RHI – Incentive or Inhibitor to UK GSHP growth?

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ABSTRACT

In 2013 a "renewable heat incentive" (RHI) was introduced in the UK to accelerate the adoption of renewable heat technologies in order to meet the EU 20/20/20 RES Directive. The incentive scheme had to encompass multiple heat technologies at domestic and non-domestic scale, set appropriate tariffs, and establish heat metering requirements and tariff control mechanisms. At the time of introduction, heat pumps, including GSHPs, were expected to develop as significant, long-term contributors to the de-carbonisation of heat in the UK. This paper describes the evolution of the RHI, specific issues related to GSHP systems, and the ensuing impact that it has had on the UK GSHP industry.

1. INTRODUCTION

As part of the UK's attempt to meet the EU RES Directive a number of initiatives were put in place to accelerate the adoption of renewable electricity, renewable heat and low carbon transport. One such initiative is the Renewable Heat Incentive (RHI), a tariff mechanism introduced to encourage the deployment of renewable heating technologies. The policy was constructed by the UK Department of Energy & Climate Change (DECC) and is administered on their behalf by OFGEM, (Office of Gas & Electricity Markets). This brief paper is written by practitioners in the ground source heat pump sector. Whilst they have also participated in communication with DECC, OFGEM, and the UK Ground Source Heat Pump Association (GSHPA), they do not have sight of the full inner workings and objectives of these organisations. This paper is therefore a view from the outside – by knowledgeable players in only one sector of the renewable heat scene.

2. Background to UK GSHP activity.

It has been pointed out before (Curtis 2001) that the UK was a late arrival to Ground Source Heat Pumps, compared say to parts of mainland Europe, and North America (USA/Canada). While there had been some prior activity with small horizontal and vertical DX systems, and a few horizontal GSHPs, the first modern closed loop borehole installation was in 1995. The first non-domestic, borehole based, closed loop GSHP installation occurred in 1999.

The background to GSHP activity in the UK up to 2013 and 2015 respectively is provided in the two earlier UK Geothermal Country Update papers (viz for EGC 2013 (Curtis et al 2013) and for WGC 2015 (Batchelor et al 2015)). These also refer back to earlier histories of GSHP evolution. A very short summary is that the installation rate progressed from a single installation in 1995, through three orders of magnitude to multiple thousands per annum in 2009. The installation rate fell significantly after that, and the rate of 10,000 installations per year has yet to be realized, as will be discussed here. A comprehensive review of the evolution of GSHPs in the UK domestic sector up to 2013 is provided by Rees (Rees, Curtis 2014).

During the period from 1995 to 2009 a number of events helped the technology along. There was a recognition by the Departments of Energy and Environment that domestic scale GSHPs could be considered as one of the "micro-generation" technologies, alongside solar thermal, biomass boilers, solar PV and micro–CHP. This allowed them to be included in an early incentive scheme, the Clear Skies programme. Whilst this did not lead to significant uptake in domestic GSHPs, it did increase awareness amongst architects and other specifiers of the potential of the technology. The scheme provided a small capital grant for any of the eligible technologies.

This scheme was superceded by the Low Carbon Building Programme (LCBP), which covered both domestic and non-domestic buildings (new build and retrofit). This scheme was moderately successful and started to accelerate the adoption of the various "onsite" renewable energy technologies.

3. Development of the RHI

In 2009, the UK along with other EU countries signed up to the EU RES Directive, or the 20/20/20 scheme. Due to the fact that the UK at that time had miserably low percentages of renewable electricity and heat, the UK renegotiated a target of 15/20/20. (ie 15% for the renewable energy component).

In order to meet this target, DECC set about devising new incentive schemes to accelerate the uptake of both renewable electricity and renewable heat technologies. Primarily for on-site adoption, two major incentive schemes were proposed, and legislated for, in 2008. A tariff based Feed-in-Tariff (FIT) was proposed for electricity generating technologies, together with a similar tariff based Renewable Heat Incentive – the RHI, for renewable heat technologies.

The electric FIT covers solar PV, micro/medium wind, and micro/medium hydro. In principal, and in practice, it was relatively easy to rollout. Given that the scheme pays for all electricity generated, it is only necessary to install a generation meter and for the beneficiary to report the total generation to the administrator. Above a certain threshold (50kW for PV) an export meter also has to be fitted and the beneficiary is also paid a (lower) "export" tariff on all electricity exported to the grid. Below the threshold, the Export tariff is paid on a "deemed" basis of 50% of all of the generation. The significant feature to bear in mind is the ease with which excess electricity generation can by supplied to the grid.

While the operation of the scheme was handed by DECC to OFGEM, the electricity utility companies act as the administrators of the tariff, ie customers report their generation and export figures to their chosen utility, who carries out basic accountancy checks and then pays the customer. The tariff itself is paid out of the revenues of utility companies - it does not get paid from general taxation. It is therefore viewed as a "tax" on all electricity consumers. The tariff period is 20 years, and different technologies were assigned different tariffs, related to the anticipated capital cost of the equipment. In theory the tariffs were meant to deliver the same return on capital, or payback after a similar number of years.

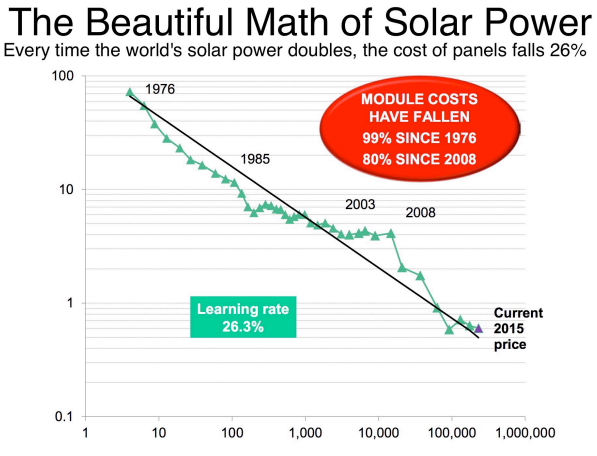
Because of the relative ease of implementation, the legislation for FIT was put in place in 2008, and the scheme went live in 2010.

A number of policy related issues were realised at the time. In order to ensure that any system receiving FIT was of a satisfactory quality, and safe, it was felt necessary to establish standards both for any equipment and for any would be installers. To this end the Microgeneration Certification Scheme (MCS) that had been developed for the earlier Clear Skies scheme was extended, covering both equipment and installer standards. (www.microgenerationcertification.org) This had to address all of the technologies that FIT applied to.

It can be argued that while any equipment should be required to be safe, and be properly designed and installed, the fact that FIT is paid on all generated electricity, automatically incentivizes the delivery of efficient, reliable equipment that has been properly installed.

Soon after the FIT scheme came in to operation, the newly elected administration was faced with a challenge. It became very apparent that because of the time between announcement and initiation of the scheme, the tariff for solar PV was far too high. Because of the extraordinary pace of cost reduction in Solar PV, (Figure 1), the tariff had already become far too generous by the time installations started to be commissioned. This was leading to runaway take up, with total tariff payouts over 20 years beginning to look excessive. The government had to act very quickly and enacted derogation measures to reduce the tariff in line with the dramatic capital cost reductions. This exercise led to the development of a formal, publicly declared derogation mechanism, which allowed manufacturers, installers and would-be customers to understand how and when the tariffs would or could be reduced.

Figure 1: Log-log plot of solar PV costs with time.



In the meantime, the RHI scheme was still not activated, despite have been announced at the same time as FIT. This arose for a number of reasons, (not all of which the authors may be aware of):

Firstly, it became apparent that the simplicity of installing an electricity generation meter for the grid connected FIT technologies, was going to be far more complex for the heat based technologies. The whole

concept of "useful heat" had to be appreciated, ie the tariff had to be carefully designed not to incentivise the generation of excessive heat that could be lost to atmosphere through chimneys or leaky buildings.

There was a danger that the parallel drive to introduce energy efficiency in buildings could be overridden by subsiding unduly large quantities of "renewable" heat.

The issue of appropriate metering, and the location of the metering had to be resolved. For example with heat pumps - should the renewable heat content be measured (ie from air / water / ground) or should the delivered heat be monitored? The latter is easier to do but it is then necessary to understand and / or estimate the efficiency (SPF or average COP) of the installations in order to estimate the renewable heat content. The complexity of this issue led to debates over whether the heat should be metered, or "deemed". These issues had to be resolved for all of the applicable technologies, viz solar thermal, biomass, air / water / and ground source heat pumps, for both domestic, and non-domestic installations. For biomass the vexed question of the long term "sustainability" of the fuel supply has had to be addressed in order to prevent overzealous use of poorly maintained wood supplies.

Unlike the FIT schemes, the costs of the tariff are met from central taxation, ie not from the utilities. Government therefore had a stronger duty to ensure that any spending was only going to be directed at efficient technologies. Because of the outcome of a previously initiated study into the performance of 82 domestic ASHPs and GSHPs, there were concerns that heat pumps were failing to deliver efficiently. (EST 2010, Dunbabin,Wickins 2012). DECC therefore instigated an interim domestic funding scheme, RHPP (Renewable Heat Premium Payment) to allow for several hundred domestic heat pump installations to be installed, instrumented and monitored. (UCL 2016). DECC had also initiated a review and update of the MCS installation standards for heat pumps in order to try to improve on the performance of installed systems (Curtis et al 2013).

In the non-domestic sector, faster progress was made in developing the requirements of the RHI, and the scheme went live in 2012. In this case there was a requirement for all installations to be appropriately (heat) metered. Perhaps surprisingly, there are no design standards in place for these larger systems, and the heat pumps do not have to be MCS registered. The heat pumps have to show manufacturer evidence of a minimum COP at specified temperatures, and the designer is required to show that a minimum SPF of 2.7 will be achieved in practice.

In the case of ground source heat pumps there was a significant hiatus in the scheme when OFGEM/ DECC were presented with applications for GSHPs that could deliver heating and cooling. The initial reaction was that these systems would not be allowed. The logical extension of this approach could have resulted in the installation of GSHPs that only delivered heating in order to qualify for RHI, with separate, inefficient, air sourced chillers installed to deliver cooling. After extensive consultation with the GSHP industry that centred around definitions of what amounts to "naturally occurring heat" the matter was resolved. GSHPs and ASHPs that deliver heating and cooling are paid RHI for delivered heat (only). This issue is beginning to rear its head again in the light of EU discussions that are focusing on the delivery of "renewable " cooling and the role that heat pumps will play.

It should be noted that non-domestic installations can be bi-valent, but only the heat delivered by the heat pump qualifies for RHI. Confusingly, the tariff is calculated for the "delivered" heat, not the renewable heat. In addition, the tariff applies for a period of 20 years, as per FIT.

The RHI scheme for domestic installations was finally started in 2014. The principal features as far as GSHPs are concerned are:

- The tariff is for 7 years.

- For mono-valent systems the tariff is based on the "deemed" heat requirement of the property, and it applies to the energy extracted from the ground.

- For bi-valent systems, or 2nd / holiday homes, the heat needs to be metered.

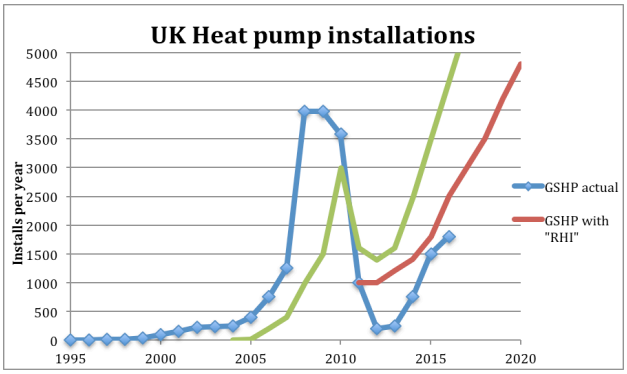
- The equipment has to be registered under MCS, and the installer has to be MCS trained and registered.

In order for the annual heat demand of the property to be deemed, the customer has to have a separate energy assessment of the property carried out in order to obtain an Energy Performance Certificate (EPC). As well as providing the basis for the RHI "deeming", it is a requirement that the property meets a minimum energy performance level, eg through insulation / draught proofing etc. in order to avoid excessive payment being made on highly inefficient properties. To be fair, it is noted that this requirement is also applied to building related FIT, ie there is a minimum energy efficiency standard required on a property before solar PV FITs are paid out at the full tariff level.

4. Outcomes – intended or otherwise.

Figure 2 shows the history of GSHP installations in the UK up to 2009. A very gradual rise from nowhere, (1 domestic system in 1995), gradually stimulated by the Clear Skies Program and then accelerated under the Low Carbon Building Programme. A combination of events then stalled the industry catastrophically. (Blue line in Figure 2).

Figure 2: Actual and projected UK heat pumps



The individual factors that contributed to this were:

- Aftermath of global financial crisis

- Overnight cessation of the LCBP at the 2010 election.

- Cessation of the Building Schools for the Future Programme

- Slowdown in the UK house building industry

- Slowdown of the construction industry – because of the financial crisis.

- Diversion of interest to Solar PV because of the high PV feed-in-tariff.

- Delay in committing to GSHP installations due to the announcement, but non-arrival of the RHI scheme.

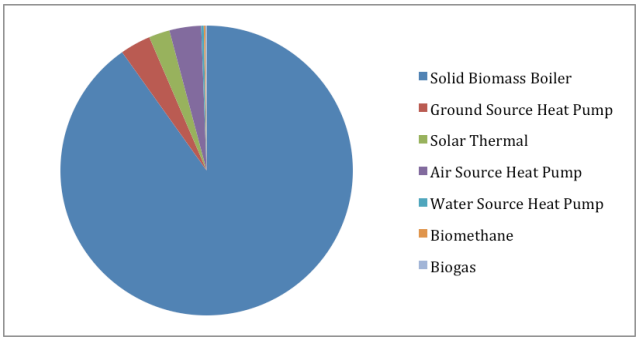
This caused total hiatus in the nascent UK GSHP industry. Too many players were left chasing too little work, and a severe re-structuring occurred, with notable players leaving the industry.

It took from three years (non-domestic) to four years (domestic) for the RHI scheme to be fully developed and rolled out after its initial announcement at the same time as FIT.

Figure 2 illustrates the authors' prediction of what might have been expected to happen under RHI, in order for ASHPs and GSHPs to begin to significantly contribute to the RES renewable heat target (Red and green lines, Figure 2). In reality, the RHI has failed to accelerate the take up of GSHPs in a significant way (Blue line in Figure 2).

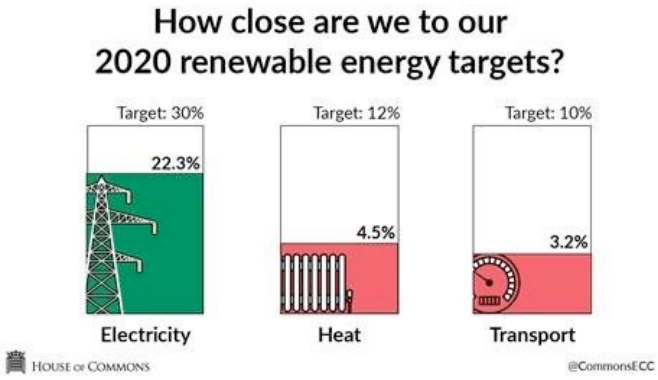
The pie chart of Figure 3 starkly illustrates the take up of RHI by the different renewable heat technologies, up to the time of writing. It is immediately apparent that biomass has dominated the take up of the RHI. This suggests that there is something inherently unbalanced in the tariffs being offered for the different technologies, given that the intention would be to see broadly equal take up across the technologies. This is despite the automatic derogation in tariffs, that had been developed for FIT and PV, coming into play and attempting to slow the take up of biomass.

Figure 3: Breakdown of 2.6GW of Renewable Heat receiving RHI. (2.4GW non-domestic, 2.3GW Biomass) (up to March 2016)



In a post election budget review in November 2015 UK government expenditure was examined with a view to making significant reductions. Probably because of the lack of progress in achieving the RES Renewable Heat Target (Figure 4), and under pressure from the UK Climate Change Committee, the RHI survived the budget view and has been kept in place until financial year 20/21. However, DECC has now gone out to consultation on the RHI scheme. It is expected that announcements will be made later in the year, with legislation coming into place in April 2017. This will leave three years to attempt to accelerate the uptake of the Renewable Heat Technologies towards the 2020 target.

Figure 4: UK RES Targets and Achievement - 2016



For the UK GSHP industry the effect of the combined events that stalled the industry in 2009 may have a very significant impact on how the industry now develops. If, nothing else, it can be seen from Figure 3 that it is going to take something like 10 years to recover to the rate of installations that had already been achieved in 2009. This is very probably a reflection on the fact that GSHPs do not come in a box and sell like PV panels. It takes time for installers to be properly trained, to gain experience, to develop a profitable sales pipeline, and the gestation period for new-build non-domestic projects can often be several years.

Perhaps of longer term significance is the potential threat to GSHPS from ASHPs. From a carbon reduction perspective, electrically driven heat pumps connected to low / zero carbon electricity offer one of the few routes to de-carbonised heating (and cooling). From a purist's point-of-view, it doesn't matter in a moderate climate such as the UK, whether the heat pumps are GSHPs or ASHPs. The difficulty for the GSHP market is that high efficiency ASHPs are becoming increasingly available that are easier and cheaper to install. The difference in annual SPF is narrowing, and it can be difficult to argue the financial (and CO_2) benefit of GSHPs. The authors therefore anticipate that the take-up of ASHPs in the UK will be significantly faster than the take-up of GSHPs. The nine year hiatus in the industry means that it starts again from a much weaker base and will have to fight hard for market share. To this end, the industry will need to look for possible cost reduction methods, and innovative designs. One example of this is the development of Thermal Screw Piles (Reid et al 2016) and the adoption of lower cost drilling methods that are already being evaluated elsewhere in the EU. The use of communal ground loop arrays in domestic social housing, and the optimisation of bi-valent GSHPs to deliver heating and cooling in non-domestic buildings are areas where GSHPs may still show cost-effective benefits.

5. Conclusions

Driven by the EU RES directive, the UK established incentives to accelerate it from a position as a very poor performer in the EU Renewable Energy "Charts", towards its 15/20/20 goal. In order to drive the uptake of renewable heat, the unique Renewable Heat Incentive was developed, a tariff based scheme based on payment for heat produced with time. Unlike the simple metering of electricity required for the more common Feed-in-Tariff schemes, it took nearly four years to deal with issues around "useful heat", heat metering, eligible technologies, efficiency requirements, equipment standards and installer certification. Along the way, equipment standards and installer standards were improved under the extensive Microgeneration Certification Scheme. For GSHPs this included a revamp of the installer standard for heat pumps, and new the development of a simple paper based design methodology for domestic GSHP systems. (Curtis et al 2013). To satisfy treasury requirements, a vey comprehensive monitoring scheme of hundreds of domestic air source and ground source heat pumps was undertaken.

Unfortunately the delay in developing and initiating the RHI, together with other impacts that primarily arose from the global economic recession, almost brought the nascent UK GSHP industry to its knees. Whilst not entirely to blame for the decline in GSHP activity, the delay in implementation of RHI led, at the very least, to stagnation of the industry while potential customers waited to see the details of the scheme, or even switched horses to the generous and operational Solar PV FIT programme.

The UKGSHP industry awaits the outcome of DECC's RHI review in the hope that the incentive scheme will be restructured in such a way as to rebalance the tariffs for the relevant technologies and lead to a lasting recovery and steady long term growth. The RHI may then, belatedly for GSHPs, be finally recognized as a worthwhile incentive.

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