Title: Renewable Heat Incentive - Domestic **IA No:** DECC0099 **Lead department or agency:** DECC **Other departments or agencies:**	**Impact Assessment (IA)** **Date:** July 2013 **Stage:** Final **Source of intervention:** Domestic **Type of measure:** Secondary legislation **Contact for enquiries:** Marten Ford – domesticrhi@decc.gsi.gov.uk

Summary: Intervention and Options

RPC: n/a - Spend measure

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANCB in 2009 prices)	**In scope of One-In, One-Out?**	**Measure qualifies as**
-£1.8bn	N/A	N/A	No	N/A

What is the problem under consideration? Why is government intervention necessary?

The renewable heat market is largely developing and has been identified as a sector that could cost-effectively provide around a third of the UK Government's target of 15% of energy from renewables by 2020 and also help meet longer term decarbonisation targets. A step change in the uptake of renewable heat generating technologies is required to achieve this potential contribution and prepare the market for mass roll out in the 2020s.

Currently these technologies are unable to compete financially and there are a number of market failures that prevent their deployment such as the lack of carbon price in the non-traded sector and information asymmetries, as well as barriers such as perceived risks associated with new technologies, and costs of disruption associated with switching. Without government intervention, the private sector is not expected to achieve the required uptake.

What are the policy objectives and the intended effects?

The domestic Renewable Heat Incentive (RHI) scheme aims to **(1)** incentivise the roll out of renewable heating systems in the domestic sector to help meet part of heat's share of the 2020 renewable target. **(2)** Prepare for mass rollout of renewable heating technologies in the domestic heating sector during the 2020s by building sustainable supply chains, improving performance, reducing costs and reducing the barriers to take-up of these technologies.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

This final stage impact assessment follows on from the September 2012 consultation and a fresh evidence gathering exercise. The policy, as set out in detail in accompanying policy document and discussed in this publication, offers the best balance of support to prepare for mass roll-out of domestic renewable heating in the long term and support for heat's share of the 2020 renewables target.

The finalised policy has been strengthened in a number of areas, for example it provides more support for better performing technologies by paying on a renewable heat basis so that payments contribute directly towards meeting the 2020 renewables target and thereby incentivise higher performing heat pumps.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 2015 and 2017

Does implementation go beyond minimum EU requirements?			**No**		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro** No	**< 20** No	**Small** No	**Medium** No	**Large** No
What is the CO2 equivalent change in greenhouse gas emissions? (Million tonnes CO2 equivalent)			**Traded:** 0.7	**Non-traded:** -17.8	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister: .... Date: 11th July 2013

Summary: Analysis & Evidence **Final Policy Design**

Description: This Impact Assessment appraises the final design of the domestic RHI scheme

FULL ECONOMIC ASSESSMENT

Price Base Year 2014	PV Base Year 2014	Time Period Years 27	Net Benefit (Present Value (PV)) (£m)		
			Low Deployment: -£1,424m	**High Deployment:** -£652m	**Best Estimate Deployment:** -£1,836m

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low Deployment	-		-	**£1,967m**
High Deployment	-		-	**£2,431m**
Best Estimate Deployment	-		-	**£2,912m**

Description and scale of key monetised costs by 'main affected groups'

The range of NPV estimates displayed above represents high/central/low deployment scenarios, and not NPV scenarios. These scenarios have different assumptions about cost effective uptake which mean that the highest resource costs are experienced in the central deployment scenario.

Cumulative gross resource costs to society of RHI tariffs over the lifetime of the policy are estimated at around £2,800m.

Other key non-monetised costs by 'main affected groups'

The administration costs of the scheme have not yet been finalised so are not included in this calculation.

The ecosystem impacts, food security impacts and ozone impacts of a reduction in air quality resulting from increased biomass combustion are highly uncertain and have not been monetised.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low Deployment	-		-	**£543m**
High Deployment	-		-	**£1,779m**
Best Estimate Deployment	-		-	**£1,077m**

Description and scale of key monetised benefits by 'main affected groups'

Monetised benefits include both traded and non-traded carbon savings. Much of the renewable heat uptake will be outside the EU ETS and will represent additional UK carbon savings. The value of non-traded carbon savings is estimated to be £973m, with a small cost in traded carbon emissions, as households switch fuel type (to electricity) into the traded sector. Estimated air quality impacts of the scheme are estimated to be £100m. These air quality impacts are benefits, unlike in previously published analysis. In previous analysis air quality estimates were only based on increased biomass uptake which caused negative air quality impacts. In the latest estimates air quality impacts are modelled taking into account uptake of all technologies. In this case negative air quality impacts associated with biomass uptake are counteracted by more coal and oil heated households taking up renewable technologies than those using gas or electricity. More detail is included in the section on air quality. These are included in the present value calculations.

Other key non-monetised benefits by 'main affected groups'

Non-monetised benefits include the avoided cost of alternative renewables to meet the 2020 target, greater diversification of the heating mix, improved UK competitiveness in green technologies, innovation and performance improvement (leading to lower fuel bills) benefits and reduced technology costs due to learning from wider deployment. Barriers associated with renewable heat may also be removed over time as a result of the policy being implemented.

These benefits have not been monetised and are not included in the present value calculations.

Key assumptions/sensitivities/risks | **Discount rate (%)** | Social: 3.5% |Householder: 7.5%

The analysis assumes a social discount rate of 3.5% for the calculation of the net present value of costs and benefits, and a private discount rate of 7.5% for the assessment of the required tariffs and projected uptake. Assumptions on the private discount rate as well as fossil fuel and carbon price are key drivers of the present value ranges. Changes in the renewable technology costs and performance have affected the above estimates since consultation. Further analysis on technologies, as well as a change in methodology such that tariff payments are made on the basis of renewable heat output only, has also affected the composition of projected uptake and the associated costs.

Sensitivities considered include variations in cost and fossil fuel price data, as well as different market conditions.

BUSINESS ASSESSMENT (Final policy design)

Direct impact on business (Equivalent Annual) £m:			**In scope of OIOO?**	**Measure qualifies as**
Costs: n/a	**Benefits:** n/a	**Net:** n/a	No	N/A

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Strategic Overview

1. Today, almost all of the heat used for heating homes and hot water comes from burning fossil fuels. Only a very small proportion of households use renewable heating, due to the higher costs compared to fossil fuel technologies, and barriers such as the perceived risk. This means that domestic heating and hot water accounts for around 15%[1] of UK emissions.

2. By 2050 emissions from heating in homes will need to reduce to almost zero in order to reduce emissions by 80% on 1990 levels and comply with agreed climate change targets on decarbonisation. To achieve this, we need to prepare now for mass rollout of low carbon heating in the 2020s, by supporting cost reductions and improvement in performance of technologies. In the shorter-term, domestic heating also needs to make a contribution towards heat's share towards the UK's 2020 target of 15% of energy from renewable sources. Two per cent[2] of heat demand currently comes from renewables. A significant increase in take-up of renewable heating, starting now, is required to achieve these goals, which would not happen without Government intervention.

3. In the 2009 Renewable Energy Strategy, the Government committed to the Renewable Heat Incentive (RHI), a financial incentive scheme to encourage uptake of renewable heating technologies among householders, communities and businesses. In 2011 the non-domestic RHI opened for applications, and DECC consulted on proposals for a domestic RHI in September 2012. This Impact Assessment will explore the impacts of a domestic RHI scheme due to launch in spring 2014.

4. More detail on the timeline of the RHI from inception to date, and going forward, can be found in annex A.

[1] Emissions from Heat: Statistical Summary (2012), available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/140095/4093-emissions-heat-statistical-summary.pdf
[2] Based on 2011 statistics. Calculated using DECC (2012) Digest of United Kingdom Energy Statistics.

Rationale for Intervention

5. The domestic RHI has a two-fold purpose, firstly to contribute renewable energy in order to meet the UK's 2020 target for sourcing 15% of energy demand from renewable sources. Secondly to help develop the renewable heat market and supply chain so that it is in a position to support the mass roll out of low carbon heating technology required in the 2020s and onwards in order to meet decarbonisation targets. The domestic RHI is designed to achieve these goals by incentivising cost effective installations, creating cost reductions for installation and operation and finally improving performance of renewable heating systems.

6. The market for domestic renewable heat is currently very small and less mature than for conventional technologies such as gas, oil and electric resistive heating. This is because renewable heat options such as air source heat pumps (ASHP), ground source heat pumps (GSHP), biomass boilers and solar thermal are largely unable to compete on costs with conventional heating options.

7. In addition to cost differences there are a number of non-financial barriers to the uptake of renewable heat; for example the risk (perceived and real) associated with installing relatively less mature technologies, or the required behavioural change necessary to use the renewable heat technologies.

8. The tariff offered by the domestic RHI scheme should address the issues identified above by making renewable heating technology competitive with conventional technology in terms of costs. The core benefits are set out below.

Preparing the Supply Chain

9. The Heat Strategy and Carbon Plan set out the importance of renewable heat deployment beyond 2020. Domestic heating made up 28% of the UK's energy demand in 2010 so will play a key role in putting the UK on a cost-effective decarbonisation pathway to meeting our 2050 decarbonisation target and the UK's carbon budgets.

10. Mass roll out and deployment of technologies such as heat pumps is expected to be required from the 2020s, and it is critical that a domestic supply chain exists at sufficient levels to allow the ramp up of deployment quickly during this period. By encouraging deployment the RHI stimulates learning, encourage improvements in technologies and their application, and bring down costs through productivity improvements and economies of scale. In other words the RHI could help in building a sustainable supply chain required up to 2020 and onwards.

Renewables Target

11. The EU's Renewable Energy Directive (RED) sets out a legally binding target for the UK to ensure 15% of energy consumption is met by renewable sources by 2020. Although the infraction penalty for not meeting this target is not currently monetised, it is described as being commensurate with the costs of meeting the target[3].

12. Domestic renewable heat offers a cost effective way to contribute towards the target. The costs of supporting deployment are generally lower than the total support given to offshore wind through Renewable Obligation Certificates (ROCs), the carbon price floor and EU Emissions Trading System (ETS). It is difficult to make direct comparisons between the domestic and non-domestic scheme due to different scheme objectives. The domestic scheme is designed to contribute to the 2020 renewables target, and also prepare for meeting longer term decarbonisation targets through building sustainable

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[3] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF

supply chains, improving performance, reducing costs and reducing the barriers for take-up of these technologies. In contrast the main objective of the non-domestic scheme is to generate renewable heat to meet the 2020 Renewables target, though it does have a secondary focus for beyond 2020.

13. Without the policy, the domestic RHI's anticipated contribution to the renewables target in 2020 would have to be made up from another source, for example non-domestic heat, transport or electricity. If the shortfall cannot be made up in other sectors then the UK would be liable for fines for not meeting the 2020 targets as mentioned above. The cost of replacing the domestic RHI's contribution has not been quantified in the Impact Appraisal section due to insufficient information on the cost of delivering additional renewable energy in other sectors and the infraction penalty.

Carbon Emissions and pricing

14. The negative externality of carbon dioxide emissions is not typically reflected in the prices paid by householders for gas and oil heating. In other words the burning of fossil fuels for heating is under-priced from a social perspective. This is not true for electricity, as the electricity market now prices in the carbon externality through the EU ETS and the UK's carbon price floor.

Reducing barriers to renewable heat and increasing innovation

15. Domestic renewable heat is a relatively new market with low deployment compared to conventional heating systems. Because it is a new market there are significant risks and uncertainties which act as a barrier to householders who are considering investing in a system. These barriers can be addressed in part by the provision of information and protection of consumers through standards and guidelines. However it is likely that the deployment and successful application of these technologies will be a key driver in removing barriers across the population.

16. Alongside the benefit of a developed and ready supply chain, there is the additional benefit of product development and improvement in the installation of domestic renewable heating. In other words the benefits to society of marginal increases in performance or marginal decreases in costs are not reflected in the price of renewable heating. Given the critical role of domestic renewable heating in long term carbon reduction targets, any such improvements being brought forward in time could result in large benefits to the UK. Some of this could be attributable to domestic RHI deployment.

Counter-factual

17. As demonstrated above, the domestic RHI policy is key in developing the renewable heat market enough to enable successful mass deployment in the 2020s. It also makes an important contribution to the renewable energy target in 2020. It is important to consider what the alternative view of the renewable heat market and renewable energy production in general could look like without the domestic RHI scheme.

Renewable Heat Market

18. Without the support offered by the domestic RHI from spring 2014, the Renewable Heat Premium Payments would end and there would be no other support for this market. This would have several key impacts:
    - **Renewables target –** The domestic RHI's anticipated contribution to the renewables target would have to be made up from another source. There may be constraints in delivering additional heat in these sectors, or it might be significantly more expensive. If the shortfall cannot be made up in other sectors, the UK may be liable to pay fines.
    - **Deployment of RH technology in GB –** It is likely that only currently cost effective renewable heat technology would be installed in the domestic sector. This would probably be air source heat pumps (ASHP) and a small amount of solar thermal (see counterfactual section under impact appraisal). The deployment of ground source heat pumps (GSHP) and biomass boilers are likely to be close to zero. This only considers the renewable heat market which RHI would directly affect (specifically not new build).
    - **Supply Chains and Market readiness for mass deployment –** With no supporting policy, market intelligence suggests that the businesses of some renewable heat installers and manufacturers would not be viable. This would mean that these skills and experience would have to be imported, take time to develop, and delay and make more expensive the decarbonisation of the heat supply required to meet the 2050 target and nearer term carbon budgets.

Policy Outline

19. For a detailed overview of the whole scheme the accompanying policy document fully describes the scheme. As a summary, ***Box 1: Key features of the domestic RHI Policy*** picks out the features important to keep in mind for this Impact Assessment.

Box 1: Key features of the domestic RHI policy:

- Seven year tariff scheme, open to all (on and off gas grid)
- Supports air and ground source heat pumps, biomass boilers and solar thermal
  - Minimum efficiency standard for heat pumps a requirement
  - Air quality and biomass sustainability standards for biomass a requirement
- Open to owner-occupiers, private and social landlords, self-build and legacy applicants (those who have installed eligible systems since 15th July 2009). All those eligible will receive the final tariffs shown below.
- Energy efficiency requirement: Green Deal Assessment and loft and cavity insulation required.
- Tariffs paid per kWh of renewable heat output. These will be paid for through general taxation and classed as Annually Managed Expenditure (AME).
- Heat demand estimated (deemed) using Energy Performance Certificate and RdSAP for space heating and MCS for solar thermal, with metering in certain cases e.g. where bivalency is an option.
- Additional incentive for installing a metering and monitoring package will be available to a fixed number of households installing heat pumps or biomass boilers.
- All installations to be meter-ready where possible, with planning underway for a metering for evaluation programme.
- The budget of the domestic RHI scheme will be controlled through a budget

20. At consultation we asked stakeholders for their views on the proposed approach to the tariff scheme and whether this was the most efficient way to drive down costs, increase innovation and achieve value for money and also develop a home grown supply chain. The general consensus was that a tariff based approach was the preferred option.

21. Since the consultation there have been a number of changes to the proposed domestic RHI policy. For a detailed overview of the whole scheme the accompanying policy document fully describes the scheme. The full rationale for the policy is explained in the accompanying response to the consultation.

Other important policy features

22. Biomass installations will have to comply with air quality standards in order to be eligible for the RHI tariff. Additionally biomass fuel should be obtained from sustainable sources. More details on both of these issues can be found in the domestic RHI policy document.

23. An additional element of the domestic RHI scheme is support for individuals who install eligible metering and monitoring service packages. These householders will receive an additional payment each year for the tariff length designed to compensate for the costs of installing and maintaining a metering and monitoring system. These packages will allow customers and installers to understand how heating systems are working in specific households. This should allow improvements in performance and the remedying of faults. It will also help DECC to monitor performance over time.[4]

[4] Where a Metering and Monitoring Service Package is to be installed on a deemed RHI heating system then the RHI tariff payment will continue to be based on deeming.

24. More information on these, and other options considered at consultation can be found in the accompanying policy document, technical supplements and annex to this Impact Assessment.

Value for Money of the proposed tariffs

Value of the Cap

25. When the non-domestic scheme was launched in November 2011, DECC set out that none of the tariffs should be set above the support provided to offshore wind, as this was judged to be the marginal technology that could be deployed to meet the 2020 renewables target.

26. Therefore paying more than this level was considered not to offer good value for money in terms of contributing to meet the 2020 renewable targets.

27. The cap was estimated to be 8.5p/kWh in 2011, based on the value of Government support for offshore wind, which after increases to take into account inflation would equate to 9.5p/kWh in 2014/15 prices – when any proposals in this consultation will be implemented. At the time the scheme launched, the only technology affected by the cap was solar thermal, due to its high cost per unit of renewable heat. The rest of the tariffs were below the cap.

28. The current cap was based on the support that offshore wind receives from the Renewables Obligation (RO); it also took into account the support received from Levy Exemption Certificates (LEC). Taking into account the latest assumptions about the value of the RO and LEC would increase the VfM cap to around 10p/kWh (in 14/15 prices).

29. Also, in setting the original cap, the impacts of the Carbon Price Floor (CPF) and the EU Emissions Trading Scheme (ETS) on the wholesale electricity price were not taken into account.

30. While neither the EU ETS nor the CPF are subsidies paid to the renewables sector, they impose costs on fossil fuel based forms of electricity generation. This provides an additional advantage to renewable electricity producers, such as producers of offshore wind. If these costs were factored into the cap calculation, the price of support would be up to around 11.3p/kWh (in 14/15 prices).

31. The appropriate level of cap is being considered as part of the on-going tariff review, but the range of the proposed cap is 10p to 11.3p/kWh over a 20 year tariff or 19.2p to 21.7p/kWh over a 7 year tariff.

Solar thermal Considerations

32. The available evidence suggests that solar thermal would require a higher level of support to drive deployment and cost reductions than the support for offshore wind. When considering the tariff level for solar thermal it is important to take account of the following:
    - **Evidence and tariff setting methodology -** The current evidence base and tariff setting methodology is not adequate to capture the significant impact of occupancy (household size) and geographic position on rate of return. Stakeholders have indicated that a methodology that takes this into account would suggest a tariff level equivalent to around 27p/kWh may be sufficient to grow the domestic market.
    - **Cost reductions -** Stakeholders have suggested that significant deployment could drive cost reductions in the installation of the technology. NERA estimate that this could be 20% by 2020 and STA suggest the reduction could be 30%. However, it is unclear to what extent GB deployment will drive this and how much will be driven by deployment and innovation abroad.
    - **Strategic value** - Solar thermal may have a valuable role as a complementary technology to improve the efficiency of other renewables. As a source of heating for hot water rather than space heating, it can work with biomass or heat pumps so that systems do not need to be run, less efficiently, throughout the summer to meet low heat loads at high

temperatures. It is also the most well-accepted and understood renewable heat technology among consumers.[5]

- **Additionality** - Because of the uncertainties around deployment and what level of tariff is needed to drive additional deployment, it will be important to closely monitor the level of additional deployment of solar thermal installations in order to minimise the proportion of spend that is deadweight. Indicative analysis indicates the deadweight could equate to around £1.4m per year for 7 years for if baseline deployment is assumed to be 5,000 installations a year.

33. Given stakeholder insight and the unknown drivers of deployment, it appears reasonable to conclude that a tariff equal to the VfM cap could result in higher deployment than current levels. This would be offered only to the retrofit market as DECC believes that building regulations and consumer demand will drive deployment in the new build sector if the market is sustained. As such it could offer a value for money but small-scale contribution towards the renewables target while allowing the solar thermal market to develop and achieve cost-reductions.

34. This would have to be monitored carefully to ensure that cost reductions were being achieved and there was a significant growth in installations from the current yearly deployment of approximately 5,000.

35. The announcement of the exact support for domestic solar thermal will be made in conjunction with the tariff review.

[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191541/More_efficient_heating_report_2204.pdf

Affordability and Budget Management

Spending Context

36. The RHI as a whole is funded out of general taxation and spending is controlled through the Annually Managed Expenditure framework by HM Treasury. The budget for RHI is set at each spending review and commitments made are funded for the full length of the tariff payment lifetime.

37. The 2015/16 Spending Review was completed in June 2013 and set the expenditure level on RHI for that year. The table below details expected expenditure on the whole of the RHI scheme in the next two financial years and the budget settlement envelope.

Table 1: Spending Review Settlement for RHI

	2013/14	2014/15	2015/16
Settlement	£251m	£424m	£430m

38. Spending on domestic RHI can be broadly split into 3 categories:
    - **New installations –** new installations following the launch of the domestic RHI
    - **Legacy installations –** installations since 15th July 2009 will, if certain conditions are met, be eligible for RHI.
    - **Metering and monitoring** – individuals who install a metering and monitoring package will receive an additional payment. Proposals for support can be found in the policy document and technical supplements

39. The spending risks associated with these categories of RHI support are different and can be controlled through different methods detailed below.

Spending Control Mechanism

40. There are several mechanisms available to DECC to control the spending on domestic RHI which will ensure that the domestic scheme offers good value for money, controls costs and sets the domestic market on a path of sustainable growth.
    - **Degression –** if spending reaches certain pre-set levels then the value of tariffs available to new entrants will be decreased in a similar manner to the degression mechanism in the non-domestic scheme. This will have the effect of reducing payments to new installations and reducing demand as the number of cost effective opportunities for householders will reduce.
    - **Caps on yearly spend –** A (possible) additional method is to announce a certain level of spending DECC is willing to fund in each financial year, both for new installations and separately for metering and monitoring packages, and stop accepting new applications after the cap is reached.

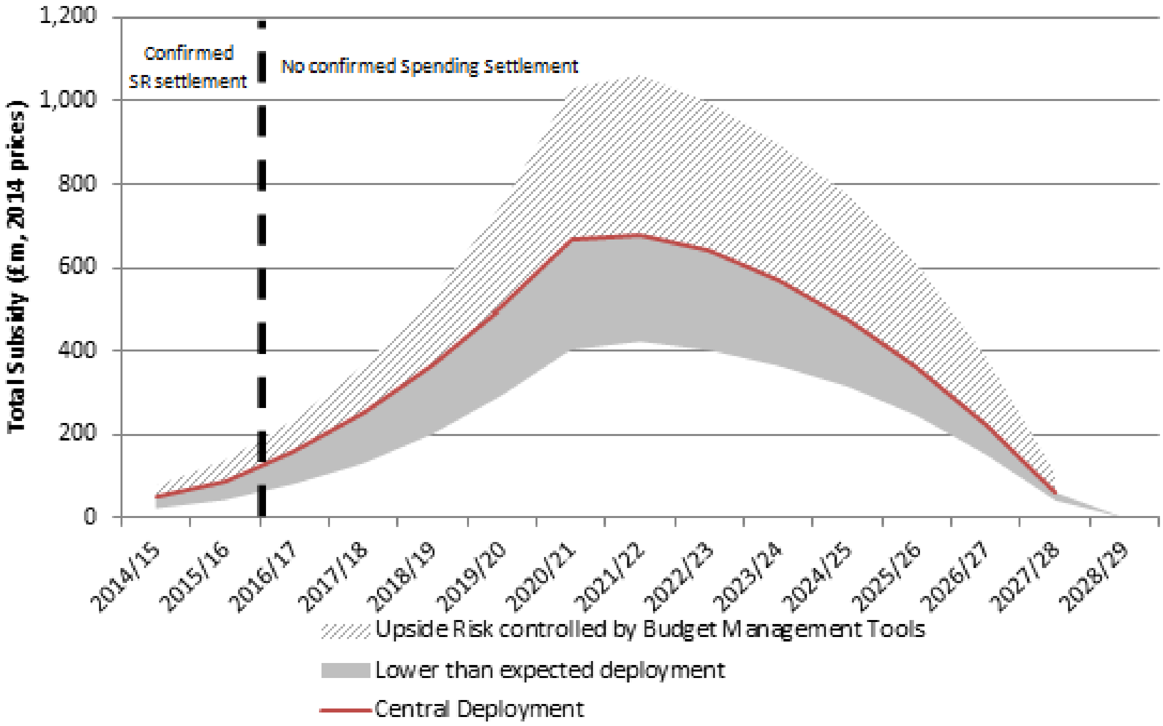
41. Budget management policy including degression triggers and other cost control measures will be announced later this year.

42. DECC is currently reviewing and updating the non-domestic RHI budget management approach in light of the recent tariff review consultation and the Spending Review settlement; proposed extensions to the current scheme; and the proposed introduction of the domestic scheme. This may mean that some adjustments to the current non-domestic degression triggers are also required alongside the introduction of a robust budget management mechanism for the domestic scheme to ensure that overall expected deployment is affordable. DECC will provide an update later this year.

Spending profile

43. The projections for domestic RHI spending are very uncertain and subject to the uncertainties detailed in the Impact Appraisal section of this Impact Assessment. Additionally as degression policy has not yet been finalised there is potential for this profile to change. However using the central, high and low deployment scenarios set out it is possible to give an idea of the range of possible spending associated with the domestic scheme.

Chart 1: Indicative Spend on domestic RHI scheme



£m, 2014 Prices, Round to nearest £10m	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Cumulative total to 2028	Discounted Total
Low Deployment	£20m	£40m	£80m	£130m	£200m	£290m	£400m	**£3,120m**	**£2,410m**
Central Deployment	£50m	£90m	£160m	£250m	£370m	£510m	£670m	**£5,090m**	**£3,960m**
High Deployment	£70m	£140m	£240m	£370m	£530m	£750m	£1,030m	**£7,940m**	**£6,160m**

44. Chart 1 captures the spending implications of the domestic RHI scheme. The central deployment scenario indicates the estimated spending of the domestic scheme with the tariffs and policy outlined in this Impact Assessment and the domestic RHI policy document. While there is a large amount of uncertainty, this is a level of deployment which DECC judges to be a reasonable central estimate and is broadly in line with market intelligence available to the department.

45. These scenarios do not yet reflect detailed decisions about the cost control framework for the domestic scheme, including trigger levels for tariff degression. They are therefore subject to revision.

46. These scenarios are **indicative scenarios only** and actual deployment will be under constant review, so DECC can appropriately manage the scheme. Additionally spending projections post 2015/16 are purely indicative as a budget allocation for the period beyond this has not yet been agreed.

Cost and Performance Evidence

47. In autumn 2012, DECC commissioned, through a competitive tender process, new evidence on use, costs and performance assumptions of renewable heat technologies from a consortium led by the Sweett Group. This process involved contact with industry and stakeholders, who submitted relevant evidence to the Sweett Group for processing and compiling into a suitable form for modelling. The data received underwent both an external and internal peer review (by engineers and other specialists). The complete Sweett report is available online[6].

48. As well as data received from the Sweett Group, evidence on cost and performance collected from the Renewable Heat Premium Payments (RHPP) was used to validate and provide depth to the analysis. In addition to an improvement in use, cost and performance data, input data on fossil fuel prices, carbon values and grid intensities have been updated in the RHI model using up to date data published by DECC.

6 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/204275/Research_on_the_costs_and_performance_of_heating_and_cooling_technologies__Sweett_Group_.pdf

Tariffs and Payment

Tariff set-up

49. Tariffs are set to compensate householders for the additional costs of installing renewable heat technologies compared to conventional heating technologies such as oil or gas fuelled boilers. They have the following features:

- Payable over a period of 7 years
- Payable on deemed renewable heat output and metered if a bivalent system or a second home
- Payable quarterly in arrears
- Increased every financial year in April by the Retail Price Index (RPI) rate
- Tariffs can be reduced (degressed) if total spend hits certain triggers, to be determined in later in 2013

Table 2: Final tariffs for Domestic RHI (on renewable heat output)

	Biomass	ASHP	GSHP	Solar Thermal
Tariff (p/kWh) ***(Equivalent payable on total heat output)***	12.2	7.3 *(4.7)*	18.8 *(13.2)*	At least 19.2
Tariff Range proposed at Consultation[7] ***(payable on total heat output)***	*(5.2 – 8.7)*	*(6.9 – 11.5)*	*(12.5 – 17.3)*	*(17.3)*

50. Following the evidence received from the Sweett report[8] and RHPP data DECC has revised the appropriate tariffs for domestic RHI renewable heating technologies. There are some significant changes which have been made to the tariffs most notably for net capital cost (Biomass is more expensive than previous evidence suggested, ASHPs are slightly cheaper) and load factors, which are the fraction of time a heating technology operates at the equivalent of full load for. Additionally DECC has updated the fuel price projections used to derive these tariffs.

Tariff setting method

51. The domestic RHI tariffs are designed to compensate households for the additional costs of the renewable heating system over the fossil fuel counterfactual for an off gas grid household. This includes compensation for several different components of additional cost:

- **Additional capital, operating and fuel costs -** The compensation for net capital and operating costs is required because renewable heating systems are typically significantly more expensive to install then conventional systems. They can also be more expensive to operate in some cases.
- **Financing costs of the capital expenditure at 7.5% -** Funding renewable heat technology also requires more financing then conventional technology because of the greater capital outlay and there is a cost associated with this. A rate of return of 7.5% has been used to align with the approximate cost of finance. A Green Deal plan is one financing mechanism householders could use for some of the costs (APR varies between 7% and 12%).

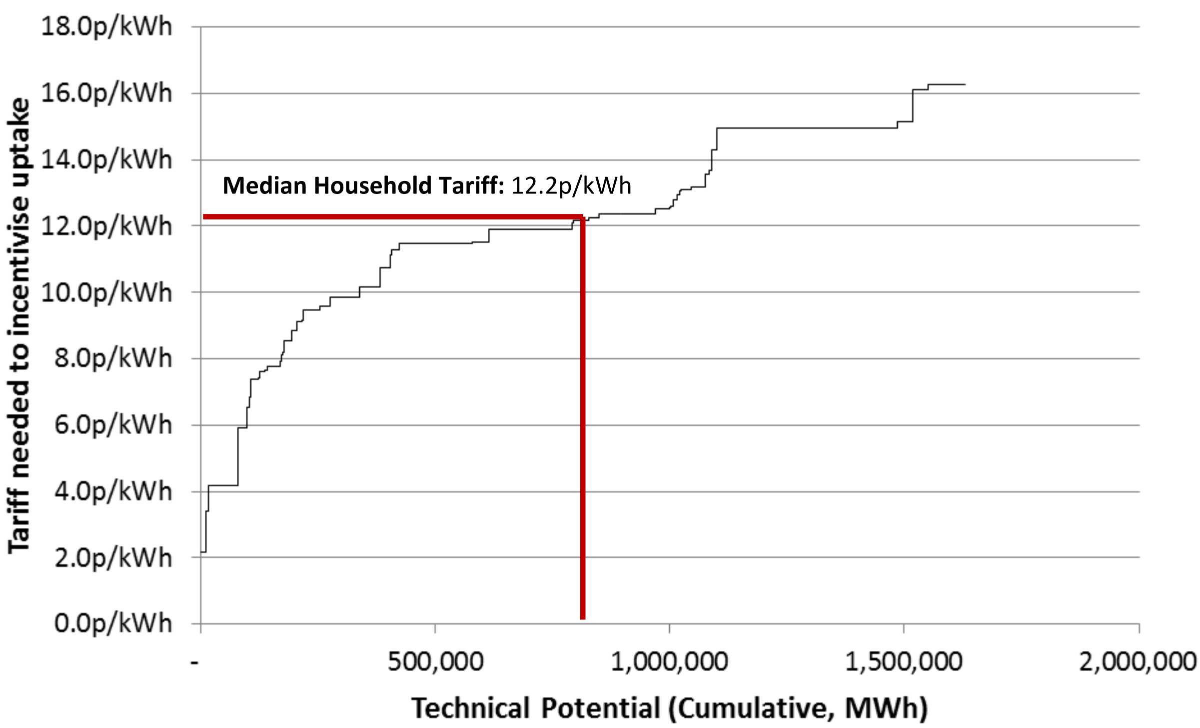
[7] 17.3p/kWh was the consultation value for money cap.
[8] See reference 5

- **Non-financial barriers e.g. hassle, disruption and perceived risk -**Householders will be committing to large upfront costs with several key uncertainties; performance risk, risk of access to subsidies, risk to house value and hassle costs. A householder will require some financial compensation to overcome these barriers. More information on these barriers is available in Annex G.

52. The tariff setting method has two other important characteristics. The first is how the compensation is decided and the second is what population of households is used to derive a tariff.

53. The tariffs are set on the "median cost opportunity" of the off gas-grid housing sector. This means that a tariff is calculated for each off-gas-grid household type that is deemed appropriate[9] for a renewable heat technology. The tariffs are then ranked in ascending order and the household type at the midf point of total energy consumption is chosen. In other words this creates a cost curve which plots potential deployment and the tariff they would need for the renewable heating technology to have the same lifetime cost as their current conventional technology. For example chart 2 shows the cost curve for biomass and the tariff required to incentivise the median household type. The annex C provides more detail on tariff setting and steps through an example of setting the tariff for biomass boilers.

Chart 2: Cost Curve for Biomass on a 7 year tariff



54. The median household is chosen to set the tariff for a number of reasons:
    - **Objectives of the scheme –** The domestic RHI is designed to prepare the supply chain and the renewable heat market for mass deployment in the 2020's, not offer mass deployment today. By offering a tariff based on the median eligible household the methodology is intended to strike a balance between providing an incentive to encourage deployment of renewable heat and under/overcompensating households.
    - **Data Quality –** there is inherent uncertainty in the technology cost and household data as this is a developing market with little historic track record of deployment. By taking the median installation this should ensure that the data used is as reliable as possible. More information on how we intend to minimise this uncertainty can be found in the section on "Uncertainty in deployment projections".

[9] Based on modelling by NERA/AEA

- **Over compensation –** Householders who are positioned below the median installation will be given a tariff higher than they require to make the choice to install renewable heat i.e. overcompensated, whilst households above the median installation will be given a tariff lower than they require to make the choice to install renewable heat i.e. undercompensated. Some degree of under and overcompensation is inevitable with any subsidy regime that operates in a market in which participants have varying characteristics without case-by-case tariff setting.

The method is based on costs associated with households off-gas grid because these households will generally be more cost effective due to the higher cost of the alternative (e.g. oil or electric heating). However we would expect there to be some cost effective opportunities on-gas grid.

55. The proposed tariffs are subject to a Value for Money (VfM) cap of the total support for offshore wind; only solar thermal is subject to this cap. The exact level of support for solar thermal will be at least 19.2p/kWh and confirmed in later in 2013.

Tariff Breakdown

56. The tariffs set out above compensate for 3 distinct components, capital and financing costs, on-going costs and barrier costs. They can be split up to identify the compensation for these elements:
    - The majority of the tariff compensates for the additional capital cost associated with generally more expensive renewable heat technologies. For example, biomass boilers are relatively expensive and therefore have higher capital cost compensation than air source heat pumps.
    - The second largest component of the tariff is due to barrier costs, including financial and non-financial barriers.
    - On-going costs, which include both fuel costs and maintenance costs, are generally cheaper for renewable heat technologies. For example, ground source heat pumps are generally energy-saving and therefore have an off-setting effect on on-going cost.

Table 3. Breakdown of Tariffs[10]

p/kWh	Capital costs	On-going costs (fuel and maintenance)	Barrier costs	Final tariff
ASHP ATW	6.2	-1.0	2.0	**7.3**
Biomass	9.5	-0.4	3.1	**12.2**
GSHP	16.8	-3.5	5.4	**18.8**

57. It is important to note that this breakdown is only for the median installation. Both the direction (whether the renewable technology is more or less expensive) and magnitude of the costs will vary from household to household given the significant variation in the UK housing stock.

Potential for choosing between domestic and non-domestic installations

58. Householders could choose to create a small heat network with a neighbouring household if the non-domestic scheme offered a greater return. They will make this decision based on the comparative levels of the tariffs between the domestic and non-domestic scheme, the different time scales of returns and the other differences in schemes (such as metering requirements in the non-domestic scheme). A detailed comparison of the tariffs is included in the annex.

Examples of installations

59. There is significant variation in the UK housing stock, with large variation in size, building condition and energy use. This variation means that the costs and benefits of installing a renewable heating system under the RHI will vary significantly from household to household, unlike "plug and play" technologies such as solar PV.

[10] Solar Thermal is subject to a Value for Money cap so this breakdown is not included

60. The table below shows an example installation for each technology; however these should not be treated as ‘typical’ due to variation in systems and households. These case studies are therefore a guide only.

61. The example below is based on Sweett Group’s use, cost and performance data and looks at the costs associated with various renewable heating technologies. The house considered is an off-gas grid semi-detached household in a rural location.

Table 4: Example costs and payments of renewable heat technology

Technology Installed	Heat Demand (MWh/yr)	Capex, £		On-going & Fuel costs, £/yr		Tariff Payment, £/yr
		Off-gas heating	Renewable	Off-gas heating	Renewable	
ASHP	10	3,500	6,100	850	800	500
Biomass	10	3,500	8,700	850	770	1,300
GSHP	10	3,500	10,500	850	730	1,400

62. Householders should consider their own personal circumstances and installer quotes before making a decision to invest in a renewable heating system.

63. Householders could also choose to install a solar thermal system to provide hot water in addition to their main space heating system. Based on data from RHPP it is estimated that a householder could receive around £300 per year in subsidy from a solar thermal installation.

Metering and Monitoring Packages

64. Consumers who choose to install Metering and Monitoring service packages will receive an additional payment (on top of the basic tariff). The packages will be developed by industry and consist of an advanced set of metering designed to enable consumers and industry to understand how well a renewable heating system is operating. The packages will monitor heat output, electricity supply and a number of key diagnostic temperature parameters and will present the monitored data clearly to consumers and industry.

65. The additional payment householders will receive is designed to cover the costs of the package discounted over the 7 year tariff. Table 5 below shows the anticipated upfront costs of installing a service package and the additional payment they will receive once a package is installed.

Table 5: Metering and Monitoring service package costs

	Anticipated Upfront Cost	Additional payment
ASHP - ATW	£1,200	£230
Biomass	£1,060	£200
GSHP	£1,200	£230

66. Solar thermal installations will not be eligible for a Metering and Monitoring Service Package because evidence suggests it would not be cost effective to install such packages for these technologies.

67. Installing a package will have benefits for consumers, industry and DECC. Consumers will be able to see their own energy use and performance of heating systems, industry could benefit from the data from the packages enabling them to improve the overall standard on heat pump and biomass unit selection and installation.

68. The accompanying documents provide more details about how Metering and Monitoring Service Packages will be rolled out.

Impact Appraisal

Uncertainty in Deployment Projections

69. There is significant uncertainty around a number of important factors that will determine the deployment of renewable heating technologies under the RHI. The projections in this Impact Assessment are subject to similar uncertainty.

70. The modelling presented in this Impact Assessment comes in two parts, tariff calculation and uptake modelling.

- **The tariff calculation model** has been extensively internally quality assured and been found fit for purpose.

- **The uptake modelling** has not been fully quality assured, however has been cross checked with market intelligence. This does mean that the accuracy of the modelling should be treated with caution, however given the general uncertainties across the domestic scheme these remain second order concerns.

71. The projections and analysis should be treated with caution and remain indicative.

Demand Led Scheme

72. The domestic RHI scheme is a demand led scheme which central estimates project will increase deployment from 5,500[11] installations under RHPP in 2012/13 (and other deployment outside the RHPP and retrofit markets) to approximately 160,000 installations per year supported by the RHI by 2020/21.

73. The potential market size is also highly uncertain; both in terms of what may be technically possible and actually feasible. The technical question of how many households could install renewable heating is based on the best available evidence, but is uncertain and judgement led. The feasibility depends on delivery by a market which has experienced significant turbulence in recent years and also demand from a consumer base who have previously been used to conventional technology. The uncertainty demonstrated in this Impact Assessment reflects this overall uncertainty.

Costs and performance of installations

74. Following publication of the domestic scheme consultation DECC commissioned the Sweett Group to gather further evidence of costs and performance on renewable heating technologies. While this has improved the evidence base there is still significant uncertainty about the costs householders will incur and the performance of technologies.

75. The performance of the technologies is based on the design data DECC collected through RHPP, which has been analysed by DECC. It is not based on actual performance as would be collected in a field trial or monitoring programme. DECC considers metering and monitoring service packages key to helping ensure that design estimates are reached, without the continued learning and monitoring offered by the packages there is significant risk that the actual performance of installations will fall below the level anticipated in this Impact Assessment. DECC's "metering for evaluation" programme will independently assess actual performance of technologies.

76. A sensitivity analysis has been carried out to determine what the effect of a 20% reduction in efficiency compared to anticipated performance would do to renewable heat produced by 2020/21. This can be found in Annex F.

[11] Does not include Social Landlord installations. Full details can be found: https://www.gov.uk/government/statistical-data-sets/rhi-and-rhpp-deployment-data-april-2013

Consumer choice

77. The projections of deployment are based on households making investment decisions in a rational way. Therefore if a renewable heating system is more cost effective than a conventional heating system, they will install it. Consumer preference and knowledge will be key to ensuring deployment; however there is extreme uncertainty about how householders will make these investment decisions for renewable heating products. DECC will monitor this closely through a process evaluation.

78. The other aspect of consumer choice is when householders have a choice between multiple RHI technologies, as often several may be suitable and cost-effective for their household. It is difficult at this point to assess how consumers will weigh up the costs and benefits of different systems. DECC's modelling generally assumes that householders will make the choice which is most cost effective for them.

Degression and cost control

79. The projections presented in this Impact Assessment do not take into account cost control and degression policy as discussed in the affordability section. The exact nature of degression triggers and cost control policy will be determined later in 2013, when it has been possible to assess the whole RHI and the best way to achieve the objectives of the domestic and non-domestic schemes.

Further developments of the costs and benefits analysis and projections

80. As the scheme rolls out, DECC will have access to substantially more information about how consumers make choices, the actual costs and performance of installations and how degression may affect deployment. This will come from a variety of sources, from evaluation surveys, monitoring data and the benefits management programme. These sources of information will be monitored closely to assess and develop the projections presented in this Impact Assessment and to help in managing programme delivery.

Modelling and Data Sources

Method

81. The appraisal of the policy has been conducted through the RHI Model, which was developed by NERA[12] and adapted by DECC to represent the current policy position and latest evidence. Further information on the RHI model and modelling approach can be found in the annex.

82. The model projects deployment by analysing different household segments and identifying the cost effective opportunities which households may take-up. These cost effective opportunities are ranked to form a supply curve[13] for the technology.

83. The RHI Model is not best suited to projecting solar thermal deployment. This is because solar thermal deployment is driven by factors not included in the model (such as occupancy) and the model was primarily designed for space heating technologies. Therefore for presentation of installations and subsidy costs an off-model approach has been used based on market intelligence. Including solar thermal in this way has been necessary to better demonstrate the expected total subsidy and installation profile.

Deployment Projections for the Domestic RHI Scheme

Counterfactual

84. In the counterfactual situation, where there is no domestic RHI, there are likely to be only solar thermal and air source heat pump installations in the retrofit market, and no (or very little) delivery of ground source heat pumps or biomass boilers. It is however difficult to assess the renewable heating market without a domestic RHI scheme as the market has been supported by RHPP and the expectation of RHI for some years.

- **Ground Source Heat Pumps (GSHP) and Biomass Boilers:** The Sweett Group evidence collection indicates that there exists no current cost effective opportunities in the domestic sector, compared to householders' current conventional heating systems. While there may be a small number of additional installations without government support this will be very close to zero.
- **Air Source Heat Pumps (ASHP) –** The Sweett Group evidence for ASHPs is that there are cost effective opportunities particularly in the off-gas grid housing stock. The RHI model predicts a growing number of ASHP installations based on increasing awareness of renewable heating technology.
- **Solar Thermal –** Market intelligence suggests there is a base level of demand for this technology without any tariff of around 5,000 installations a year. In the RHI model this level has been kept constant over time i.e. approximately 5000 new installations will be installed every year.

85. The RHI model projects around 117,000 ASHP and 50,000 solar thermal installations by 2020/21. By 2020/21 it is estimated these installations will be producing 0.5 TWh of renewable heat. These are the

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[12] http://www.nera.com/67_5554.htm

[13] A potential supply curve shows the full range of cost-effective opportunities i.e. how much heat can be achieved at what cost for all renewable heat technologies. A technical supply curve shows these cost-effective opportunities but also takes into account wider factors such as supply industry constraints (e.g. availability of skilled workers and infrastructure) and resource constraints (e.g. availability of sustainable biomass feedstock).

levels of deployment, renewable heat and carbon savings expected to happen in the segment of the Renewable heating market which could be supported by RHI.

86. The deployment forecasts are for "**RHI eligible" installations only**, so do not include installations in the new build market, or outside the Microgeneration Certification Scheme (MCS). These are forecasts for ASHPs and Solar Thermal which would meet the standards equivalent to RHI if it existed in the counterfactual.

Table 6: Summary of key results from counterfactual scenario

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Lifetime (until 2041)
Renewable Heat produced (TWh)	0.1	0.1	0.2	0.2	0.3	0.4	0.5	**11.8**
Carbon Savings (MtCO2)	0.0	0.0	0.1	0.1	0.1	0.1	0.2	**2.6**
Total Installations (cumulative, 000's)	13	30	50	73	102	131	165	

87. Under the counterfactual scenario the UK would have to employ other policies to meet the renewables target or face the potential for unlimited EU fines incurred from not meeting interim and 2020 renewables targets. DECC would expect a continuing level of deployment in the new build sector and in other sectors of the renewable heating market which RHI is not intended to cover. This could grow over time as these technologies build awareness and householders become more comfortable using them

88. These projections are subject to significant uncertainty. The historic deployment of renewable heating technology has been supported by several different policies. For example Renewable Heat Premium Payments (RHPP) has offered a cashback incentive on installation costs and additionally all installations meeting certain criteria since July 2009 will be eligible for the RHI. Both of these policies have supported the market, making underlying demand hard to identify. As such the baseline forecasts should be treated with caution.

Deployment of domestic RHI

89. The domestic RHI scheme incentivises uptake by offering a tariff payment to householders who take-up an approved renewable heating technology. This should make renewable heat technology financially attractive compared to conventional heating technology.

90. The modelling methodology is set out in more detail in the annex. To summarise it calculates cost effective opportunities for householders considering the installation of a renewable heating technology and projects this decision-making process forward to 2020/21. While there are large uncertainties in the costs and performance data and in how householders will make decisions under this new incentive system, DECC considers this model the best available way to assess the relative costs and benefits of the domestic RHI.

91. Forecasts of heat deployment are very uncertain because the average size of an installation can vary from household to household. These projections of heat deployment are therefore uncertain because the households who take-up domestic RHI may well vary in characteristics from the modelling presented.

92. The modelling of the domestic RHI scheme replicates the policy position as closely as possible to project renewable heat produced, carbon savings, installations and overall costs and benefits of the scheme. The table below outlines the headline deployment of the domestic scheme:

- It is expected that by 2020/21 the domestic RHI will support the production of 3.9TWh (range of 1.9 to 6.1 TWh) of renewable heat. Of which 3.5TWh would be additional heat bought on by the domestic RHI.
- A total of 745,000 (range of 390,000 to 920,000) installations of renewable heat technology installations will be supported through the domestic scheme.
- As with the counterfactual these forecasts only cover the RHI eligible section of the market and exclude renewable heating installations not supported by RHI.

Table 7: Summary of key deployment impacts of domestic RHI[14]

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Lifetime (until 2041)
Renewable Heat produced[15] (TWh)	0.2	0.4	0.9	1.4	2.1	3.0	3.9	**85**
of which additional	*0.2*	*0.3*	*0.7*	*1.2*	*1.8*	*2.6*	*3.4*	***73***
Total Installations (cumulative, 000's)	46	109	194	285	419	575	745	
of which additional (cumulative, 000's)	*33*	*79*	*144*	*212*	*318*	*444*	*579*	

93. The breakdown of installations supported by domestic RHI is outlined below and demonstrates that while we expect relatively few biomass installations, they contribute a significant amount of heat towards the central scenario of deployment of heat.

Table 8: Breakdown of number of installations by technology type (thousands)

Culm. Installations by 2020/21	ASHP - ATW	Biomass	GSHP	Solar Thermal	Total
Installations supported by RHI	343	65	148	188	**745**
Additional installations because of RHI	*226*	*65*	*148*	*140*	***579***
Proportion of deployment upto 2020/21	*46%*	*9%*	*20%*	*25%*	
Proportion of renewable heat deployment in 2020/21	27%	45%	27%	0%	

94. The heat deployment split between technologies in the central scenario above compares to almost all heat being delivered through ASHPs under the counterfactual, as there is no deployment of biomass boilers or GSHP.

95. The figures presented so far give the central projections of deployment. However the uncertainties, outlined in detail in the section on Risks and Sensitivity analysis, mean that it is important to consider a range based on appropriate sensitivity scenarios. The table below demonstrates the ranges of deployment and heat produced under plausible scenarios, these are detailed in the Sensitivities section of this Impact Assessment.

Table 9: Range of possible deployment scenarios

	Total deployment supported by 2020/21 (000's)	Renewable heat generated in (TWh):	
		2020/21	Lifetime (until 2041)
Low	390	2	41
Central	**745**	**3.9**	**85**
High	920	6	135

[14] Excludes Legacy applications
[15] These figures represent renewable heat produced only, total heat produced will be higher

96. By increasing or decreasing the total cost and customer awareness for renewable heating technology the deployment varies significantly. These estimates do not represent an upper or lower bound of deployment, only a plausible high and low deployment range which demonstrates the uncertainty associated with the domestic RHI. See the section on uncertainty in deployment projections for more information on how DECC intends to minimise these uncertainties.

Costs and Benefits of the Domestic RHI Scheme

97. The costs and benefits of the domestic RHI scheme are detailed in this section. There are broadly two categories, those which can be monetised, and those which cannot. This Impact Assessment will go through at high-level the benefits, costs, NPV calculation and then look in more detail at the non-monetised benefits.

Benefits

98. **Carbon benefits –** are the carbon reductions resulting from the increased deployment of renewable heat displacing heating that uses fossil fuels. The table below demonstrates the carbon savings over future carbon budgets out to 2041.

Table 10: Carbon benefits over lifetime of the scheme

$MtCO_2$	Carbon Budget 2 (2013-17)	Carbon Budget 3 (2018-22)	Carbon Budget 4 (2023-27)	2028-32	2033-37	2038-42	Total
Total Carbon Savings	1.0	4.3	4.8	4.9	4.0	0.6	**19.7**
Additional Carbon Savings	*0.8*	*3.6*	*4.2*	*4.3*	*3.7*	*0.5*	***17.1***

99. **Deployment of renewable heat –** The proposed tariffs are projected to deploy 3.9TWh of renewable heat, contributing to the 2020 renewables target at cost effective levels. If this renewable heat was not deployed through domestic RHI, the renewable heat forgone would have to be produced in another renewables scheme, or the UK would face an infraction penalty for not meeting the 2020 target. This benefit has not been quantified because of inadequate information on the costs of delivering additional renewable energy from other sectors and how much the infraction penalty would be.

100. **Developing the renewable heat market –** The domestic RHI scheme enables the renewable heating market to be ready for mass deployment and the decarbonisation of the domestic heating systems in the 2020's. By creating a sustainable market in the period to 2020 it will make this transition cheaper over the 2020's and cheaper to reach the 2050 targets. The benefit has not been quantified because the future policy framework for supporting the mass deployment of renewable heat is not yet known.

101. **Innovation, cost reduction and reducing barriers -** By supporting renewable heating deployment DECC expects that costs will reduce and performance may increase over time. Additionally the barriers that customers currently face when thinking about renewable heating such as the risk around unproven technologies and hassle costs will reduce if deployed successfully. These benefits have not been quantified because they are difficult to monetise.

Costs

102. **Net capital and on-going costs (resource costs) –** When householders take-up a renewable heating system, incentivised by the tariff payment, there is a cost to society as the renewable heating system is more expensive than the conventional heating system. The resource cost represents this cost.

Other

103. **Air quality impacts –** deployment of renewable heating systems within RHI will have an indeterminate effect on air quality. On one side Biomass deployment produces pollutants which can have an effect on individuals' health in the areas surrounding the biomass installations. This impact will be limited by the air quality and sustainability standards associated with the scheme. On the other by replacing coal and oil boilers with more efficient electrically powered heat pumps air quality could improve. Analysis by DEFRA has indicated a small improvement in air quality as a result of the domestic scheme, though this is highly uncertain.

NPV Calculation and method

104. Table 11 shows the net monetised costs and benefits of the domestic RHI. In common with many of the renewable policies the net present value of the domestic RHI is negative. This is because in part the other benefits outlined above, such as deployment of renewable heat and support to the renewable heat market, are not monetised so not included in the NPV calculation. Also, the avoided costs of not meeting the 2020 Renewables Target through cost effective deployment of renewable heat in the domestic sector are not counted as a benefit because these costs are very uncertain.

Table 11: Monetised costs and benefits of RHI

£m discounted 2014 prices

Per annum in 2020	Central
Resource costs	-171
Air Quality Costs/benefits	6
Carbon Benefits in traded sector	-1
Carbon Benefits in non-traded sector	46
Domestic RHI NPV	**-120**

Cumulative to 2020	Central
Resource costs	-524
Air Quality Costs/benefits	21
Carbon Benefits in traded sector	-2
Carbon Benefits in non-traded sector	138
Domestic RHI NPV	**-367**

Policy lifetime	Central
Resource costs	-2,898
Air Quality Costs/benefits	104
Carbon Benefits in traded sector	-15
Carbon Benefits in non-traded sector	973
Domestic RHI NPV	**-1,836**

105. The costs and benefits of renewable heating technology supported by the RHI are projected to last 20 years after the last installation, so stretch to 2041. The carbon benefits generally increase over time as the valuation of carbon increases.

106. The approach values changes in air pollution using the Pollution Climate Mapping (PCM) model and follows the best practice appraisal approaches recommended by the Defra led Interdepartmental Group on Costs and Benefits (IGCB)[16].

[16] http://www.defra.gov.uk/environment/quality/air/airquality/panels/igcb/pathway.htm

107. In the PCM based approach, emission estimates (due to increase in biomass deployment) are used to model the (population weighted) mean concentration of pollutants. Concentration-response functions then link changes in pollution concentration to changes in mortality, which are subsequently monetised.

Air Quality Impacts

108. The analysis suggests that the RHI will lead to an improvement in air quality. The main reason for this is that the RHI will encourage households using coal and oil as a heating source to switch to renewables, including biomass, and the associated air quality improvement will outweigh the air quality cost associated with households switching from gas and electricity to biomass. In other words, the distribution of uptake significantly affects whether there is an improvement or deterioration in air quality.

109. Previous RHI Impact Assessments have used the damage cost method which only monetised the biomass impact on air quality and did not take into account the rural location of many biomass installations.

Carbon savings

110. The domestic RHI delivers carbon savings overall through the installation of less carbon intensive heating systems, this could be through a zero carbon solar thermal installation, or less carbon intensive heat pumps or biomass boilers.

111. The carbon emissions in the traded (electricity) sector are projected to increase due to the domestic RHI scheme. This is because the installation of heat pumps for some households will increase their electricity use (traded emissions), while decreasing their oil or gas use (non-traded). This movement of households heating into the traded sector can increase emissions in this sector.

Other Impacts of Domestic RHI

Cost effectiveness of the Domestic Scheme

112. While the renewable heat produced by the domestic RHI scheme is not monetised in the NPV calculation it is useful to assess the cost effectiveness of the scheme. This can be done by looking at the resource cost per kWh of renewable heat produced as well the carbon cost effectiveness.

Table 12: Resource cost per unit of renewable heat produced and tonne of CO_2 abated (discounted average over 20 years)

	Resource Cost effectiveness (p/kWh)	Carbon Cost Effectiveness (£/tCO^2)	Non traded comparator[17] (£/tCO^2)
Central Deployment scenario	4.0	169	85

113. The cost effectiveness of the domestic RHI scheme will vary over time and by technology. The carbon cost effectiveness of domestic RHI is £169/tCO2; while this is high compared to other policies, carbon savings in the short term are not the primary objective of the policy. Instead the domestic RHI will move households onto the electricity grid for heating, or to sustainable biomass energy sources. This means that as the grid is decarbonised, the cost effectiveness of the policy will increase.

Cost reductions

114. By 2020 the costs associated with domestic RHI technologies should have declined. Some of this will be as a result of domestic deployment, while some of the cost reduction will be due to international deployment.

115. Economies of scale in the production of technologies will mainly result from international deployment as GB demand for these technologies is small compared to international demand. Domestic deployment, however, can drive cost reductions through more efficient installations and better use of systems.

116. The heat Technology Innovation Needs Assessment (TINA)[18] estimates that there is potential for 30% cost savings in the installation and running of heat pumps. It also estimates the cost breakdown of a heat pump:

Table 13: Indicative cost breakdown of a heat pump

	Heat Source	Heat Pump technology	Heat Distribution	Controls	Installations	Design	Operation and maintenance	Fuel Input
Total Costs	10%	20%	variable	5%	20%	3%	4%	38%
Upfront Costs	**17%**	**34%**	**variable**	**9%**	**34%**	**5%**		

117. Based on the heat TINA, analysis by NERA and market intelligence from trade organisations, the modelling assumes a cost reduction of approximately 20% by 2020 for all technologies. We expect that

[17] This is a weighted average of the projected non-traded carbon price over the lifetime of the policy.
[18] http://www.lowcarboninnovation.co.uk/working_together/technology_focus_areas/heat/

competition between installers will bring the installation price down over time as they reduce their own costs through experience.

118. There will be a number of measures in place to mitigate some of the risk associated with overcompensating technologies if costs were to decline:

- The cost control framework, details of which are due to be published later this year, will assist in keeping us within budget by degressing tariffs if technology costs come down.
- The 2015 Review will also provide an opportunity to review both the policy itself and the tariffs available, including providing an opportunity to take on board any up to date cost information.

119. These measures should help minimise any deadweight associated with the policy as a result of cost reduction.

Better performing technologies

120. We expect the suite of measures contained in the policy to help drive improvements in system performance - principally, paying for *renewable* heat (rather than all heat), metering and monitoring service packages, metering for payment and metering for evaluation.

121. For potential customers uncertain about the running costs of their new technology, metering and monitoring service packages should give them confidence that their installer will be able to evaluate and sometimes improve their installation if required.

122. The suite of policy measures aimed at driving improvements in system performance will also collect data that will allow DECC to evaluate current levels of performance and track these over time. Where required, the data collected through the policy will provide the evidence required to work with industry to improve training, qualifications and standards as well as driving improvements without intervention by DECC.

123. If a heating system is considered to be in operation for 20 years then even a small efficiency improvement can have a significant impact on energy bill savings to consumers; for example a negligible improvement in average ground source and air source heat pump Seasonal Performance Factor (SPF) of 0.01 (which is approximately 0.6 % of a base case SPF of 2.5) and an improvement of biomass efficiency of less than 1 % could result in a saving to consumers of £53 million given RHI predicted uptake.

124. To put these efficiency improvements in context, DECC has investigated the impact of monitoring heat pumps for 1 year[19] and then fed back the results to manufacturers and installers. Installers were then allowed to make changes to the technology installed prior to monitoring the systems for a second year. Preliminary analysis of the second year data indicates that system efficiencies improved by approximately 10 % on average across the systems monitored, though it should be noted that this was a small sample of 38 systems and is not an indication that year-on-year improvement is possible.

Reducing barriers to uptake

125. The tariffs presented include compensation for risk barriers – that is, the risk and perception associated with the technology in the eyes of the householder. This could include risk of underperformance, access to subsidies and fuel price rises.

126. Over time, we expect these barriers to reduce as renewable heat is more widely deployed and the awareness and reputation of the technologies improves. Coupled with the expected cost reductions

[19] "Detailed analysis from the first phase of the Energy Saving Trust's heat pump field trial", March 2012, Dr. P Dunbabin, C. Wickins

described above, this should lead to a reduced tariff. Ultimately, our ambition is that renewable heat should be able to compete with fossil fuels without subsidy in the long term.

Administration costs (Ofgem)

127. The domestic RHI scheme will be delivered initially by Ofgem, who will conduct the accreditation, validation and payment of the scheme.

128. DECC continues to work closely with Ofgem to confirm the delivery arrangements for the scheme in order to ensure it works as effectively as possible in the early years and offers the best possible value for money. More details can be found in the domestic RHI Policy Document.

129. As the exact delivery arrangements are still being finalised, this Impact Assessment does not contain estimated costs of delivery. These will be developed over the coming months.

Risks

Risks associated with tariff setting

130. Setting tariffs has a number of risks associated with it. There is an upside risk that the tariffs over-incentivise uptake and a down-side risk that tariffs under-incentivise uptake.

131. The upside risk of over-incentivisation will be mitigated by the cost control mechanism detailed in the policy document. This will reduce tariffs for future applications for RHI by set amounts if the spend on the technology is above certain triggers. This should bring deployment back towards the central projection of deployment and also ensure costs do not exceed the RHI budget.

132. The downside risk of under-incentivisation will be mitigated through the RHI review process, where the scheme is considered and deployment tracked. The first of these regular reviews is scheduled to take place in 2015 and will allow DECC to take on board additional emerging evidence.

Risks associated with deployment

133. The domestic RHI has many risks associated with deployment and the potential costs and benefits. It is important that DECC has systems in place to manage these risks effectively. There are several systems which are worth noting:

- **Degression –** as discussed in the Affordability section of this Impact Assessment, degression and cost control provides an important tool to prevent the market growing at an unsustainable rate and controlling DECC's spending. Triggers for degression will be considered later in 2013, along with the non-domestic scheme.
- **2015 review –** the domestic RHI has a built-in review point in 2015 which will allow DECC to assess its effectiveness. This will allow DECC to take on board actual deployment and cost evidence to ensure the scheme is offering the right support to the renewable heat market at an affordable price.
- **Evaluation planning –** a summary of the post implementation review is set out in this Impact Assessment. DECC will develop its evaluation plans over the coming months to ensure it is collecting the right evidence to support appropriate monitoring and understanding of the scheme. This includes exploring the opportunity to collect any baseline data before the scheme launches.
- **Benefits management, performance management and monitoring –** DECC is working with Ofgem to ensure that we will have detailed information required on the installations supported through the RHI. Alongside Ofgem data we will have access to existing systems for data collection, such as Energy Performance Certificates (EPCs) and the Microgeneration Certification Scheme (MCS). This data will feed into performance management and benefits realisation work so that DECC can track and assess the policy and its impact as it develops.

Risks associated with performance

134. As outlined in the uncertainties section of this Impact Assessment there are also risks associated with the performance of renewable heating systems. Metering and monitoring packages[20] are key to helping ensure that the design estimates reported in this evidence are reached. Without the continued learning and monitoring offered by the packages there is significant risk that the actual performance of installations will fall below the level anticipated in this Impact Assessment.

[20] Outlined in detail in the associated policy document and technical supplements

Sensitivity Analysis

Deployment sensitivities: high & low scenarios

135. The factors discussed above make it very important to highlight the large uncertainties in the forecasted figures. To demonstrate these uncertainties high and low deployment scenarios are presented with the central deployment projection.

136. The scenarios presented here are in the absence of any management of domestic RHI spending through degression. Degression triggers will be set later in 2013, which will enable spending and risk to be controlled. More details of this aspect of the policy can be found in the section on Affordability in this Impact Assessment and in the associated policy document.

137. The scenarios, which make different assumptions about the potential costs and benefits consumers may face when thinking about installing technologies, are detailed in the below table:

Table 14: Scenario description

	Low	Central	High
Fuel Prices	DECC low price projections	DECC central price projections	DECC high price projections
Capital cost of Renewable heating system	Sweett capital costs plus 10%	Based on Sweett analysis	Lower capital costs based on RHPP data
Customer awareness	Low increases in awareness to 2020	Gradual awareness build to 2020	Gradual awareness build to 2020

138. The scenarios have focused on 3 key factors which will affect uptake:

- **Fuel Prices –** changes in fuel price projections will mean the relative costs of conventional and renewable heating systems will change. Generally, a higher fuel price will make ASHP and GSHP more attractive as a householder will save energy by switching towards these technologies. Biomass may become less attractive if the costs associated with it increase.
- **Capital Costs –** A lower capital cost for renewable technology will make it more attractive compared to a conventional technology. Within RHPP capital costs were generally lower than our analysis would expect under RHI (based on data collected by the Sweett Group).
- **Customer Awareness –** Customers' awareness for the new technologies supported by RHI will increase over time through word of mouth and supply chain action. This growth, however, is very uncertain and has been varied in scenarios to give a range.

139. Additional scenarios are considered in the annex, with potential trajectories to 2020/21 presented.

Table 15: Summary of costs and benefits of deployment scenarios

£m discounted 2014 prices

Per annum in 2020	Low	Central	High
Renewable Heat produced (TWh)	1.9	3.9	6.1
Resource costs	-114	-171	-142
Air Quality impacts	2	6	2
Carbon benefits in traded sector	-2	-1	-3
Carbon benefits in non-traded sector	25	46	85
Domestic RHI NPV	**-89**	**-120**	**-58**

Cumulative to 2020	Low	Central	High
Renewable Heat produced (TWh)	5	12	17
Resource costs	-340	-524	-369
Air quality impacts	6	21	9
Carbon benefits in traded sector	-2	-2	-4
Carbon benefits in non-traded sector	65	138	241
Domestic RHI NPV	**-271**	**-367**	**-124**

Policy lifetime	Low	Central	High
Renewable Heat produced (TWh)	41	85	135
Resource costs	-1,950	-2,898	-2,404
Air quality impacts	30	104	35
Carbon benefits in traded sector	-17	-15	-27
Carbon benefits in non-traded sector	513	973	1,744
Domestic RHI NPV	**-1,424**	**-1,836**	**-652**

140. The carbon savings increase throughout the scenarios as deployment increases. However the NPV of the high deployment scenario is higher than in other scenarios because the high scenario includes a faster growth in consumer awareness. This means that more cost-effective opportunities are taken up earlier in the RHI, reducing the resource costs associated with the scenario. This demonstrates the uncertainty in any cost benefit analysis and the importance of fast growth in consumer awareness for bringing forward cost effective installations.

141. The ranges shown in this section show the importance of several aspects of the domestic policy. The first is the budget management strategy which will use degression to reduce new tariffs if pre-set spending levels are achieved to prevent over deployment. The second is the 2015 review which will provide an opportunity to review the scheme and how it is performing against the stated objectives.

Carbon valuation sensitivity

142. The main benefit monetised in this assessment are the carbon savings achieved by the scheme, which have a significant impact on the overall benefits which can be achieved. As such an additional sensitivity has been carried out using the high and low carbon valuation series produced by DECC.

Table 16: Carbon valuation sensitivity

NPV	Central Demand forecast
Low carbon valuation	-£2,300m
Central carbon Valuation	-£1,800m
High carbon Valuation	-£1,400m

Interaction with Other Policies

Non-domestic RHI

143. Some individuals and social housing providers (SHP) may have a choice about whether they apply to the domestic or the non-domestic RHI depending on the approach they take to installing renewable heating technologies. The analysis presented in annex D shows tariffs under both the domestic and non-domestic schemes are broadly comparable. The analysis also shows that applying to the non-domestic scheme has perceived drawbacks, for example the metering required is potentially costly, where as it is only required in bivalent systems or second homes.

How we see the Green Deal and ECO working with RHI

144. In order for a household to access the RHI they will need to undergo a Green Deal Assessment. This will give them tailored advice on energy efficiency measures which are suitable for their household. The energy efficiency criteria associated with the RHI states that if they are recommended loft and cavity wall insulation then they should install these measures before they will be eligible for RHI.

145. Green Deal Finance available through the Green Deal Assessment allows a householder to access a loan attached to their house (as long as the measures have a green tick for full finance and an orange tick for partial finance). For households taking up the Green Deal Finance for non-RHI measures there is the option of using any headroom in their arrangements to part-finance the renewable heat technology (discussed below).

146. For households wishing to take up the RHI, having to take up cavity wall (CWI) and loft insulation (LI) measures first has three potential effects:

- Some may go ahead with both the CWI and LI measures and RHI, incurring the additional barrier cost of the Green Deal Assessment, but potentially unlocking further benefits associated with the policy. This may increase Green Deal uptake relative to the counterfactual.
- Some may be put off by the additional barrier of the Green Deal assessment, or not be prepared to take up the CWI and LI and do neither.
- Some may do the CWI and LI measures and then realise the RHI is no longer as appealing as the costs of heating their home have dropped significantly.

147. In this Impact Assessment DECC assume that these effects net off against each other and do not result in a higher insulation rate than estimated by the Green Deal. This is something DECC is keen to understand and will use RHI and GD monitoring data and research to explore.

Feed in tariffs and solar thermal

148. The RHI will offer additional support for solar thermal, which competes for roof spaces with Solar PV. A household typically has a fixed amount of roof space: with the launch of the domestic RHI making solar thermal more cost competitive with PV, consumers will have a choice whether they use their roof to provide them with electricity or hot water (though combination systems do exist). This competition will be monitored.

Wider Impacts

Impacts on small firms

149. The RHI is a voluntary subsidy scheme. Therefore, a full Small Firms Impact Test (SFIT) is not undertaken here. However, as noted at consultation small firms who manufacture or install renewable heat technologies will benefit from the RHI tariffs.

150. Small firms are also expected to benefit from business and job creation opportunities generated from the increased demand for renewable technologies. Currently, a significant proportion of the firms which carry out domestic and other small scale installations are small firms. Therefore, we expect a proportion of the installation and maintenance of the projected uptake to be carried out by small firms.

Competition assessment

151. The RHI tariff aims to compensate for the additional costs of the renewable heat equipment and for the higher risks and uncertainties associated with its use compared with conventional heating alternatives.

152. The RHI is expected to have an impact on the competitiveness of the UK in the field of renewable heat technologies, both in terms of manufacturing, installation and maintenance. Firms that currently operate in those segments are expected to see an improvement in their market position relative to the counterfactual of no renewables support. Entry barriers are also expected to be lower than before as the RHI stimulates demand for the technologies and provides demand certainty for new entrants.

153. The RHI tariffs will also have an impact on the competitiveness of renewable technologies against each other as households will often make a choice between conventional technology and several renewable heating options.

154. Finally, the RHI is expected to impact on the underlying cost of renewable technologies with two possible opposite effects:

- Increased support could lead to inflationary pressures on the retail prices of renewable heat equipment; while on the other hand,
- Support levels are expected to kick start growth in a very immature UK market, promoting economies of scale and technological advance which could drive manufacturing and supply chain costs downwards in the long term.

155. These effects are captured to a certain extent through the future learning rate assumptions that are included in the RHI model analysis. Scheduled reviews of the RHI, for example the 2015 Review, will allow for these impacts to be monitored and better reflected in the scheme going forward.

Rural proofing

156. While there is a large degree of uncertainty involved in predicting uptake patterns in terms of geographic location due to extremely limited historical data, rural populations are expected to benefit more from the RHI compared to suburban and urban dwellings because a higher percentage of rural homes are off the gas grid and rely on more expensive fuels such as heating oil.

157. In addition, constraints associated with the use of certain technologies, such as requirement of storage for biomass feedstock used in biomass boilers or the space requirements for the installation of horizontal-loop Ground Source Heat Pumps, mean such technologies are particularly suitable for rural properties.

158. For certain technologies the planning system could impose significant constraints, especially in areas of protected landscape, in conservation areas and green belts. However, this is expected to be less relevant for domestic installations than in the non-domestic sector.

Sustainable development

159. Renewable Heating is an important step in decarbonising the UK economy towards a more sustainable future. Heat pumps are seen in the UK's Heat Strategy as key long term drivers of decarbonising domestic heat demand.

160. Biomass presents challenges in terms of sustainability and air quality. While it is an important tool in meeting the Renewable Energy Directive (RED) target and saving carbon emissions, it may play a diminishing role in the long term decarbonisation of domestic heat demand.

161. As such it is important to ensure that both the biomass used in the scheme is sustainable, meeting the requirements as set out in the policy document, and that biomass uptake is constrained by degression to ensure that unsustainable growth is not possible.

Statutory equalities duties

162. The RHI is a voluntary subsidy scheme which covers a range of renewable heat technologies. Through these technologies a wide range of households with specific needs will be able to access the scheme should they wish to do so.

163. Equality impacts of the scheme should be neutral, considering the possible impacts on the protected characteristics of age, disability, gender reassignment, marriage and civil partnerships, pregnancy and maternity, ethnicity, religion or belief and sex and sexual orientation, in line with the public sector duty which came into effect in April 2011.

164. All applications for funding will be treated equally and in line with the eligibility criteria, which does not discriminate against any of the above protected characteristics. We do not expect, therefore, the RHI to have any adverse equality effects.

Justice system

165. Ofgem will be responsible for administering the domestic RHI at its inception. As part of this role it will be responsible for ensuring compliance with the eligibility criteria of the scheme. Where it identifies non-compliance it may decide to take enforcement action. Ofgem will have a range of enforcement tools, including the power to withhold payments (temporarily or permanently), power to reduce payments, the power to suspend participants and the power to exclude them altogether. These sanctions will be issued by Ofgem and appeals will be heard internally.

Post Implementation Review

166. The domestic RHI scheme has review points built into the policy, the first in 2015. We will use a range of evidence including monitoring data, relevant research and market intelligence to inform the review. The initial cohorts applying for RHI will have similar profiles to those applying for RHPP and this will inform decisions around the timing of additional evaluation research.

167. The evaluation of the scheme will be carried out in line with HMT guidance on evaluation. It will focus on how the scheme is working in practice; whether it is meeting its objectives; why it is (or isn't) delivering as expected; and whether it is value for money.

168. An evaluation plan is being developed to identify the evaluation research questions and identify the data DECC will have to answer them. Where necessary, the evaluation will need to carry out research with people who have been involved in the scheme, as well as those who haven't, to understand how it has worked and the impact it has had.

169. The additional information that will be key in any review of the scheme will be the metering and monitoring data of installations themselves. This will help DECC assess the learning and innovation in the renewable heat sector, one of the key objectives of the scheme.

170. We plan to commission a RHI evaluation in Autumn 2013.

Annex A: Indicative Timeline

2008	Energy Act passed. Included enabling powers for Renewable Heat Incentive
2009	Renewable Energy Strategy launch
2010	**February:** Consultation launched setting out indicative tariffs and policy design **April:** Consultation closed
2011	**March:** initial scheme announced, with domestic and non-domestic schemes treated separately. The non-domestic scheme to go ahead in 2011. **July:** RHPP launched for domestic applications **November:** Non-domestic RHI launched
2012	**March:** RHPP extended for an additional year and consultation on non-domestic interim cost control July-November: Consultation on long term cost control, air quality and biomass sustainability standards **September-December:** Consultations on domestic RHI and changing scope of non-domestic RHI
2013	**January:** Statement on non-domestic tariff review **March:** RHPP extended for a further year **May:** Non-domestic tariff review consultation review launched **July:** Domestic scheme announcements
2014	**Spring:** Domestic scheme launched Formal review of non-domestic scheme
2015	2015 Review; Formal review of domestic scheme begins
2016	Changes from 2015 review introduced.
2017	2017 Review; Second formal review of domestic scheme begins
2018	Changes from 2018 review introduced
2019	
2020	Renewable Energy target assessed – 15% of UK energy to come from renewable sources
2021	RHI closes to new applications
2020's	Beginning of mass roll-out of renewable heating technology

Annex B: Changes since Consultation IA

The Consultation Impact Assessment set out a number of options which were considered for the domestic scheme. This section summarises what those options were and how a decision was made.

Sub Option a: Tariff Capping

The proposed tariffs are subject to a Value for Money (VfM) cap of the total support for offshore wind; only solar thermal is subject to this cap. The exact level of support for Solar Thermal will be determined with the non-domestic tariff review response. This will be at least 19.2p/kWh and is discussed in the Impact Assessment.

Sub Option b: To incentivise improved performance

The consultation suggested that tariffs would be paid on total heat output. To incentivise improved performance the domestic RHI now pays on renewable heat only. Under this measure, a greater payment would be received by heat pumps with a higher efficiency as they would produce more renewable heat.

Sub Option c: To incentivise new build homes

New build will not be eligible for the RHI, other than where properties are self-build. The rationale for this is it avoids the deadweight cost of subsidising the 7000-8000 MCS installations that are currently going into new build each year. In other words subsidising these installations would not be good value for money as there would be few truly additional installations.

Sub Option d: Bivalency – To incentivise greater takeup

Bivalency refers to the option to keep or install a conventional heating system to go alongside the renewable system. A back up fossil fuel system will be allowed, provided metering equipment is also installed. Hybrid systems, which use a conventional and renewable heating technology, will also require metering equipment to be installed. The rationale for this is it will reduce the risks associated with a new technology, it will be more efficient in summer and will also minimise opportunities for gaming.

Sub Option e: Tariff Longevity: To incentivise the use of biomass kit after 7 years

At consultation we considered splitting the biomass tariff into one tariff for an initial period comprising upfront and barrier costs with an additional tariff for the operational costs only paid over 20 years. This was intended to prevent switchback after the 7 year payment period. We have chosen not to split the tariff for several reasons. Firstly, it would add unwelcome complexity to the scheme. Secondly, stakeholders at consultation raised concern that householders would be unlikely to adopt a technology which pays out over 20 years and may impact on biomass uptake and meeting our 2020 renewables target.

Sub option f: Social Landlords

Social landlords will be included within the scheme and will receive the same tariff as all other domestic applicants. The rationale for this is that social landlords will be able to facilitate in driving the development of the renewable heat supply chain and cost reductions essential to long-term viability of renewable heating. Social landlords have specialist knowledge of their tenants properties, local suppliers and also might be able to deploy at significant scale given the volume of housing stock they manage. We have not identified any specific cost savings we expect Social Land Lords to be able to access.

Sub Option g: Disaggregation

To ensure value for money at consultation we proposed considering disaggregating tariffs further where substantial cost differences occur. A potential opportunity for this was seen between horizontal array and vertical borehole heat pumps. The reasoning for the decision to pay one tariff for GSHPs is discussed in more detail in the Government Response.

Annex C: Tariff Setting Methodology

Methodology for Tariff Setting

The methodology that DECC has used to calculate tariffs is to identify the amount of subsidy per kWh required to compensate for the difference between the lifetime costs of renewable heating technologies and the lifetime costs of counterfactual technologies, paid over 7 years. We have carried this calculation for each technology and each house type. These calculations are described in detail and worked through using our example of a biomass boiler below.

Please Note: there are some exceptions where this methodology is different for example for Solar Thermal, no counterfactual capex is considered. For electric heating the cost of water heating is added to the counterfactual.

Calculating a levelised cost

In setting tariffs DECC has calculated the levelised cost, and the tariff required to offset additional costs, for each technology in each house type.

The levelised cost of a renewable technology is the present value of all costs and benefits of the renewable technology divided by the lifetime energy output of that technology. This gives a cost figure expressed in £/MWh, which essentially demonstrates the cost of producing a unit of energy using that technology, by spreading out all the associated costs across all the heat produced.

The net levelised cost of a renewable technology is the cost of the renewable technology minus the cost of the counterfactual technology, levelised.

In calculating RHI tariffs we have examined this net levelised cost as we aim to compensate for the additional costs of installing renewable heat only, for households that need to replace their existing heating equipment.

In calculating a levelised cost DECC has assumed an average cost of capital of 7.5%.

The example below steps through the details of the calculation for a household installing a median cost biomass boiler.

<u>Example (numbers may not sum due to rounding):</u> For a median cost biomass boiler the levelised cost is calculated as follows:

First the heat output of the boiler is adjusted to account for increases in efficiencies of the property (e.g. insulation) resulting from Green Deal ticks.

This is shown below:

$$Adjusted\ Heat\ Output = Annual\ Heat\ Load * Efficiency\ Factor \quad (1)$$

$$Adjusted\ Heat\ Output = 20.71 * 0.85 = 17.6\ MWh \quad (2)$$

Following this the annuitised capital expenditure is calculated over the lifetime of technology using equation 3 and a discount rate equal to the cost of capital, 7.5%.

$$Annuitised\ Capex = \frac{Upfront\ Capex * Discount\ Rate * (1 + Discount\ Rate)^{Lifetime}}{(1 + Discount\ Rate)^{Lifetime} - 1} \quad (3)$$

$$Annuitised\ Capex = \frac{1007.52 * 0.075 * (1 + 0.075)^{20}}{(1 + 0.075)^{20} - 1} = £98.8/_{kW} \quad (4)$$

From this the levelised capital expenditure (capex) of the biomass boiler can be calculated.

$$Levelised\ Capex = \frac{Annuitised\ Capex * Capacity}{Heat\ Output}$$ (5)

$$Levelised\ Capex = \frac{98.8 * 15}{17.6} = \frac{£83.7}{MWh}$$ (6)

The same calculations are carried out to calculate the capital expenditure of the counterfactual technology. However our modelling assumes that if, for example, electric heating could be replaced by a biomass boiler, it could also have been replaced with a gas or oil boiler. As such, the gas/oil boilers form the counterfactual cost when the counterfactual fuel is electricity (as it is in this example).

$$Levelised\ Capex = \frac{£34.2}{MWh}$$ (7)

The total costs of the biomass boiler and the counterfactual (CF) technology, per MWh, are calculated below.

$$Capex\ \&\ Operating\ Costs = Levelised\ capex + Opex + Fuel\ cost$$ (8)

$$RH\ Capex\ \&\ Operating\ Costs = 83.7 + 6.1 + 67.0 = \frac{£156.9}{MWh}$$ (9)

$$CF\ Capex\ \&\ Operating\ Costs = 34.2 + 10.2 + 65.0 = \frac{£109.3}{MWh}$$ (10)

We then need to calculate the net cost which is the difference between the total costs. In calculating the net costs we also need to consider the non-financial barriers associated with installing the renewable heat technology and the counterfactual.

For the biomass boiler the explicit barriers include admin burdens, demand side barriers and inconvenience to the household. The implicit barriers include perceived risk barriers e.g. risk around technology and impact on house value. Both the explicit and implicit barriers sum to £15.90/MWh. These have been calculated using a rate of return of zero as they are non-financial costs and as such no cost of capital should apply to them.

The net cost is then calculated as follows:

$$Net\ Cost = Levelised\ RH\ Cost - Levelised\ CF\ Cost + Levelised\ Barriers$$ (11)

$$Net\ Cost = (156.9 - 109.3) + 15.9 = \frac{£63.4}{MWh}$$ (12)

Calculating the required tariff

We then convert the *net cost* into a *required tariff.* This means taking the *present value* of the *net levelised cost* and annuitizing again, this time over 7 years so that 20 years' worth of costs are paid over 7 years. This calculation is detailed below:

The present value of the cost over the lifetime of the technology is calculated using a discount rate of 7.5% over the length of the lifetime of the technology, 20 years.

$$\text{Present Value} = \sum_{i=1}^{lifetime} \frac{Net\ Levelised\ Cost}{(1 + discount\ rate)^i}$$

$$Present\ Value = \sum_{i=1}^{20} \frac{63.4}{(1.075)^i} = \frac{£646.7}{MWh} \qquad (13)$$

To calculate the cost each year over the length of the subsidy, the present value of the cost is then annuitized using a discount rate of 7.5% and lifetime of the subsidy, 7 years.

$$Required\ Tariff = \frac{Present\ Value * Discount\ Rate * (1 + Discount\ Rate)^{Subsidy\ Length}}{(1 + Discount\ Rate)^{Subsidy\ Length} - 1} \qquad (14)$$

$$Required\ Tariff = \frac{646.7 * 0.075 * (1.075)^7}{(1.075)^7 - 1} = \frac{£122.1}{MWh} = 12.2p/kWh \qquad (15)$$

Establishing a Cost Curve

Having established the required tariff for each house type, the next step is to establish a cost curve. For this we use the technical potential of the renewable technology. The technical potential is the number of households of each house type which will be replacing their heating system in any given year for each house type, multiplied by the proportion of that house type which is considered suitable for that technology and the average heat use of each house.

For each technology, we take all the *required tariff* data, for all the different house types, and match them with the technical potential for that house type[21]. For the domestic scheme we only include house types which are not on the gas grid, as the tariffs aim to reward the median cost of off-gas grid opportunities.

We order this data by the net cost, so the lowest cost opportunities are first, and plot this with the cumulative technical potential to form a cost curve.

Example: For Biomass Boilers we take the net cost and technical potentials for all house types which do not have gas as the counterfactual fuel and could install a small biomass boiler. We then order the data in terms of net cost, with the lowest net cost (and therefore the most cost effective) technology first and the highest net cost last. The technical potential is then converted to cumulative figures by considering the technical potential of all the house types which have a lower cost.
The cost curve for all small biomass boilers is shown below. Note that this has been converted to a 20 year basis.

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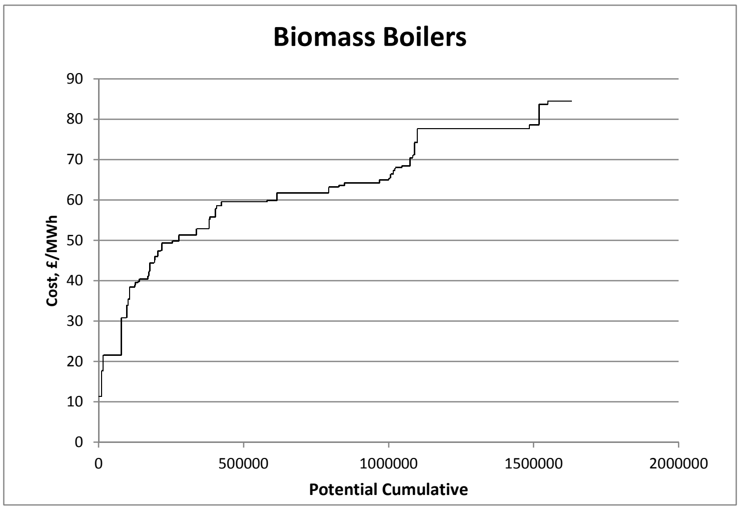
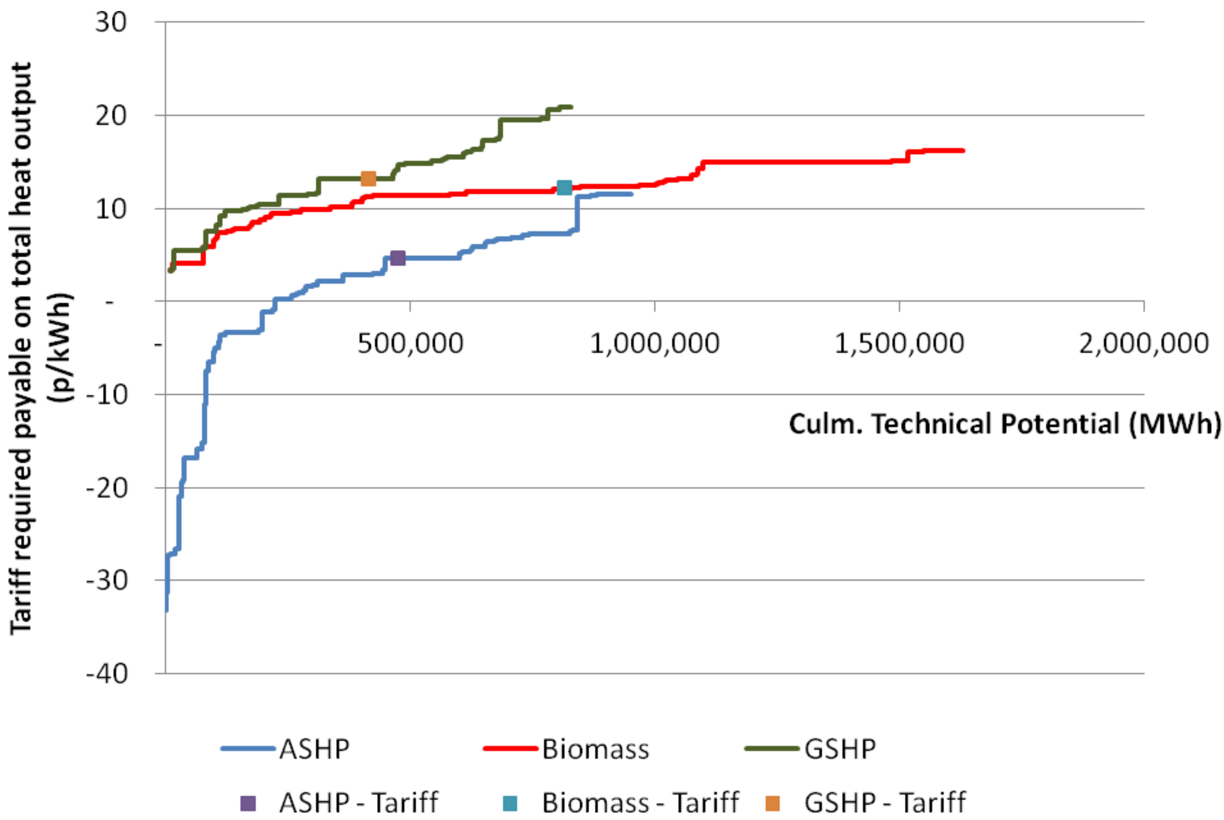
[21] This is a slight simplification to the more detailed methodology which excludes barrier costs when deriving the cost curve and adds them back in for the final tariff calculation. For this worked example we have not included these steps, but it makes only a very marginal difference.



The steps in the curve are different house types. The length of the step is how much renewable heat could be produced by that house type and the height of the step indicates it's cost per MWh.

Cost Curves

Below for reference are the costs curves of the off-gas grid technical potential for the alternative technologies, excluding Solar Thermal.



There are several key features of these cost curves:

- The technical potential is dependent on the suitability of renewable heating technology for installation in different households. This is based on modelling NERA and AEA carried out and remains in principle the same as previous modelling
- The shape of the cost curves is important in determining how households make decisions between technologies, if both are eligible.
- The data collected by Sweett and DECC's modelling suggest that there are cost effective opportunities off the gas grid for ASHP, but not for Biomass boilers or GSHP
- The most certainty on data will tend to lie in the centre of the cost curve, with more uncertainty at the ends of the cost curves.

As with the rest of the modelling presented in this impact assessment, these conclusions must be treated with caution and are indicative of the costs DECC expects households to face.

Annex D: A comparison with non-domestic tariffs

The comparative tariffs available for the domestic and non-domestic schemes are important for two main reasons. Firstly, they influence the choices industry will make about focus on these different markets. Secondly, if there is a differential it introduces the opportunity for households choosing whether to be classed as domestic or non-domestic. A household might re-classify themselves as non-domestic by creating a mini heat network with a neighbour..

To compare the tariffs on like-for-like terms the non-domestic tariffs need to be converted to payment on a 7 year period and on renewable heat only. Table D1 details the tariffs available on a comparative basis, and also demonstrates the tariffs that would be paid to domestic households if they were calculated on all potential instead of off-gas grid only.

Table D1: Tariffs compared*[22]

p/kWh	ASHP - ATW	Biomass	GSHP
Proposed Domestic Tariff	7.3	12.2	18.8
Non-domestic Tariff paid over 20 years and on total heat output	2.5**	6.4***	7.2-8.2
Equivalent Non-domestic tariff paid over 7 years and on Renewable Heat output	7.4	12.3	19.2-21.7
Domestic Tariffs if calculated on all of the grid	9.6	13.1	23.2

* Solar Thermal not included as it is subject to any Value for Money Cap
** Based on indicative update in Tariff Review consultation
*** Based on average small biomass tariff

The differences in tariffs are due to several reasons:

- **Objectives of scheme:** The domestic scheme is expected to contribute a smaller amount of heat towards the renewable heat target than the non-domestic scheme. As such, the wider scheme aims around growth of renewable heat supply chains and preparing for mass deployment of renewable heat are more significant. The tariff for the domestic scheme is therefore set on off-gas grid properties, whereas the non-domestic tariff is set on all properties.
- **Compensation Provided:** The domestic scheme is designed to offer a 7.5% rate of return on net capital invested; whereas the non-domestic scheme offers a 12% rate of return. These compensate for different things, the domestic rate of return is designed to approximate the Green Deal Finance rate and compensate for the costs of capital. The non-domestic rate was derived by NERA analysis of the hurdle rate firms would need to invest in RHI. Additionally the treatment of barrier costs is different, with them fully compensated in the domestic scheme and only explicit barriers compensated for on the non-domestic scheme. This has different relative effects for different technologies because the impact crucially depends on the shape of the cost curve and the make-up of costs for the median installation.
- **Types of installations suitable:** installations in the domestic and non-domestic scheme vary in terms of size, cost, use and efficiency. A key difference is load factors, where non-

22 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/204446/Tariff_Review_Consultation_for_PUBLICATION.pdf

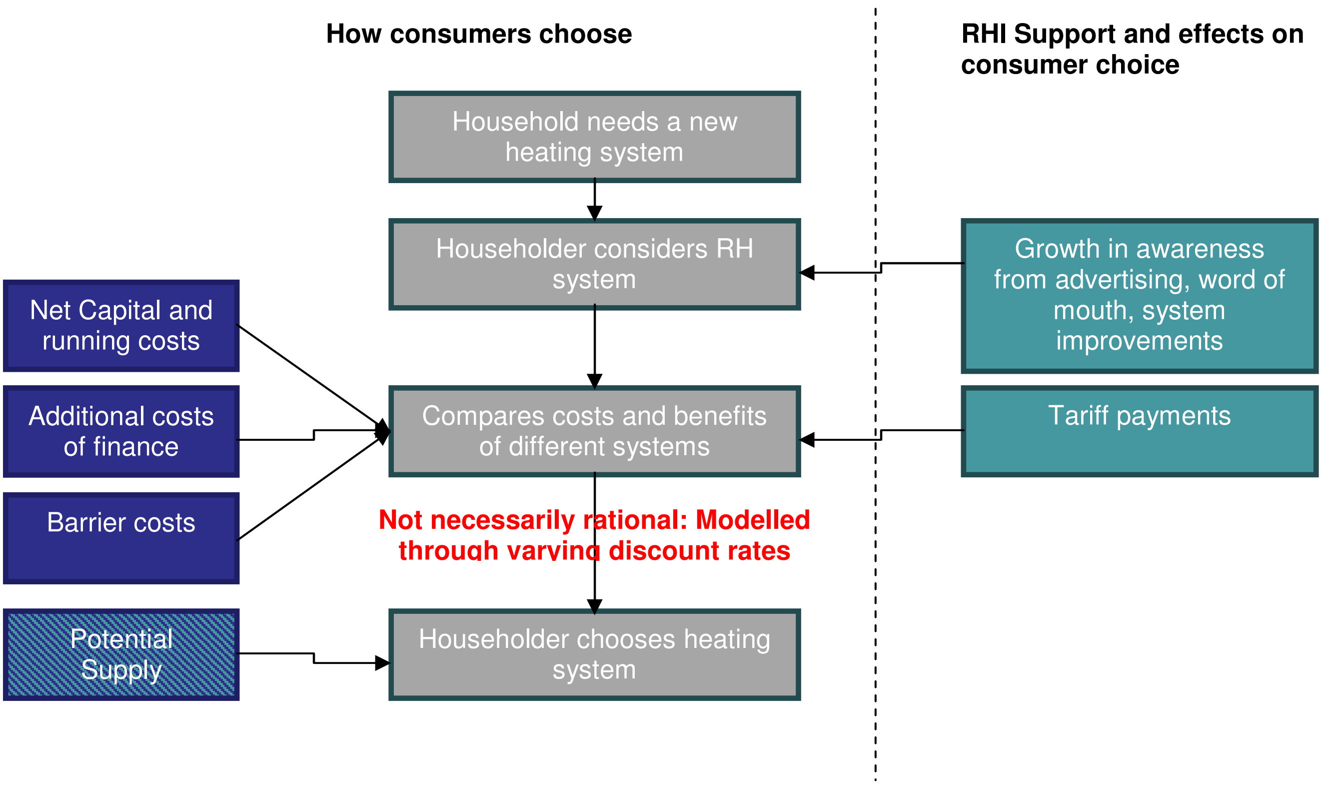
domestic systems generally have lower load factors. These all influence the cost of installation for the median installations, making exact comparisons difficult.

Due to the reasons outlined above it is difficult to provide strictly comparable tariffs and therefore make a judgement about which are more generous, however the outline reasons for differences in tariffs are due to objectives of the scheme, types of compensation provided and the types of installations installed or used in the different sectors.

Annex E: Model Summary

The RHI analysis has been carried out using an economic and technical model built by independent consultants (NERA). The model was designed to test possible renewable heat deployment levels under different supply and demand side growth assumptions and to enable testing of various tariff designs (e.g. different tariff levels, tariff bands or tariff lifetimes) and the impact of alternative policy designs on key metrics (e.g. uptake of renewable heat, subsidy and resource costs, CO2 savings, etc.). The below diagram outlines at a very high-level how the model works, and what the key inputs and outputs are. More information can be found in the NERA 2009 and 2010 supporting reports that are referenced in the summary sheets:

Flow Diagram 1: Simplified RHI Model structure



The assumptions feeding into the model are:

- **Fuel Prices** – the fuel price series used in the uptake modelling are consistent with the published DECC energy price series
- **Technology data –** technology costs and performance data are taken from Sweett Group's evidence gathering conducted in early 2013. This has then been peer reviewed and refined by DECC engineers.
- **Barrier costs** – Barrier costs used within the RHI model are consistent with the Ipsos-Mori (more detail on barrier costs can be found in Annex G)

- **Technical Potential –** Analysis conducted by NERA and AEA which looks at the eligibility and suitability of households
- **Maximum possible supply –** based on supply constraints developed by NERA from looking at potential growth rates in the supply of renewable technology.

The likely future Demand for renewable heat is driven by calculating for each house-type, for each technology, the net cost of installing and using renewable heating including barriers and financing costs. A distribution of financing costs is used for each house type to reflect the variation of individual circumstances. Householders are assumed to consider Renewable Heating as their current system reaches the end of its life (which is in line with the long-term trend in heat system replacements- roughly once every 15 years). These opportunities, where boilers are nearing the end of their life, are the most cost-effective opportunities and hence the target of the RHI.

For each house category the renewable technologies are ranked in terms of the their net costs after tariffs are taken into account and demand for each technology is determined by how many properties have profitable opportunities. Demand for each technology changes each year as costs/fuel costs change. For example demand for GSHPs rises as capital costs are expected to fall and fossil fuel prices rise.

Supply of each technology is constrained by the size of the supply chain (in reality this will likely be constrained by trained labour (both installing and designing systems), equipment (such as large drilling equipment) and the manufacture of products which can grow each year, but there is a maximum growth rate achievable for each technology (derived by AEA as the likely maximum at which supply chains can afford to expand, given training, equipment purchasing, admin and uncertainty). The amount the supply chain grows is a function of the number of installations in the previous year, up to the maximum growth limit. Therefore supply in each year is finite.

The model then matches demand with supply, with demand switching to second choice technologies if necessary (in the real world this would happen because prices of the most demanded technologies would rise with demand). This calculates the expected deployment in that year. For that deployment the model then works out how much heat is produced/money spent/carbon saved etc.

Annex F: Sensitivities

1. Deployment of renewable heat technology is very uncertain due to a whole range of factors, from fuel prices to growth in awareness. Within the modelling approach used it is possible to capture some of these sensitivities to give an indication of the ranges of uncertainty which surround RHI deployment. In addition the model itself is very sensitive to the assumptions made about various factors.

2. The sensitivities which are focused on below aim just to demonstrate the range of uncertainty and give an indicative range of deployment and unconstrained costs. Table X.X briefly describes the scenarios used and demonstrates the difference in additional renewable heat deployment by 2020 under each of these scenarios.

Table F1: Description of scenarios

Scenario	Description	Renewable heat produced in 2020/21
Central	Uses central assumptions for all inputs e.g. fossil fuel prices, capital expenditure, awareness and barrier costs.	3.9 TWh
High Fossil Fuel Prices	Uses the standard DECC high Fossil fuel price scenario. This generally increases deployment of RH technologies as it makes them more attractive compared to conventional technology.	5.1 TWh
Low Fossil Fuel Prices	Uses the standard DECC low Fossil fuel price scenario. This generally decreases deployment of RH technologies as it makes them less attractive compared to conventional technology.	3.2 TWh
RHPP Capital Expenditure for RH installations	Uses the average Capital expenditure for RH technologies seen under RHPP. This tends to reduce the capital expenditure needed for installations, so makes RH technologies more competitive compared with conventional technologies.	5.3 TWh
High Capital expenditure	Increases the capital expenditure for RH technologies by 10%. This reduces the competitiveness of RH technologies.	3.7 TWh
Slow growth in awareness of RH technology	Reduces the growth in awareness of renewable heating technologies, meaning fewer householders consider RH when replacing their heating system.	3.1 TWh
Lower actual performance of renewable heating technology	Performance of all renewable heating technology is 20% lower through-out the whole RHI programme than anticipated.	2.7 TWh

Annex G: Barrier Costs method

Under the RHI householders will be committing to large upfront costs for heating equipment which, at least in the early years of the scheme, is largely unknown to the vast majority of householders. As such households are expected to require compensation for risks of installing renewable heating systems which may otherwise act as a barrier.

Since the consultation, DECC has been considering the best approach to treatment of barrier cost compensation. There are two main pieces of research which attempt to capture what barrier costs might be for domestic householders:

a. NERA conducted a review of available evidence for previous RHI Consultations[23]. They largely drew on work conducted by Enviros and Element Energy[24], which estimated implicit barriers faced by householders.
b. Ipsos-Mori used a preference survey in Autumn 2012 to identify householders' barriers when taking up renewable heat.[25] A full technical annex to this report will be published later in 2013.

The barrier costs included in the setting of tariffs should not distort the relative offers to consumers between technologies greatly. In order to ensure a comparable offer to consumers, the rates of return on investment for the differing technologies are kept the same. The Ipsos-Mori method causes the rate of return for tariffs to vary significantly between technologies, whereas the NERA method does not. DECC has therefore chosen to use NERA's analysis of barriers for tariff setting.

The Ipsos-Mori preference study however gives a good indication of the technology specific barriers which householders face. This has therefore been used for the deployment projections. By using NERA's approach to barriers, any uptake model would not get the choice between technologies correct.

Deployment sensitivity to barriers

There is significant uncertainty about the actual barriers customers face when looking to install renewable heating technology. To test the sensitivity of deployment to change in barrier costs an alternate set of barriers derived from the Ipsos-Mori preference survey was used. These barriers were approximately 20 to 30% lower than the barriers used in the central model. The effect was to increase the deployment of renewable heat in 2020 by 6.5% to 4.2TWh.

This result highlights the uncertainty in renewable heat deployment and the barriers customers could potentially face.

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[23] http://www.rhincentive.co.uk/library/regulation/100201RHI_design.pdf.

[24] Element Energy (2008), *The growth potential for Microgeneration in England, Wales and Scotland*.
Enviros Consulting (2008a), *Barriers to renewable heat part 1: supply side*, report for BERR.
Enviros Consulting (2008b), *Barriers to renewable heat part 1: supply side*, report for BERR.

[25] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191541/More_efficient_heating_report_2204.pdf

Extract from RHI Tariff Review, Scheme Extensions and Budget Management Impact Assessment

The July 2013 domestic RHI Impact Assessment did not consider the budget management policy of the RHI as this was set out in December 2013. Instead a qualitative Impact Assessment was carried out in association with the non-domestic RHI. This can be found:

https://www.gov.uk/government/consultations/renewable-heat-incentive-expanding-the-non-domestic-scheme

For completeness the sections discussing the domestic RHI are outlined below

Section 5C. Proposed revised budget management mechanism
Paragraph 131 & 132

Section 5D. Impact evaluation of budget management changes
Paragraph 138 & 139

Section Annex 8: Calculation of triggers
Paragraph 140 & 141
Paragraph 146 to 152

Annex 9: Domestic budget management choices and implications
Paragraph 153 to 154

Domestic mechanism

131. In the policy document, “The first step to transforming the way we heat our homes,” and the associated Government Response, “A Government Response to ‘Proposals for a Domestic Scheme’ September Consultation” published in July 2013[26], we confirmed that the main method of controlling the budget for the domestic RHI would be degression (lowering) of the tariffs paid to new applicants as spend on the domestic scheme reaches “triggers” set out in the RHI Regulations. The broad outline can be found below, more details can be found in the accompanying policy document:

a. **Timing and frequency of degression** - tests of whether spend on each tariff has reached its degression trigger will take place on a quarterly basis, with announcements of whether a degression has been triggered being made by 1st June, 1st September, 1st December and 1st March. The announcement will provide one month’s notice of any tariff reduction taking place.

b. **Triggers** - degression triggers will be set for each tariff in the scheme until the end of 2015-16. Degression will only occur if spend on that tariff has reached a degression point; tariff triggers will not be affected by non-domestic deployment, other domestic technologies or applications from those who installed before the launch of the scheme. Degression will occur if a technology is deploying above its trigger, even if total scheme deployment is low.

Every quarter we will forecast expenditure based on both applications and accreditations to the scheme to check whether a degression trigger has been hit. We will forecast expenditure based on the deemed heat usage of the property, except for second homes where we will reduce the deemed heat based on how often the property is occupied and bivalent properties which are metered.

Following a degression, the reduced tariffs would apply to new RHI applications only. Installations that had already been accredited would continue to receive the tariff in place at the time they were accredited.

c. **Size of degressions -** as a general rule hitting a trigger will result in a 10% reduction in the tariff however if spend goes above a second higher “super trigger”, a 20% reduction will take place. We do not expect this to happen however it will guard against sudden and unexpected over-deployment of any technology.

d. **Subsequent degressions -** when a degression has taken place in the previous quarter, rather than test whether spend is above the trigger we will test whether spend has grown faster than the trigger has grown in that quarterly period. If growth in forecast spend was above the growth in the trigger a further degression would take place, if not, no degression would take place. This will apply to both 10% and 20% degressions.

132. The rationale for these decisions compared to the non-domestic scheme are summarised in Annex 9.

Technology specific effects for domestic technologies

138. In the domestic RHI policy document and Government Response published in July 2013[27] it was confirmed that the budget for the domestic RHI would be managed through degression (lowering) of tariffs as pre-set levels of spend are reached. With the confirmation of the exact mechanism it is possible to qualitatively assess the impact that this budget management system may have on tariffs. As the system is an integral part of the policy it is not possible to separately identify the effects of budget management compared to other parts of the policy.

139. The implications for domestic tariffs are summarised below in several scenarios. These cover the majority of scenarios which could occur in the opening two years of the domestic scheme. It includes the implications of particular deployment scenarios and the rationale for combinations of degression. This does not include the "super trigger” to simplify the analysis of the implications. If deployment is above the “super trigger” then a 20% degression is applied to that technology, to control costs and ensure value for money.

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[26] https://www.gov.uk/government/consultations/renewable-heat-incentive-proposals-for-a-domestic-scheme
[27] https://www.gov.uk/government/consultations/renewable-heat-incentive-proposals-for-a-domestic-scheme

Table 1: Deployment scenarios for domestic RHI

Technology one	Other technologies	Degression	Rationale
Below trigger	**Below triggers**	No degressions for any technology	No technology deploying at level anticipated and budgeted for. Therefore no need for degressions to control costs.
Above trigger, below super trigger	**Below triggers**	10% degression for technology above trigger, no degressions for any other technology	One technology is above anticipated deployment. This suggests that tariff is above level necessary to incentivise budgeted demand level and should be reduced to maintain scheme diversity and ensure value for money. Other technologies are deploying below level anticipated and budgeted for. Therefore there is no need for degressions for these technologies.
Above trigger, below super trigger	**Above triggers, below super triggers**	10% degression for each technology above trigger	All technologies are above anticipated deployment. This suggests that tariffs are above level necessary to incentivise budgeted demand level and should be reduced to maintain value for money and budget control.

Annex: Trigger setting and implications

140. The overall aim of the budget management system is to control spending to a level no greater than the central estimate of deployment, based on our latest MI. While it does not eliminate these risks, it does control them by reducing tariffs for new applicants, and would potentially reduce deployment by making the RHI less financially attractive.

141. The updated central MI deployment forecasts are therefore the basis of developing triggers for both the domestic and non-domestic scheme. Any upwards deviation from this implies a greater chance of overspend.

Domestic trigger setting

142. The domestic triggers give equal shares of the budget to ground source heat pumps, air source heat pumps and biomass boilers and allow a smaller budget for solar thermal (in-line with the deployment our central scenario MI predicts for this technology).

143. The evidence base for deployment of domestic technologies in the first few years of the scheme is highly uncertain. There is some MI on potential installations over the SR period. There is however weak evidence about the average heat demand of households who take up the RHI.

144. In the absence of any better evidence, this is a pragmatic option that allows the market to decide between technologies (within the parameters of the tariffs we have set). It also allows growth in deployment for all technologies through to the end of 2015/16.

145. The solar thermal budget is set lower than the budget allocated to other technologies to reflect the fact that solar thermal will usually be used for water heating rather than space and water heating, so heat loads are likely to be lower than those associated with the other technologies.

146. Metering and Monitoring service packages are an important aspect of the domestic scheme to help both installers and householders. The budget given to these installations will be a fixed amount which when reached will close support to MMSP for the rest of the financial year.

147. Installations prior to the launch of the RHI, but after July 2009 (Legacy applications) can still apply for RHI provided they meet the conditions set out in the July policy document. These will not count towards the calculation of whether triggers for degression have been met because they were deployed before the start of the scheme and are therefore not indicative of the current effect of the scheme and its tariffs on the market. If included they could trigger a degression that would drive tariffs too low to incentivise new deployment.

148. Legacy applications will also have a guaranteed tariff for the first year of the scheme. This is to reduce the risk of a rush of legacy applicants at the beginning of the scheme (which could result in delays and expense in processing applications) and to treat phased applications (phasing is necessary to manage the scheme delivery costs associated with these applications) fairly.

Table 2: Summary of Triggers at the end of 2014/15 and 2015/16

		100% Triggers							
		Apr-14	Jul-14	Oct-14	Jan-15	Apr-15	Jul-15	Oct-15	Jan-16
Domestic Technologies	Air Source Heat Pumps		£2.4m	£4.2m	£6.0m	£8.4m	£11.9m	£15.5m	£19.1m
	Biomass Boilers		£2.4m	£4.2m	£6.0m	£8.4m	£11.9m	£15.5m	£19.1m
	Ground Source Heat Pumps		£2.4m	£4.2m	£6.0m	£8.4m	£11.9m	£15.5m	£19.1m
	Solar Thermal		£1.2m	£2.1m	£2.9m	£3.9m	£5.0m	£6.1m	£7.2m

Domestic budget management choices and implications

149. The domestic RHI budget management system has been designed with some differences to the non-domestic system. This is to better reflect the differences in technologies, scheme objectives and potential customer reaction to degression. The system will also be simpler to reflect the different customer base, making it easier for small installers and private householders to assess the potential returns from RHI.

150. Table 3 below highlights the major changes and describes why these alterations have been made:

Table 3: Degression differences between domestic and non-domestic RHI

Current non domestic RHI	Domestic RHI	Rationale
Degression triggers for each tariff and a total trigger based on whole scheme deployment	Degression triggers for each tariff and no total trigger	Tariff triggers ensure a mix of technologies to support long term growth of renewable heat. They reduce the risk of low deployment of technologies that are more expensive but may be more cost effective in the long term, ensuring that one technology does not dominate the whole domestic budget. Domestic triggers will not be scaled, instead they will be set based on splitting the available budget between technologies. There will, therefore, not be a total trigger, which simplifies the degression mechanism compared to non-domestic. This does however make it more likely that degression for any one technology will be triggered as it is entirely based on the deployment of that technology rather than also being at least partially reliant on healthy deployment in other technologies.
Degression does not occur if overall deployment is less than 50%	Degression occurs if tariff triggers are met, even if overall deployment is low	The domestic scheme aims to support a mix of technologies that which supports mass deployment of renewable heat in 2020's / 2030's. Hitting a trigger implies that a technology is over-incentivised and, in a scheme where securing diverse deployment is the primary aim, it is better value for money that tariffs are degressed.
5% initial degressions followed by 10% and 20% degressions	10% degressions if triggers are breached	A 5% degression might not be large enough to have an appreciable effect on deployment; particularly for the cheaper tariffs (the difference between an annual payment of £500 and £475 is unlikely to have very much effect). It also may not be enough of a decrease in the cost of those applications that do come forward to manage the budget. Whereas a 20% reduction may be too great, unless deployment is significantly above where we would expect it to be and we need to significantly reduce the number of installations coming forward and the cost associated with those installations.
Setting a "super trigger"		The "super trigger" would provide additional control, similar to a cap, without risking a stop-start scheme which could damage the market. It would guard against sudden and unexpected over-deployment of any technology which would imply either initial tariffs were too high or there have been major cost reductions e.g. due to cheaper imported technology. Given that domestic project install times tend to be shorter than non-domestic, quarterly degressions of 10% could be insufficient

		to control deployment in this situation.
Triggers set by MI for most technologies	Budget split equally across space heating technologies	An even budget split between the main space heating technologies is pragmatic and allows the market to decide between technologies. There is a lack of evidence for any particular technology split in the domestic scheme given the change in types of households who may apply for RHI compared to previous support programmes