The Domestic RHI Scheme – September 2012 Consultation

Factsheet 1: Introduction to Renewable Heat

What is renewable heat?

Heat energy derived from “renewable non-fossil fuel sources”, such as the sun, the air, the ground and from biomass (e.g. wood).

What sort of renewable heating technologies are available?

We have identified four technology types that we propose supporting under the domestic Renewable Heat Incentive (RHI) scheme:

- Air to water heat pumps
- Biomass boilers and biomass pellet stoves with back boilers
- Ground source heat pumps
- Solar thermal panels (flat plate and evacuated glass tube)

Air to Water Heat Pumps

Air to water heat pumps are types of air source heat pumps (ASHPs).

ASHPs extract heat from the outside air using an electrically driven refrigeration process which is then used to provide space heating via radiators, underfloor heating or fan coils, as well as hot water heating.

ASHPs are relatively simple and easy to install, with little routine maintenance needed generally. They perform best in warmer weather. Issues that need to be taken into account when installing ASHPs are potential noise and planning consent implications.

Ground Source Heat Pumps

Ground source heat pumps (GSHPs) operate in a similar way to ASHPs, but instead of using air they take their heat from the ground, lakes or rivers. They tend to be installed in one of two ways. The most economic method is generally to install a “slinky”, or network of horizontal piping, under the surface layer of soil outside the house. Where space is at a premium, GSHPs are connected to pipes installed in vertically bored holes. In both cases the piping contains a liquid which, after being warmed by the earth, enters the GSHP where the heat is upgraded and transferred to a second medium, usually water and glycol, which is then used to heat the building via radiators, underfloor heating or fan coils.

GSHPs tend to be more expensive to install than ASHPs, but unlike ASHPs, are not affected by colder weather and are less likely to have significant noise or planning consent issues.

Biomass boilers and biomass pellet stoves with back boilers

These systems generate heat through the combustion of organic matter (such as wood or other plant residues). They can provide both space and domestic hot water heating. Unlike the other three domestic renewable heating technologies, biomass boilers need fuel to be purchased regularly and for the fuel to be manually fed into hoppers[1].

When considered in terms of eligibility for the RHI, issues that need to be borne in mind are ensuring the fuel is obtained from a sustainable source and complying with air quality standards.

[1] A container (typically funnel-shaped) in which the fuel is stored in readiness for burning.

Solar thermal flat plate and evacuated glass tube panels

Solar thermal technologies concentrate ultraviolet radiation from the sun onto a collector which transfers the heat energy to a working liquid which is then used to produce domestic hot water. All solar heating systems contain a storage element in the form of a hot water tank. This is to ensure that the heat can be provided at the desired time and not just when the sun is shining (solar heating can operate in shady conditions, but with lower efficiency). The amount of heating a system can provide is primarily dependent on the surface area of the collector and its orientation.

Solar thermal systems are different from solar photovoltaic (PV) systems, although both are normally roof-mounted. Rather than generate heat, solar PV systems generate electricity. They receive government support under a separate scheme – the Feed-in Tariffs (FITs) scheme[2].

Why would a consumer want to install a renewable heating system?

Consumers might install a renewable heating system for various reasons, including to:

- Help the environment
- Reduce dependence on fossil fuels and their fluctuating prices
- Save money
- Replace a poorly performing heating system

What benefits might a consumer get from installing renewable heating?

Renewable heating systems offer a low-carbon route away from exposure to fossil fuel markets, which have seen recent price fluctuations in a generally upwards trend. A reduction in heating-related greenhouse gas emissions would also be achieved. Furthermore, renewable heating technologies such as heat pumps and solar thermal require little routine maintenance after installation.

The benefits of renewable heating are revealed in more detail in case studies at the end of this Factsheet.

[2] Information on the FITs scheme is available on the DECC website: http://www.decc.gov.uk/en/content/cms/meeting_energy/Renewable_ener/feedin_tariff/feedin_tariff.aspx

Why are installation levels of renewable heating currently not that high?

The current primary barrier to uptake of renewable heating is the cost. Other issues raised have included the disruption involved in installing and the space required for certain technology types, the ease of use and aesthetics.

What role will renewable heat play in the future?

The UK has committed, through European legislation, to achieving some ambitious renewable energy (including heat) targets to help combat climate change. We expect to see the mass rollout of renewable heat during the 2020s in order to meet them. Given this direction of travel, over time there will be an increasing focus on householders (and others) to make the switch from fossil fuels.

Why do we need an RHI subsidy scheme?

Whilst the long-term vision is of widespread renewable heat use, at the moment, the number of such systems being installed in the country is very low. We think a subsidy scheme is therefore needed to boost investment and uptake and hopefully drive down the costs of renewable heating systems as a result. Furthermore, the scheme could help create green jobs and develop the skills to install and maintain equipment in the future. The domestic RHI scheme offers this as well as the security of government support for consumers if making the transition to renewable heat early.

Case Studies

CASE STUDY:
Ground Source Heat Pump

The Cawdell Family – customer profile

Property type: Converted barn with garage
Location: Off-gas grid, rural Staffordshire
Previous heating system: Oil boiler
Current heating system: 12kW Ground source heat pump with ground array (installed May 2011)
Cost of system: c. £15,000
Financing: Self-financed (savings)

Customer motivations and experience of installing a *ground source heat pump*

The Cawdell's main motivation was to upgrade to a system that could comfortably meet their heating requirements and also deliver savings on their energy costs, because:

- The previous oil heating system provided an inadequate amount of heat and hot water for a family of four and they had to supplement it with electric fan heaters
- The volatile price of oil resulted in unpredictable, high fuel bills

The decision to install a GSHP was an 'investment' decision. In the short term the system will save significantly on energy bills (c.£1000 per year), delivering a payback of ~15 years. With no intention to move the family view this as an investment in their home.

Mr and Mrs Cawdell decided they wanted to replace their system and contacted installation company, *Purple Energy* for advice on what type of heating system could best meet their needs defined above. They had not considered a GSHP previously, however *Purple Energy* made a recommendation for the technology, based on the family's needs and the availability of outside space for a ground loop – they may not have considered this technology had the installer not recommended it to them.

Experience so far:

- **Controls:** The system is easy to use – the family have not had to touch the controls since the installer initially programmed them – the family also like that they do not have to handle fuel (the alternative solution was a biomass boiler)
- **Visual impact:** After the initial works there is minimal impact as the indoor unit is neatly out of the way in the garage, no alterations were required to their existing wet central heating distribution system.
- **Performance:** The family no longer have to supplement their heating system with electric fan heaters and the system is performing well.

"We are delighted with the heat pump system. It provides consistent, comfortable heat and produces lots of hot water which is really important for our family of four" (Mr Cawdell, homeowner)

Source: Delta-ee / Danfoss(2012)

CASE STUDY:
Biomass (pellet) boiler

The Lord Family – customer profile

Property type: 4-bed 18th Century Cottage
Location: Off-gas grid, Derbyshire
Previous heating system: Anthracite Boiler
Current heating system: 25.5 kW Pellet fired boiler and 1.5 ton pellet store.
Cost of system: c. £12,000
Financing: Self-financed (from retirement lump sum)

Customer motivations and experience of installing a *biomass pellet boiler*

The Lord's decision to upgrade their system was taken when their old anthracite boiler broke down. Initially the family were keen to replace it with an oil boiler. The priority for the family was to:

- Reduce the amount of effort required to keep the house warm – the anthracite hopper had to be filled twice daily
- Have a more controllable (and reliable) source of heat
- Reduce the need for supplementary heat provided by an inefficient old Aga.

The Lord family approached a small local heating installer, *Elliott's of Bakewell,* who have a strong reputation in the area for installing high quality oil boiler systems. Having recently installed a biomass boiler for himself, their installer recommended a wood pellet boiler as the answer to the Lord family's problem. Mr Lord had not previously considered wood fuel but liked the idea that this would provide the controllable heat they required, and cut his carbon emissions.

The pellet boiler was installed in the old coal store located adjacent to the front door of the property, and a 1.5 ton pellet store added which can hold several months' supply of fuel (average pellet consumption for a domestic boiler is 5 tons).

Experience so far:

- **Installation:** there was minimal disruption, the system is compatible with their existing heat distribution system.
- **Ease of use:** The family finds the system easy to use and less time consuming then their previous system. It is automated so only needs filling infrequently – filling 200kg of pellets takes about 10 minutes, and would last for a week when temperatures are at their coldest, longer the rest of the year. As a bonus the family have also been able to remove the old Aga. The control system is straightforward and effective.
- **Space required:** The unit is hidden in an old cold store and no thermal store was required, so no internal space was lost, however the family have gained some space with the removal of the old Aga**.**

"It's almost like having gas! It's got the same ease of use as a gas boiler" (Mr Lord, homeowner)

CASE STUDY:
Air source heat pump

The Westwood Family – customer profile

Property type: Farm house renovation
Location: Off-gas Suffolk
Previous heating system: Oil boiler
Current heating system: 16 kW air source heat pump (x 3) & under-floor heating throughout
Financing: Self-financed from sale of old house

Customer motivations and experience of installing an *air source heat pump*

During the renovation of his new home, Mr Westwood was interested in installing a heating system that would meet all their heat and hot water needs, at as low running cost as possible (without any need for supplementary heat). As the home is in an off-gas area the family considered several options:

- Upgrading the existing oil-fired boiler and radiator system – however the family were conscious of rising oil prices
- Installing a biomass boiler - although they would prefer to avoid handling fuel deliveries
- Upgrade to an all-electric heating system and replace the radiators with under-floor heating.

Due to the factors mentioned above, an all-electric system was preferred and the Westwood family considered both ground source and air source heat pumps. In the end an air source heat pump was chosen due to the significantly lower upfront cost. Mr Westwood then went online to research the products being offered by various companies and then contacted local heating firm GAH Ltd. to supply and fit his chosen brand.

GAH fitted 3 × 16 kW low temperature inverter-driven air source heat pumps (the system was purposely over-sized to negate the need for any back-up). Mr Westwood had to apply for planning consent, but this was easy and simple to do. GAH also programmed the system to the family's requirements. As a refrigeration engineer himself, Mr Westwood was familiar with the operating principle of the technology, but had no previous experience with residential heat pumps.
Experience so far:

- **Running costs:** The family are very satisfied with the running costs of heating their 6,000 sq. ft. home
- **Performance:** All of the home's heat and hot water are supplied by the heat pumps and they have no need for supplementary heat, even in winter. The under-floor heating is really effective and they like the lower, more distributed heat.
- **Ease of use:** Mr Westwood finds the operation straightforward, and uses individual room thermostats installed with the system to easily alter the heat delivery to any room as necessary – overall the system is very responsive.

"My experience of using the heating system has been very little – I've not had to touch it since it was set up. I just have to make sure the batteries are OK in the room thermostats" (Mr Westwood, homeowner)

Source: Delta-ee / Daikin (2012)