Policy recommendations for renewable heating and cooling in the United Kingdom

D15 of WP4 from the RES-H Policy project

A Working Document prepared as part of the IEE project "Policy development for improving RES-H/C penetration in European Member States (RES-H Policy)"

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The RES-H Policy project

The project "Policy development for improving RES-H/C penetration in European Member States (RES-H Policy)" aims at assisting Member State governments in preparing for the implementation of the forthcoming Directive on Renewables as far as aspects related to renewable heating and cooling (RES-H/C) are concerned. Member States are supported in setting up national sector specific 2020/2030 RES-H/C targets. Moreover the project initiates participatory National Policy Processes in which selected policy options to support RES-H/C are qualitatively and quantitatively assessed. Based on this assessment the project develops tailor made policy options and recommendations as to how to best design a support framework for increased RES-H/C penetration in national heating and cooling markets.

The target countries/regions of the project comprise Austria, Greece, Lithuania, The Netherlands, Poland and UK – countries that represent a variety in regard of the framework conditions for RES-H/C. On the European level the projects assesses options for coordinating and harmonising national policy approaches. This results in common design criteria for a general EU framework for RES-H/C policies and an overview of costs and benefits of different harmonised strategies.

This Working Document

This Working Document summarises policy recommendations to improve the policy framework for RES-H/C in the United Kingdom. A policy set has been proposed based on the different elements of the policy analysis that has been conducted throughout this project. The document describes the proposed policy instruments and a strategy how to best implement it in the light of the specific national context. It analysis the interaction of the proposed policy set with the existing policy framework (e.g. for the building sector) and provides a proposal for monitoring and evaluating the policy impact on the development of RES-H/C.

Similar documents have also been prepared relating to the other countries/regions targeted within this project.

1 The Proposed Policy Set

A key justification for the 'RES-H Policy' project is to assist EU Member States in determining the best options for the support of renewable energy sources of heating and cooling (RES-H/C). When this project began RES-H policy experience with practical application of such policy was limited across the EU. However, since it began in October 2008 the UK has moved rapidly to address this policy vacuum. The rapid acceleration of the uptake of the Renewable Heat Incentive (RHI) as the key mechanism to support renewable energy sources of heat (RES-H) in the UK since the beginning of this project has thrown up some difficulties in terms of discussing different policy options with UK stakeholders, since the selection of the RHI has been something of a *fait accompli*. Nevertheless, the RHI has much to recommend it as a mechanism, and the consideration that has gone into its design has highlighted numerous interesting approaches to the problems inherent in supporting RES-H/C which are likely to be of considerable interest outside the UK. The process of selecting appropriate policy instruments to model for impacts on stimulus of RES-H deployment, costs, greenhouse gas emission reduction and employment effects inevitably lead to a plurality favouring development of an RHI model. Selecting a second instrument in this contact had something of the air of redundancy but was addressed by selecting a mechanism which would work with the RHI. This led to data which estimated the full cost of meeting UK RE targets for 2020, which has some value for assessing total cost to that point.

The project can also be seen to provide value in that it considers a number of possible 'flanking' instruments which overcome barriers which the RHI is not designed to address, and which are sufficiently diverse that no alternative single mechanism could be expected to efficiently address. Recommendations for providing additional support in this manner are discussed in section 5.

Our conclusions do concur with the adoption of the RHI, and this can be justified in a number of ways in regard of comparing the aims of policy and the likely impacts – both positively and negatively and by demonstration of the problems with the alternatives.

1.1 The Renewable Heat Incentive

The RHI is a tariff style mechanism which aims to meet the specific needs of the UK RES-H sector through the provision of sufficient financial incentive to drive market demand for eligible RES-H technologies. Phase one of the RHI makes support available from July 2011 and applies only to use of RES-H for non-domestic usage. Phase two of the RHI is scheduled to begin in October 2012. The levels of financial support available under phase one is shown in Table 1. The level of the tariffs to be made available in phase two are not yet available and will be subject to a public consultation prior to phase two.

Levels of support					
Tariff name	**Eligible technology**	**Eligible sizes**	**Tariff rate (pence/ kWh)**	**Tariff duration (Years)**	**Support calculation**
Small biomass	Solid biomass; Municipal Solid Waste (incl. CHP)	Less than 200 kWth	Tier 1: **7.6**	20	Metering Tier 1 applies annually up to the Tier Break, Tier 2 above the Tier Break. The Tier Break is: installed capacity x 1,314 peak load hours, i.e.: **kWth x 1,314**
			Tier 2: **1.9**		
Medium biomass		200 kWth and above; less than 1,000 kWth	Tier 1: **4.7**		
			Tier 2: **1.9**		
Large biomass		1,000 kWth and above	**2.6**		Metering
Small ground source	Ground-source heat pumps; Water-source heat pumps; deep geothermal	Less than 100 kWth	**4.3**	20	Metering
Large ground source		100 kWth and above	**3**		
Solar thermal	Solar thermal	Less than 200 kWth	**8.5**	20	Metering
Biomethane	Biomethane injection and biogas combustion, except from landfill gas	Biomethane all scales, biogas combustion less than 200 kWth	**6.5**	20	Metering

Table 1: Levels of financial support within phase one of the RHI

The technologies eligible for support under the RHI are very much in line with those qualifying under the 2009 Renewables Directive, effectively emphasising compliance with the Directive as the focus of UK RES policy. The aim of the RHI is to make eligible RES-H technologies economically viable, such that investors will be incentivised to use the technology preferentially over other alternatives. The subsidy provided by the RHI has been calculated on the basis that it will typically allow a 12% rate of return on investment (DECC 2011).

The tariffs are calculated to compensate for the additional cost of renewable heat. That is, they do not compensate for the '*full cost either of the renewable heat equipment or any fuel used by the renewable heat equipment, but only for the additional cost of such equipment and fuel above that of the fossil fuel alternative'. (DECC 2011)*

The exception to both of these points is in regard of solar thermal where the level of the tariff is intended to meet the full cost of solar thermal systems and is set at a level which is roughly equivalent, in terms of financial support per unit of energy output, to the level allocated to what is currently considered to be the marginal cost effective technology required to deliver the UK's 15% renewable target, offshore wind. This results in a support level of 8.5p/KWh for solar thermal.

1.2 Other Options Considered

Options which were rejected for development within the UK policy instrument modelling element of the project included:

A Renewable Heat Obligation: When the project began in October 2008 the UK was in the process of assessing the options for instruments to support RES-H in the UK and a number of reports assessing the relative merits of different options had been or were in production (DEFRA/BERR 2007a; DEFRA/BERR 2007b; BERR/Enviros 2008; BERR/NERA 2008). Further, to this, the UK had an established history of supporting renewable energy sources of electricity (RES-E) through the application of a tradable green certificate or quota mechanism known as the Renewables Obligation (RO). An equivalent quota instrument, the Renewables Heat Obligation (RHO) for the support of RES-H had been mooted and an attempt made to bring it into law in 2005 with some support from the industry, with selection of the instrument based largely on the grounds that it was likely to be most politically acceptable and thus more likely to win political support for adoption. Industry support appeared to stem from a feeling that any mechanism would be better than none, and little consideration of the effectiveness of an RHO was carried out at this point. This iteration of the RHO failed due to a general election bringing the parliamentary session to a close in May 2005. The potential for an RHO was considered again from 2007 as part of various assessments for the support of RES-H, with an eventual determination that it would be more expensive than a Renewable Heat Incentive (BERR/NERA 2008), a conclusion which also fitted with the growing volume of evidence that tariff mechanisms delivered RES-E at lower unit costs than quota mechanisms (Mitchell, Bauknecht *et al* 2006; Ragwitz, Held *et al* 2006; IEA 2008).

Since these conclusions had been reached, and were supported with a considerable amount of evidence it was not felt to be fruitful to take the RHO forward as a possible mechanism for RES-H support in the UK.

The project started out by considering the full possible range of instruments that might be applied to support RES-H across its Member States. These were narrowed to a selection of instruments which might be applicable in the UK through a multi-step consultation process (Xie and Connor 2010; Connor and Xie 2010).Four policy instruments were then suggested to UK stakeholders as potentially worthwhile for consideration within the context of the ongoing development of the RHI that was occurring at this stage. These were:

- The Renewable Heat Incentive

- Direct subsidies/grants: The direct payment of subsidy against installed RES-H capacity, with the goal of reducing the price of installation and thus driving up demand.
- Use Obligation: An obligation on developers of new buildings (with potential expansion to later include buildings undergoing major refurbishment) to include sufficient provision of RES-H and/or RES-E technologies to provide a specified fraction of predicted total energy use from renewable sources.
- The RHI combined with a Supplier Obligation (RHI + SO), effectively compelling utilities to install RES-H on private properties but able to access payments under the RO for doing so. This option was provided to allow a second option which would fit with the RHI. The UK already has a form of SO in place, the Carbon Emissions Reduction Target (Ofgem 2011).

The feedback from stakeholders confirmed the view that the RHI was inevitable, but stakeholders thought it would be beneficial to model the RHI + SO option to allow greater insight into the costs of meeting the UK's RE targets.

Grants were rejected wholesale as a useful mechanism going forward on the basis that they were perceived to have historically been a poor fit in driving RES-H on the grounds that limited budgets have tended to lead to a stop-start driver for demand and it was preferable to have support which would provide greater stability of growth.

It is also notable that there was also little enthusiasm for the application of a Use Obligation, despite the fact that other EU Member States have been keen to adopt the mechanism and see it as a key driver of demand for RES-H (E.g. Germany, Spain and Austria). A Use Obligation was not seen as a good fit for the UK, on the grounds that it might require inspections of homes, especially where the obligation applied to refurbishment of property and this was seen as invasive and politically unattractive by stakeholders during consultation. The mechanism was also seen as potentially unfair in terms of cost impact on individuals and in relation to issues such as fuel poverty. This viewpoint was reiterated by a number of attendees at the UK dissemination conference for the RES-H Policy project.

It should be noted however that the 2009 Renewables Directive calls for a form of Use Obligation to be in place by 2014 in all Member States unless an acceptable alternative policy is enacted. The UK Government is moving forward with the RHI and there is an apparent expectation that, along with other UK policy actions will be regarded as an acceptable alternative in promoting renewable energy. This is discussed in greater depth in section 3.1.

Further to this point, it should also be noted that in 2006 the UK adopted building regulations which increasingly tightened energy efficiency requirements for new homes, with an end result of new homes built after 2016 being required to be 'Zero Carbon Housing', with Wales having a adoption target around 2011/12. This effectively meant that new homes would have to have some amount of renewable energy generation associated with them – effectively a form of Use Obligation. However, in a budget an-

nounced in March 2011, the regulations for 2016 were loosened, and there is now an expectation that not all energy use in new homes will have to be mitigated, even by the 2016 date. This is discussed in section 3.1.

Bearing these factors in mind, then the selection of the RHI as both the instrument to be modelled, and as a result of both our models and those published by the UK's Department of Energy and Climate Change (DECC) was straightforward. The second instrument to be modelled was less clear cut but was determined by a majority following stakeholder input to be the RHI plus Supplier Obligation.

1.3 Details of the Renewable Heat Incentive

Metering and Measurement: The RHI aims to provide a subsidy to RES-H based on generated output. The RHI as originally proposed assessed the output of RES-H qualifying for subsidy on two bases. Output could be metered in installations that were sufficiently large that costs of metering would not be too great a burden, or – in smaller installations – output would be 'deemed'. 'Deeming' paid out against the estimated number of units of heat calculated to be the *'reasonable heat requirement* (or heat load) that the installation is intended to serve' (DECC 2010). The goal was to design a system which provided enough incentive to install a RES-H system but only enough that this would be the case if the installation was in a building which already had high levels of energy efficiency.

Phase one of the RHI will now not feature 'deeming' and most of the technologies will need to be metered to qualify for payment. The exception to this is for installations of biomass burners in small and medium commercial premises. While it was felt that deeming was too complex a methodology to try to apply in the diverse set of conditions likely to occur in the many buildings which might fit into this category, concern over the potential for over-generation to access excessive subsidy led the government to instead introduce capacity payments for that technology. These will see RES-H installations in these premises subsidised at two 'tiered' tariff levels. the tariff rate will drop from tier 1 to tier 2 when the amount heat corresponding to 15% of annual heat load has been reached. In other words, the kWh of heat generated corresponding to 1,314 peak load hours of generation.

It is not clear yet whether payments made on a 'deemed' basis will be instituted within phase two of the RHI.

1.4 RES-H Policy Project Recommendation: The Renewable Heat Incentive

The most obvious reason to support the introduction of the RHI as the central support instrument for RES-H in the UK is that it is already in place as a legal framework and that it meets with the approval of the key stakeholders. Clearly the buy-in of the key actors is fundamental, and even where project outputs to suggest other policy instruments then at this stage they would have to consider the cost of adopting other policy and the delay that would be caused to creating the conditions to favour deployment and thus in stimulating the expansion of RES-H generating capacity.

There are however, other justifications which support the use of an RHI type mechanism, or undermine the potential for use of an alternative. The qualitative assessment of the benefits and disbenefits of different policy options (Connor, Bürger et al. 2009) for the support of RES-H carried out in the early stages of the project threw up a number of possibilities for instruments that might be applied in the UK.

1.5 Justification for the RHI from the outputs of the RES-H Policy Project

The models produced by the project as detailed in project deliverable D13. Some conflicting results do arise from the modelling outputs. The results produced for the domestic and commercial building sectors using the INVERT modelling process suggest the RHI can usefully drive forward uptake in those sectors, though they suggest the level of penetration will be contingent on whether prevailing energy prices are high or low. Higher prices will mean RES-H deployment much nearer to the target figures. The models have been updated to use the figures published in the latest DECC guidance on the RHI potential to drive, and the results of this is shown in Table 2.

	RHI, low energy price		RHI, high energy price		RHI + SO, low energy price		RHI + SO, high energy price	
Year	2020	2030	2020	2030	2020	2030	2020	2030
RES-H Total (TWh)	20.4	34.7	37.4	68.9	72.1	95.8	62.3	99TWh
Share RES-H	4%	9%	8%	17%	15%	23%	13%	24%
Billion € (annually)	1.7	2.7	2.9	5.0	4.7	6.9	4.6	7.6
Avoided GHG Emissions (Mt)	4.8	8.4	9.4	18.2	19.4	29.9	16.9	30.0

Table 2: Results of using the March 2011 DECC figures in the INVERT model

These outputs show that applying the RO will drive installation but even with high energy prices will not allow the UK to reach 12% RES-H penetration in these sectors. Low energy prices will see a very large shortfall and will likely make it impossible for the UK to reach its overall 15% renewable energy target for 2020. The baseline model suggests that stimulating deployment will require some form of financial subsidy.

The application of the RHI to the industry sector drives very different behaviour. The results from the Green-X model suggest that the RHI may not be necessary to drive industry uptake of RES-H if energy prices are high, but that it can provide a stimulus which drives growth by around an additional 50% of capacity if applied within a low energy price scenario.

This would suggest that the RHI will be essential but that particular care must be taken in regard of its application to the industry sector, since it is possible that it will provide rent to technology takers who would have made the investment anyway.

This suggests then that there is a case for another mechanism to drive deployment of RES-H in the domestic and commercial sectors alongside the RHI. A mechanism such as a Supplier Obligation because it compels deployment, and hopefully does so at minimum cost might be appropriate in ensuring that targets are actually met. While this would mean increased costs, it would provide much greater likelihood of the UK meeting its national target while driving significant contributions to reducing UK greenhouse gas emissions. An SO might also provide other advantages, for example, allowing public support to be more easily directed to a wider representation of individuals, including more vulnerable members of the public such as those in fuel poverty, rather than simply being captured by those individuals with the capital to invest in the RHI (Connor, Bürger et al. 2009).

Application of a Supplier Obligation to broaden the use of RES-H in the UK would require only a relatively small number of changes in the current application of the carbon Emissions Reduction Target (Ofgem 2011), though this might be politically difficult in regard of (i) supplier reaction and perhaps more significantly (ii) the political implications of the costs that would be associated with adopting the CERT on the scale required and the impact this would have on consumer bills. This is particularly significant given the recent decision to have the costs of the RHI met from general taxation rather than via consumer bills (DECC 2011).

The outputs of the model suggest an additional financial mechanism is not needed to stimulate RES-H uptake in industry.

It should be noted that while the financial subsides discussed here will be essential to growth in most circumstances, the models are built on assumptions relating to the rapidity of uptake, skilling up and the spread of awareness concerning the technologies and their effective use. To ensure that the rates are achievable, these goals need to be matched with policy initiatives that ensure that growth can occur at the necessary rates. Consideration of these ‘flanking’ policies is detailed in section 5.

2 Implementation of the Renewable Heat Incentive

The RHI is an actual policy and is currently in the process of implementation. Given that the purpose of this project is to assist Member States in selecting appropriate policy any assessment has to take care not to equivocate over what may be relatively minor details. The most fruitful position would seem to be one which considers the general findings of the project in informing good practice in RES-H policy and to consider how our findings might best inform the RHI as currently planned in both its phases.

The key aspects of the phase one RHI tariffs, applying from 2011 for the non-domestic sectors will be (DECC 2011):

- Support for a range of technologies and fuel uses including solid and gaseous biomass, solar thermal, ground and water source heat-pumps, on-site biogas, deep geothermal, energy from waste and injection of biomethane into the grid;
- Support for all non-domestic sectors including: industrial and the commercial sector; the public sector; not-for-profit organisations and communities in England, Scotland and Wales;
- RHI payments to be claimed by, and paid to, the owner of the heat installation or the producer of biomethane;
- Payments will be made quarterly over a 20 year period;
- For small and medium-sized plants (up to and including 45kWth), both installers and equipment to be certified under the Microgeneration Certification Scheme (MCS) or equivalent standard, helping to ensure quality assurance and consumer protection;
- Tariff levels have been calculated to bridge the financial gap between the cost of conventional and renewable heat systems, with additional compensation for certain technologies for an element of the non-financial cost;
- Heat output to be metered and the support calculated from the amount of eligible heat, multiplied by the tariff level;
- Biomass installations of 1 MW_{th} capacity and above will be required to report quarterly on the sustainability of their biomass feedstock for combustion and where they are used to produce biogas;
- Eligible non-domestic installations completed on or after 15th July 2009, but before the start of the RHI, will be eligible for support as if they had been installed on the date of its introduction;
- The Gas and Electricity Market Authority (Ofgem) will administer the RHI including: dealing with applications; accrediting installations; making incentive payments to recipients; and monitoring compliance with the rules and conditions of the scheme; and

- The RHI will be funded from general Government spending, not through the previously proposed RHI levy.

The current plan for implementation is to initiate phase one in July 2011 and phase two in October 2012, with the second phase pending a consultation over support provision. Phase two, once in place is currently planned to be backdated to provide payments for any RES-H system installed after July 15th 2009. Phase two will be preceded by a transition phase, the Renewable Heat Premium Payment (RHPP) which will give systems a one off payment prior to the initiation of phase two, with the aim of reducing the cost of purchase of new systems and ensuring that demand is not disincentivised in the period up to the introduction of phase two, it is currently expected that RHPP payments will being in July 2011. This is outlined in the RHI document published in March 2011.

2.1 Legal basis for the RHI

The adoption of the RHI requires primary legislation, and has already been included in the Energy Act 2008. A number of elements in the stated policy presented in the THI document of March 2011 (DECC 2011) suggest the UK Government is trying to move ahead with the RGI without any further recourse to primary legislation in order to avoid significant delays to the introduction of support. Any changes to the implementation of the RHI will require secondary legislation, including the introduction of the phase to provide support to the domestic sector.

It is notable that the RHI document emphasises the need to limit costs associated with the RHI and that all elements of its application will need to remain within the financial limits of the funds allotted to the RHI within the Comprehensive Spending Review (Footnote: It is notable that the RHI was only required to be considered as an element of the Spending Review as it was omitted from the agreement between the two political parties forming the current Coalition Government in the UK. This omission does not suggest that the RHI is a priority despite its central role in the UK's efforts to meet its 2020 targets for renewable energy.) While it is understandable for a Government to wish to place limits on policy, it must be noted that tariff mechanisms do not typically have an upper spending limit. It is a disadvantage of their application that since they have their basis in setting a price and allowing the market to set the volume that can be delivered at that price, that there is no obvious upper limit to the total cost of their use. Some limitation on the total cost can be enacted by modelling expectation of delivery of capacity against prices prior to implementation but this is no guarantee of actual delivery against price once implementation occurs. Other limits can be applied through regular reviews and through digression. The reason for the typical absence of a cap, and for the problems with limiting total costs following an unexpectedly high demand for tariffs is that a key advantage of the mechanism lies with the stability that it creates in terms of demand. This stability means investors enter the industry with some guarantee that demand will continue and that it is worthwhile for them to invest in manufacturing capacity, in developing supply chains and other costs such as staff training. Experience with support of RES-E across the EU has demonstrated that this stability is rooted in predictable guaranteed payments over time. It is essential to this stability that there

is little of no risk of payments being limited or reduced unexpectedly. Where the mechanism has potential upper limits, which are not transparent to stakeholders ahead of time, then there is increased risk, which implies increased capital cost and potentially discouragement of investors, slowing the rate of expansion of RES-H.

2.2 Barriers to the Implementation of the Renewable Heat Incentive

The advanced nature of the RHI means it is unlikely to face significant barriers to its adoption. It has the backing of the current UK Government and was the chosen instrument of the preceding Government, now in opposition, which should tend to mean little if any political difficulty. Perhaps the only codicil to this is that the current Government wish to limit the total amount of budget available to the RHI, which may have implications for perceived risk by investors and reduce long-term stability in the sector.

2.3 Stakeholder Response to the Renewable Heat Incentive

The RHI seems likely to be welcomed quite warmly by the various stakeholder groups relevant to RES-H in the UK.

The issue of certification has been raised by some stakeholders as a barrier to new companies entering the market and there does seem to be a need for Government to take action to ensure that achieving accreditation both as an installer and for products is simplified, whilst maintaining protection for both those purchasing equipment and for the taxpayer who will be funding the RHI.

The RHI will mean increases in the tax burden for all UK taxpayers. The previous Government had intended the cost to be met from a tax on energy consumers, effectively being passed on as part of energy bills. The new Government however has made the decision to have the cost met directly from the public purse, it can be assumed this is to avoid additional costs on bills leading to political criticism. While this is at odds with the polluter pays principle, it can be assumed that it will mean less political barriers to the adoption and long-term stability of the RHI. The UK does have some political groups who protest against the tax burden in general but this is unlikely to be a significant barrier to the RHI.

3 Interaction with the existing policy framework

The UK government has made it clear it is aware that there is potential for altering the current framework for incentivising renewable CHP through the use of discrete instruments for heat and electricity with the aim of achieving improved overall renewable energy use. Essentially this would herald a move away from treating heat output as waste. Currently, since only electricity is incentivised, operators will tend to produce only the minimum amount of heat required to meet the standards for Good Quality renewable CHP. Support for heat output under the RHI, or other instruments could change the incentives to operators and thus potentially their behaviour, specifically to increase use of the heat output beyond minimum standards. The initial consultation document for the RHI named some other issues to be considered in relation to the RHI, these included potential administrative and compliance costs and consistency with European law such as the Cogeneration Directive (DECC 2009). However the Cogeneration Directive is not considered in the recent RHI document (DECC 2011). The recent document does qualify the conditions pertaining to support of CHP under the RHI.

3.1 Instruments targeting the building sector

The UK has a system which uses separate building regulations and building codes. The UK building regulations are the source of technical building information. The code of practice relates to specific aspects of the design and production of the building and civil engineering construction in harmony with the EU standards. UK building codes comply with the EU Directive on Energy Performance of Buildings (Directive 2002/91/EC) Article 1 requirements. The UK has developed a specific code over time, the Code for Sustainable Homes (CSH) with the specific aim of engendering more 'sustainable homes', and which the Government wishes to influence the future direction of sustainability issues relating to new dwellings. The CSH has developed in parallel to the building regulations for domestic dwellings but became legally binding in May 2008 and was adopted England and Wales in May 2009. The CSH will become increasingly tough as regards energy efficiency, it delineates six separate ratings of sustainability for new dwellings, homes built in 2010 must achieve at least a rating of three, with this minimum increasing to four by 2013 and six by 2016. This last rating refers to what the government is calling 'zero carbon homes'. (Al-Hassan 2009; CLG 2009)

The CSH was changed almost immediately upon adoption in 2009 so it is difficult to comment on its long-term effectiveness as yet, nevertheless it will have significant implications for the quality of new dwellings in the UK in the immediate and long term future. The Government is concerned to ensure that the proposed RHI not conflict with other policy goals of improved energy efficiency, and that it does not provide incentives for exploitation of the mechanism without meaningful contributions to sustainable energy use. This effectively meant that new homes would have to have some amount of renewable energy generation associated with them – effectively a form of Use Obligation. However, in a budget announced in March 2011, the regulations for 2016 were

loosened, and there is now an expectation that not all energy use in new homes will have to be mitigated, even by the 2016 date.

Oversight of Quality of RES-H Installation

The Microgeneration Certification Scheme (MCS) is “an independent certification scheme accredited by the United Kingdom Accreditation Service (UKAS), which assesses installer companies and products against robust standards” (DECC, 2010). The goal of adopting the MCS is to enable provision of independent assurance and legitimacy to small-scale onsite energy installations, though it has received some criticism regarding oversight and administration on its initial adoption. The underlying aim is to provide quality assurance for investors in microgeneration technology and to protect consumers, taxpayers and energy users from abuse of support schemes. The MCS forms the basis for eligibility for grants under the Low Carbon Buildings Programme and for any microgeneration technology used under CERT. The UK Government proposed in February 2010 that the MCS will be used as the basis for accreditation for any small or medium RES-H technology to be eligible to receive subsidy under the Renewable Heat Incentive (DECC 2010).The current proposal of the UK Government is that the RHI will pay out a fixed tariff per estimated unit of heat energy generated by small and medium applications based on Building Energy Model (SBEM), for non-domestic buildings. It will also be informed by assessments related to the creation of Energy Performance Certificates (EPCs) for new buildings. SAP is currently used to demonstrate compliance with relevant building regulations in the UK. Both SAP and SBEM can be used to estimate the heat requirement for space and hot water heating, though this can be regarded as something of a blunt instrument, with the calculated outputs providing a rough and often inaccurate guide to actual needs. Neither methodology is appropriate to estimating heat loads in industrial situations. (DECC 2010)

The previous UK Government had concerns about the appropriateness of directly using the figures produced by an EPC in a new building in deeming heat loads relating to the RHI. All new homes constructed in England from 2016 onwards were to be ‘zero-carbon’ with the aim of requiring a high level of energy efficiency (similar regulations will apply in other parts of the UK, with different dates for adoption). The current Government has delayed this target to 2018 and suggests it will monitor the implications that the regulations will have for RES-H and for support offered under the RHI.

3.2 Global instruments addressing GHG mitigation

The introduction of any form of bonus mechanism aimed at supporting RES-H is certain to require State Aid approval at the EU level. The European Commission has considerable powers to monitor, control and restrict the forms and levels of aid given by all Member States to undertakings. The objective of State Aid control is to ensure that government interventions do not distort competition and intra-community trade. In this respect, State Aid is defined as an advantage in any form whatsoever conferred on a selective basis to undertakings by national public authorities. The State Aid rules apply to aid granted by the State or through State resources.

The UK CRC Energy Efficiency Scheme (formerly known as the Carbon Reduction Commitment) is a UK mandatory climate change and energy saving scheme, due to start in April 2010. The instrument is a form of 'cap and trade' mechanism aimed at forcing large public and private organisations to reduce their CO2 emissions; its stated goal is to impact on organisations outside the EU ETS. This scheme might overlap with the RHI and it has been pointed out that it might cause an unintended adverse treatment of renewable generators that are part of the EU ETS (REA 2009). The government has made clear that where 'renewable electricity receives financial support (under the RO or FITs), such electricity does not count towards compliance with the CRC obligations'. (DECC 2011)

4 Monitoring and evaluation

The Office of Gas and Electricity Markets (Ofgem) is the UK's regulator for the supply of gas and electricity. The adoption of the RHI will see it being made responsible for a number of roles as regards the operation of that support mechanism. These are to include:

- Accreditation: Ofgem determines eligibility
  - Pre-accrediting larger systems as appropriate
  - Reviewing applications
  - Checking eligibility
  - If the requirements are met, accrediting the system
- Registration of owners (via submission of proof of installation)
  - A central register will be maintained, containing data on all accredited systems.
  - Ofgem will obtain annual compliance declarations from participants.
  - Ofgem will also arrange for inspections, site visits and other checks as required.
  - Ofgem will prepare and publish annual reports on the progress of the RHI.
- Changes in ownership
- Making payments on a quarterly basis, based on metered output.
- Monitoring the operation of the mechanism
- Enforcement: Sanctions available to Ofgem include:
  - Suspending or withholding payment temporarily or permanently
  - Reducing payments and adjusting them retrospectively
  - Excluding participants from the scheme
  - Acting against certified installers who don't follow the rules
  - Prosecuting for fraud
- Data collection to be used in assessing RHI effectiveness

The multiplicity of roles to be undertaken by Ofgem in relation to the RHI is not without controversy and there has been criticism of the decision to place Ofgem in roles which are well outside its current range of competencies. Ofgem has announced that it currently considering proposals as to how it will address the administrative challenges associated with the RHI but has published no detail at the time of writing.

Monitoring Performance of the RHI

There are a number of elements of monitoring that might enhance the application of policy. The Government is proposing to gather performance data from installed RES-H devices as a qualifier for funding, depending on the precise nature of the information gathered this might mean more detail as to relative performance of each technology, the impacts of physical geography on performance by different technologies (for example, on solar thermal performance) and in relation to installed capacity. This information could inform future subsidy levels, allowing for more precise targeting of support in future and reducing excessive subsidy. It should allow for more accurate modelling of outputs against investment in subsidy with benefits for planning to meet national re-

newable energy targets. This will require a degree of transparency as regards performance data.

5 Flanking measures

While the project has modelled key financial instruments it is clear from the RES-E policy experience and from experience thus far with RES-H Policy (for example in Austria – see Egger et al (2009)) that rapid deployment of renewables energy technologies is best served by a coherent and co-ordinated policy package which contains different instruments which together aim to overcome the many different barriers which cam hinder uptake. Thus as well as financial barriers, policy should also address issues such as administrative hurdles, planning issues, availability of trustworthy information and education of stakeholders, quality of devices and their installation, identification of training deficits and encouragement of investment in skills by industry.

5.1 Additional Policy Measures to Support RES-H/C in the UK

Non-financial barriers: Apart from existing economic barriers there is a range of non-monetary barriers that hinder potential investors from investing in RES-H/C devices. For instance such barriers comprise legal or administrative hurdles, psycho-social aspects such as attitudes, preferences, fears, technical hurdles as well as information deficits and information asymmetries. In order to create a coherent policy framework a special focus needs to be laid on policy elements that specifically address these hurdles. Policy elements that proved to be effective encompass information measures (e.g. minimum information requirements for architects, planners, installers etc.), measures for awareness raising and motivation, training and education (e.g. for architects, installers). It is important to tailor these measures to the specific context and needs of the different target groups. Furthermore Member States should implement measures to overcome existing administrative barriers. This could be achieved e.g. by streamlining administrative procedures.

Efficient system performance: RES-H/C applications operate effectively only if they enjoy a strong fit with the overall system in which they are installed. For example, a ground source heat pump cannot deliver the desired performance if the respective building has an inadequate heating system and insulation. Support policies for RES-H/C must incentivise good overall system performance including the provision of energy efficiency, preferably as a precursor to accessing public subsidy. The initial consultation on the RHI attempted to apply a methodology which made available only enough subsidy to make RES-H economically viable in cases where it was located in premises with adequate energy efficiency. The revised RHI document specifically moves the RHI away from having a role relating to energy efficiency (DECC 2011, pp59). It is recommended here that a clear policy linking RES-H deployment strategy to energy efficiency should be established as soon as possible and preferably before the adoption of phase 2 of the RHI.

Importance of the current residential building stock: Turnover of residential building stock in the UK is roughly 1% annually (Roberts 2008) with no expectation that this will increase in the near future, thus the building sector in 2020 and even by 2030 will still be dominated by buildings in existence today. In addition due to building codes new

buildings have a much lower specific heat demand than existing buildings. For that reason support policies need to address two different target groups: (i) new buildings (ii) potential for RES-H/C in the current building stock. This needs to be considered along with the need for policy which accounts for RES-H/C at the same time as energy efficiency measures, as mentioned above.

Non domestic buildings: More than one third of building-related energy use is from non-residential building. Non-residential buildings often have different characteristics regarding thermal demand (e.g. higher cooling demand due to internal thermal loads) and demand profiles. Non-residential buildings also offer large potentials for the use of renewable heating or cooling devices. Therefore the support framework for RES-H/C should also provide elements that specifically address these potentials while taking into account heat load profiles. As noted below, the non-residential sector has a high penetration of air conditioning capacity and policy should consider whether this can be met with RES-C technologies whilst also considering RES-H, for example, through promoting the use of reverse cycle heat pumps.

Quality standards: While not required specifically by the 2009 Renewables Directive (European Commission 2009) it is apparent from previous experience with RES-E that some form of oversight of the quality of equipment installed is important and that this is likely to require regulation from Government where non-experts are taking a significant role in the deployment of RES. This involvement is inevitable in the deployment of RES-H since high penetration in the domestic sector is key to the UK meeting its targets for RES expansion. The UK Government has ruled that small-scale RES-H installations (<45kW$_{th}$) must be certified under the Microgeneration Certification Scheme (MCS) or an equivalent certification scheme to access government subsidies provided through the RHI (as well as the microgeneration feed-in tariff for RES-E). This is regarded by the UK Government as essential where the ability to meter actual outputs is not economically or technically feasible and a policy instrument must instead be based on either an estimated output or related to the capacity of the installation. It is felt that the absence of such a system risks the sale of shoddy equipment, with potential to undermine faith in the technology and long-term goals for displacement of greenhouse gas emissions.

MCS accreditation is required for both installers and installed equipment if the developer is to qualify for subsidy under the RHI. The MCS has however been criticised by various stakeholders involved in givng their opinions within the scope of this project for being too difficult and expensive for small companies to access. The Government might usefully consider how it might be reviewed to better support RES-H ahead of the introduction of phase 2 of the RHI in October 2012, at the latest.

Biomass Supply Chain: It is evident that the potential demand for biomass could easily outweigh the available resource. This will clearly have implications for the potential to increase the use of biomass in delivery of RES-H. The development of similar projects across the UK is predicted to similarly impact on local provision of biomass, it has been suggested that the available biomass resource in the UK will be able to meet only

5-10% of demand by 2014 with import of biomass to meet local demand the only alternative. For example, it was noted during the UK dissemination event for this project that a biomass burning CHP generating facility is currently being built in Scotland which it is estimated will require all the available biomass in Scotland and part of northern England. The UK Government needs to act urgently to enable clear supply lines of available biomass resource from overseas and must act to ensure that introduction of biomass into the UK for combustion purposes comes from certifiably sustainable sources and does not have deleterious effects on the economy and society of the provider. The UK government must also take into account that the UK will be competing with other EU Member States to source biomass in connection with their own renewable energy targets, and that will this significantly impact world prices with resultant complications for the cost of displacing fossil fuel combustion.

Transparency and Data Provision: A key recommendation of the RES-H Policy project is to encourage aggregation and dissemination of performance data from RES-H/C systems, to inform the policy process and consumer choice and to advance accuracy of reporting. The recent announcement of the RHI links provision of subsidy under the Renewable Heat Premium Payments (RHPP) to compulsory submission of data to the regulating body, in order to improve knowledge about performance. This is to be welcomed and the UK Government should ensure this reporting remains in the eventual RHPP and RHI documentation.

Training and Awareness: There is a need for Government to work with the private sector to identify training deficits likely to impact upon deployment across the range of RES-H/C technologies and to act to support the provision of training which best meets the needs of individuals and companies wishing to enter the RES-H/C market. It is likely that some technologies may be particularly retarded by the absence of particular skill sets relevant to that technology and these must be identified and incentives provided within the UK's current education sector.

Effective policy might include training for architects, installers and planners to improve awareness of RES-H/C technologies and how these might be better integrated into the design and development of new buildings and the refurbishment of older buildings. This will require a batch of different measures aimed at influencing the behaviour of different educational providers, from higher education institutions such as universities producing architects and other relevant technically capable graduates through further education providers and other skill builders.

It should be noted that stability of the national policy framework applied to support RES-H/C is likely to influence the behaviour of companies and individuals in making decisions about investment in staff training.

It was noted in both UK stakeholder consultation and dissemination that convincing potential adopters of RES-H/C that the technology is capable of delivering energy to meet their demand expectations may be a major barrier to adoption of the technologies. Essentially, the public need to be convinced that the technology works. This requires both public awareness campaigns and preferably, demonstration of working

technology, in situ, something that could be addressed through siting of installations in public buildings.

Public Procurement: The overcoming of concerns about both RES-H and RES-C technologies can be addressed through their installation in public buildings, and especially those open to the general public such that there use can be obviated to visitors. Such a policy would kick-start demand, creating a market for new technology and new skills, help to raise awareness of the technology and contributing to overcoming concerns about the applicability of their use. It is appropriate to stimulation of both renewable heating and cooling.

Broadening the Scope of RES-H/C Technologies: The RHI allows for subsidy of a limited list of eligible RES-H/C technologies (DECC 2011). It specifically renders some technologies ineligible. Work needs to be done to ensure that these technologies are adequately considered in terms of their potential to contribute to UK renewable energy and climate change targets and the steps needed to achieve this. The RHI document outlines RES-H technologies not to be considered in phase one or two but which might be possible sources in the future (DECC 2011, pp84). A key lesson of the RES-E policy experience is that less developed technologies can be more probably advanced in technological and commercial maturity by considering their specific needs rather than attempting to drive this with the same instrument applied to all technologies, regardless of their state of advancement (Foxon et al 2005). It is thus recommended here that DECC consider all possible support for these technologies, including R&D funding as appropriate, public procurement and other relevant options taking into consideration the particular characteristics of each technology.

5.2 Policy Measures Specific to Industry

Industry is a major energy consuming sector in Europe, and as such requires considerable policy attention. Measures for the long-term development of sustainable and renewable energy supply specific to industry are needed to ensure the achievement of targets for both renewable energy deployment and CO_2 emissions reduction. Some potential considerations specific to RES-H in industry are as follows:

Low Relative Energy Prices: Industry benefits from relatively low energy prices: large purchase contracts allow competitive pricing, relatively low tax levels are in place in many MS, and industry has access to lower transmission and distribution fees. This results in a difficult starting position for RES-H technology in displacing fossil fuels, as the relatively low prices make competition difficult. Penetration into the industry sector is further constrained by the higher requirements from industry for financial returns of projects compared to for example households. Governments need to recognise this in setting policy.

Strategic Benefits: Industrial application of RES-H offers the potential for a large capacity increase in a single development, equivalent to dozens or even hundreds of domestic scale installations, offering the potential for quicker wins. In terms of applied

policy this can also mean lower transactional and administrative costs. Industry can also have a higher and more consistent heat demand, making the economics of supply more viable.

Education & Awareness: The RHI as currently being introduced is specific to industry in many ways. Nevertheless the huge potential for displacement of fossil fuel heat generation in industry means that it may be worthwhile for the UK government to adopt some measures which specifically act to encourage adoption of RES-H technologies. As in other sectors, education and awareness of the opportunities may play a large part in stimulating interest in the technology, and the earlier this is done then the more rapid will be acceleration of the technology. Our models suggest that earlier action will allow for greater volume of capacity by EU target dates.

Pilot Plants: Awareness is best driven by sight of working plants and Government needs to move to rapidly identify opportunities for new technologies and to provide the additional support for pilot plants that may be required.

Using Roof Space: Large commercial and industry premises frequently are generally characterised by large amounts of roof space. These offer significant potential or solar thermal close to the point of use for lower grade heat.

Creating Market Environments: Governments have the potential to play a facilitating role in bringing parties together (residual heat, geothermal hot spots, concentrated solar thermal). This would ideally not be limited to facilitating more use of RES-H but would also include the potential for matching producers of waste heat to significant heat loads.

The European Union Emissions Trading Scheme: The ETS is likely to have only limited potential to drive RES-H through higher energy prices. Current CO_2 prices (15-20 euro/ton CO_2 with peak to 30 euro/ton CO_2, translated to 1-2 euro/GJ fuel) are too low for a substantial stimulation of renewable heat. Our modelling suggests CO_2 prices would need to be around 200 euro/ton CO_2 but this is not expected, and such a figure would have the potential for far more significant implications in terms of European competitiveness. Because the amount of CO_2 allowances is fixed renewable heat at an ETS location does not result in CO_2 reduction: the total cap remains unchanged (less CO_2 in country A means more CO_2 in country B). But of course the use of renewable heat in ETS-sectors will contribute to the renewable energy target. On the other hand, renewable heat, if not based on buying biomass, helps with ETS-risk management for industrial companies. An important risk of high CO_2 prices is scarcity of biomass through demand from the industry and electricity sector, resulting in higher biomass prices.

5.3 Policy Measures Specific to Renewable Cooling

Public procurement emerged as a key flanking mechanism to support the growth of RES-H in the UK and elsewhere. Given the comparative absence of experience with the technology in the UK it would make sense for the UK Government to support the deployment of some high profile RES-C installations. While researching this project it

became apparent that there is very little consideration given to the use of RES-C and little familiarity with the technology by potential installers. Large-scale, public facing deployment might help to increase awareness and to familiarise some key stakeholders with the technology. Penetration in the private sector is likely to require some form of subsidy to stimulate adoption.

Two potential areas where action might be directed where suggested as a result of the stakeholder consultation undertaken during the RES-H Policy project.

Air Conditioning in the Commercial Sector: While penetration of cooling or air conditioning of any sort is low in the domestic sector in the UK, practically all commercial premises have air conditioning installed. An increasing number of scenarios for the UK's development towards its 2050 sustainability goals predict that the UK will increasingly electrify its heating needs. Effectively this suggests large-scale implementation of heat pumps. The use of heat pumps for heating purposes can, with the use of reverse-cycle heat pumps also act to provide cooling. Consideration of the extra electricity that would be expended in driving the heat pumps to provide this cooling would have to be considered, as well as the expenditure of fuel displaced by the move from standard air conditioning units. The use of ground source heat pumps in this way, actually offers advantages, since warming of the ground when there is a cooling load will lead to an enhanced Coefficient of Performance when there is a heat load in colder parts of the year.

It should be noted that the UK scenarios for decarbonising energy supply also include a switch to heat pumps in the domestic sector. These could also be reverse cycle heat pumps, but it should be noted that where these are installed in homes, they would typically not be displacing existing cooling technology and instead represent a potential for 'comfort taking', and the expenditure of additional energy in doing so. Government must be careful in considering how any support instrument impacts uptake in this area when providing incentives for renewable cooling.

Refrigeration: Chilling of food requires the use of large amounts of energy for refrigeration. This offers significant potential for displacement of fossil fuel electrical generation by some form of RES-C technology, though appropriate policy might also consider the potential for the use of waste heat for cooling purposes via heat exchange.

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