RENEWABLE HEAT INCENTIVE FOR NORTHERN IRELAND

A REPORT FOR THE DEPARTMENT OF ENTERPRISE, TRADE AND INVESTMENT (DETI)

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Progress Note

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1. INTRODUCTION

In this note, we set out the progress we have made on a number of fronts since submission of the Interim Report, in developing our analysis. Rather than at this stage incorporating the material into the Interim Report previously submitted, we thought it easier to provide it separately, so that the new material is clearer. This will, however, be incorporated into the Draft Final Report.

We begin by providing information on the levelised costs of the different technologies which could potentially be eligible for use in Northern Ireland in meeting the 10% renewables heating target. This should be seen as very much a first cut of the data and will be subject to further refinement.

We then set out the scenarios and options that will form the core of the future analysis. In particular, we have worked up specific Northern Ireland Challenge Fund and longer term RHI options. It will be useful to receive feed-back on whether or not these adequately capture how DETI might see such option operating, given the assumptions made on beneficiary eligibility.

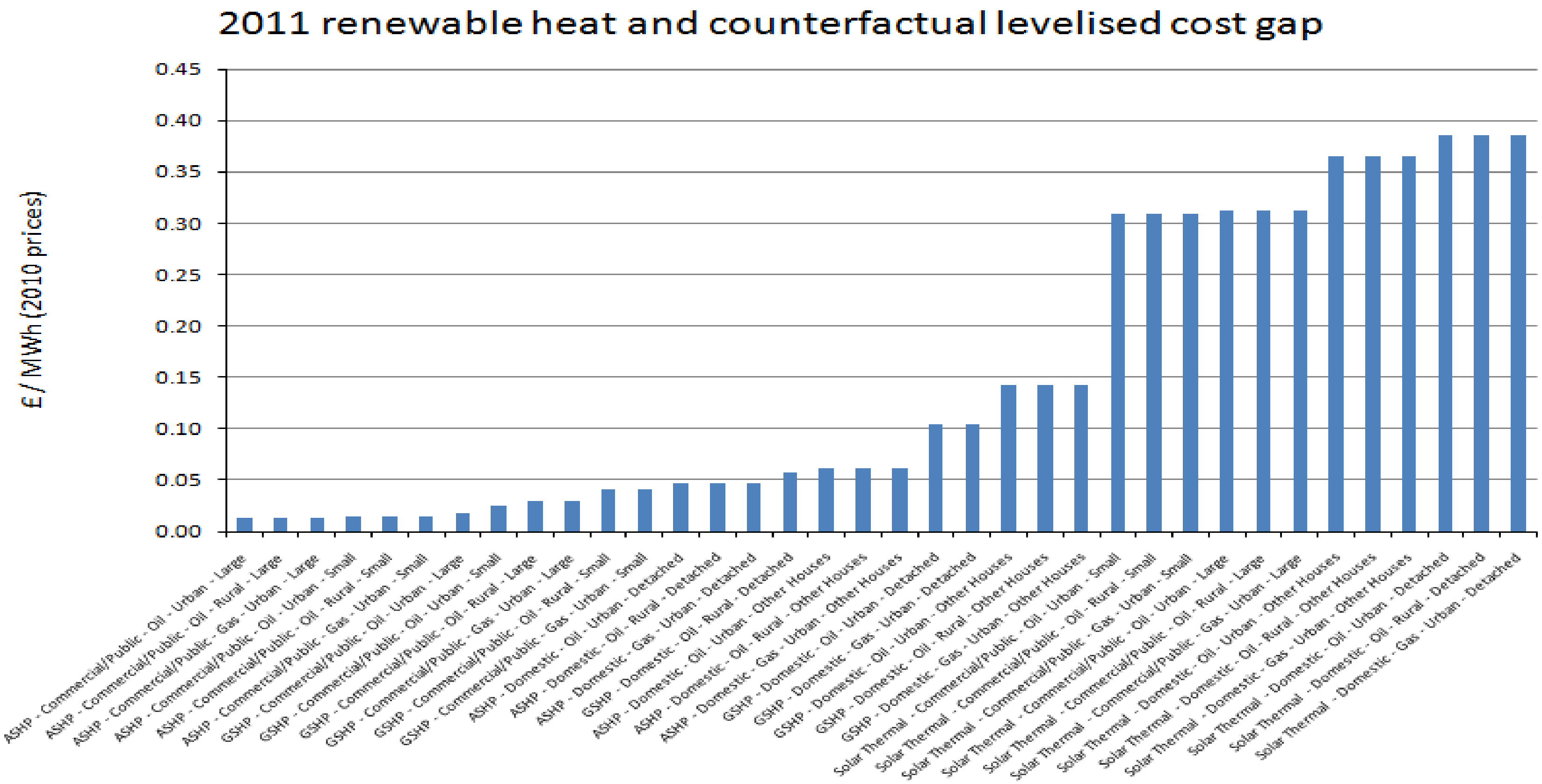
We then consider some of the factors that we will need to be taken into consideration in determining which approach to take. This involves both factors that might affect eligibility for support, including cost and availability of biomass and issues related to the roll-out of gas, as well as factors to be taken into consideration in evaluating administrative and competed allocations of subsidy.

Finally, in addition to summarising the next steps in our approach, we set out some of emerging views on the issues.

2. LEVELISED COSTS

Understanding the levelised costs of different renewable heating technologies is important as it provides an initial view of the levels of subsidies that are likely to be required to make them affordable. Figure 2.1 below shows the relative gap between the levelised cost of key renewable technologies and the relevant counterfactual, whether this is heating oil or gas. Whilst this is an initial first cut analysis, the main message from the chart is the high cost of solar thermal compared to other technologies.

Figure 2.1: Gap between levelised cost of renewables and counterfactual



3. OPTIONS AND SCENARIOS

3.1. Administered versus competitively allocated subsidies

As discussed in our previous report a key issue is whether any subsidy is awarded on an administered basis or whether it is awarded competitively. Eligibility for subsidy award, in terms of beneficiary and / or allowed technologies, will however be the same.

In administered approaches, the amount of subsidy awarded is fixed for a given type of technology (or beneficiary). Most of the recent support to renewables within the UK has followed the administered approach, although with separate bands to reflect differing technology costs. The specific form of support can involve a grant, typically paid in one go, or a series of payments over time, as in the case of a Feed in Tariff (FIT).

In competitively allocated approaches, the amount of subsidy award is variable (although often subject to an overall cap). Both FITs and grants can both be competitively allocated.

One approach to awarding grant subsidies, especially where there is a finite amount of subsidy available, is to establish a so-called challenge fund, where different bidders compete for the available subsidies. This involves inviting bids to which the available challenge funding is allocated and in which winning bidders are awarded grants[1].

3.2. Funding scenarios

DETI is currently facing a degree of uncertainty as regards the exact commitment of central government funding to the RHI. It is not clear whether funding will be made available beyond the initial allocation. As a result, DETI is concerned about entering into the twenty year commitments envisaged in the GB RHI, especially as the policy is for the funding of any such FITs to come from the Treasury – from where funds for that purpose need to be allocated through the budgetary process, rather than raised through a levy on customers.

As a result we have been asked by DETI to take forward our analysis in the context of two funding scenarios. The first of these is the initial £25m funding envelope, the second scenario is one in which the more long term funding is available.

In analysing options within these scenarios, the aim is to understand what might be achieved for the available funding as regards progress towards the 10% target, given some of the potential problems that might arise in achieving a widespread take-up.

3.2.1. Options to be considered

The challenge fund option is considered in both funding scenarios; however, in the more constrained scenario the alternative is an administered grant scheme, whereas in the less constrained one, it is a Northern Ireland specific RHI.

[1] It is possible to award FITs through a challenge fund, but this would be unusual as a challenge fund typically involves resources which are available at the time of competition. In contrast, a FIT involves the commitment of future resources.

The challenge fund and RHI approaches can be seen as elaborations of the two of the original short-listed options we presented – "bang for buck" and "NI RHI". The first of these options being a competitively allocated challenge fund, whereas the latter is large a Northern Ireland specific allocation of the GB RHI.

A key advantage of a challenge fund approach over the administered approaches is the flexibility that it has, not just in terms of accommodating different viability (affordability) gaps, but also in how it can be structured to be weighted towards particular beneficiary groups. It should help to access the cheapest available renewable heating options and to understand better the likely take-up of renewable heat technologies. A further advantage of challenge fund approaches, is that it is possible for them to evolve over time, in order to incorporate learning from previous competitions. Alternatively, a challenge fund can be used to determine what the required subsidy level is to achieve the desired objective, which can then be "hard-coded" within an administered approach.

However, it is essential to ensure that the approach does not represent a barrier to scheme take-up by being overly complex.

In the second scenario, we have considered how the assumed funding might be deployed through an NI version of the GB RHI. While we have taken the GB RHI as the basis of the NI RHI, we have not followed it in every respect. As noted in previous work for DETI[2], it would have significant deadweight losses if applied to NI.

In the next two sections we elaborate in more detail how Northern Ireland specific challenge fund and NI RHI FIT approaches might work, assuming that the focus in on a targeting households and businesses, whilst trying to minimise any competition with potential competition with a roll-out of the gas network.

[2] [reference to AECOM/ Pöyry report]

4. HOW A CHALLENGE FUND COULD WORK

In this section we present the outline of a "challenge fund" approach to delivering the maximum quantity of renewable heat for the £25m available – in other words, the most "bang for buck". The following section sets out our specific proposal for NI

4.1. A grant scheme

Without competition grants would be awarded on a first come first served basis for eligible beneficiaries and technologies. The main difference with a challenge fund is the lack of competition for the available subsidy.

4.2. Challenge fund competition rules

As challenge funds are competitions they need rules. The competition rules for the challenge fund should be designed so as to promote and safeguard the overall objectives of the fund. This can assist in the achievement of secondary as well as primary objectives (say a wide distribution of funding to different beneficiaries as well as achieving renewable heat generation targets).

The starting point for these rules is the basis on which the availability might be allocated and to whom – that is, who qualifies for entry into the competition. The rules can then be structured so that the subsidy is distributed in the desired way and in allowed amounts.

4.2.1. Eligibility

A first metric is to determine who is eligible to enter the competition. For instance, is the competition solely limited to households or is it also open to businesses? Furthermore, do households have to apply directly for the funds, or are intermediaries allowed to bid for funds too? It is also necessary to determine whether any renewable technology is excluded, *ex-ante*.

4.2.2. Competition frequency

Competitions can take place at regular intervals to help meet several objectives. First, this can reflect the availability of funding; that is, they can reflect government budgeting cycles. Second, by spreading competitions over time it allows for learning to take place. This can involve both greater awareness on the part of bidders of the existence of the competition as well as regarding the costs of technology and the required subsidy levels. Both of these factors are likely to involve a more economically efficient delivery of subsidy. Third, having regular competitions, allows the approach (that is the competition rules) to be adapted to take into account learning from previous competitions.

4.2.3. Structures of competitions

Whilst it is possible to have a sole competition, it is also possible to split this up into separate divisions. This can be done for several reasons, such as:

- **Beneficiaries**: Ensuring that all eligible groups have an opportunity to benefit from the scheme, even though some may be advantaged more than others (the equivalent of having different age groups in Blue Peter competitions). In theory, it would be possible to structure divisions along the lines of "households vs businesses"; and "single households versus multiple-household schemes".

- **Technologies**: Ensuring that different types of renewable technology have opportunities where different cost structures would mean that one would be likely to be so competitive on a "level playing field" type competition, that the other would not be able to access the available funds.

In considering such divisions, a number of issues arise. In particular, the competition becomes more complex with implications for its marketing and for its administration, although these should not be insurmountable.

4.2.4. Evaluation metrics

Different types of challenge fund have used different evaluation or ranking metrics. Often the approach has been to evaluate between bids for grants for different business plans. This can often involve a combination of technical and financial evaluation criteria. The more complex the competition the more expensive it is to administer, with for instance, the need for external experts to assist in understanding and evaluating bids.

Alternatively, the competition rule can be very straightforward, such a clear metric. In the case of renewable heat, the key metric could sensibly be the subsidy cost per kWh unit of output achieved, where the subsidy award takes the form of an upfront grant.

4.2.5. Caps

Whilst the main advantage of a challenge fund approach over that of an administered scheme, is the flexibility it provides in achieving a required return for investors, there should clearly be a limit or a maximum level of subsidy pay out, say per measure of output (such as £/per kWh of renewable heat generation as per the example above). This might be set in an *absolute* sense, at a margin over what calculations show it might have to be to achieve the desired investment, or in a *relative* sense, such a margin over the next bidder, or indeed as the lower of *absolute* and *relative* margins. However, structured, the caps implemented can reflect what the providers of the challenge fund are willing to tolerate as regards subsidy award, whilst providing a degree of flexibility that is greater than in fixed rule, administered schemes.

4.2.6. Maximum allocations

It is also possible to set maximum allocations to a given bid. This might be invoked in order to ensure a fairer distribution of the available funding. This can be set on a lifetime or per competition basis; the latter being most relevant to a situation where intermediaries were regular bidders in regulator competitions.

Table 4.1 illustrates how such an approach could work in terms of ranking based on £s per kWh of renewable heat generated for an assumed single subsidy pool of £1.5m, in which any bid is not allowed to be 25% more expensive on the chosen measure than the best bid.

Table 4.1: Illustrative challenge fund £1.5m competition

Bid rank	Bidder category	Subsidy bid £s	Cumulative Awared £s	Annual output kWhs	Ranking metric £s/kWh	*Excess over best bid*	Comments
1	ESCO	25,000	25,000	950	**26.32**	*na*	Qualifying bid
2	Household	2,650	27,650	95	**27.89**	*6.0%*	Qualifying bid
3	ESCO	25,500	53,150	900	**28.33**	*7.7%*	Qualifying bid
4	Household	1,500	54,650	52	**28.85**	*9.6%*	Qualifying bid
5	Housing scheme	100,000	154,650	3,450	**28.99**	*10.1%*	Qualifying bid
	Other	1,272,850	1,427,500				Qualifying bids
500	ESCO	30,000	1,457,500	930	**32.26**	*22.6%*	Qualifying bid
501	ESCO	42,000	1,500,000	1,299	**32.33**	*22.9%*	Qualifying bid
502	Household	3,000	**1,503,000**	92	**32.61**	*23.9%*	Exceeds available amount
503	Household	5,000	1,508,000	150	**33.33**	***26.7%***	Exceeds cap

4.2.7. Automatic re-entry

A further rule is where or not to allow bids that failed to secure funding in one competition, to be automatically re-entered for the next competition. The advantage of this is that there will always be bidders and if all the other competition rules set out above are followed, then there would not appear to be any major disadvantages in allowing this to happen.

4.3. An option for Northern Ireland

We have developed an option for how an initial competition might be structured in Northern Ireland. The Competition Rules have been designed to reflect a number of objectives, but in particular, to focus on areas where renewables are not in competition with the roll-out of the gas network.

The resulting rules are summarised in Table 4.2 below.

Table 4.2: Summary of proposed competition rules

Competition rules	Recommendation	Options/ variants to be considered	Comments
Frequency	Bi-annually	Quarterly	More frequent competitions to be considered where administration process has capacity to handle more frequent competitions
Sector eligibility	All rural households and businesses, including ESCOs. Industrial applications to be dealt with outside the competition	Could limit to houses meeting insulation criteria	To begin with, best to maximise potential take-up in target areas. However, address secondary aim of reducing competition to gas – therefore exclude areas to be met by gas[3]. ESCOs and other intermediary approaches should also be allowed where cost effective. Evidence from Reheat is that they deliver a significant proportion of the renewable heat deployed.
Technology eligibility	All household and commercial business based.	Specific exclusion of bio-fuels that could compete	Initial focus on households and smaller businesses rather than commercial sector

[3] It is possible that renewable-based heating will be less attractive in areas which anticipate a gas connection within a reasonable period of time.

Competition rules	Recommendation	Options/ variants to be considered	Comments
Evaluation metric	Annual kWh of heat produced per £ of subsidy		Evaluation metric takes into account grant based nature of the challenge fund
Cap	25% greater more than calculated cost	Reduce if found to be excessive	This should provide a reasonable degree of flexibility whilst not being excessive
Maximum payment	None initially	Limit to no more than [10%] of any competition	Limits can be imposed where it is deemed not acceptable for a single beneficiary to receive large proportion of funding available
Separate divisions	None initially	Consider single household versus intermediary	Any divisions need to be based on a firm rationale. Intermediaries should be considered where there is a potential for much greater take-up or where cash poor customers might be assisted.
Automatic re-entry	Yes		There are unlikely to be any issues that flow from this

4.4. Administration

There are two main issues regarding administration. First, how applications might be processed and second, on what basis actual payments would be made. On the whole, much of the bidding and other processes could be web-site based.

4.4.1. Scheme administration

Administration of the scheme should not be necessarily much more complex than an administered grant scheme. The main difference is that bids are ranked which involves dividing one number by another; that is, heat generated by subsidy cost. Bidders could be required to do this, or the scheme administrator could do so.

4.4.2. Subsidy payments

Ideally, any payments from the fund should only be made once the actual technology has been installed. For reasons discussed later, any approach should also aim to minimise any pre-funding costs to the beneficiary as this could act as a barrier to take-up. By pre-funding, we mean the beneficiary having to pay for the technology before the subsidy is received.

A way of structuring this is for the supplier of the technology to install it and then to receive payment from the challenge fund administrators. The beneficiary of the subsidy (say, household) would receive notifications from the challenge fund administrators that it had a winning bid. On the basis of this, it would contract with a supplier for installation, most likely making a down payment on the purchase. Once the equipment was installed, the beneficiary would pass the notification letter / subsidy voucher to supplier / installer who would then seek reimbursement from the challenge fund administrators. There is an option as to whether full or random physical verification processes would also be part of the process; for instance, the period between submission of the voucher and receipt of the payment might allow time for a verification which may or may not occur (but the supplier / installer would have to assume that this was highly likely).

5. How an NI RHI could work

The structure that we propose for the NI RHI is summarised in Table 5.1 below.

5.1. Approach overview

Table 5.1: Proposed structure for NI RHI

Aspect	Proposed NI RHI	GB RHI	Reasons for difference if any
Duration of payments	20 years		
Sectors covered	All, from the start	Non-domestic initially, with domestic included fully from 2012	Focus on industrial and commercial sectors could have negative impact on gas network roll-out, and only targets a little under 40% of heat demand. Difference in practice may be small since domestic installations are due to join GB RHI from 2012.
Technologies	As GB except (depending on analysis) excluding solar thermal	[List of technologies shown separately]	Will be based on detailed assessment of appropriateness for NI. Solar thermal has very high levelised cost.
Payment levels[4]	Small number of bands, each possibly covering multiple technologies	Deliver 12% return for each technology	Previous study for DETI showed significant deadweight losses with different incentives for each technology in NI. Experience of Reconnect suggests that there is a risk of over-incentivising more expensive technologies
Payment profile	Front-loaded for domestic[5] Flat, quarterly for commercial/ industrial	Flat, quarterly	Upfront capital costs a major barrier to domestic consumers, particularly those on low incomes
Metering/ deeming	Deemed for domestic, metered for industrial and commercial		
Delivery body[6]	Ofgem		
Treatment of energy efficiency	Buildings receive grants or incentive based on the heat requirement of a reasonably efficient building of that type		

[4] In both cases, solar thermal would receive a 6% return.

[5] For some technologies with significant on-going fuel costs, an additional stream of payments may be appropriate.

[6] We understand that DETI is confirming with Ofgem that Ofgem is content to be the delivery body for a possible NI RHI.

We set out below a more detailed justification for each decision – the vast majority of which are the same as for the challenge fund approach.

5.2. Rationale for suggested approach

5.2.1. Sectors covered

Excluding the domestic sector immediately removes the potential to address over 60% of heat demand, and could prevent consumers receiving the benefits of reduced on-going energy bills, for some renewable heat technologies.

Since extension of the gas network is driven by supplying industrial and commercial demand, moving up to a third of that demand to renewable heat could significantly harm the objective of further roll-out of the gas network.

5.2.2. Technologies eligible

Subject to the more detailed modelling, we may propose excluding technologies which are very expensive in the NI context – in particular, solar thermal.

5.2.3. Payment levels

Our overall approach has been driven by a desire to achieve the maximum possible renewable heat for a given level of subsidy. Subject to more detailed modelling, we may therefore propose to provide a flat rate subsidy for all technologies, or only a very limited number of bands. While this would result in some deadweight losses, it should be more efficient per unit of renewable heat deployed than a highly banded approach

We also note the lesson from Reconnect that providing more subsidy for more expensive technologies can lead to them being preferentially installed.

5.2.4. Payment profile

A payment profile which is front-loaded, or covers a relatively short period, has significant advantages compared to one that covers a relatively long period, particularly for domestic consumers. Firstly, it helps to overcome the large upfront cost of renewable heat equipment, and reduce the net outlay at the start. Secondly, because Government discount rates (from the Green Book) are low compared to household rates, two payment profiles can have the same net benefit for households, but one can be much cheaper for Government. The example below illustrates this, showing the net present cost to Government of providing what is the equivalent to the consumer of a £1,000 grant.

Table 5.2: Cost to Government of payment streams versus value to consumer

Payment profile	**Cost to Government at Green Book rates**	**Value to consumer at 12%**
20 years flat (GB RHI)	£1,902.74	£1,000.00
Flat 15 years	£1,691.04	£1,000.00
Flat 10 years	£1,471.91	£1,000.00
Half in year 1, then flat in years 2 to 10	£1,333.10	£1,000.00

The disadvantage is that funding requirements can be larger in early years of the scheme (but there is less need for long-term future funding).

5.2.5. Other decisions

We have followed the GB RHI approach in many respects. For example, we have followed the approach of setting the subsidy at a deemed level (either based on capacity or on output) based on what a well-insulated property of that type would provide. This gives appropriate incentives for energy efficiency measures (which can be very cheap and in many cases cost-effective), and avoids perverse incentives to generate additional renewable heat to receive additional subsidy.

6. ISSUES TO BE CONSIDERED

In this section we consider some of the issues that will need to be taken into account in the analysis. We begin by looking at the potential impact on the roll-out of the gas network, before considering the roll that may or may not be played by biomass and biofuels. Finally, we examine the difference between project returns and household returns which will need to be factored in – to the extent possible - to the analysis of administered and challenge fund approaches to subsidy allocation.

6.1. Gas network

Oil currently provides the majority of Northern Ireland's heating needs, and so in any realistic scenario that delivers the 10% target, there will be less oil heating in future. We expect however that there could be some take-up of bio-liquids, which could help to offset any reduction in demand for the oil supply chain.

We will also consider the impact of the renewable heat target on the rollout of the gas network in the two funding scenarios.

In the first scenario, because of the relatively limited funding, any impact on the gas network is likely to be limited. We will analyse the number of renewable installations that could be delivered by the £25m of funding, and compare this to the size of the gas customer base. Our expectation is that, even if uptake levels are as we anticipate, the number of renewables installations will be relatively small.

In the second scenario, one approach is to assume straight line growth from today to 2020, and make the simplifying assumption that, since gas and oil heating are roughly the same price, a gas customer is equally likely to switch to renewables as an oil customer, given a level of subsidy. If we were to assume that the 10% target was achieved by 2020, then 10% of customers that would have been on oil will have switched, as would 10% of customers that would have been on gas.

The exact impact on the present value of the gas industry's revenues depends on the discount rate chosen and assumed growth in gas connections, as well as on the other assumptions, but is of the order of 7-8%. Further analysis will consider the shift to renewables from gas in more detail.

This estimated impact may well be an over-estimate, since straight line growth is optimistic, and there are many other factors that go into the decision to switch from gas than the simple economics. We believe that there may be less switching from gas than the pure economic analysis suggests. On the other hand, significant shifts in the relative price of gas and oil, such as from the forthcoming gas price review, could move this conclusion in the other direction. A significant move away from gas could weaken the economic case for further extending the gas network.

In the light of this, and DETI's stated ambition to extend the gas network, we recommend that DETI considers, in the context of its wider objectives, whether it would be appropriate to restrict subsidies only to those domestic or non-domestic consumers that are unlikely to have the option of gas by 2020.

6.2. Biomass resource in Northern Ireland

We have analysed the biomass resources and prices that might be available to Northern Ireland. More detail is in Annex A, but the implications are set out below.

6.2.1. Implications for Northern Ireland

One of the key findings of the price analysis is that prices for wood pellets for heat and power are currently set within the international market and that other fuels are likely to follow this trend in the future. This means that for all biomass fuels that can be easily transported (such as processed wood fuels) international demand will set the market price. Consequently for fuels such as wood pellets, Northern Ireland bioenergy developers will find themselves in an international market regardless of whether they import fuels or not.

Conversely it is more likely that prices for fuels that cannot easily be transported, such as feedstock for anaerobic digestion, mixed solid wastes and some agricultural residues, will be influenced by local supply and demand factors. This will be important in the development of the proposed chicken litter plant in Northern Ireland, which will be influenced more by local issues related to alternatives for disposal of chicken litter than by international biomass prices. It is also possible that there will be a small local market for wood fuels such as logs and chips, in part because local foresters may prefer to develop a local supply and in part because some of the fuels are produced and used on site in industrial premises, outside of the biomass market (this use is more likely to be influenced by alternative fuel prices).

A number of UK developers have announced their proposals to develop large scale biomass electricity plants situated on UK ports and designed to import much of their biomass fuel demand. Examples of this are the Heron plant in development by Drax7 and the Prenergy plant at Port Talbot.8

There have been concerns that these plants will use scare UK resources, increasing prices for UK biomass fuels and preventing the development of local, small-scale plants. However, this is not necessarily the case. Work by Oxford Economics as part of the AEA (2011) study indicated that large-scale use of biomass will result in a global market for biomass and that the international market will set prices. Essentially the developers of these plants have realised that there is not sufficient biomass in the UK to adequately supply these plants are economic prices so they have looked for more plentiful supply from abroad. The analysis by AEA (2011) indicates that there are large resources of biomass in other parts of the world, notably north and South America, other European countries and Eurasia and non-EU Eastern European countries. There has been some speculation that these developments could stabilize the biomass market by allowing investment in the infrastructure required for processing and export and by developing suitable port facilities in the UK. This may result in better trading mechanisms for biomass, stabilizing supply in all markets and decreasing the risk in the market place. This remains speculation and has yet to be demonstrated, but these developments do show that the intention of the developers is not to threaten the fragile UK biomass market but to strengthen it.

[7] This is a 290MW plant being built at Immingham. The plant will use 1.4 million t/y biomass including energy crops, forestry and agricultural residues, recycled timber and recycled paper.
[8] This is a 350MW plant that will use around 3 million t/y wood chips and wood pellets from North America.

6.2.2. Impact on development of bioenergy in Northern Ireland.

An earlier AEA study (AEA 2009) indicated that the main areas for development of bioenergy in Northern Ireland were:

- the production of wood pellets from sawmill waste;
- the use of forest residues;
- the cultivation of energy crops, notably SRC;
- the use of poultry litter, MBM and tallow in a single plant;
- the integration of energy recovery into solid waste management, including energy from waste and landfill gas; and
- the use of livestock wastes and food waste in anaerobic digestion to produce biogas.

Many of these areas are relevant to heat as well as electricity generation.

In addition the Department of Enterprise, Trade and Investment have issued a Bioenergy Action Plan for 2010-2015. This has four objectives:

- To raise awareness and understanding of the benefits and opportunities of all forms of bioenergy within the public and private sector and wider community.
- To create and maintain a supportive and encouraging policy and regulatory framework within the bioenergy sector can develop and thrive.
- To encourage and support targeted investment in key areas of the overall bioenergy supply chain to stimulate growth.
- To continue to encourage focused and Northern Ireland relevant research into bioenergy and further work to address gaps in knowledge and identify future research actions.

As part of this plan DARD has launched the Biomass Processing Challenge Fund to support the purchase of various technologies that improve business efficiency and sustainability at farm level using cost effective and sustainable methods of processing agricultural wastes and other appropriate biomass material to generation electricity and heat primarily to support agricultural activities.

Using the findings of AEA (2009) as our starting point and taking the aims and objectives of Northern Ireland's Bioenergy Action plan into account, we have used the findings of AEA (2011) on the constrained biomass resource in the UK to examine the most promising bioenergy technologies for Northern Ireland. To the list provided above we have added the use of used cooking oil and tallow for biodiesel production. The results are shown in the table below. Whic shows the potential sources of bioenergy for Northern Ireland and the key constraints on its use. This indicates that long term policy stability, integration of the bioenergy resource with energy markets, and investment in infrastructure, facilities and equipment are all important to the successful establishment of biomass for electricity and heat generation in Northern Ireland.

Bioenergy relevant to Northern Ireland	Key constraints on supply – from AEA (2011)	Comments
The production of wood pellets from sawmill waste	Incomplete or immature supply chain Volume of residues available Aggregation of supply from dispersed sources; inertia or disinterest among potential suppliers Bark content Achieving high quality required Sustainability certification requirements.	Balcas has already demonstrated the potential for wood pellets in Northern Ireland. Elsewhere in the UK there is a shortage of wood residues suitable for energy use, particularly where there are bioenergy plants. The bioenergy Action Plan states that further engagement with the sawmill sector is envisaged.
Forest Residues	Lack of harvesting, storage and drying facilities Inertia/disinterest by forestry sector Need for long term policy stability Achieving appropriate moisture content Difficult terrain for site access.	AEA (2011) assumed that 50% of residues are left in the forest for biodiversity and other reasons. Site access is a significant issue in parts of the UK. DARDNI have grant available to support forestry processing and marketing to support the forestry supply chain. There is also support under the Woodland grant scheme and Farm Woodland Premium scheme. DARD forest service is aiming to increase forest cover in Northern Ireland as outlined in its Forest Strategy. DEAR is also exploring ways to decrease barriers to woodland creation.
Cultivation of energy crops	Main constraint is availability of material and equipment for planting, which constrains rate at which energy crop area can be expanded. Insufficient funds for the establishment of energy crops compared to food crops. Perception of risk and uncertainty: insufficient margins compared to alternative crops; inconsistent yields. Lack of technology providers for harvesting and collection Location of resource compared to fuel demand. Proliferation of and cost of sustainability certification schemes.	AEA (2011) assumed a rate of planting for energy crop which restricted the contribution to 2030. Northern Ireland would be affected by this constraint. DARD already supports energy crops to the maximum allowed by regulation.
Use of poultry litter, MBM and tallow	Dispersed nature of resource For poultry litter public perception of the combustion plant is likely to be a significant constraint.	Tallow from Northern Ireland is currently exported to UK There are plans to develop a 30MW poultry litter plant
Integration of energy recovery into solid waste management, including energy	Development of energy recovery is very dependent on waste management policy. Wastes are often tied to long term waste management/disposal	Lack of large scale landfill sites will limit the development of landfill gas in Northern Ireland. It is unlikely that landfill gas will be used for heat. However, there is potential for use

Bioenergy relevant to Northern Ireland	Key constraints on supply – from AEA (2011)	Comments
from waste and landfill gas	contracts. Landfill gas likely to decrease as diversion of biodegradable waste from landfill increases. Public perception of energy from waste is poor. Perception of risk and uncertainty is high. Strong policy preference for recycling.	of heat from energy from waste, providing suitable local heat loads can be identified. Bioenergy Action plan notes the need to reassure the public and elected representatives about bioenergy projects – and energy from waste in particular.
The use of livestock wastes and food waste in anaerobic digestion to produce biogas.	Perception of risk and uncertainty. Perception of low returns: requirement for substantial upfront investment. Current disposal is relatively straightforward. High water content of some feedstock makes transport expensive. Integration into energy markets may be expensive or difficult.	Many constraints are likely to be specific to the local region and this is true for Northern Ireland. Often the feedstock is available in areas where energy demand is low. Integration of the two is important for success. DARD is proposing to establish an Anaerobic Digestion Portal in liaison with NNFCC and Defra.
Used cooking oil and tallow for biodiesel.	Incomplete or immature supply chain Investment needed to bring household resource to market For Northern Ireland there may be competition for the resource from biodiesel producers in GB.	In the UK the market for UCO is driven by the biodiesel industry. The Renewable Fuels Agency (RFA) provides information on prices for UCO, which show prices between £250 and £550/t. The RFA reported an increase in the number of companies using UCO to supply their Renewable Transport Fuel Obligation in 2009-10 compared to 2008-9. There may be opportunities for Northern Ireland to uniquely use bio-liquids from these sources as heating fuels, but there may also be competition for this UCO resource from elsewhere in the UK.

6.3. Bioliquids resource

In our view, bio-liquids can provide a useful if small contribution towards renewable heat in Northern Ireland however other renewable heat technologies will be important in ensuring renewable heat targets are met. NI has an estimated UCO resource from domestic and catering sources of 7,200t/y, which could produce 6,300t/y biodiesel. This is 0.7%of the domestic energy demand currently met by oil. To meet 10% of the energy demand met by oil in domestic households in NI would require 89,000t/y biodiesel, which would require 94% of the UCO currently collected in the UK. There is potential to double the collection of UCO in the UK, but this would require large scale domestic UCO collections.

6.4. Financeability and limits to the use of project hurdle rates

The starting point for our analysis of subsidy has been to establish what is required to provide a given project return for different technologies, given differing oil or gas counterfactuals. However, the take up of technologies by household is more likely to be determined by household rather than project returns.

However, household returns will be determined by the specifics of given households, such as through their ability to borrow, which will affect their returns. This is a particular issue for FITs and will also be important for administered grants, depending upon what proportion of overall costs might be accounted for by a given grant amount. This suggests a larger role for challenge fund approaches which can accommodate these differences, although modelling such differences will be challenging.

6.5. The return on renewables investment

The methodology used to determine the required subsidy for a given renewable investment inputs a target project return (12% on most types of investment), establishes the levelised project costs and then the revenue required – comprising any savings on the "technology" replaced, such as heating oil – and any subsidy required to achieve the project return (that is, a positive net present value once net cash flows are discounted by the target return).

This overall project return is, however, based on pre-financing cashflows, irrespective of whether or not these cashflows are sculpted to increase the return, reflecting the time value of money (that is, cash today, is worth more than cash tomorrow). Through discounting, a smaller upfront grant payment as opposed to a flow of FIT payment paid over time, which are amount to more before discounting, can produce the same project return post discounting.

It is, however, the post financing cash flow – that is after any borrowing interest and repayments which are taken into account, which will determine an investor's equity return. This may need to be significantly greater than the project return[9].

6.6. Ability to finance

The equity return is an important aspect of a project investment's financeability from the equity investor's perspective. Financeability also means the ability of households to finance their investment in renewables heat, whether through investing their own money as equity, or whether they borrow to finance the investment. The greater the extent to which an investment is financed through debt, that is leveraged, the greater the equity return will be. Moreover, it is very possible that many households would be willing to contribute to such investments, but they would either wish or need to borrow to finance the rest of the investment. Thus, the ability to borrow will determine whether or not households are able to invest in renewables heat generation and the returns that they can make from investment.

[9] In corporate financing theory, the appraisal and the financing decision should be kept separate. The former establishes whether a project is viable – ie it achieves a required hurdle rate – whether, its financing structure will determine the equity IRR (that is, the level of equity return).

The ability of households to borrow, will largely be determined by household disposable income as this will be taken into account in the credit decision of whoever lends to them to finance the investment. In reality, most households will have a "credit headroom" which will be determined by their income; whether or not they choose to utilise this on such renewable heating investments is a further issue.

Taken together, however, the household investment decision will take considerably more into account than just a project's return. This may be particularly sensitive to specific household circumstances and might be difficult to determine ex-ante. By incorporating a degree of flexibility into the determination of subsidy for renewable heating, is likely to result in a wider take up. Balancing this flexibility with competition for the available subsidy, will help to achieve better value for money and efficiency in subsidy delivery; (that is, not paying more subsidy than is required to achieve a given objective).

7. NEXT STEPS AND EMERGING VIEWS

Our aim over the next few weeks, now that we have cost information, will be to examine how the different options might work under the different funding scenarios.

This will involve refining the options, in terms of beneficiary and technology eligibility reflecting both our own findings and the views of DETI. We will then analyse the options to see which might be preferable under each funding scenario. Much of this will to involve attempting to evaluate the possible benefits of competitive subsidy allocation over fixed, taking into account the potential household financeability issue discussed in Section 6.

However, our ultimate recommendation to DETI will take into account the nature of the funding envelope which could rule out a specific Northern Ireland RHI as an option. Where DETI does not have a sufficient degree of comfort about continued funding beyond 2015, we see no alternative to some form of capital grant scheme, whether this be administered or competed. Before conducting any detailed financial analysis, we believe that there are some strong prima facie arguments in favour of a challenge fund along the lines of the proposal in Section 4, given the uncertainties about what actual take-up of technologies will be, and at what subsidy requirement. Our proposal will of course be subject to consultation.

In the case where DETI does receive sufficient comfort on continued funding, there are still arguments in favour of a challenge fund, at least initially so as to help establish what levels of subsidy might be required for take up of the initiative. However, we will also be likely to recommend that DETI consults on the option of moving to a NI version of the RHI over the long term, along the lines set out in Section 6.

In any scenario where renewable heat is incentivised, there may be some switching from current or potential future gas customers to renewable heat. On purely economic grounds, this is to be expected, as the costs of oil and gas heating are similar and so any subsidy that provides enough incentive to switch from oil to renewables is also likely to provide an incentive to switch from gas. There are many other factors that go into the decision and so we believe that there may be less switching from gas than the pure economic analysis suggests. This ignores any consideration of possible fuel price rises, which could move the decision either way. The important point for our purposes is that any significant move away from gas could weaken the economic case for further extending the gas network.

In the light of this, and DETI's stated ambition to extend the gas network, DETI might want to consider whether it would be appropriate to restrict subsidies only to those domestic or non-domestic consumers that are unlikely to have the option of gas by 2020. This is ultimately a policy judgement for DETI to make in the context of its wider objectives.

ANNEX A: BIOMASS RESOURCE

A recent Study (AEA 2011), supported by DECC, examined the biomass resource available to the UK to 2030, taking constraints on supply into account. This study examined both domestic UK supply and internationally traded biomass.

For the UK it examined the resource available across the whole of the UK, without splitting the resource into regions, so there is no Northern Ireland-specific data. However, the information on constraints and the need to factor these constraints into supply estimates is relevant to Northern Ireland.

For global supplies the report indicates the amount potentially available for import into the UK. This resource could be brought into any suitable port, although facilities for storage, handling and onward transport will be important.

The methodology used in the study is summarised in Box 1.

Box 1 Principles of methodology used in UK and global biomass study

For UK resources:

Resources considered: energy crops, agricultural residues, forestry residues, stemwood, sawmill co-products, arboricultural arisings, sewage sludge, livestock manures, waste wood, renewable fraction of wastes, landfill gas and crops used for first generation (1G) biofuels.

The first step in this analysis was to define the total UK resource of each biomass source. Constraint analysis was then applied to this, by considering alternative markets (and the degree to which these are price dependent), market, policy, infrastructural and technical constraints and the effect these have on the total resource. This analysis provided a constrained resource. The next step examined the difference that price or time might make to the availability of the resource and provided an indication of the total resource available at a range of prices.

For global resources:

Only tradable resources were considered, including wood fuels (including energy crops), agricultural residues and liquid transport fuels. The world was divided into regions and best available data for each biomass source for each region was considered. Total resources available were estimated, and then constrained according to infrastructure required for export and the market for the biomass in country. The land available for energy crops was estimated from information on land use. The amount of biomass available to the UK was considered under a range of scenarios which included investment scenarios, the impact of high demand for biomass and the impact of sustainability standards.

A number of the results of this study are relevant to the use of bioenergy in Northern Ireland. The study showed that there are some generic constraints that are important to the supply of biomass across the UK. These include factors that influence the market and investor confidence. The report also found that there were two key ways to stimulate increased supply of bioenergy resources:

- By addressing constraints considered to be easy or moderately difficult it is possible to significantly increase in the amount of resource available. For example, it was estimated that the resource available in the UK in 2020 was around 450PJ/year at £4/GJ if constraints considered to be easy to address were removed; addressing moderately difficult constraints results in an increase to biomass supply equivalent to 530PJ/year at this price.

- Increasing the price that can be paid for biomass increases supply – using the example above, increasing the price to £10/GJ did not result in a significant increase of biomass available in 2020; but addressing easy and medium constraints and increasing the price to £10/GJ resulted in an increase to 590PJ/year.

This shows that at low prices overcoming constraints are important in developing the supply side of the market and that the impact of increased prices, while significant, is less pronounced. Other key conclusions were:

- A proportion of many UK feedstocks is available now and at a relatively cheap price, but to develop their full potential considerable investment in collection, processing, logistics, transport, storage etc. is required.

- For some feedstocks the perception of risk and uncertainty associated with the market means that potential suppliers are hesitant to invest in the infrastructure required. Higher prices would enable a better return to overcome these issues, although, fundamentally, secure market demand is required.

- For some feedstocks there are competing uses, which are price dependent. These feedstocks will not necessarily go to the bioenergy market unless the price is right.

Box 2 summarises the most important common constraints on biomass supply.

Box 2 UK and global biomass study: Key constraints
The following were found to be the factors common to most feedstocks that need to be addressed to improve biomass supply:

Policy constraints – a secure, long-term policy framework is required to provide confidence to the market. For some resources other policy, such as environmental policies (for waste) and agricultural policy (for crops) influence availability.

Market constraints – the current 'immaturity' of the market is important in influencing investment in supply by adding *risk* and *uncertainty* to the cost of developing bioenergy, both of which increase the cost of finance.

Technical issues – were not found to be very significant, although investment in crop yields could make a significant long term differences to supply and price; and investment in better harvesting, processing and drying technologies may improve quality as well as supply.

Infrastructural issues – investment is required to enable the collection, storage and transport of feedstock, as well as basic harvesting or fuel preparation infrastructure. For imported supplies, infrastructure at ports can be important. For UK supplies processing, transport and storage are all important.

Key UK biomass resources

The results for the UK analysis indicated that the full range of biomass resources is needed to achieve maximum UK supply. However, some resources dominate supply. Currently these include landfill gas, wood residues, agricultural residues, food waste for anaerobic digestion and crops for biofuels. In 2020 other resources also become significant such as the recovery of the renewable content of solid waste and an increase in forestry products. Short rotation forestry is not a significant resource before 2025. Biodiesel from tallow and used cooking oil makes a small but significant contribution which does not increase with time.

Global resources

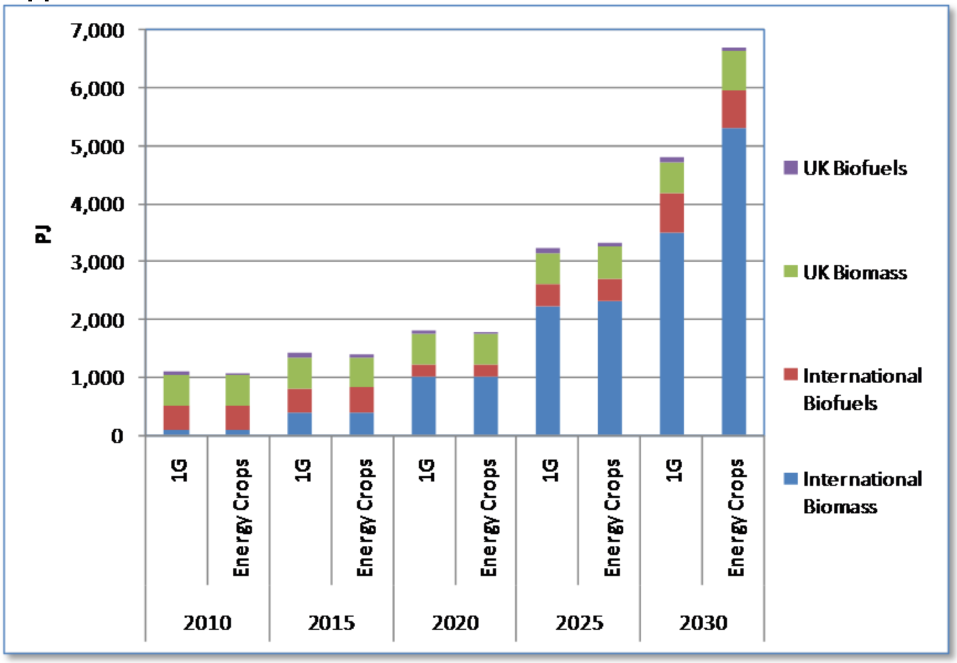
A number of the global resources results may be important if biomass supply is imported for Northern Ireland. The first of these is that the UK as a whole cannot achieve its ambitions for bioenergy, even given investment in addressing constraints, without importing biomass. This fact has been recognised by biomass developers across the UK, many of whom are considering imported supply for large-scale biomass plants.

The second important finding is that the major part of the international resource in the future is from the use of land to grow energy crops. In reality this may also include the use of land for fast growing forestry plantations, similar to those already used to supply chip to the paper and pulp industry in South America and Australia.

Furthermore, a large proportion of the current international resource (i.e. forestry and agricultural residues) is widely dispersed and not easily accessible for the international market. Thus, while there are considerable resources in theory, in practice investment is needed to enable the resource to be accessed.

The graph below shows the development of the resource with time at £10/GJ with easy and medium constraints addressed.

Figure 1 Example of results obtained for biomass resource available to the UK with land use maximised for first generation crop production (1G) or for energy crops such as short rotation coppice.



Biomass prices

Biomass prices were examined for both heat use and for electricity generation. For heat use biomass prices were related to wood fuel. The report provides range of prices depending on whether or not the fuel is delivered in bulk or bagged, the quantity delivered and the quality. Prices were estimated from market sources and suppliers and for 2010 and 2020 prices for wood fuels for heat were estimated to be:

Bioenergy price forecasts for wood pellets (£/GJ)

	Current			2020			
	Low	Central	High	Low	Central	High	Very High
Bulk	11	12	13	12	13	15	17
Bagged	13	15	17	15	17	19	21
Overall	12	14	16	14	15	18	19

Bioenergy price forecasts for wood chips (£/GJ)

		Current			2020		
			High			High	Very
Domestic (inc. VAT)	6	7	9	6	7	10	11
Industrial/ commercial (exc. VAT)							

Prices for large-scale electricity fuels are more variable and depend on the biomass feedstock, the degree of processing required and the method of transport. Only 2010 prices were provided, but these do give an insight into current market prices. These prices were obtained from suppliers and developers in the UK. These prices tend to be set in negotiation between generators and their suppliers. Long term contracts are likely to be negotiated as floor and ceiling prices, with annual negotiations to determine the actual price, which will be dependent on issues such as inflation, prices for biomass in competing markets, the price of alternative sources of energy etc. Prices for biomass fuels at the power station gate as provided in the report are:

2010 prices £/GJ	Low	Central	High
Prices for large scale power generators			
UK wood feedstocks	6	7	8
Imported wood feedstock	7.5	8.5	10
Energy crops	3.5	7	8
Agricultural residues (UK)	0.5	2.5	4.5
Mixed solid wastes	-12	-8	-4
Waste wood	-2	1	3
Solid recovered fuel (SRF)	-6	-2	1
Wet feedstocks for anaerobic digetstion	-10.5	5	11