenced by the reform announcements?

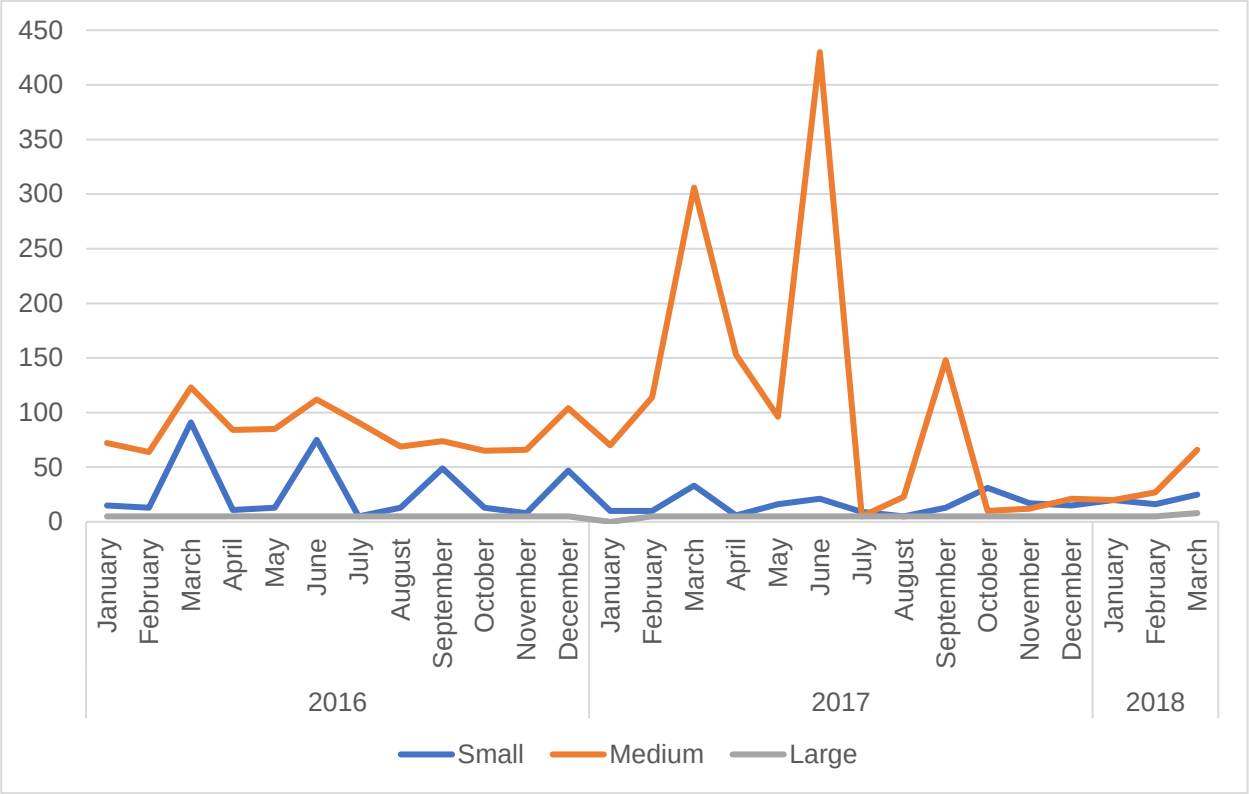
Number of applications

Figure 22 shows the number of non-domestic biomass applications per month since March 2016. The chart illustrates the dominance of the medium-scale category over this period (installations sized over 200 kWth and below than 1MWth[28]) in terms of the number of applications during the interim period. See chapter 3 for details of biomass deployment since the start of the scheme, prior to 2016 the non-domestic scheme was dominated by small biomass applications, with an overall peak for small biomass applications reaching over 2,000 in the month of December 2014. The reduction in small sized biomass applications coincides with degressions to that tariff which started in July 2015.

With the focus of this report being on scheme activity during the interim period, the focus here is on medium-scale biomass applications, where peaks in applications were observed to coincide with proposed changes due to reforms. There were clear spikes in the number of medium-scale applications following the reform announcements - in March and June 2017. These spikes involved all forms of heat use (space, water and process).

Figure 22 Number of non-domestic biomass applications per month, Jan16-Mar18

[28] Up to the 20th of September 2017, 'medium biomass' installations were those sized over 200 kWth and below than 1MWth. This definition is applied in this research report. Changes to the non-domestic scheme implemented on the 20th of September 2017 removed the banded tariff structure for biomass installations.



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

Influence of the RHI in general

Non-domestic applicant survey data highlights the significance of the RHI in heating system decisions. For 65% of non-domestic biomass applications between January 2015 and September 2017, applicants said they would not have installed a renewable heat technology without the RHI. This is consistent with surveys of applicants for these technologies between 2014 and 2015, where this figure was 63%[29]. It should be noted that 7% of non-domestic biomass applicants in this period stated that they did not know what they would have done in the absence of the RHI.

The qualitative research confirmed that the RHI played a significant role in influencing heating system decisions among those who submitted applications for non-domestic biomass following the reform announcements. For some applicants interviewed, the RHI had been fundamental to their decision to install a renewable heating system at all, whilst for others it had been fundamental to their decision to install a biomass system rather than another form of renewable heating. Even in cases where the RHI was not fundamental and a mixture of reasons for investing in biomass were cited, the availability of RHI was among those reasons.

Influence of the reform announcements

Across both the June and March spikes it is possible that, alongside the degressions, a contributory factor was that applicants were looking to get installations before the

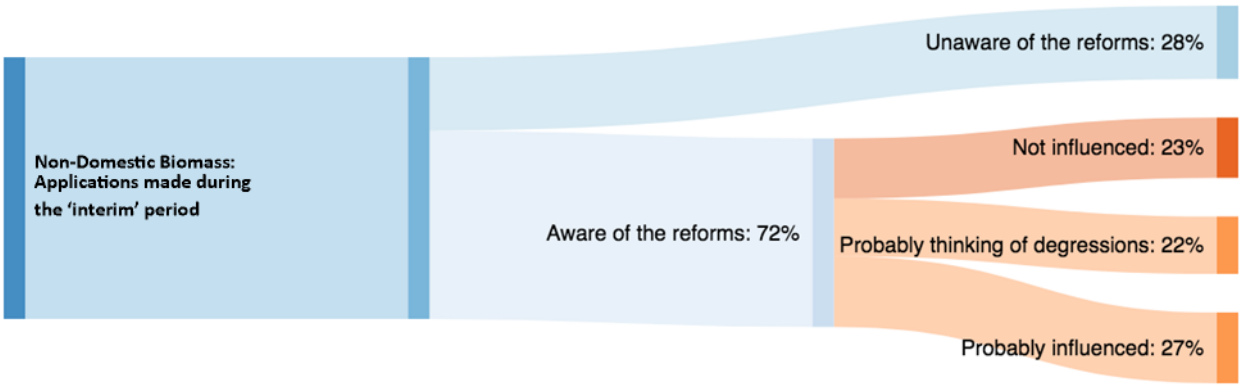
[29] Report from waves 1-24 of the domestic RHI census of accredited applicants. https://www.gov.uk/government/publications/report-from-waves-1-24-of-the-domestic-rhi-census-of-accredited-applicants [Accessed: 4 February 2019]

announced ‘Spring’ timing for the reform. Given installation lead times it would make sense that applicants and installers were looking to install before/during ‘Spring’ and commissioned the projects based on that timeline; this would be consistent with the domestic heat pump qualitative evidence. By the same logic, the subsequent delays to the reforms might have had little impact where contracts were already in place.

Analysis by installation capacity reveals that installations at the lower (200-299 kW) and higher (900-999 kW) ends of the medium tariff band were the principal contributors to both spikes.

The relationship between the reform announcements and degressions, and the spikes in applications is supported by data from the detailed applicant monitoring. This suggests that just over a quarter of non-domestic biomass applications were influenced by the reform announcements, as illustrated in Figure 23, with a further one fifth saying they were influenced by the reforms but who were probably referring to the tariff degressions[30].

Figure 23 Proportion of non-domestic biomass RHI applications (April 2016 – September 2017) for which respondents reported (a) being aware of at least one proposed reform and (b) being influenced by the reform proposals



Source: Winning Moves, Non-domestic biomass applicant monitoring survey with applicants successful from April 2016 to September 2017; (n=206)

Data from the survey indicates that:

- Those making an application for a new heating installation were more likely to be influenced by the reform announcements than those making an application for a system to replace a previous fossil fuelled system. Whist there was direct evidence to explain why this was, it may be reflective of new systems being more driven by the income opportunities associated with the RHI, and applicants for such systems therefore being more attuned to potential changes in this income.
- Applications from the agricultural sector were more likely to be influenced by the reform announcements than those in other sectors. This may be reflective of supply chain issues within the agricultural sector. The qualitative research indicated that

[30] Judgement based upon (a) their open-end response on the influence of the reforms (assuming they provided one / a clear one) and (b) the timing of their application i.e. If their application was near to one of the degressions.

suppliers and installers were actively engaged with applicants in this sector and therefore may have played a role in keeping them abreast of the proposed reforms.

- Those making multiple applications were more likely to be influenced by the reform announcements than those making single applications.

How did medium-scale non-domestic biomass applicants react to the reform announcements, why, and under what circumstances?

The section below describes the different ways in which non-domestic biomass applicants responded to the reform proposals, why they responded to the proposals in the way they did, and the circumstances which influenced this.

Applicant types 1-3 were all influenced by the reforms, whilst applicant types 4 and 5 were not. As noted above, we know from the survey data that those making applications for new heating systems (rather than those replacing a fossil fuel system), those in the agricultural sector and those making multiple applications were more likely to be in types 1-3.

Non-domestic biomass applicant type 1: "The anticipated reforms sped up my application (installation not viable post-reform)"

This describes cases in which the applicant perceived the installation to be so financially sensitive that it would only be viable if it took place in advance of the reforms or an anticipated degression taking place. In response, the applicant made their application earlier than would have been the case in the absence of the reform announcements or an anticipated degression.

Summary of the theory for applicant type 1

Where… medium-scale non-domestic biomass applicants were aware of the reforms to the RHI, believed that these would reduce the RHI payments, and they had the ability to flex their installation timing

then…these applicants installed their technology and applied to the RHI as soon as possible to guarantee their tariff

because… their installation would not have been financially viable after the reforms

It is not possible to establish from the detailed applicant monitoring the proportion of applicants who made up this type, but it was a subset of the roughly one quarter of non-domestic biomass applicants who were aware of the reforms and who also said that the proposed changes affected the timing of their installation. In these cases, the applicant was aware of the planned reforms and were able to influence the timing of the installation. As noted in the previous section, we know from the survey data that those installing new (as opposed to replacing fossil fuel system) heating systems, those in the agricultural sector and those making multiple applications were more likely to report that the reform announcements influenced their installations.

What distinguishes this type of applicant from types 2 and 3, whose applications were also influenced, was that the degree of financial sensitivity of their installation. In type 1 cases, the installation was so sensitive that it was not perceived to be viable post-reform. Among the applicants interviewed in the qualitative research, there were two distinguishable types of financial sensitivity. Firstly, the perceived financial sensitivity of the installation could have stemmed from the business case being marginal. In other cases it may not, strictly speaking, have been about viability but simply from there being a perception of significant financial risk associated with the project (such as a high level of borrowing), i.e. it was perceived that the project would not have been worth the risk following the reforms or an anticipated degression.

> *Well, the thing is, we would have already paid for it. As I say, it was in train. It was being paid for, it was being installed. The issue for me became one of, "Get your fingers out so I can actually get this registered." It's possible that rather than becoming an issue of not being delivered, it could have become a financial white elephant. Because of the change that was actually implemented partway through. That would have been particularly galling, actually, if that had happened.*
>
> *Non-domestic biomass applicant*

Non-domestic biomass applicant type 2: "The anticipated reforms sped up my application (perceived reduced benefits post-reforms)"

This describes cases in which the applicant perceived that their installation would have still been viable after the reforms or an anticipated degression, but financial attractiveness would have been reduced. As with applicant type 1, the outcome was that the applicant made their application earlier than would have been the case in the absence of the reform announcements or an anticipated degression.

Summary of the theory for applicant type 2

Where… medium-scale non-domestic biomass applicants were aware of the reforms to the RHI, believed that these would reduce the RHI payments, and they had the ability to flex their installation timing

then…these applicants installed their technology and applied to the RHI as soon as possible to guarantee their tariff

because… applicants wanted to avoid a reduction in income.

As with applicant type 1, it is not possible to establish from the detailed applicant monitoring the proportion of applicants who made up this type, but it was a subset of the roughly one quarter of non-domestic biomass applicants who were aware of the reforms and who also said that the proposed changes affected the timing of their installation.

Key contexts in this applicant type were similar to those in applicant type 1, i.e. the applicant was aware of the planned reforms and were in a position to influence the timing of the installation. The distinguishing factor in these cases was that the installation was not perceived to be as financially sensitive as in applicant type 1.

I knew in September the RHIs were changing again, and I thought, "Well, if we don't put them in now the payback is going to be even longer"

Non-domestic biomass applicant

The qualitative research highlighted a number of factors which impacted on the level of financial sensitivity, such as the fuel supply. Those with access to their own fuel, i.e. landowners with existing forestry or the potential for forestry, may have had significantly lower fuel costs and therefore a less sensitive business case. In other cases, the business case may have been impacted by the nature of the business.

The qualitative research highlighted cases in which installing earlier was more attractive not just because of the anticipated reform impacts but also for wider business reasons, e.g. a desire to install prior to a period of higher heating demands in the approaching autumn/winter seasons.

We needed them in before the winter anyway. We wanted them in before September, to get them running for the winter months anyway. The plan was to either get a CPH [sic] unit in before the winter months or the biomass.

Non-domestic biomass applicant

Non-domestic biomass applicant type 3: "The anticipated reforms sped up my application (installation driven by income opportunities not available post-reform)"

This describes cases in which installations were largely or solely driven by a desire to secure income opportunities that would not be available after the reforms were implemented.

Examples of this include process heat uses that were new and were specifically prompted by the pre-reform RHI, as well as applicants who choose to install a renewable heating system instead of a non-renewable because they have access to biomass fuels which would generate an income under the RHI. It is perhaps not surprising that there were no applicant interviewees who felt that this description fitted their case, given that the inference is that some uses were to some extent 'created' solely to benefit from RHI.

However, interviews with installers suggested that this applicant type did exist, and one installer reported seeking to influence such applicants in light of the proposed reforms.

We had two or three customers who, we knew that the changes to the eligibility around drying were going to come in, because they did a consultation in September. We said, "Look, you've really got to get your orders in before Christmas, because we're not going to have a hope of getting the install done before the end of March. Which is when we think the changes are going to happen."

Non-domestic biomass installer

In response to the reform announcements, these applicants made their application earlier than would have been the case in the absence of the reform announcements. Changes to the eligible heat uses are likely to be most relevant to this applicant type.

Summary of the theory for applicant type 3

Where… medium-scale non-domestic biomass applicants for drying uses were aware of the proposed review of eligible heat uses, they believed that these would remove the opportunity for them to benefit from the tariffs, and they had the ability to flex their installation timing

then…these applicants installed their technology and applied to the RHI as soon as possible to guarantee their tariff

because… applicants wanted to capitalise on an investment opportunity that would not be available post-reform.

The proportion of applicants who may have been of this type is unclear. However, applicants who fitted this applicant type are likely have included a) the 5% of biomass applicants who would not have installed any heating system in the absence of the RHI, and b) a small subset of the 60% of applicants who would have otherwise installed a non-renewable system, or replaced their existing non-renewable systems in the absence of the RHI.

These applicants are likely to have been aware of the proposed review of eligible heat uses, as this is most likely what would have sped up their application, and the survey data suggests that the proportion of non-domestic biomass applicants who were aware of this proposed review was relatively small – less than one third of all non-domestic biomass applicants.

Non-domestic biomass applicant type 4: “I was unable to speed up my application (despite perceived reduced benefits post-reforms)”

This describes cases in which the installation was deemed to be more attractive financially if it took place in advance of the reforms or an anticipated degression. However, in this applicant type there was an inability to influence the timing of the installation, so the timing of the application was unaffected.

As with applicant types 1 and 2, the applicant was aware of the planned reforms. In some cases, as in applicant type 2, installing earlier was more attractive not just because of the anticipated reform impacts but also for wider business reasons, e.g. a desire to install prior to a period of higher heating demands in the approaching autumn/winter seasons.

Summary of the theory for applicant type 4

Where… medium-scale non-domestic biomass applicants were aware of the reforms to the RHI, and they believed that these would reduce the RHI payments they would receive, but they did not have the ability to flex their installation timing

then…the timing of the application for, and installation of, their technology was unaffected by the reforms

because… they were unable to speed up their installation or application.

The inability to influence the timing of the installation stemmed, for example, from it being dependent on other elements of a wider refurbishment or construction programme. This tallies with the findings from the survey data analysis, which indicated that those making applications for heating systems to replace fossil fuel systems (most refurbishment schemes are likely to fall into this category) were less likely to report being influenced by the reform announcements than those making applications for new systems.

The distinction between this applicant type and those in which the applicant had been able to speed up their installation was not clear-cut in all cases. For example, interviewees reported having sought to speed up their installations by, for example, putting pressure on their installer or other contractors involved in a wider project, but were unsure whether this had made a material difference to the timing of the installation.

> *No [the proposed reforms did not materially impact on our application], because we had been installing for quite some time at that point because it was a big project with a long timeframe, so it was all in train really… I spent all my days stamping up and down, in the building technical services area saying, "Please, please get on." I don't know if the install happened more quickly. I would like to think it did, but I doubt it.*
>
> Non-domestic biomass applicant

Non-domestic biomass applicant type 5: "RHI reform announcements had no influence on my application timing or technology choice"

This describes cases in which the applicant was either unaware of the reforms or unconcerned about their impact, so the installation was unaffected.

Summary of the theory for applicant type 5

Where… medium-scale non-domestic biomass applicants were either unaware of the reforms to the RHI or were unconcerned about their impact (e.g. because the benefits of their installation would not be affected by the reform proposals)

then…these applicants did not change the timing of their application or installation

because… the reforms would have no impact on their application or installation.

Data from the detailed applicant monitoring suggests that a significant proportion of applicants fell within this applicant type. Over half of non-domestic biomass applicants were either unaware of the reforms or were aware of the reforms but said that the proposed changes had no effect on their application.

The survey data indicates that both of these groups (i.e. those unaware and those aware but not influenced) shared some similar characteristics:

- those who were replacing a previous heating system with a renewable heating system were more likely to be unaware or not influenced than those installing a new system;
- those in non-agricultural sectors were more likely to be unaware or not influenced than those in the agricultural sector; and
- those making single applications were more likely to be unaware or not influenced than those making multiple applications.

In terms of those who were aware of the reforms but unconcerned about their impact, the qualitative data suggested that this could have stemmed from, for example:

- the new heating system being necessary anyway, and therefore perceived to be less sensitive to changes in tariff income; or
- the particular installation being less impacted by the changes in banding and tiering

Non-domestic biomass applicant type 6: "RHI reform announcements made me uncertain about the future of the RHI so I delayed or cancelled my installation"

This describes potential cases in which the RHI reform announcements or degressions made the applicant uncertain about the future of the RHI, i.e. they were concerned that further changes to the scheme might be introduced prior to their installation being completed, which would negatively impact on the financial attractiveness of their installation. The outcome was that a potential or planned installation was either postponed or cancelled.

Evidence to support the existence of this applicant type came from installer interviews. Since the installation was postponed or delayed these organisations did not become RHI applicants and therefore were not surveyed or interviewed.

Summary of the theory for applicant type 6

Where… prospective medium-scale non-domestic biomass applicants were aware of the reforms to the RHI and were a larger and more risk-averse company

then…these prospective applicants delayed or cancelled their installation

because… they were concerned about the future of the RHI

The absence of non-applicant interviews means we have limited evidence in relation to this applicant type but installer interviews indicated that one potential key context was potential applicants who were larger businesses. These types of potential applicants were seen by installers to be more risk-averse and, therefore, more likely to push back decisions during a period of uncertainty.

> *Anyone with a corporate, kind of, mentality, where they like to work things through and understand the risks, just thought the risks were too great. So, anyone of a decent size, it was unlikely that they were going to go ahead, probably, but it just dramatically reduced the number of clients who had the appetite to do something.*
>
> Non-domestic biomass installer

6. Influence of reform announcements: applications for other technologies

This chapter presents high-level findings about the influence of reform announcements on other technologies, based on survey data and consultations with industry stakeholders. At this stage, we have not undertaken in-depth interviews with applicants or installers for these technologies so our insights on their reasoning are very limited.

In this chapter we focus on the following technologies.

- Biogas and biomethane – non-domestic
- Combined Heat and Power (CHP) – non-domestic
- Solar thermal – domestic and non-domestic
- Heat pumps – non-domestic scheme (not covered by section 4)
- Biomass – domestic scheme (not covered by section 5)

This chapter does not cover deep geothermal schemes as there have yet to be any RHI applications for this technology.

Common themes emerging from the analysis of the technologies discussed in this chapter are that:

- Past tariff degressions for some technologies had a major influence on the timing of applications, tending to create quarterly spikes in demand in anticipation of potential degression.
- In the absence of evidence from in-depth interviews with applicants for these technologies, it is unclear whether applicant behaviour was really being influenced by anticipated tariff degression, by general uncertainty about the future of the RHI or by specific reforms for particular technologies.
- There appears to have been a hiatus in investment decisions for some large-scale technologies (e.g. biomethane and large-scale CHP), potentially in anticipation of the introduction of tariff guarantees.

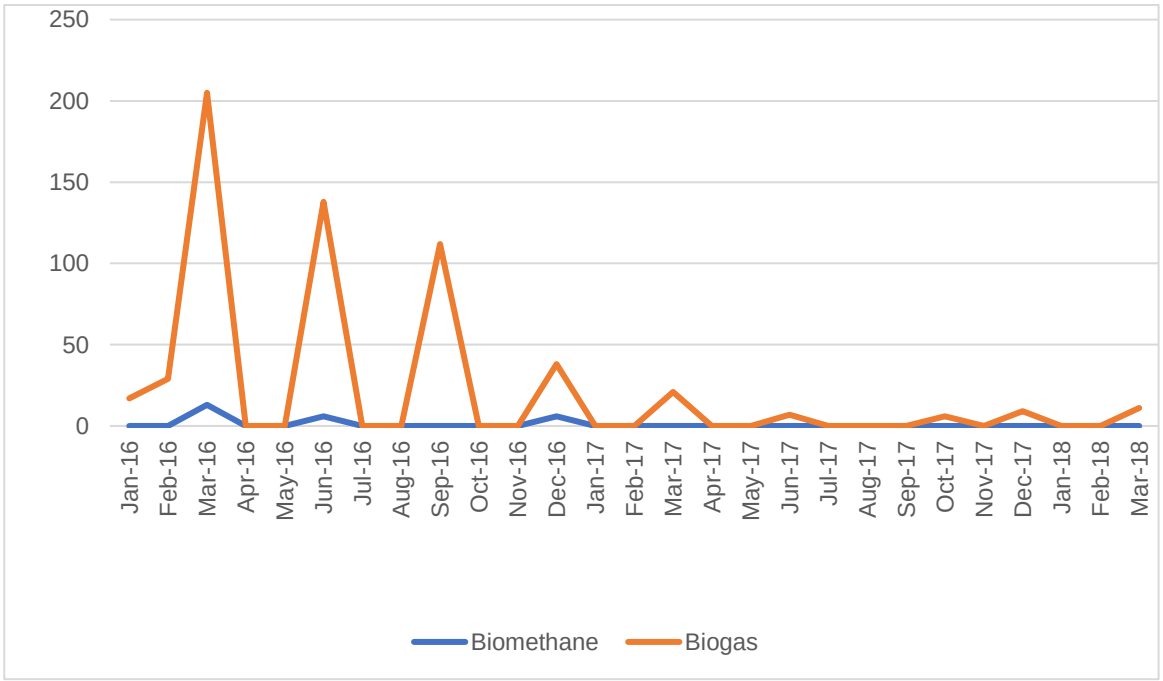
Biogas and biomethane applicants: to what extent, why, and under what circumstances were they influenced by the reform announcements?

Background to biogas and biomethane applications

The number of biogas and biomethane applications rose from 109 in 2011 to 310 for the year to January 2017. The total number of full applications from April 2011 to March 2018 was 762 for biogas and 93 for biomethane. 420 of the biogas plants (representing 144 MW) and 56 of the biomethane plants have received RHI payments as of March 2018. There is overlap between these two categories: most biomethane plants have a biogas CHP component and therefore apply for RHI under both the biogas and biomethane categories, while biogas plants may apply for biogas CHP or for their biogas boiler only.

Biogas and biomethane applications peaked in 2016 and have fallen during 2017. While these applications are influenced by many factors, the reduction in applications coincides with a series of quarterly degressions from January 2015 (for biomethane) and from April 2016 (for biogas), with the latest degressions being applied in July 2017. Over this period, the tariffs have decreased to around 40% of their original values[31]. Application numbers, shown in Figure 24 below, show distinct peaks at the end of each quarter, before the degressions took effect. To avoid disclosure about the status of individual plants, figures are shown as zero for months when application numbers fell below 5.

Figure 24 Number of full applications received for biogas and biomethane, by date of first application



[31] All non-domestic tariff degressions are announced and recorded at https://www.ofgem.gov.uk/environmental-programmes/non-domestic-rhi/contacts-guidance-and-resources/tariffs-and-payments-non-domestic-rhi

Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

Unlike most other technologies, biogas and biomethane plants are potentially eligible for a number of renewable energy incentives (relating to heat, power and transport fuel), not just the RHI. Stakeholder consultations undertaken for the sustainable markets assessment indicated that the RHI currently provides a significant proportion of revenue for biogas and biomethane operators. This is consistent with findings from the applicant survey[32] that 75% of biogas and biomethane respondents cited the RHI as one of the factors behind their decision to invest in the technology.

The role of alternative renewable energy subsidies, alongside the RHI, can be seen in the applicant survey findings. Self-reported additionality, i.e. the extent to which the RHI has stimulated renewable heat installations that would not otherwise have happened, appears to be lower for biogas and biomethane than the wider non-domestic scheme. In total, only 37% of these applicants stated that without the RHI either no system would have been installed (34%) or a non-renewable system would have been installed (3%). This can be compared to 63% of installations from wider non-domestic applicants. However, a further 34% of biogas and biomethane applicants stated that without the RHI they would have installed a different renewable technology, compared to only 15% in the wider non-domestic scheme.

The differences in survey results therefore suggest that in the case of biogas and biomethane, the RHI is having an impact on both the decision to install any technology and the decision to install biogas or biomethane instead of another renewable technology. In contrast, the wider non-domestic scheme is more commonly influencing decisions to install a renewable heat technology instead of a non-renewable system. It should be noted that there are still 15% of biogas and biomethane applications where the applicant states that they would have installed the same technology even if the RHI had not been in place. The role of the RHI and its reforms is discussed further below, however additional research is planned to understand these self-reported perceptions and the contexts in which different investment decisions are made.

Influence of reform announcements on biogas and biomethane applications

The reforms for biogas and biomethane (detailed below) combined increased tariffs with tighter restrictions on allowable feedstocks. This means that the impact of the reforms are likely to depend strongly on each applicants' circumstances, with some being motivated to apply before the reforms and some motivated to apply after, while others may have been influenced by the overall uncertainty in whether the reforms would be implemented. The reform announcements in December 2016 sought to manage this uncertainty by giving applicants who applied after December 2016 but before the reforms came into force, the choice between which regime the wanted to operate under.

The Anaerobic Digestion and Bioresources Association (ABDA) Market and Policy Report (November 2017) [33] highlights that a significant number of biomethane plants are still in the pipeline and reports that RHI policy changes and delays to reforms have contributed to the

[32] This survey covered biomethane and biogas applicants from January 2015 to September 2017 inclusive, but questions about the influence of the reforms were only asked regarding applications from April 2016 onwards.
[33] http://adbioresources.org/adba-market-policy-reports/adba-market-policy-report-november-2017/

low level of applications during 2017. ABDA predict that applications may increase in future years, after introduction of the reforms.

It is clear that the RHI reform package has significant implications for future biogas and biomethane investment. In particular[34]:

- New biogas and biomethane plants have to source 50% of feedstocks from waste but will receive an increased tariff (and those applying during the interim period were given the option of applying under these new terms);
- Increased tariff for new biogas and biomethane plants complying with the new feedstock requirements, for example the first tier of biomethane production (up to 40,000 mWh of generation) increased from 3.3 to 5.6pence per kWhth.
- New plants cannot not claim RHI for heat used for digestate drying;
- Introduction of tariff guarantees to provide certainty over tariff rates where plants have long installation and commissioned timelines (e.g. those investing in biomethane and large biogas plants).

The hiatus in biogas and biomethane investment shown in Figure 24**Error! Reference source not found.** above is consistent with evidence from industry stakeholders that these investments are strongly dependent on RHI funding[35]. This is also supported by the applicant survey finding of a high level of awareness of proposed reforms amongst biogas and biomethane applicants (88% aware of the reforms, see section 3 for details), including high levels of awareness of the individual reforms.

It may be relevant here that a high proportion of biogas and biomethane investors are multiple applicants for RHI: the retrospective survey found that 63% of biogas applicants had submitted multiple applications, representing 81% of biogas and biomethane applications (this compares to 20% of applicants for other non-domestic technologies, accounting for 43% of non-domestic applications). This may be partly explained by some applicants applying for both biogas CHP and biomethane RHI at the same time.

The survey of biogas and biomethane applicants between April 2016 and September 2017 provides evidence to understand the impact of the reforms on applications for these technologies, see Figure 25. Across both technologies, 53% of respondents said that the reforms influenced the timing of their installation, while 48% said that it influenced the timing of their RHI application[36]. As shown in Figure 25 below, 22% also said that the reforms influenced the size of their installation, while 21% said that they affected the operation of their technology or their choice of technology. Only 6% said that reforms influenced the location of their plants, and 32% said that the reforms had no effect on their installation or application. It is not clear whether the applicants reporting timing influence had sped up or slowed down their installations, and whether the applicants were speaking

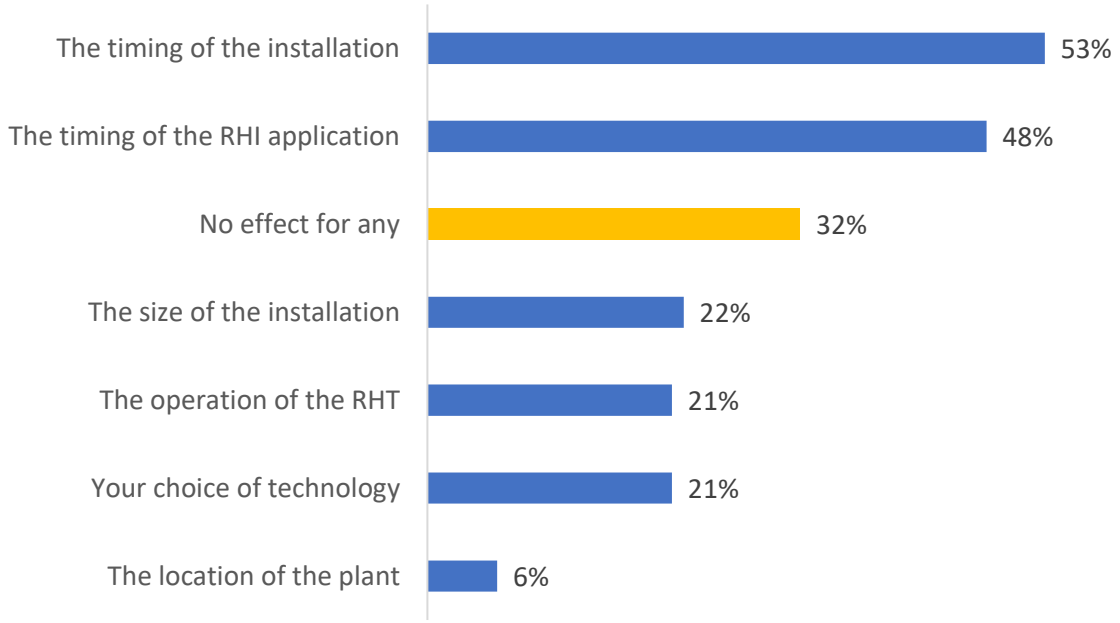
[34] Department of Energy and Climate Change (2016), The Renewable Heat Incentive: A reformed and refocused scheme, 3 March 2016. Available at: https://www.gov.uk/government/consultations/the-renewable-heat-incentive-a-reformed-and-refocused-scheme [accessed: 24 May 2018]

[35] Stakeholders included Renewable Energy Association, Sector bodies and manufacturers, Renewable Energy Finance Forum, BSRIA, Anaerobic Digestion & Bioresources Association, WRAP

[36] Applicants completing the survey could select more than one influence that the reforms had on them.

solely about the impact of proposed reforms or whether they were also influenced by recent degressions in biogas and biomethane tariffs.

Figure 25 The impact of the reforms on biogas and biomethane installations (multiple choice, application weight: n=189, N=816)



Source: Applicant survey for biogas and biomethane applications between April 2016 and September 2017.

In the absence of in-depth qualitative data, we do not know how biogas and biomethane investors' or potential investors' reasoning was influenced by the reform announcements. Our preliminary analysis, set out above, suggests that the reform announcements, combined with tariff degressions, contributed to the deferral of many investment decisions. Early indications from installation figures following the introduction of scheme reforms on the 25th of May 2018 showed an immediate rise in biomethane applications, suggesting elements of the reforms had positively influenced the biogas and biomethane market. Further research with those who applied immediately after the reforms came into force will be included in the next phase of this evaluation.

CHP applicants: to what extent, why, and under what circumstances were they influenced by the reform announcements?

CHP plants can involve large or small-scale investment, although they are typically larger. The mean cost of CHP plants applying to the RHI scheme is nearly £2.5 million.

CHP plants can potentially claim subsidy from a range of sources for the heat and electricity they generate (e.g. RHI for heat; Feed-in-Tariff, Contracts for Difference, Capacity Market etc. for electricity). This might be interpreted as implying low additionality, but we do not currently have evidence to assess the degree of additionality of CHP applications.

From the start of the non-domestic RHI scheme until 31st March 2018, 70 CHP plants have applied for RHI and 43 installations have been accredited, while others are still in development. In most months, the number of CHP plants applying to the scheme has been between 0 and 5, but in March 2017 there were 23 applications. This spike took place prior to a change in rules requiring new plants to achieve a higher electrical efficiency in order to qualify for the CHP tariff, from April 2017 onwards[37].

We do not have sufficient granularity in survey data to assess the awareness of reform announcements amongst CHP applicants. And we do not have separate findings about CHP in the consultations undertaken for the sustainable markets assessment. However, we note that the most recent published statistics for the non-domestic RHI scheme show a marked increase in the capacity attributable to CHP schemes in the final months of 2017 and in the first quarter of 2018[38]. The numbers of CHP applicants in these months are still low, implying that a few large schemes may have joined the scheme during these months (e.g. CHP plants processing energy from waste).

This post-reform increase suggests that there may have been a hiatus in investment in large CHP schemes, similar to that observed for large biomethane plants, that may be partly attributable to the delays and uncertainties associated with the reform announcements. Given the scale of some CHP investments, it is plausible that investors were also deferring investment decisions until the proposed tariff guarantees were actually introduced. In future research, we will seek to understand the role of tariff guarantees and other reforms, and their announcement, on CHP investment decisions.

Solar thermal applicants: to what extent, why, and under what circumstances were they influenced by the reform announcements?

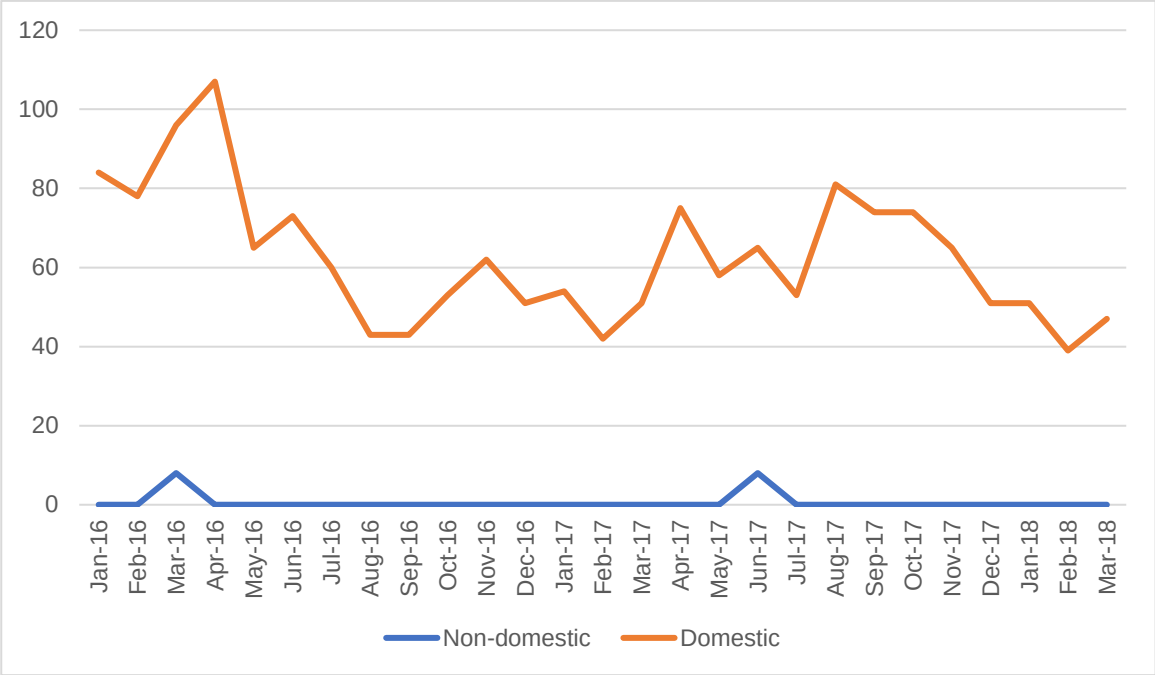
This section covers both domestic and non-domestic solar thermal applicants.

As shown in Figure 26, the numbers of applications for the domestic scheme have been significantly higher than those for the non-domestic scheme. To avoid disclosure of progress with individual projects, non-domestic applications are shown as zero for those months where there were fewer than 5 applications.

Neither group has been directly affected by RHI reform announcements, except for inflationary-related tariff adjustments and minor updates to eligibility criteria. However, around a third of domestic solar thermal applicants who responded to the retrospective survey, and who were aware of proposed RHI reforms, said that they were influenced by the reforms. Most of these reported that the reforms influenced the timing of their application.

Figure 26 Solar thermal applications to the non-domestic and domestic schemes, by date of first application

[37] BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018
[38] See Figure 1.1 in Key Statistics *(BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018)*



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

Most non-domestic solar thermal applicants were also aware of the reforms. In particular, most were aware that heat uses eligible under the RHI scheme were being reformed and that RHI tariffs might be reduced for new applicants. Around half of those aware of the reforms said that they had been influenced by them.

Given that the reform announcements had no direct impact on solar thermal applications, and there have been tariff increases rather than decreases for this technology in both the domestic or non-domestic scheme, applicants' statements that they were influenced by proposed reforms may imply that they were also applying for other technologies. In the surveyed sample, both domestic and non-domestic solar thermal applicants were more likely to be multiple applicants than was the case for other technologies apart from air source heat pumps.

Alternatively, their awareness may have arisen from general awareness of potential tariff degressions or to general uncertainty about the future of the RHI scheme. They may also have chosen solar thermal because it wasn't influenced by reforms / tariff degressions. We do not currently have in-depth evidence to distinguish between these possible reasons for solar thermal applicants reporting that they were influenced by the reforms.

Non-domestic heat pump applicants: to what extent, why, and under what circumstances were they influenced by the reform announcements?

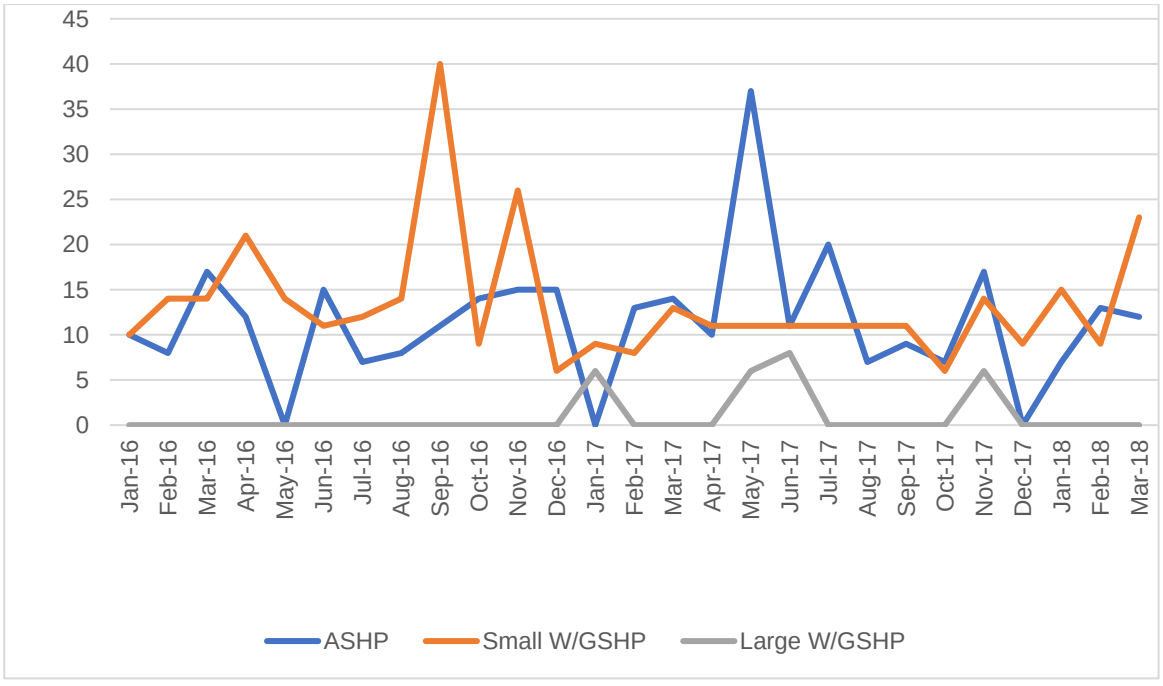
Applications for non-domestic heat pumps have been much lower than those for domestic heat pumps, although some installations have been relatively large-scale. From April 2014 to end March 2018, there had been 478 applications for non-domestic ASHPs, 811

applications for small GSHP/WSHP (<100 kW) and 195 applications for large GSHP/WSHP (> 100 kW)[39].

BEIS anticipated that the reform package relating to non-domestic heat pump applications would be sufficient to drive deployment in this sector and help grow the heat pump supply chain[40]. Heat demand limits did not apply to non-domestic applicants, while heat pump tariffs were set to increase under both schemes. The reforms also introduced new rules for shared ground loop systems (i.e. Ground source heat pumps covering multiple properties) that allow payments for these systems to be deemed rather than metered, which should reduce costs and administrative burden for operators. While these reforms could be expected to increase demand for non-domestic heat pumps, there were delays associated with the introduction of these measures which may have affected demand during the interim period.

As shown in Figure 27**Error! Reference source not found.**, there was some volatility in the number of applications for non-domestic heat pumps during the interim period, but there were no clear trends overall. As the numbers of applications were small, some of the observed volatility may simply be noise. To avoid disclosure, data is shown as zero for months where applications numbers were between 0 and 5.

Figure 27 Non-domestic heat pump applications (full applications received), by date of first application



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

[39] BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018
[40] Department of Energy and Climate Change (2016), The Renewable Heat Incentive: A reformed and refocused scheme, 3 March 2016. Available at: https://www.gov.uk/government/consultations/the-renewable-heat-incentive-a-reformed-and-refocused-scheme [accessed: 24 May 2018]

Care must be taken in interpreting findings from the applicant survey of non-domestic heat pump applicants, as the sample sizes were low. There is insufficient data to provide reliable estimates of self-reported additionality for these applicants. But the findings indicate that most non-domestic heat pump applicants were aware of proposed reforms. Of those saying that they were aware, most were aware that RHI tariffs could decrease for new applicants and that eligible heat uses might be reviewed.

Of those who were aware of the reforms, more ASHP applicants said that they were influenced by the reforms, compared to GSHP and WSHP applicants. Non-domestic ASHP applicants tended to report that the reforms influenced their choice of technology and the size of their installation, rather than the timing of their installation.

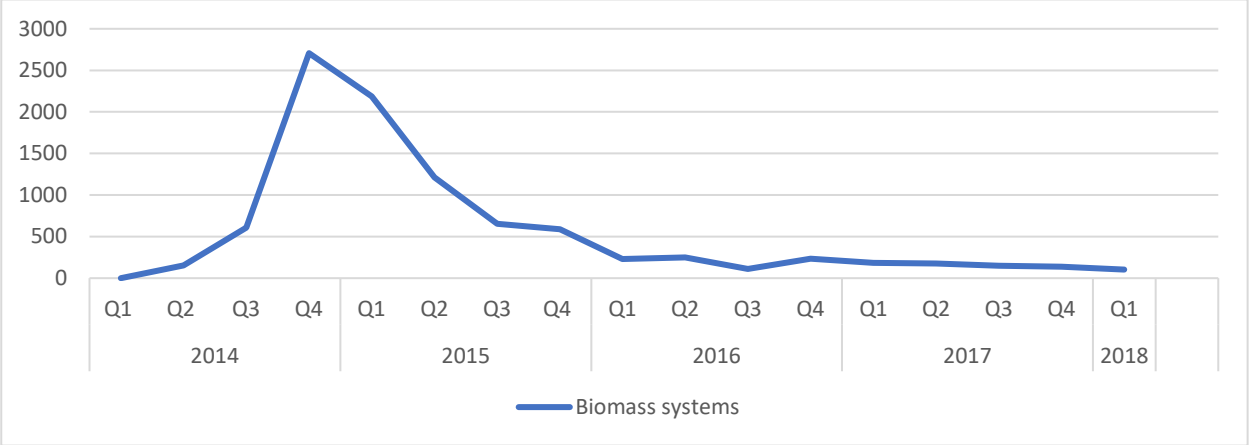
We do not have sufficient in-depth evidence to understand fully why some non-domestic heat pump applicants said that they were influenced by the reforms, including potential tariff decreases, despite the fact that there have not been any degressions of heat pump tariffs to date. One possible explanation, suggested by qualitative research with heat pump installers, is that some installers saw shared ground loops as an upcoming opportunity because reforms would allow savings to be deemed rather than metered (thereby reducing the cost of installing meters). But delays in the reforms had meant that new shared ground loop investments (particularly those by social landlords and by risk-averse corporate clients) were now being put on hold.

> *I have to say people are getting quite twitchy now because some of them have got installations that are 12 months old that are awaiting RHI application that can't apply because the new regs aren't in and the systems for receiving those applications aren't in place. Now we're starting to see projects being put on hold because of it.*
>
> Heat pump manufacturer-installer

Domestic biomass applicants: to what extent, why, and under what circumstances were they influenced by the reform announcements?

Figure 28 shows that large numbers of domestic biomass applications were received in the early years of the domestic RHI schemes: there were 13,109 domestic biomass applications from April 2014 to end March 2018. The average size of domestic biomass systems supported by the RHI up to February 2018 was 27 kW (for new and legacy installations), significantly smaller than non-domestic biomass systems (where the average size for a small biomass system over the same period was 118 kW).

Figure 28 Biomass boiler applications to domestic RHI scheme by quarter, by date of first application



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

As a result of the high number of biomass applications, the domestic biomass scheme has been subject to a number of degressions, similar to non-domestic biomass[41]. There were quarterly degressions during 2015, and then bi-annual degressions in January and July 2016 and 2017. Since 2014 the domestic biomass tariff has decreased to 32% of its original value (as of July 2017). Since these degressions, applications for domestic biomass have fallen significantly, from over 2,500 per quarter at the end of 2014 to 100-200 per quarter in 2017.

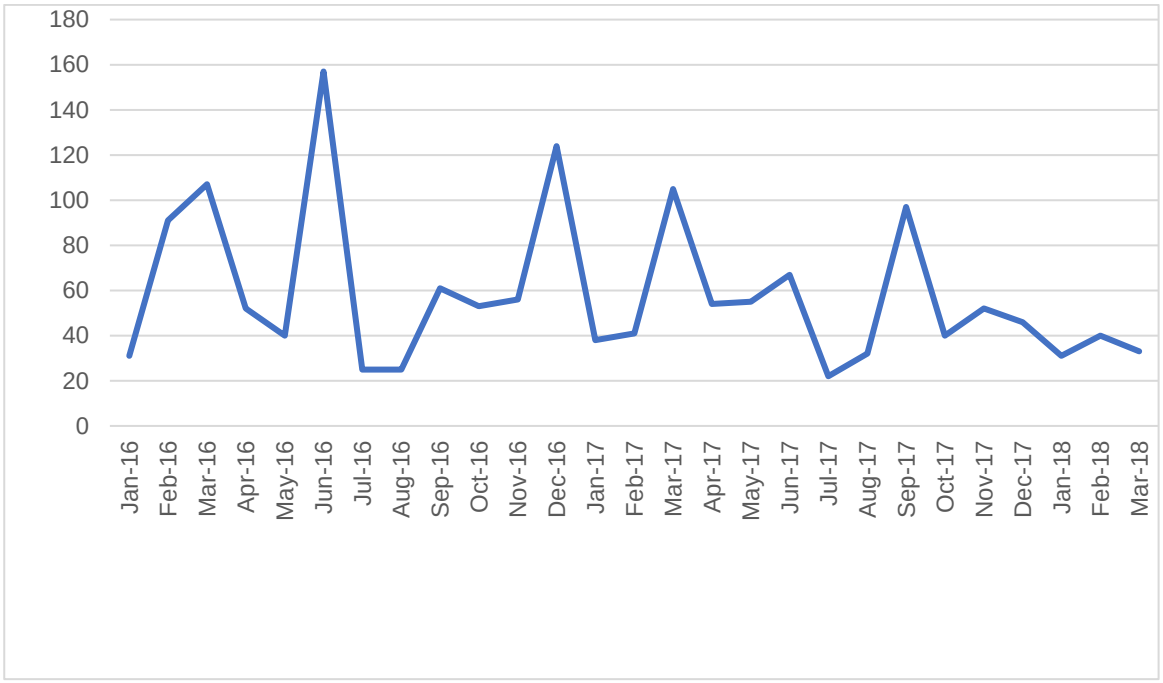
Additionality for domestic biomass applications was slightly higher than for the domestic scheme as a whole: respondents to the applicant survey found that 54% of applications between March 2016 and September 2017 would not have gone ahead with a biomass installation without the RHI, compared to 44% for the whole domestic scheme.

The reforms announced in December 2016 affected domestic biomass in two ways. Firstly, they proposed the introduction of heat demand limits for larger properties (which might be expected to worsen the financial case for some larger domestic customers). Secondly, they proposed a slight increase in biomass tariffs, to reverse the effect of some degressions and maintain the supply chain.

The pattern of applications, shown in Figure 29 below, shows spikes for most quarters up to September 2017, including those months that align with reform announcements and expected implementation, namely December 2016, March 2017, June 2017 and September 2017. This may reflect uncertainty amongst customers and their advisers about when degressions would be applied. The monthly installation numbers are low relative to the 2014/15 peak of over 2,500 applications per quarter, as shown in Figure 28.

Figure 29: Domestic biomass applications during the reform 'interim period' (full applications received), by date of first application

[41] All domestic tariff degressions are announced and recorded at https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi/contacts-guidance-and-resources/tariffs-and-payments-domestic-rhi/histrocial-tariffs

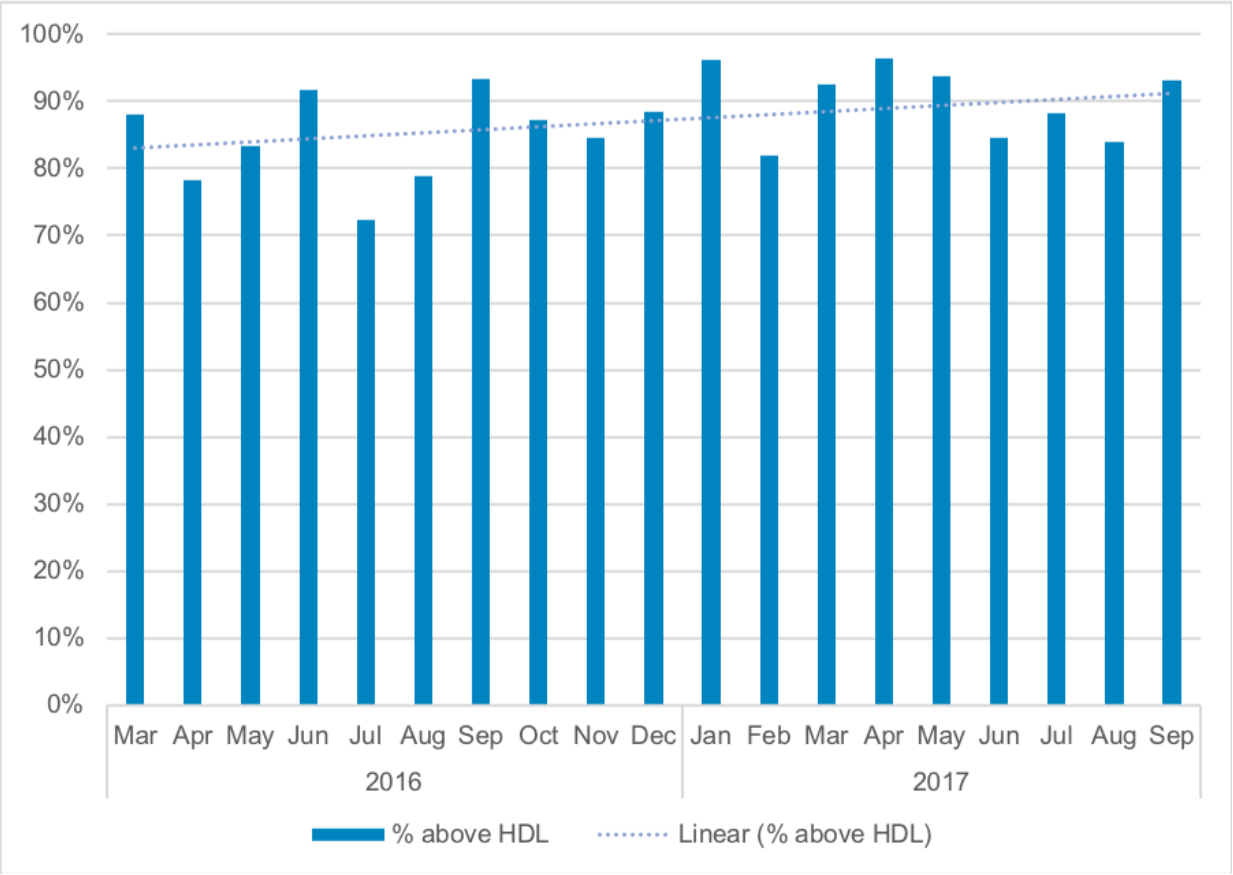


Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

Well over half (61%) of biomass applicants in the applicant survey who applied between April 2016 and December 2017 stated that they were aware of proposed reforms. Of those who were aware, nearly two thirds said that the reforms had no influence on their actions, while the remainder were influenced either by the reforms or by the biomass tariff degressions. Where applicants were influenced, the reforms generally influenced the timing of their installation or their application rather than their choice of technology or the size of their installation.

Despite the majority of these applicants reporting that the reforms had no influence on their actions, there was a small spike in application numbers ahead of the September 2017 introduction of the heat demand limits, see Figure 29. This is to be expected given that 80% of applications between March 2016 and September 2017 had heat demand in excess of the proposed heat demand limit. Figure 30 shows that while there was a slight upward trend during this period in the proportion of these systems potentially subject to the heat demand limit, there were no obvious spikes to suggest that applicants for larger biomass installations were influenced to apply ahead of the introduction of the heat demand limits.

Figure 30: Proportion of domestic biomass applications per month that were for installations that heat demand over the heat demand limits introduced in September 2017



Source: BEIS, Non-Domestic RHI and Domestic RHI monthly deployment data, March 2018

7. Influence of reform announcements: installers

This chapter presents findings on the influence of the reform proposals on renewable heat technology installers. It focuses primarily on domestic heat pump and non-domestic biomass installers, as the majority of the interim period evaluation evidence was focused on these two groups, but some evidence regarding the wider installer market is drawn from the sustainable markets assessment workstream.

Note that as a result of the small samples involved, the findings may not be representative of the full range of experiences of installers who undertook fewer heat pump installations between December 2016 and September 2017.

To what extent were installers influenced by the reform announcements?

The interviews with installers suggested there were three main types of response to the reform proposals. Due to the qualitative nature of the research here it is not possible to estimate the proportions of installers that fall into each category, the evidence below highlights the situations in which each of these installer types is located.

- The proposed RHI changes did not result in any significant changes to the business during the interim period (December 2016 to September 2017), compared to what would have happened otherwise.
- The proposed RHI changes (and past degressions, in the case of biomass) resulted in the business undertaking fewer installations during the interim period compared to previous years, but the business had developed alternative strategies to limit the negative impacts.
- The proposed RHI changes, and the associated delays and uncertainties, resulted in the business undertaking the same number or fewer installations during the interim period, compared to what would have happened otherwise.

For the latter two types, the responses of biomass installers were likely to have been influenced by a longer-term decline in the overall numbers of biomass installations, particularly in the domestic and small-scale non-domestic sectors.

One other outcome was identified in the interim applicant theory (see Appendix C) but was not directly observed in the interviews:

- Additional installations took place in the period December 2016 to September 2017 compared to what would have happened otherwise, leading to higher renewable energy deployment and carbon abatement. Given the relatively high number of medium-sized biomass installations during the interim period, compared to the

previous 12 months, it is possible that installers who were specifically focused on this sector may have completed additional installations.

What types of installers were influenced by the reform announcements, why, and under what circumstances?

Installer type 1: "We carried on as normal"

These were installers who were aware of the proposed reforms but did not make any changes to their business approach or experience any significant changes in installation numbers between December 2016 and September 2017 as a result of them.

This installer type was only observed for domestic heat pump installers. Consultation carried out as part of the sustainable markets workstream indicate that the biomass market was more reliant on RHI support and is therefore likely to have been more sensitive to the reform announcements and degressions.

This type of installer reasoned that the reforms would not have any significant impact on their business. This was either because (a) they believed that the technologies they installed would not be affected (for instance because they installed heat pumps below the proposed heat demand limits), or (b) they felt that for their customer base, the RHI was not a key driver (for example because consumers were self-builders) and therefore any changes to the RHI would not impact on customer demand.

> *You put things in place, but you don't commit. I think that's been the biggest issue throughout the whole period of renewable energy and the RHI. You almost want to say, "Right, I can build a business case around this in the business, and we'll set up ready for this," but then it's been let down so many times that… I mean, how many companies have we seen go under where they've set a business up – "We're going to start selling PV" – and then, all of a sudden, the PV tariff gets cut overnight and thousands of people are out of business? So, yes, it's really hard to predict the business at the moment and build a business around the RHI. We haven't really done that now. We try and make it stand up on its own without the Incentive.*
>
> Domestic heat pump installer

Other factors that contributed to the installers not changing their business approach were:

- General scepticism about Government policy announcements and the extent to which they would result in actual change
- Businesses already working at full capacity felt that they did not have any need, or any capacity, to respond to the reform announcements
- Businesses with a long-term approach to business development felt that success was not based on short-term responses to policy announcements
- Installers had a diverse business offer; which helped to buffer them against any potential changes to the market.

Installer type 2: “Business for our primary customer base remained static or shrunk, but we were able to diversify into other areas”

This describes installers whose business for their primary customer base (for example domestic heat pump or non-domestic biomass customers) remained static or shrunk, but who were able to offset the impacts to some extent by diversification into other areas.

In the domestic heat pump sector, for example, an installer-manufacturer reported that the reform announcements had ‘very little impact’ on their domestic heat pump installation business, but used the reform proposals (in particular, the switch from metered to deemed payments for shared ground loops) to secure increased orders of shared ground loops[42]. An important factor in the success of this installer in securing these orders appeared to be its focus on developing business with social housing landlords. The interview evidence suggested that social housing landlords were more prepared to go ahead with installations based on the reform announcements themselves[43], whereas commercial developers seemed more risk-averse, and did not want to install until after the reforms had been implemented.

For non-domestic biomass, where installers worked across the small and medium biomass bands (and possibly domestic installations too) there were examples of installers being able to offset a decline in the number of smaller installations by increasing the number of higher value medium-sized installations they undertook. Other non-domestic biomass installers reported having other strands to their business, such as boiler servicing, which became more of a focus during this period of perceived uncertainty in the installation market.

> *We basically focused a lot more on service. So, the service website has probably been up and running for about six months now, six to nine months. So, we’d made a decision that we were going to focus much less on selling kit and developing projects with customers, and focusing much more on service, because the market for selling projects is so volatile, and the government seems to make snap decisions at a whim.*
>
> Non-domestic biomass installer

The sustainable markets assessment workstream also highlighted the importance of domestic wood burning stoves in the biomass market (which are excluded from RHI). It may be that some installers were able to focus more on this sector of the biomass market during the interim period.

[42] Note that this business reported a similar story for its manufacturing business, which experienced ‘record sales’ in large heat pumps (potentially a result of an industry ‘push’ to install larger heat pumps before the introduction of the heat demand limits) was countered by declining sales in smaller heat pumps during the same period.

[43] As well as the statement in the reform proposals that all installations after that date would benefit from the new arrangements, once the regulations came into force.

Installer type 3: “We undertook fewer installations or our business stagnated”

This installer type describes installers who experienced a decrease, or stagnation, in installations during the period from December 2016 to September 2017, as result of the proposed RHI reforms.

In the domestic heat pump sector one example includes an installer whose primary business was the installation of domestic heat pumps to high heat demand customers. They were aware of the reforms and knew that the reforms would negatively impact on their business. As a result, they stopped marketing domestic heat pumps and informed customers in their existing pipeline that installations and applications would need to be completed by the end of March 2017, ahead of the anticipated reform implementation in April. This installer also sought to divert their business to the shared ground loop market. After the reforms were announced in December 2016 they signed contracts with commercial developers for shared ground loop installations. But these installations were subsequently postponed following the delays to the reforms, resulting in a loss of potential business for the foreseeable future.

> *It was no longer a viable proposition.... We couldn’t sell any of the bigger domestic properties from April because we didn’t know. You can't realistically and ethically go to the customer and say, “We can do this for you,” when you could be given two days’ notice that RHI is changing.*
>
> Domestic heat pump installer

In the non-domestic biomass sector, installers interviewed for the qualitative research appeared to be negatively affected by the nature of their business operation. Where, for example, installers:

- imported boilers, longer lead-in times made them less attractive to time-conscious applicants
- had a customer base focused on larger and more corporate customers, these were seen to be more risk-averse and, therefore, more likely to push back decisions during a period of uncertainty.
- were uncomfortable with sizing boilers to maximise tariff returns (for example specifying a medium-band boiler where a small better fitted the heat demand), they may have lost business to installers who were more prepared to do so

> *We believe, as a company, that we will size the boiler appropriately… When we go the customer, we might say to them, for example, “We think you need 100kW boiler.” They will go out to a competitor, who will say, “No, no, no, you can earn more money if you put a 200kW boiler in.” We’ll say, “But that will run very inefficiently, if you oversize the biomass boiler it’s fundamentally inefficient.”*
>
> Non-domestic biomass installer

Looking more widely, the MCS data (which includes domestic and some smaller non-domestic RHI installations) indicates an ongoing decline in registered biomass installers since a peak of circa 1,000 in September 2014 to circa 330 as at February 2018 (See Figure 8 in section 3 for more detail). Heat pump and solar thermal installer numbers have

also been on a downward trajectory since September 2014. It should be noted, however, this could include the consolidation of smaller installers into larger companies, or the effect of increased charges and administrative requirements associated with MCS certification.

Installer type 4: “We undertook additional installations in the interim period”

This installer type was not observed in the qualitative interviews with installers. It is likely, however, that there were installers who were able to profit during the interim period. Medium-scale biomass installations, for example, were significantly higher in the ten-month interim period than the preceding ten months (1,444 installations versus 833 installations). Installers who were specifically focused on specific sectors of the market may therefore have experienced additional demand for installations during the interim period.

8. Conclusions

This chapter presents the conclusions from this study. It considers how the evidence presented in the previous chapters help to answer the two key questions posed by BEIS for this synthesis report:

- How have the successive reform announcements in 2016 and 2017, and the way that they have been implemented, influenced RHI applications?
- For whom (applicant types, supply chain sectors, technology types) and in what contexts has this influence been most marked and why?

This research has focused specifically on the 'interim period' between the reform announcements and their introduction. It considered how the renewable heat market was influenced in the lead up to the reforms coming into force. The evidence presented does not support conclusions on whether the reforms achieved their aims, this question will be addressed in future reports from this evaluation.

The findings highlight that the RHI reform announcements and their subsequent delays played a significant role in influencing specific parts of the renewable heat market in the between March 2016, when the proposals were first consulted on, and 20 September when the first tranche of reforms came into force. This is consistent with historic scheme deployment, where scheme changes and degressions have resulted in short-term spikes in applications.

For applications between April 2016 and September 2017, 17% of domestic applicants and 19% of non-domestic applicants (excluding biogas and biomethane) reported being influenced by the proposed reforms. Among biogas and biomethane applicants the influence of the reforms was much higher, at 69%.

The evidence indicates that the reform proposals and their delays had three distinct effects:

- Speeding up some applications and installations that stood to lose out when the reforms came into force. This was the case in particular for domestic heat pump applicants;
- Influencing applicant decisions about the size of their installation where applicants stood to lose out when the reforms came into force. This was the case in particular for non-domestic biomass applicants; and
- Delaying or slowing down applications for large scale non-domestic technologies that stood to benefit from the reforms (particularly from tariff guarantees), such as biogas, biomethane and shared ground loops.

The reform announcements are most likely to have contributed to the spikes in applications in March and September 2017 for domestic heat pumps (driven by applicants wanting to avoid the expected introduction of heat demand limits) and the September 2017 non-domestic medium-biomass spike (driven by applicants wanting to avoid the removal of tariff banding).

However, it is also clear that general uncertainty about the future of the RHI, as well as the expectation of tariff degressions, were also drivers that contributed to applicants applying or installing sooner than they otherwise would have. It is likely that the reform proposals and subsequent delays may have contributed to this general market uncertainty.

This uncertainty suggests that consumers lacked clarity about the scheme during this period. Whilst the scheme reforms were designed to create a longer-term platform for investment, and included measures to reduce uncertainty (such as providing biomethane applicants applying before the reforms were implemented the choice over the pre or post-reform tariffs and requirement), it also seems that delays caused by external factors may have added to customer confusion in the short-term.

Qualitative and quantitative evidence highlighted that installers and other third parties played an important influencing role in some decisions about heating technology choice, sizing and installation timing. The evidence also suggests that the general uncertainty about the scheme created an opportunity for some installers to 'push' installations through during the interim period.

The influence of the reform proposals on applications is consistent with the concept that much of the renewable heat market remains subsidy-driven. But the evidence also highlighted that there are elements of the market that are less subsidy-dependent (such as domestic heat pump self-builders and renovators and the installers that service them).

The extent of the impact of the reforms on applicants was largely determined by a number of key factors:

- Customer awareness of the reform proposals and perceptions about how the proposals would impact on them;
- The financial sensitivity of the installation (i.e. the extent to which changes in RHI subsidies would affect the viability of a renewable heat technology being installed); and
- Customers' ability to alter the timing of their installation.

For installers, the extent of the impact of reforms was largely determined by:

- The technology involved and the extent to which the reforms impacted on it;
- The ability of the installer to diversify into other areas (or the extent to which they had already diversified);
- The nature of the customer base, such as the extent to which their customer base was driven by the RHI subsidy;
- The nature of the installer's offer (such as their ability or willingness to respond to customer demands); and
- The lead-in times of the supply chain used by the installer.

Glossary and definitions

Term	Definition
RHI stakeholders referred to in the report	
Applicants	Householders (domestic scheme) or organisations (non-domestic scheme) which have taken up or tried to take up the RHI
Multiple applicants	Householders (domestic scheme) or organisations (non-domestic scheme) which have made more than one application to the RHI
Participants	Individuals that took part in the qualitative interviews conducted as part of this evaluation.
Respondents	Individuals that took part in the quantitative surveys conducted as part of this evaluation
Methodological terms used in the report	
Theory-based evaluation	An approach to evaluation which provides an overarching framework for understanding, systematically testing and refining the assumed connections (i.e. the theory) between an intervention and the anticipated impacts. The focus of theory-based evaluations is not only on understanding whether a policy has worked, but why, and under what conditions a change has been observed.
'Realist' evaluation	A type of theory-based evaluation which typically asks: "what works, for whom, under what circumstances?" It begins by developing a set of hypotheses (or theories) on those factors or processes that explain why an intervention has had a particular result (called a mechanism), and what effect the context of an intervention has on these mechanisms.
CMO	Context-Mechanism-Outcome configurations (CMOs) are used as the main structure for realist analysis. They describe the theoretical connections between contexts, mechanisms and outcomes (i.e. 'in this context, that particular mechanism fired for these actors,

	generating those outcomes') which are tested and refined in the evaluation.
Technological terms used in the report	
Biomass boilers	Boilers that burn biomass (RHI-eligible fuels include wood logs, chips and pellets, straw and agricultural residue, food waste, sewage sludge and biomass residues from industry) to heat hot water used to heat buildings and/or provide hot water (potentially via local heat networks) or, in some cases, to provide process steam for manufacturing.
Combined Heat & Power (CHP)	Installations which involve the simultaneous generation of useable heat and power in a single process. Biomass CHP installations are eligible for RHI.
Ground source heat pumps	Electricity-driven pumps that extract ambient heat fromthe ground. This heat is absorbed into a fluid and then pumped into a building, usually for space heating or to provide domestic hot water.
Shared ground loops	A system where a ground loop is connected to two or more heat pumps. New regulations came into force on 22 May 2018 which made shared ground loops eligible for payments through deemed heat demand under the non-domestic RHI.
Air source heat pumps	Electricity-driven pumps that extract heat from outside air. This heat is absorbed into a fluid and then pumped into a building, usually for space heating or to provide domestic hot water. Air-to-air heat pumps, which use air as the heat carrier, are not currently supported by the RHI.
Water source heat pumps	Electricity-driven pumps that extract ambient heat contained in a body of water. This heat is absorbed into a fluid and then pumped into a building, usually for space heating or to provide domestic hot water.
Solar thermal installations	Roof or ground mounted panels containing 'evacuated tube' or 'flat plate' collectors which capture heat from the sun to heat water which is typically used to provide domestic hot water.
Biomethane	Installations which use anaerobic digestion, gasification or pyrolysis of biogenic materials (for example, food wastes or maize) to

	produce biogas, which is refined into biomethane and subsequently injected into the natural gas grid. As with natural gas, the biomethane can then be used for heating applications in homes and businesses.
Biogas	Installations which use anaerobic digestion, gasification or pyrolysis of biogenic materials to produce biogas, which is used to fuel a gas engine. This produces heat (and electricity in the case of CHP installations), which might be used for space heating, hot water or industrial 'drying' processes.
Deep geothermal installations	Installations which extract heat from depths of 500m or greater. This water can be extracted and used to provide space heating and hot water for buildings (usually via local heat networks).
RHI-specific terms used in the report	
Heat Demand Limits (HDL)	Heat demand limits cap the financial support that domestic RHI participants can receive for their annual heat use. Heat demand limits have been introduced for air source heat pumps, ground source heat pumps, and biomass boilers and stoves.
Degression	Annual budgets for the RHI are fixed so Government needs to ensure that the scheme stays within budget. The means of controlling the budget for the non-domestic RHI is through degression, which operates by gradually lowering the tariffs which can be paid to new applicants as more renewable heating systems are installed. Tariffs are only reduced as estimated spend on the non-domestic scheme reaches certain expenditure thresholds or "triggers".
Assignment of Rights (AoR)	An option within the domestic RHI which allows an "investor" to help fund the purchase and installation of a household or landlord's renewable heating system. Households and landlords are then able to assign their RHI payments to the investor, who is referred to in the RHI Regulations as the "nominated" investor. Assignment of rights will came into effect on 27 June 2018.
Tariff guarantees	A tariff guarantee allows applicants to the Non-Domestic RHI for some technologies and capacities to secure a tariff rate before

	their installation is commissioned and fully accredited on the RHI. It does not guarantee accreditation - each application will still need to comply with all of the regulations in place at the time of accreditation.
Other terms used in the report	
Microgeneration Certification Scheme (MCS)	A nationally recognised quality assurance scheme, which certifies renewable microgeneration technologies and installation companies. MCS is an eligibility requirement for the domestic RHI and for non-domestic installations with a capacity of 45kW or less.

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