THE DEPARTMENT OF ENTERPRISE, TRADE AND INVESTMENT AND NORTHERN IRELAND AUTHORITY FOR UTILITY REGULATION

DETERMINATION OF THE APPROPRIATE FORM OF SUPPORT FOR INCENTIVISING THE DEVELOPMENT OF RENEWABLE ELECTRICITY GENERATION IN NORTHERN IRELAND

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Final Report

VOLUME A

Submitted by:

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EXECUTIVE SUMMARY

This report, commissioned by the Department for Enterprise, Trade and Investment (DETI) and the Northern Ireland Authority for Utility Regulation (NIAUR) and produced by Cambridge Economic Policy Associates (CEPA) and Parsons Brinkerhoff (PB), assesses alternative policy options for supporting renewable generation in Northern Ireland (NI) in the context of the Single Electricity Market (SEM).

The UK has signed up to binding targets for the proportion of energy sourced from renewable generation technologies and is committed to reducing carbon emissions. NI has the potential to make a significant contribution to the achievement of the UK's renewable electricity targets.

The primary tool for supporting the development of renewable electricity generation in NI is currently the Northern Ireland Renewables Obligation (NIRO). The NIRO operates in parallel with the Renewables Obligation (RO) in England and Wales and the Renewables Obligation Scotland (ROS) to incentivise the development of renewable electricity generation in the UK. The RO places a legal requirement on electricity suppliers to source a set and increasing proportion of their energy requirements from renewable sources in the form of Renewable Obligation Certificates (ROCs) or to pay a buy-out fee for any shortfall.

The UK renewables obligation, which determines the demand for ROCs by UK electricity suppliers, is equal to the sum of the renewables obligation size in NI and respective schemes in Scotland, England and Wales. The supply of ROCs is determined by the total volume of renewable generation in the UK, and banding[1] assumptions for different technology groups under each of the respective schemes. The value of a ROC is determined by the interaction of the demand and scarcity of supply of ROCs on a UK-wide basis.

The RO (for which the NIRO is a constituent part of) can be best described as a obligation or quota based renewable generation support scheme which in essence creates a market for renewable electricity in the UK.

Recent changes in the way Great Britain (GB) supports small-scale renewable generation, most notably the introduction of a feed in-tariff (FIT), and the presence of a FIT in the Republic of Ireland (RoI) (which is relevant given the presence of the Single Electricity Market) have led DETI and NIAUR to question whether the NIRO continues to remain fit-for-purpose in incentivising the development of all sizes and types of renewable generation in NI and realising energy policy goals.

NI has a series of unique characteristics which mean that it may be inappropriate to simply duplicate an existing support mechanism. For example, the nature of land use means that the potential for the development of certain generation technologies is greater than may be the case in GB, and the level of development of networks mean that renewable generation creates different challenges. Equally the single market structure means the interaction between the support mechanism and market operation needs careful consideration, and

[1] Banding is a means of supporting specified generation technologies by entitling them to receive more or less than a single ROC for each unit of electricity they produce.

economic factors, such as the relatively higher levels of fuel poverty in NI than GB, mean that costs to customers are an important consideration.

This report assesses a range of options for supporting renewable generation and identifies, through a combination of quantitative modelling and qualitative assessment, which would be expected to best facilitate the achievement of NI's policy goals for renewable electricity generation to 2020.

Terms of reference

The report's terms of reference require detailed consideration of:

- The overall costs associated with the operation of the NIRO in the context of the RO highlighting the economic benefits and limitations or differences that may constrain its effectiveness.
- The issues and overall costs of the operation of the NIRO with the SEM , given priority dispatch and the interaction with the RoI FIT mechanism.
- The impacts and costs of mirroring the proposed changes to the GB support mechanisms, including those for small scale generators.
- Options to 2020, including NIRO and FIT, for NI's renewable support mechanisms, including the appropriateness of a separate mechanism for small scale generation in NI.

We have sought to address each part of the terms of reference by identifying a series of key issues and questions relating to the appropriate choice of renewable generation subsidy in NI, summarised as follows:

- In respect of the NIRO:
    - What is the cost of the NIRO in its current form and what volume of renewable generation would the NIRO be expected to deliver in NI by 2020?
    - How do costs to NI customers and levels of installed capacity change under feasible amendments to the design of the NIRO (in particular, amendments to the level of the NI obligation and levels of banding)?
- In respect of large-scale generation:
    - What would be the impact on NI consumer costs and deployment of renewable generation capacity of introducing an alternative support mechanism to the NIRO?
    - How do these outcomes compare to those under the NIRO?
- In respect of small-scale generation:
    - What are the costs of small-scale and micro generation and the potential level of subsidy needed to stimulate development?

- What are the relative costs of alternative options to supporting small-scale renewable generation?

The study also specifically considers the impact of subsidy choice on the operation of the Single Electricity Market and assesses the wider factors which need to be considered (alongside the level and design of financial support) in deciding on an approach to supporting either large- or small-scale renewable generation.

Costs and impacts of the NIRO

As the existing support mechanism in place in NI, assessing the costs of the NIRO is paramount in developing a baseline against which to consider alternative options. Table A1 shows the cost to NI and GB consumers of the current NIRO and RO regimes measured in a number of ways, which capture consumer costs in 2020.

As well as considering the direct costs of the support mechanism (costs of subsidy only), it is also important to consider the total costs which customers pay for renewable electricity generation (costs of subsidy and wholesale electricity). From a customer's perspective, it is the total energy bill, rather than the components which make it up, which are important. Annual NI consumer costs, including and excluding the wholesale cost of renewable electricity generation, are shown in Table A1 below.

Table A1: Annual costs GB & NI consumers under the Base Case in 2020

Metric	Unit	Cost to NI consumers	Cost to GB consumers
Costs of subsidy			
Annual consumer cost in 2020	£m	64.6	5,481.1
Consumer cost in 2020 (per unit of renew. electricity generated)	£/MWh	15.10	53.70
Consumer cost in 2020 (per unit of electricity consumption)	£/MWh	6.40	15.80
Costs of subsidy and electricity			
Consumer cost in 2020	£m	414.1	13,672.0
Consumer cost in 2020 (per unit of renew. electricity generated)	£/MWh	96.80	133.80
Consumer cost in 2020 (per unit of electricity consumption)	£/MWh	41.00	39.50

Note: all costs are NPV, net present value.

Source: CEPA

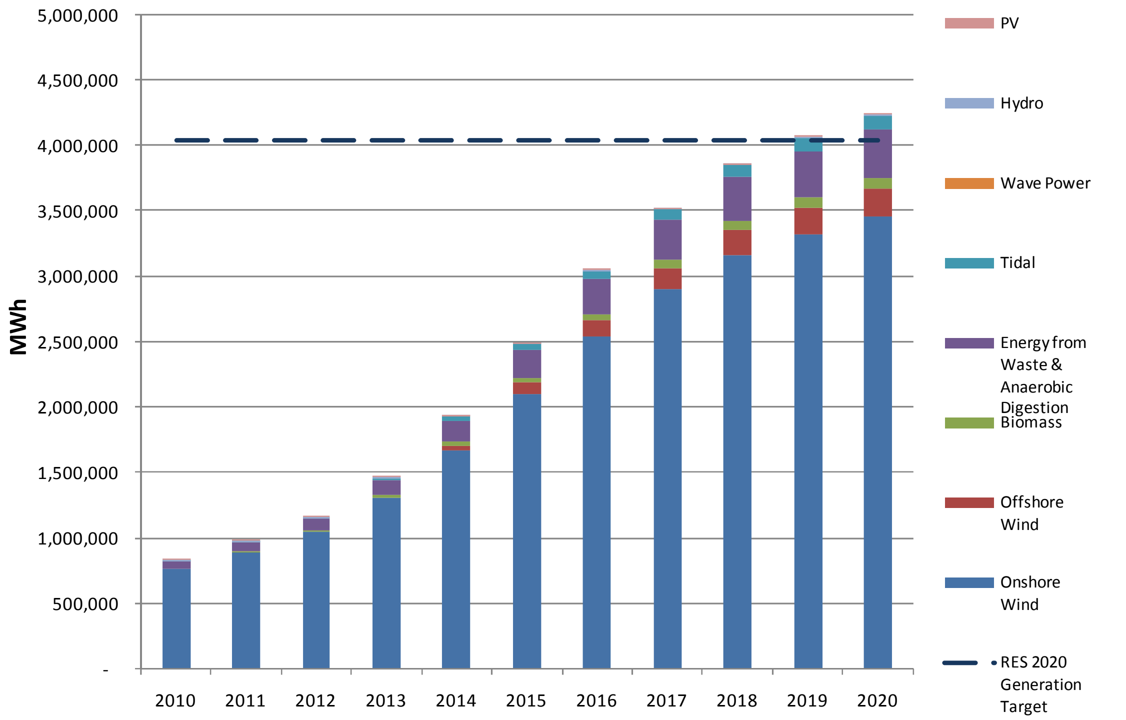
The key conclusions from the base case modelling are:

- The NIRO (and therefore subsidising renewable electricity generation in NI) is projected to cost NI electricity consumers around £65m annually by 2020, an increase of circa £33 in annual household electricity bills.

- When the total cost paid by customers is considered – that is electricity wholesale prices plus the costs of subsidy, it can be seen that customers in both GB and NI are paying a broadly comparable amount to support renewable generation.

NI has adopted a strategic objective to increase the amount of electricity generation from renewable sources to 40 per cent by 2020. Our modelling also demonstrates that the NIRO in its current form is projected to encourage a volume of renewable generation sufficient to meet this target, as illustrated in Figure A1 below. That is, ignoring wider issues and constraints, such as the operation of the SEM, system integration costs, adequacy of network infrastructure to connect a large quantity of renewable generation and arrangements for planning and consenting projects.

Figure A1: Base Case Northern Ireland renewable deployment



Source: CEPA

Having also considered potential amendments to the parameters of the NIRO, particularly the level of NI obligation, we have identified a minimal impact on the ability of the policy to deliver 2020 targets but a significant impact on costs to NI consumers. The NIRO currently operates at a concessionary obligation rate to the RO and ROS. In order to provide an upper bound to our cost estimate for the NIRO, we have modelled a situation in which the level of NI obligation is set equal to that in GB (which we term the GB Obligation scenario).

We have also identified further banding of the obligation (either by increasing or decreasing support) as a flexible route to supporting certain technologies, avoiding windfall gains or increasing the likelihood that targets are hit.

Assessing alternative support options to 2020 for large-scale generation

Having considered the costs of the NIRO in its current, and several possible future forms, we have also considered various other structures for support mechanisms, including different forms of FITs and capital grant schemes. In particular we have considered the expected impact on costs to NI consumers and levels of deployment of replicating the Renewable Energy Feed-in-Tariff (REFIT) scheme (FIT A) which is in place in the RoI and of introducing two stylised FITs which ensure delivery of the 2020 target under medium (FIT B) and high (FIT C) renewable generation cost assumptions.

This analysis, which is summarised in Table A2, allows a comparison of alternative support mechanisms to be made. However, it is important to recognise the limitations of modelling analysis, the importance of robust input assumptions (details of assumptions and sensitivity analysis are shown in Volume B) and to consider the full range of factors which impact on investor's decisions.

Table A2: Comparison of cost-benefit analysis and RES-generation deployment between Base Case and alternative support option scenarios

Metric	Base Case	GB Scenario	FIT A	FIT B	FIT C	Capital Grant
Deployment in 2020 (TWh)	4.3	4.3	2.5	4.5	4.5	4.1
Contribution of RES-generation to NI electricity demand (TWh)	42%	42%	24%	44%	44%	41%
Subsidy cost (production subsidy) (£m in 2020; NPV)	181.6	181.6	(59.4) [2]	69.5	108.9	N/A
Over subsidy (£m in 2020; NPV)	(126.8)	(126.8)	(19.0)	-	(39.4)	N/A
Cumulative Cost to NI public budget (£m to 2020; NPV)	-	-	-	-	-	818.8
Annual consumer subsidy & electricity cost in 2020 (£m in 2020; NPV)	414.1	506.5	140.0	433.8	473.3	N/A
Annual consumer subsidy & electricity cost in 2020 (£/MWh per unit of electricity consumption)	41.0	50.2	13.9	43.0	46.9	N/A
Expected impact of subsidy on average annual household bills (£s)	32.8	79.8	N/A [2]	35.3	55.4	N/A

Note 1: Resource cost net of capital grant

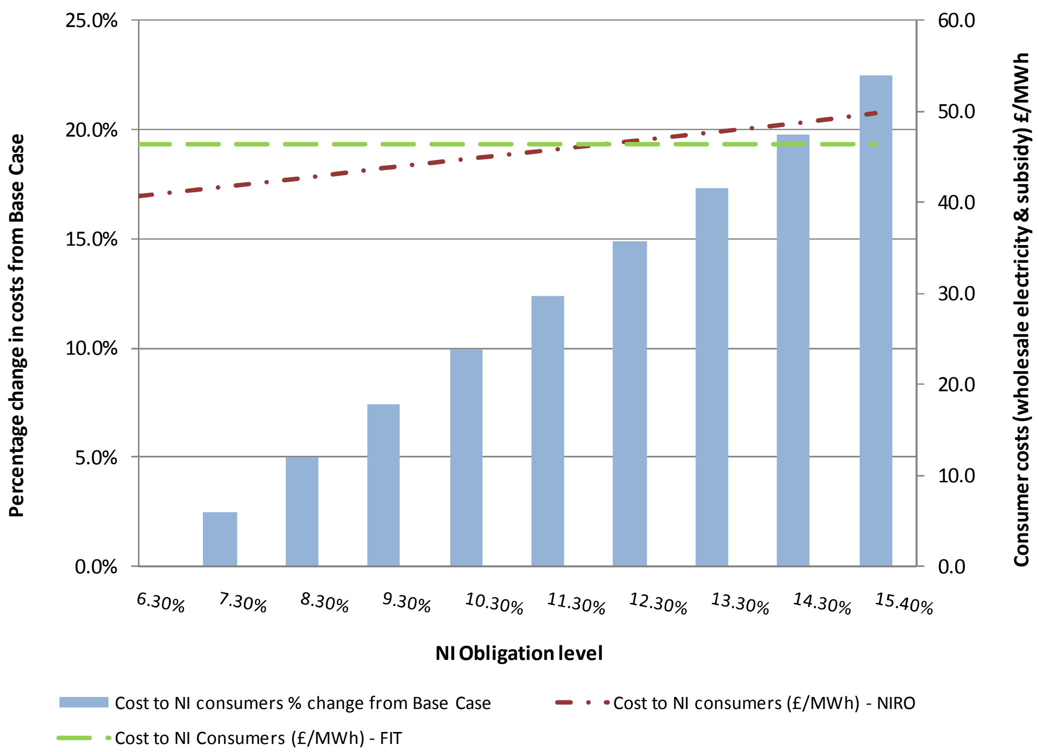
Note 2: Subsidy costs are negative as costs of funding particular renewable generation technologies (e.g. very large onshore wind) (per MWh) are less than wholesale power prices; impact of subsidy on consumer bills is as consequence negligible.

Source: CEPA analysis

Table A2 shows some interesting conclusions:

- All support mechanisms, with the exception of a policy which duplicates the REFIT scheme (which was tendered and targeted the lowest cost generators) incentivise sufficient generation to meet NI's 2020 targets.
- The subsidy cost of the FIT options (which are linked to wholesale prices) and the extent of over-subsidy are lower, suggesting these approaches are more efficient than NIRO based options and capital grant schemes.
- However, when the total costs to NI consumers (i.e. the cost of electricity and supporting renewable generation) is considered, it can be seen that the lower obligation level under the NIRO leads to the lowest cost option for NI consumers (which meets targets).
- But, the GB scenario (where the NI obligation is set at a level consistent with the RO and ROS) shows that if the design of the NIRO were to change, the conclusion above may cease to hold and there could be arguments for seeking to move away from the NIRO. This is illustrated in Figure A2 below[2].

Figure A2: Comparison of FIT Structure C and NIRO costs under alternative NI obligation levels



[2] Figure A2 shows the percentage change in NI consumer costs (including the wholesale electricity price) in 2020 under the NIRO from varying the NI obligation level. This analysis is compared to the costs of FIT Structure C, which also shows the total consumer cost per MWh (i.e. subsidy and wholesale electricity price) of a stylized FIT.

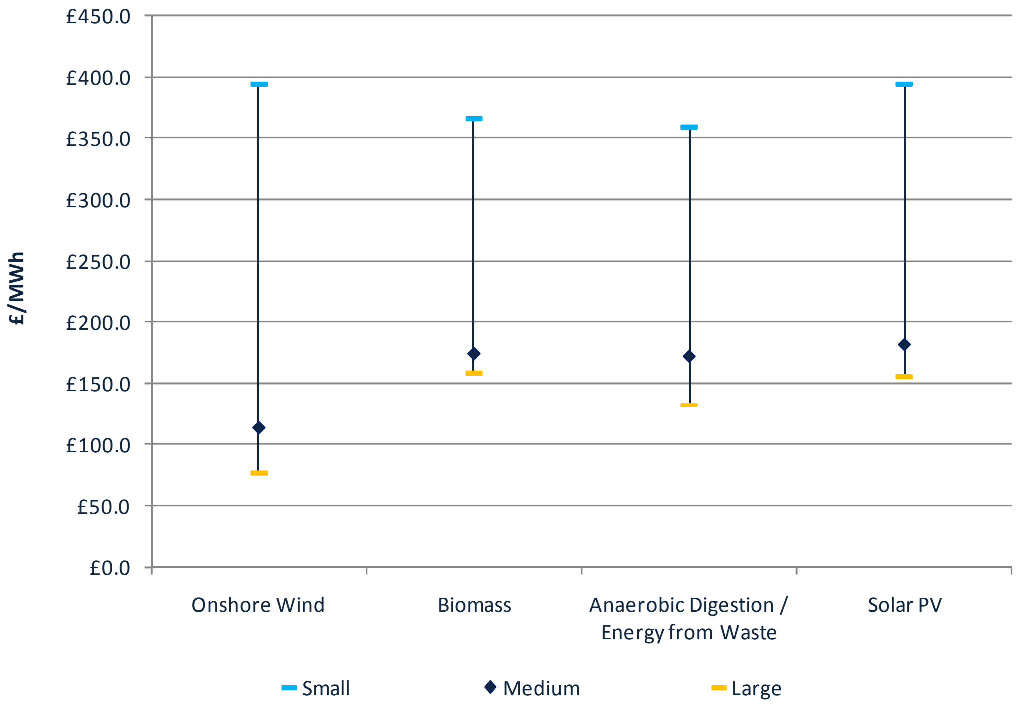
Source: CEPA

Assessing alternative support options to 2020 for small-scale generation

In recognition of the recent policy measures which have been introduced in GB to support small-scale generation, we have also focussed on the costs of replicating this scheme in NI, of seeking to achieve similar objectives via different means and of supporting small-scale generation up to different size thresholds. In addition, we have briefly considered the rationale for supporting small-scale renewable generation.

While small-scale generation can, in some circumstances, have beneficial impacts on networks and may contribute to social policy objectives, on a purely cost basis it is typically significantly more expensive than larger scale renewable generation. This is, in general, due to lower load factors which mean that capital costs, which are often relatively higher because of the relatively immaturity of technologies, must be recovered in relatively few running hours. These cost differences, which are shown in Figure A3, may suggest that, if there is a concern regarding meeting targets at least cost, there is a case for supporting larger scale technologies which can make more significant contributions.

Figure A3: Renewable technology levelised costs



Source: CEPA

Table A3 below, which also outlines the costs of amending the level at which small-scale generators become eligible for a FIT, shows that replicating the GB FIT is estimated to be a more expensive option for supporting small-scale generation than the NIRO. The indicative cumulative cost to 2020 of a small-scale FIT (depending on potential resource and size eligibility assumptions) is projected to be between £62m - £86m. This suggests that the cost of a small-scale FIT is comparable to the *total annual* cost of supporting all sizes of renewable generation in 2020 under the Base Case assumptions for the NIRO.

Table A3: Estimated cost of small-scale FIT schemes

Metric	**GB FIT**	**FIT 1 (<5MW)**	**FIT 2 (<2MW)**	**FIT 3 (<0.5MW)**
FIT resource target (% of electricity consumption)				
Contribution to NI electricity demand	N/A	3%	2%	1%
NI subsidy costs				
Indicative annual cost of FIT (£m) in 2020	17.3	18.3	14.8	13.6
Cumulative cost of FIT (£m) to 2020	77.6	86.7	68.9	62.9
Impact on household bills (£s) in 2020	8.8	9.4	7.6	7.0

Note: All costs are NPV, net present value.

Source: CEPA

Wider issues to consider

As well as focussing on the expected costs and benefits of alternative approaches to supporting investment in renewable generation, we have considered the factors, for both small- and large-scale generation which may cause the assumption that parties will invest if they can gain a sufficient return to fail to hold. We note that, irrespective of the form of support mechanism chosen, it is particularly important to also consider wider barriers to the development of renewable generation. While providing sufficient returns to investors is clearly vital, issues such as planning processes, access to manufacturing capability and timely network access can have an important impact on the development of renewable generation technologies. In addition, perceptions that investments are risky or complex can have detrimental impacts, particularly at the small-scale level.

Subsidy choice and the SEM

The study has also considered the impacts of support mechanism choice on the operation of the SEM. While we have identified a number of potential issues, including negative bidding and high and rising constraint costs, we note that the vast majority of issues have been considered by the joint regulators, and do not appear inconsistent with market rules. In addition, we do not consider that a particular form of support mechanism causes more significant issues than another and therefore consider that, were one concerned about aspects of the increasing penetration of renewable generation on the operation of the SEM, it may be appropriate to use existing governance processes to amend market rules.

Recommendation

Having carefully considered the quantitative and qualitative arguments in favour and against alternative approaches to supporting renewable generation in NI, we consider that the critical driver of the appropriate approach is the level at which the NI obligation is set.

While the parameters of the NIRO remain substantively similar to what they are today, the total costs to NI consumers under the NIRO would be expected to be lower than under other options (and the total costs of supporting renewables and the wholesale cost of electricity, per unit of renewable generation output, would be expected to be broadly comparable between GB and NI). However, were the level of the NI obligation to converge with that in GB, it is likely that a strong case for an alternative form of support could be made. However, in taking such a decision it would be important to recognise that, for all its imperfections (it is highly complex, there is not a link between the power price and the subsidy price and the price of a NIROC is set based on UK supply and demand) the NIRO seems reasonably well understood by investors and increasing uncertainty by moving schemes may not necessarily be desirable.

While we would not advocate frequent intervention, due to its impacts on investor confidence, we note that by amending ROC banding it is possible to promote certain types of technology and, perhaps equally importantly, to reduce support to technologies where costs have fallen, avoiding economically inefficient windfall gains to investors in these technologies. Therefore, the NIRO provides a relatively flexible route to targeting policy – potentially allowing areas in which NI has a comparative advantage to be realised. While this would also be true of a NI FIT, the full costs of such a scheme would be recovered solely from NI customers and there would be expected to be considerable challenges associated with developing and operating an efficient scheme.

In respect of small-scale generation, we consider that the arguments in favour of a policy to specifically support this type of generation are unclear. On purely economic grounds, a strong case can be made for a technology neutral scheme which rewards the parties which are best able to deliver required volumes of renewable energy. We also note that there would be expected to be considerable additional costs associated with any scheme targeted at small-scale players. However, we consider that if the benefits that small-scale generation can provide by offsetting production from larger-scale generation and reducing network costs are appropriately reflected through market arrangements, forming a view on the case and need for support would be considerably more simple.

Overall we do not consider that a move away from the NIRO at this stage would be justified for either large or small-scale players. We would therefore recommend that policy makers continue to monitor developments within the RO and, if necessary, make the case for maintaining the NI obligation at its current level (noting that a change in the level of obligation would have minimal impacts on GB customers and highly significant impacts on those in NI who already pay more for power). We also consider that it is appropriate to consider the wider factors which influence decision making and ensure that there are no constraints or barriers which prevent the NIRO from delivering the levels of generation required to meet 2020 targets.

1. INTRODUCTION

1.1. Purpose of this study

This report, commissioned by the Department for Enterprise, Trade and Investment (DETI) and the Northern Ireland Authority for Utility Regulation (NIAUR) and produced by Cambridge Economic Policy Associates (CEPA) and Parsons Brinkerhoff (PB), assesses alternative policy options for supporting renewable generation in Northern Ireland (NI) .

The United Kingdom (UK) has signed up to binding targets for the proportion of energy sourced from renewable generation technologies and is committed to reducing carbon emissions. NI has the potential to make a significant contribution to the achievement of the UK's renewable electricity targets.

Recent amendments to the approach to supporting small-scale renewable generation in Great Britain (GB), through the introduction of a feed in-tariff (FIT), and the presence of a FIT in the Republic of Ireland (RoI) (which is relevant given the presence of a Single Electricity Market (SEM)) have led DETI and NIAUR to question whether the existing mechanism for supporting renewable generation, the Northern Ireland Renewables Obligation (NIRO) continues to be fit-for-purpose for all sizes and types of renewable generation.

NI has a series of unique characteristics which mean that it may be inappropriate to simply duplicate an existing support mechanism. For example, the nature of land use means that the potential for the development of certain generation technologies is greater than may be the case in GB, and the level of development of networks mean that renewable generation creates different challenges. Equally the single market structure means the interaction between the support mechanism and market operation needs careful consideration, and economic factors, such as the relatively higher levels of fuel poverty in NI than GB, mean that costs to customers are an important consideration.

This report is therefore designed to assess a range of alternative policy options and to identify, through a combination of quantitative modelling and qualitative assessment, which would be expected to best facilitate the achievement of NI's policy goals for renewable energy to 2020.

1.2. Terms of reference

The project's terms of reference require detailed consideration of:

- The overall costs associated with the operation of the NIRO in the context of the Renewables Obligation (RO) highlighting the economic benefits and limitations or differences that may constrain its effectiveness.

- The issues and overall costs of the operation of the NIRO with the SEM , given priority dispatch and the interaction with the Republic of Ireland's (RoI) FIT mechanism.

- The impacts and costs of mirroring the proposed changes to the GB support mechanisms, including those for small scale generators.
- Options to 2020, including NIRO and FIT, for NI's renewable support mechanisms, including the appropriateness of a separate mechanism for small scale generation in NI.

1.3. Approach

This study uses a combination of qualitative assessment and quantitative analysis to consider the impacts of alternative approaches to supporting renewable generation (of various types and sizes) on the level of installed capacity in NI, the achievement of renewable energy policy objectives, costs to consumers and the impact on the wider operation of the SEM.

Quantitative analysis has been based largely on a detailed modelling framework which is outlined in Volume B. The modelling is necessarily dependent on a series of assumptions, including those on levels of installed capacity, generation costs, wholesale power prices and subsidy mechanism design, which drive the outputs the model produces. As such, whilst the modelling is valuable in enabling a number of hypotheses to be tested, its results must be placed in the context of a much wider qualitative assessment, in which it is used to support conclusions rather than its outputs being seen as definitive.

1.4. Document Structure

In this report, Volume A, we present qualitative assessments of alternative approaches and summary quantitative findings. In doing so, we rely considerably on Volume B, which sets out the modelling framework and analysis we have developed to test the range of scenarios and policy options set out in the terms of reference. This is provided in the following sections.

- Section 2 sets out background and context to the issues covered in this document.
- Section 3 outlines the key questions being assessed by the study.
- In section 4 we identify the costs of the NIRO in its current form and consider how those costs might change given plausible amendments to the design of the scheme.
- Section 5 considers the design of alternative options for supporting large scale renewable generation.
- Section 6 focuses on wider factors which may influence the choice of support mechanism, including the interaction between support mechanisms and the SEM and factors which may constrain the development of renewable energy.
- Section 7 focuses on small-scale generation. It briefly outlines the costs and benefits of small-scale generation before considering the costs of duplicating the recently introduced FIT and considering whether this support could be provided in a more cost effective manner using other support mechanisms

- Finally, section 8 summarises our analysis and presents conclusions.

A series of annexes provide supporting material.

2. SUPPORTING RENEWABLE ENERGY IN NI

2.1. Overview

This section provides background and context to the study. It sets out NI's energy policy goals and discusses the current levels of installed renewable generation capacity, before considering some of the specific characteristics of NI's energy sector and the technologies in which NI would expect to have a comparative advantage – which may influence or provide a rationale for supporting certain types or sizes of technology.

2.2. Energy and the wider policy context

In spring 2007, European Union Heads of Government agreed to a binding target that 20% of EU's energy (across electricity, heat and transport) should come from renewable sources by 2020. The EU Renewable Energy Directive (2009/28/EC) on the promotion of the use of energy from renewable sources came into force in June 2009: it set a target of 15% renewable energy consumption in the UK.

For the UK to meet the EU set target of 15% renewable energy for the UK, the UK's renewable energy strategy has proposed that levels of around 32% renewable electricity, 14% renewable heat and 10% renewable transport fuels will be required. Scotland has a target of 40% of its electricity to come from renewable sources and the RoI is aiming for a 40% target.

In NI's Strategic Energy Framework 2009, DETI has proposed that NI should also adopt a strategic objective to increase the amount of electricity from renewable sources to 40 per cent by 2020.[3]

2.3. The Northern Ireland Renewables Obligation (NIRO)

The primary tool for supporting the development of renewable electricity generation in NI is the NIRO. The incentive to invest in renewable generation in NI under the NIRO is created through the Renewables Obligation Certificate (ROC) price, which is determined by the interaction between the supply of ROCs and the demand for ROCs across the UK.

The total UK obligation size, which determines the demand for ROCs by UK electricity suppliers, is equal to the sum of the obligation size in NI and respective schemes in Scotland, England and Wales. The supply of ROCs is determined by the total volume of renewable generation in the UK, and banding[4] assumptions for different technology groups under each of the respective schemes.

Therefore, in order to determine the expected price of a NIROC, a renewable generator in NI must consider the demand for and supply of ROCs on a GB basis. .

This is illustrated in Figure 2.2 below.

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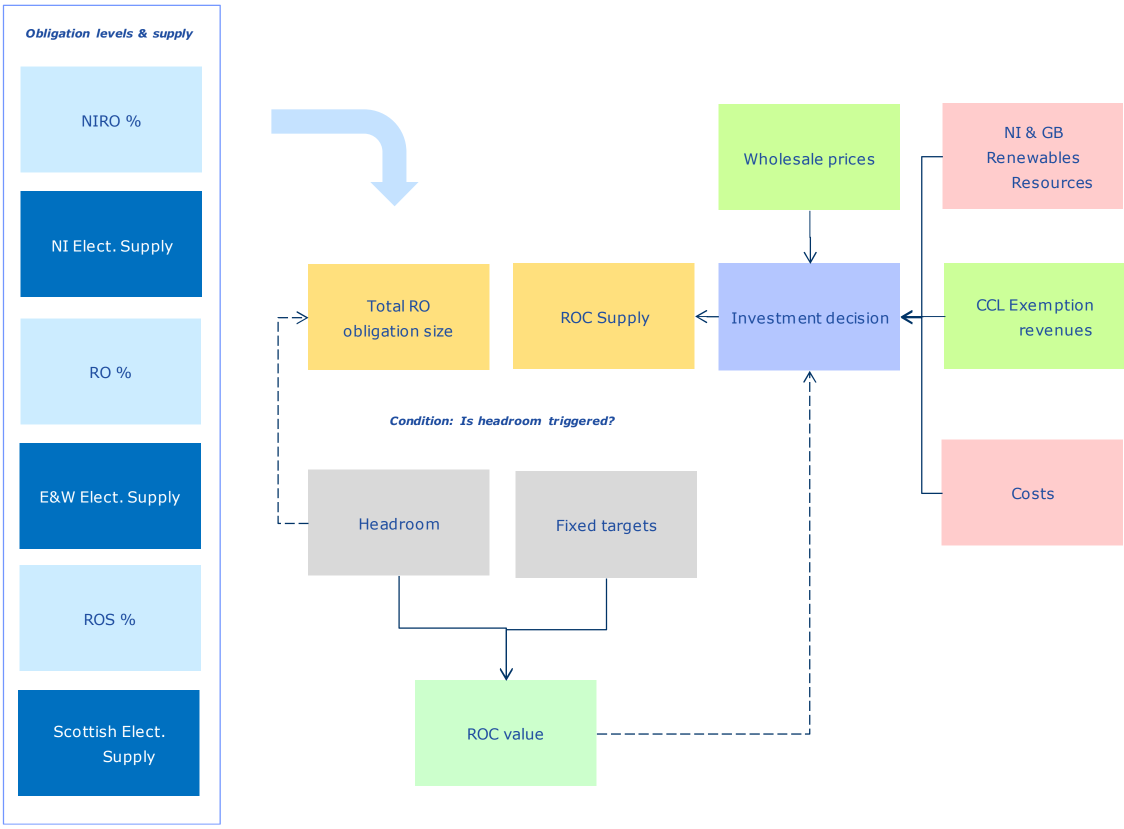
[3] DETI (2009): 'A draft strategic energy framework for Northern Ireland 2009'

[4] Banding is a means of supporting specified generation technologies by entitling them to receive more or less than a single ROC for each unit of electricity they produce.

Figure 2.1: Interactions in the RO



Source: CEPA

2.3.1. Elements of the Renewables Obligation

When it was introduced the RO was designed to be technology neutral (i.e. 1MWh of electricity generated by any technology would qualify for 1 ROC) and to meet a series of defined targets which would lead to the 2020 target being met. Where the amount of energy produced from renewable generation fell below the target, the recycling of the buy-out fund would increase the amount that could be earned under the RO and provide a stimulus for greater investment.

However, a number of concerns were expressed about the operation of the RO, specifically:

- The significant non-cost barriers to renewables development, such as grid constraints and consenting delays, would be likely to hinder the ability of price signals to lead to automatic increases in capacity.
- There was a concern among investors that ROC price spikes were too short term to influence investment decisions (because a decision to invest would lead to the ROC price falling) and hence simply led to greater profits to incumbent renewable generators.

- The mechanism was not seen as facilitating the development of anything other than near to market technologies because capital costs of alternative technologies were higher than the return received via energy prices and ROCs.

In order to counter these concerns, a series of amendments have been made to the RO (the majority of which have been mirrored in the NIRO).

Headroom

The RO has moved away from fixed targets for installed capacity and introduced a headroom mechanism with the intention of helping to stabilise the price of ROCs. The headroom mechanism operates by ensuring that there is always a positive gap between demand for ROCs (as expressed in the obligation level set by the RO) and supply and that the gap is kept at as steady a level as possible. As the price of ROCs is driven by the balance of this supply and demand, the headroom mechanism should mean that the ROC price does not fluctuate too far in either direction.

However, the headroom mechanism involves predicting, on an annual basis, the likely total volume of generation (and the likely proportion of that volume which will be derived from different renewable sources due to banding). If this assessment is incorrect it can still lead to a significant fall (often termed a 'crash') in the ROC price which can significantly increase risk for this investors. For this reason, the Department of Energy and Climate Change (DECC) has decided to progressively increase headroom from the current 8% to 10% by 2011/12.

Banding

Concerns that the RO did not provide sufficient support to incentivise investment in relatively higher cost renewable generation technologies led to the banding of the RO. This involved specifying a multiple of ROCs which could be earned by a supplier which purchased energy from a certain generation technology. For example, tidal stream in England and Wales is eligible for 2 ROCs/MWh. This effectively doubles the level of support available to renewable generators. However banding also increases the number of ROCs in circulation and makes the stability provided by the headroom mechanism more important in minimising volatility.

Stabilisation

Despite the increased stability provided by the headroom mechanism, there remains a concern that renewable generators were exposed to volatility in wholesale electricity prices. Hence DECC has also considered introducing a wholesale price stabilisation mechanism based on Contracts for Difference (CfDs) between renewable generators and a central government agency.

2.3.2. Differences between the NIRO and the RO

As energy policy is a devolved responsibility, DETI is able to make amendments to the NIRO Order to introduce amendments to the scheme. There are a number of important differences between the NIRO, the RO in England and Wales and the Renewables Obligation Scotland (ROS). In particular, the NIRO operates at a lower obligation level than in the rest of the UK. Recent amendments to the banding for small-scale generation in NI, and the introduction of a system of FITs for small-scale generation in GB, has created further disparity between the NIRO and support arrangements for renewable electricity generation in GB.

This is shown in Table 2.1 below.

Table 2.1: Main differences between the current GB and NI arrangements for renewable electricity generation

Parameter	Great Britain	Northern Ireland
Large scale generation • Obligation level • RO Period	Renewables Obligation • 0.154 ROCs/MWh – to 2015 • 2037	Renewables Obligation • 0.063 ROCs/MWh to 2012/13 • 2033
Small-scale generation	Feed in Tariff	Renewables Obligation
Wholesale electricity element	GB Wholesale price (Contracted bilateral agreements and power exchange markets. Three main operational phases: forward markets, a balancing mechanism, and imbalance exposure)	Single Electricity Market price (Mandatory pool with single clearing price – system marginal price and capacity payment)

Source: OPSI and CEPA/PB

The RO, ROS and the NIRO were introduced by the Department of Trade and Industry (DTI), the Scottish Executive and DETI respectively, although the scheme is administered by the Gas and Electricity Markets Authority (whose day to day functions are performed by Ofgem) via an Agency Services Agreement. While there are certain disparities between the design parameters of renewable generation support mechanisms in NI and the rest of the UK, the administration (and therefore operation costs) of the scheme remain common across the UK. Indeed, even with the introduction of the GB small-scale generation FIT, the RO remains the primary mechanism of incentivising large-scale renewable generation in all parts of the UK, and except for the effects of regional banding, the incentives for investment in renewable generation, created through the ROC price, also remain common across NI, Scotland, England and Wales. However, as illustrated in Table 2.1, the wholesale electricity price element of renewable generators' expected revenue streams differ between GB and NI. NI renewable generators participate in the SEM while GB generators participate in the single wholesale electricity market for GB, the British Electricity Transmission and Trading Arrangements (BETTA).

2.4. GB's small-scale generation feed-in-tariff

The UK Government has introduced a system of FITs that rewards eligible small-scale generators and provides a guaranteed price and market for exports.

Under the FIT model, a household or business that uses energy on-site will receive three different income streams:

- *Generation tariff* – a fixed price for each unit of electricity generated by the small-scale generation installation (p/kWh). The price will remain the same throughout the lifetime of an installation's eligibility for FITs payments.
- *Export tariff* – providing a fixed payment for exported electricity (p/kWh). This objective of this component of the FIT system is to reduce uncertainty and the difficulty of engaging with electricity market for small-scale generators by providing a guaranteed price for electricity exported from the generation site.
- *On-site generation* – the benefit from reducing imports of electricity by using a proportion of the electricity generated on-site. The consumer will very likely be purchasing a reduced number of kWh of electricity from their supplier which will ultimately lead to lower electricity bills.

The Generation Tariff will be set at different levels for different technologies and installation sizes. The UK Government are also proposing to lower the Generation Tariff levels for certain technologies for new projects, both to reflect and to encourage cost reductions from the relevant sectors.

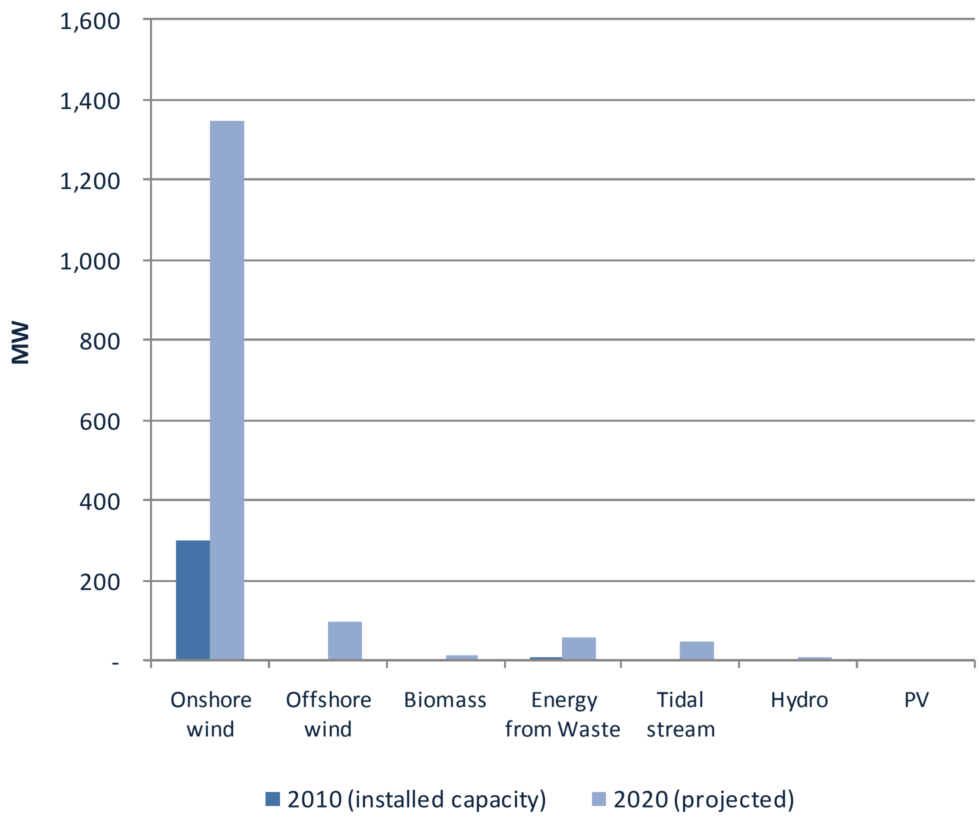
2.5. Northern Ireland's renewable potential

2.5.1. Current Levels of RE in Northern Ireland

As outlined above, NI is committed to achieving a target of sourcing 40% of energy from renewable sources by 2020. Achieving this target will require significant growth in installed capacity for all sizes and types of renewable generation technology. The current level of renewable generation capacity[5] in NI is shown in Figure 2.2 below. It can be seen that installed capacity is dominated by onshore wind. It is also notable that the only tidal stream technology in the UK is currently installed in NI.

[5] Based on data from Ofgem regarding the number of NIROCs produced.

Figure 2.2: Current and forecast level of installed capacity in NI [6]



Source: Ofgem ROC register & DETI(2009)

2.5.2. Renewable energy potential

Several previous studies have sought to quantify the increase in generation capacity that is feasible and that will be required to meet targets. Figure 2.2. shows projected NI generation capacity under Scenario 4 (High-Wind) of NI's 2009 Strategic Energy Framework. It can be seen that the bulk of developments in NI generating capacity under this scenario are expected to come from onshore wind.

A number of independent studies which examined the potential offshore wind and wave and tidal resource within NI territorial waters have identified that there is also significant potential offshore wind resources located to the north and off the east coast of NI, and significant tidal stream energy resource located within Strangford narrows, around the Copeland Islands and Rathlin Island and off the north east coast between Fair Head and Runab. Wave resource concentrated off the north coast has also been identified in a more recent study.

NI is therefore well positioned in terms of renewable resource in comparison to many other areas of the UK and Europe, particularly with regard to its wind and tidal resources.

[6] Forecast level of installed capacity shows generation mix scenario 4 (High-Wind) from NI's Strategic Energy Framework 2009.

The 2009 Ove Arup study estimated the potential renewable generation resource in NI. Five renewable electricity generation scenarios were developed ranging from 31% to 47% contribution to electricity consumption in 2020, with the variation in each scenario dependent on the extent of onshore wind resource, the contribution of large scale biomass power generation and tidal stream generation.

Table 2.2: NI RE resource, theoretical and potential installed capacity in 2020.

RE Technology	Theoretical Resource Capacity (MW)	Installed Capacity 2020 (MW)	Power Generated 2020 (GWh/yr)
Wind onshore	3,203	1,500	4,073
Wind offshore	500	500	1,402
Small biomass	13	13	91
EfW	58	50	350
Large biomass	Depends on uptake	300	2,365
Tidal power	300	50	162
Wave power	Low intensity resource	0	0
Hydro	Unknown	11	90
Micro-generation	10	6.5	46

Source: Ove Arup 2009

Subsequent to Ove Arup's 2009 study, a Strategic Environmental Assessment (SEA) of offshore wind and marine energy resource in NI has found a higher level of resource from offshore wind and tidal stream, with between 900MW and 1200MW of electricity potentially generated from offshore wind and tidal stream array developments in NI waters without significant adverse effects on the environment.[7]

Among other things, NI's location, population density and patterns of land use provide it with potential advantages in respect of certain renewable electricity generation technologies. We note the following:

- *Wind resource*: the UK long term average onshore wind capacity factor is 28.1%[8] while the long term average capacity of the existing wind farms in NI is 32.5%[9]. NI therefore enjoys an advantage in being able to offer a lower cost of RE energy production from this resource attracting investment from other parts of the UK as suppliers attempt to meet their obligations at best possible cost.
- *Tidal resource*: although tidal technology is still in development, the first UK grid connected tidal turbine was the 1.2MW Seaflow project installed at the Strangford Narrows. NI has significant potential for the development of tidal resources.

[7] DETI (2009): 'Strategic Environmental Assessment of Offshore Wind and Marine Renewable Energy'

[8] BERR (2008): 'Digest of United Kingdom Energy Statistics 2007, Table 7.4 - Capacity of, and electricity generated from, renewable sources.

[9] Ove Arup (2009) Establishment of NI Renewable Electricity Targets to 2020, for DETI.

- *Biomass and anaerobic digestion*: agriculture makes a significant contribution to the NI economy. As such the potential to develop technologies which create energy from agricultural bi-products is likely to be beneficial.

- *Wholesale energy prices*: the NI wholesale electricity price is currently higher than that in GB making renewable energy a potentially more attractive investment option in comparison to other regions of the UK.

2.5.3. Current status of small-scale generation in Northern Ireland

Table 2.3 shows the current level of installed small-scale generation capacity (i.e. <5MW) in NI as of the beginning of March 2010 by technology type and size. It is notable that compared to the current installed NI RES capacity of 312MW, small-scale generators (<5MW) provide 39.75MW or around 12.7% of the total installed capacity, and micro-generation a very small proportion of around 1%.

Table 2.3: Installed RE electricity generation capacity <5MW in NI

Technology type	Installed RE capacity (kW)	Percentage of total small-scale RE installed capacity
Hydro >15-100 kW	653	2%
Hydro >100 kW - 2MW	2,510	6%
PV ≤4 kW (new build)	295	1%
PV >4-10 kW	441	1%
PV >10-100 kW	98	0%
Wind >1.5-15kW	1,503	4%
Wind >15-100kW	1,401	4%
Wind >100-500kW	450	1%
Wind >500kW-1.5MW	4,770	12%
Wind >1.5MW-5MW	25,000	63%
Landfill gas	2,622	7%
Total	**39,747**	**100%**

Source: Ofgem / DETI

The key points to note from Table 2.3 are:

- Over 60% of the existing small-scale generation capacity in NI is provided by wind installations sized 1.5MW – 5MW. In total, wind generation contributes over 80% of installed small-scale generation capacity in NI. However, due to the lower load factor of wind relative to other technologies, it makes a lower contribution in energy terms to NI's renewable generation targets.

- Small-scale hydro, landfill gas and PV installations are the other main technologies that have to date been deployed in NI under the NIRO support mechanism. In total, these other small-scale generation technologies contribute approximately 20% of installed small scale (<5MW) capacity in NI.

2.6. The Single Electricity Market

Renewable generators in NI participate in the SEM. The SEM went live on 1 November 2007, commencing the trading of wholesale electricity in the RoI and NI on an all-island basis. The SEM encompasses approximately 2.5 million electricity consumers, 1.8 million in the RoI and 0.7 million in NI.

The SEM is a gross mandatory pool, meaning that all electricity generation (above a 10MW *de minimis* threshold) and all imports must be sold to the pool, while all wholesale electricity for distribution or export must be bought from it. Generators submit bids based on their short-run marginal cost (in accordance with the Bidding Code of Practice) of energy production. In addition to payments for energy provided, generators get capacity payments for making their generating capacity available.

The All Island Grid Study (AIGS) examined the impact of different scenarios of wind renewable generation penetration on the electricity system of the island of Ireland in the year 2020. In the light of the AIGS, and EU renewables targets for the RoI and NI for 2020, the Commission for Energy Regulation (CER) and NIAUR (jointly the Regulatory Authorities (the RAs)) have identified the need to examine the impact of increasing penetrations of wind and renewable generation on SEM.

A recent study by the RA's assessed the effect of increasing renewable generation penetration on the ability of the SEM to operate efficiently and effectively.[10] The focus of this work has, in particular, been to examine the impact that high levels of wind penetration, and more specifically the generation portfolios contemplated in the AIGS, would have on the existing design and operation of the SEM and on the ways in which generators would be remunerated in 2020.

2.7. Summary

This section has sought to provide background and context to the issues discussed in this report. It has outlined the key characteristics of existing support mechanisms and briefly summarised NI's renewable generation potential. The remainder of this report considers the most effective approach to realising this potential.

[10] RAs (2009): 'Impact of high-wind penetration in 2020 on the SEM – a modelling study'

3. ISSUES TO BE ADDRESSED

3.1. Overview

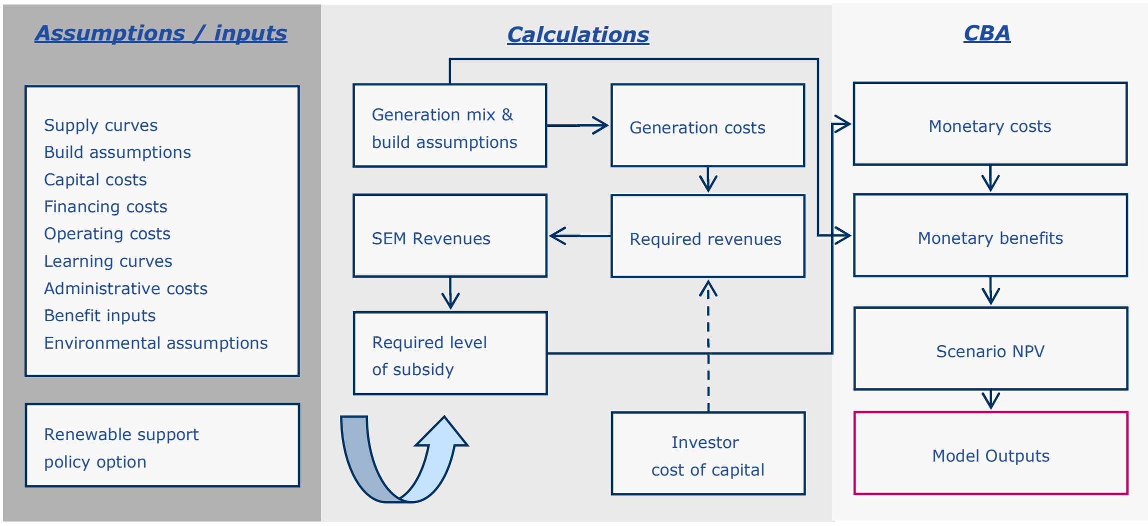
In this section we outline key questions which the quantitative (modelling) analysis, explained and detailed in full in Volume B, has sought to address. We also outline the framework of our model and the rationale for each question and discuss how modelling results inform our overall conclusions.

3.2. Modelling framework

The overall objective of the model is to allow the user to assess how alternative approaches to supporting renewable generation in NI compare to the costs, benefits and levels of deployment delivered by the existing support mechanism. These scenarios are based around the interaction of a number of policy support options – the NIRO (in its current form), future amendments to the NIRO and the UK-wide Renewables Obligation, potential FIT structures and Capital Grant schemes.

The structure of the modelling framework is summarised at a high-level in Figure 3.1.

Figure 3.1: CEPA / PB modelling approach



Source: CEPA

The calculation and simulation process in the modelling framework can be summarised as follows:

- For a given potential renewable generation resource , the model calculates the proportion of projects that are viable, based on the expected costs of different technology types/scales (which vary over time) and the revenues those projects would expect to receive via the SEM, other sources of revenues and the selected support mechanism.
- This derives a projected renewable generation supply curve in NI for each year, which is then assessed against NI's projected resource potential. Where applicable, in each year, expected revenue streams under the NIRO (i.e. the expected ROC

price) are assessed based on simulated renewables supply curves in NI and expected renewable generation deployment in GB

Finally, the model calculates the costs and benefits from renewable generation deployment (derived from the selected support mechanism) and presents a range of outputs demonstrating expected costs and benefits to NI.

3.3. Questions considered by the study

In this section we discuss each of the questions which has been considered. The remainder of the document is structured around these questions.

3.3.1. Identifying the costs of the NIRO

As the existing support mechanism in place in NI, the NIRO provides the counterfactual against which other approaches to supporting renewable generation in NI need to be evaluated. Therefore the first task is to identify a level of costs and installed generation capacity to act as a baseline against which other support mechanism options can be compared (termed the " Base Case " scenario).

The key questions to consider are:

- What is the cost of the NIRO in its current form – to NI customers and relative to the cost of the RO and ROS to GB consumers to 2020; and
- What volume of renewable generation would providing support using the NIRO be expected to deliver in NI by 2020?

In recognition of the possibility that aspects of the NIRO, including the level at which the NI obligation is set, could be required to change in the period to 2020 (though we note that there are no plans, as far as we are aware, to do so) we have also considered the impact of alternative NIRO designs on expected deployment of renewable generation and the costs paid by NI consumers. We consider:

- How would the costs of the NIRO and expected levels of deployment change under different NI obligation levels?
- What would be the consequence of setting the level of the NI obligation equal to the GB obligation?
- How would amendments to the banding levels within the NIRO later the costs and impacts of the scheme?

3.3.2. Assessing alternative options for supporting large-scale generation

Having considered the cost to customers and ability to incentivise renewable generation deployment of the NIRO in its current form and in potential future forms, we then compare these outcomes to those created by alternative support mechanisms; in particular FITs. We begin by illustrating how a policy based on replicating the REFIT scheme used in

RoI would influence costs and the ability to meet renewable energy objectives in NI, before considering alternative FIT designs, including those which ensure delivery of 2020 targets .

The key outcome of this analysis is a comparison of the effectiveness and efficiency of a range of alternative support mechanisms to the NIRO which, alongside a consideration of qualitative issues and questions relating to the compatibility of support mechanisms and the efficient operation of the SEM allows recommendations on the appropriate form of support to be developed.

The key questions we address are as follows:

- How do costs to NI customers and levels of installed capacity change under feasible amendments to the design parameters of the NIRO (in particular, amendments to the level of the NI obligation)?
- What would be the impact on NI consumer costs and deployment of renewable generation capacity of introducing a FIT which provided the same level of support as the REFIT in the RoI?
- Were one to introduce a FIT which ensured delivery of the 2020 target (given assumptions of renewable generation costs and practical resource in NI) how might that support mechanism be designed and what would it be expected to cost NI consumers?

This then allows us to illustrate, on the basis of a set of assumptions, the relative costs of alternative support mechanisms to the NIRO in its current form. It also allows us to consider whether there may be a point where there would appear to be a logic for switching between forms of support (i.e. replacing the NIRO with a different system of support for renewable generation).

3.3.3. Assessing alternative approaches to supporting small-scale generation

A second purpose of the study is to specifically consider alternative ways in which policy makers might support small-scale renewable generation were they to wish to do so. The study does not seek to focus on the case for supporting small-scale generation but instead assesses the expected costs and benefits of alternative options.

In particular, we focus on the impact of replicating the FIT scheme which was recently introduced in GB, and consider the impact of making small amendments to the design of that scheme (such as reducing the maximum level of generation supported). We also consider how comparable levels of support could be provided to small-scale generators, if desired, via amending the banding of the NIRO.

The key questions we consider are:

- What are the costs of small-scale and micro generation and what level of subsidy may be needed to stimulate development?
- What would be the additional costs (i.e. additional costs to NI customers *over and above* those already paid via the NIRO) of introducing a FIT for small-scale generation with an identical design to the mechanism in GB?

- How would this cost change were renewable generators up to 2MW and 0.5MW (rather than 5MW) supported?
- Were the NIRO, rather than a FIT, used to provide a comparable level of financial support to small-scale generation by making amendments to banding levels, how would costs change?

This allows us to develop, alongside the qualitative analysis discussed in Section 6, recommendations in respect of the design of a support mechanism for small-scale generation in NI.

3.4. Summary

A summary of the key questions and issues to be addressed by the qualitative and quantitative analysis in this study are summarised in the text box below:

Key issues to be addressed

- In respect of the NIRO:
  - What is the cost of the NIRO in its current form and what volume of renewable generation would the NIRO be expected to deliver in NI by 2020?
  - How do costs to NI customers and levels of installed capacity change under feasible amendments to the design of the NIRO (in particular, amendments to the level of the NI obligation and levels of banding)?
- In respect of large-scale generation:
  - What would be the impact on NI consumer costs and deployment of renewable generation capacity of introducing an alternative support mechanism to the NIRO?
  - How do these outcomes compare to those under the NIRO?
- In respect of small-scale generation:
  - What are the costs of small-scale and micro generation and the potential level of subsidy needed to stimulate development?
  - What are the relative costs of alternative options for supporting small-scale renewable generation?

4. THE EFFECTIVENESS AND COST OF THE NIRO

4.1. Overview

This section assesses the effectiveness and efficiency of supporting renewable generation under the NIRO in its current form, and under a number of alternative scenarios in which amendments are made to the key design parameters of the scheme.

It considers:

- the costs and impacts of the NIRO in its current form;
- how those costs and levels of deployment would change were the level of the NI obligation set equal to the GB level of obligation;
- the costs and impacts of obligation levels between these two cases; and
- the impact of making changes to banding levels to increase or decrease support to certain types or sizes of renewable generation.

4.2. Key design features of the NIRO

The key points to note about the NIRO are:

- The price of a NIROC is determined by the interaction between the supply of ROCs and demand for ROCs across the UK. Because the number of NIROCs in circulation is relatively small, they have a correspondingly small impact on the price of certificates on a GB basis (hence changes in the number of certificates in NI tend not to alter the market price of a NIROC)
- The two key parameters of the NIRO are the level of obligation and the level of banding:
    - The costs to NI consumers are determined by the level at which the NI obligation is set.
    - Returns to generators are influenced by the band within which their technology is placed.

4.3. The cost and impact of the NIRO in its current form

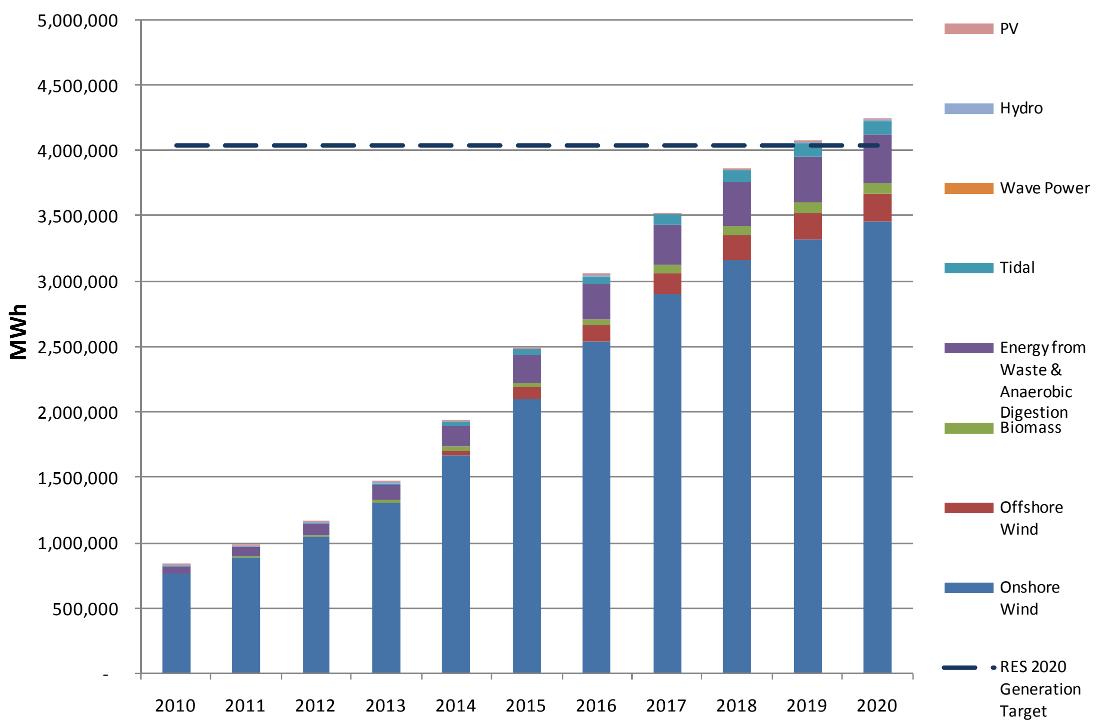
As the existing support mechanism in place in NI, the NIRO provides the counterfactual against which other approaches to supporting renewable generation in NI need to be evaluated. In this section we investigate the volume of renewable generation which the NIRO in its current form would be expected to deliver in NI by 2020 and the costs to NI consumers of funding this investment.

Volume of renewable generation deployment

Figure 4.1 shows the projected volume of renewable electricity generation in NI to 2020 under a scenario in which no changes are made to the current structure of the RO (other than those included in the RO (Amendment) Order 2010 and the NIRO (Amendment) Order 2010). We term this the "Base Case". This scenario assumes NI's statutory obligation percentage does not change from 6.3 per cent after 2012[11] and the scheme remains in operation until 2033.

The Base Case scenario can be best described as a "do-nothing" scenario for NI's renewable generation support mechanism.

Figure 4.1: Base Case Northern Ireland renewable deployment



Source: CEPA

Figure 4.1 shows that:

- The NIRO is projected to encourage deploy ment of RES-generation sufficient to meet NI's 2020 renewable electricity target by 2019 (on the assumption that there are no non-cost barriers to the deployment of renewable generation).
- For most large scale renewable technologies, the NIRO is projected to support investment in RES-generation in all years to 2020, with large onshore wind representing the most significant deployment, followed by energy from waste, offshore wind, biomass and tidal stream technologies.
- Generation build rate constraints (the amount of generation that can be installed annually) play an important part in the outcome, as the rate of incremental annual investment in all RES-generation technologies increases towards the end of the 2020 deployment period.

[11] The NIRO Order sets out a legislated statutory obligation level to 2012/13. The obligation level will be set at 6.3 per cent in this obligation period.

The NIRO in its current form is also projected to incentivise investment in certain types of small-scale RES-generation (notably onshore wind and biomass installations smaller than 5MW). It is projected that small-scale generation contributes 2.5 per cent of NI's final electricity consumption, and 5.9 per cent of total RES-generation production, by 2020.

It can also be seen from Figure 4.1 that banding of the NIRO makes higher-cost technologies such as offshore wind and tidal stream more attractive towards the end of the investment period to 2020as the costs of the these technologies are expected to fall,.

Cost to consumers

The cost to NI and GB consumers of the current NIRO and RO regimes can be measured in a number of ways, which capture costs within a particular year or the sum over a numbers of years. From a customer's perspective it is the cost they pay for power received from renewable generation and the cost of support which is relevant. Table 4.1 therefore presents the annual cost of the NIRO in 2020 and the amount being paid in total to incentivise renewable generation deployment. .

Table 4.1: Annual costs GB & NI consumers under the Base Case in 2020

Metric	Unit	Cost to NI consumers	Cost to GB consumers
Costs of subsidy			
Annual consumer cost in 2020	£m	64.6	5,481.1
Consumer cost in 2020 (per unit of renew. electricity generated)	£/MWh	15.10	53.70
Consumer cost in 2020 (per unit of electricity consumptions)	£/MWh	6.40	15.80
Costs of subsidy and electricity			
Consumer cost in 2020	£m	414.1	13,672.0
Consumer cost in 2020 (per unit of renew. electricity generated)	£/MWh	96.80	133.80
Consumer cost in 2020 (per unit of electricity consumptions)	£/MWh	41.00	39.50

Note: all costs are NPV, net present value.

Source: CEPA

The key figures to note from Table 4.1 are:

- The NIRO (and therefore subsidising renewable electricity generation in NI) is projected to cost NI electricity consumers around £65m annually by 2020.
- This is a subsidy cost of £6.40 per unit of projected electricity consumption in the region in 2020, and a subsidy cost of £15.10 per unit of renewable electricity generation.

- GB electricity consumers are predicted to pay around £10 more, per unit of electricity consumption, than their NI counterparts to pay the costs of the RO if only the renewable generation subsidy is considered in consumer costs.
- However, if the wholesale cost of electricity is also included in, NI consumer costs increase significantly and It can be seen that customers in both GB and NI are paying a broadly comparable amount to support renewable generation.

These results are primarily driven by differences in forecast SEM and GB wholesale electricity prices, but also differences in the key design parameters of the NIRO, RO and ROS. In particular, the assumption that the NIRO operates at a lower statutory obligation level than in the rest of the UK.

The estimated impact on household bills from the operation of the NIRO in 2020 is illustrated in Table 4.2. It is estimated that the NIRO (i.e. the subsidy cost of renewable generation) will lead to an average increase in annual NI household electricity bills of approximately £33 by 2020.

Table 4.2: Impact on average household and industrial/commercial bills

Metric	**Unit**	**2015**	**2020**
Household bills			
NIRO cost in 2020	£m	33.45	64.60
Impact on average annual household bill	£	17.90	32.80

Note: all costs are NPV, net present value.

Source: CEPA / PB

Conclusions on the NIRO in its current form

The analysis presented in this section shows that, due to the current concessionary rate of NI's statutory obligation level, the costs of funding renewable generation faced by NI consumers from the NIRO alone are below the level faced by consumers in GB. However, regardless of the relative impacts on consumer costs across the UK, funding renewable generation in NI can be expected to lead to a significant increase in average NI electricity consumer household bills to 2020.

NI has adopted a strategic objective to increase the amount of electricity generation from renewable sources to 40 per cent by 2020. The analysis presented in this section, also suggests that the NIRO, in its current form, could encourage deployment of renewable generation sufficient to meet this target,. That is, ignoring wider issues and constraints, such as the operation of the SEM, system integration costs, adequacy of network infrastructure to connect a large quantity of renewable generation and arrangements for planning and consenting projects, the revenues available via the market and support arrangements appear sufficient to meet the required rate of return of enough investors.

However, there are also some important qualifications to this conclusion. The NIRO is set independently of the wholesale electricity price, and unlike a support mechanism such as a FIT, which takes revenue volatility away from the investor and converts two uncertain revenue streams (the wholesale electricity and the subsidy price) into one fixed revenue stream, the NIRO exposes investors in renewable generation to volatility in SEM prices. Therefore, it is feasible that investors will require greater rates of return in order to invest in the SEM, particularly were prices to become more volatile or were there an expectation of future changes in the method of supporting renewable generation (or the commitment to supporting renewable generation at all).

The total costs to NI consumers of funding renewable generation are also uncertain; a function of volatility in SEM prices, levels of installed capacity and the technology mix that is invested in. The outturn costs and level of output from renewable generation projects in NI, and how these change in the future, may also differ from the assumptions used in the analysis.

However, perhaps most importantly, it is not given that NI will continue to retain its existing concessionary rate under the NIRO. Indeed, the statutory obligation level is only legislated to 2012/13. Were NI not to retain its current statutory obligation rate, it might be expected that the NIRO would lead to much higher consumer costs than under a "do-nothing" scenario. Possible future amendments to the NIRO, in particular, possible increases in the statutory obligation level under the scheme, as well as other changes to design parameters such as banding are investigated in the section which follows.

Conclusions on the costs and impacts of the NIRO

- The NIRO in its current form is expected to deliver sufficient investment in renewable generation to meet renewable energy targets.
- The NIRO (and therefore subsidising renewable electricity generation in NI) is projected to cost NI electricity consumers around £65m annually by 2020.
- When the costs of energy and supporting renewables are considered together, customers to NI and GB pay broadly comparable amounts.

4.4. Amendments to the NI obligation level

The previous section investigated the expected consequences of continuing to support renewable electricity generation in NI via the NIRO in its current form. However, it is possible (though we have no reason to believe it is likely) that, in the future, changes may be required to the design of the RO or the NIRO which create a need to consider the approach to supporting renewable generation in NI to ensure it remains 'optimal' from the perspective of achieving NI strategic energy goals and objectives.

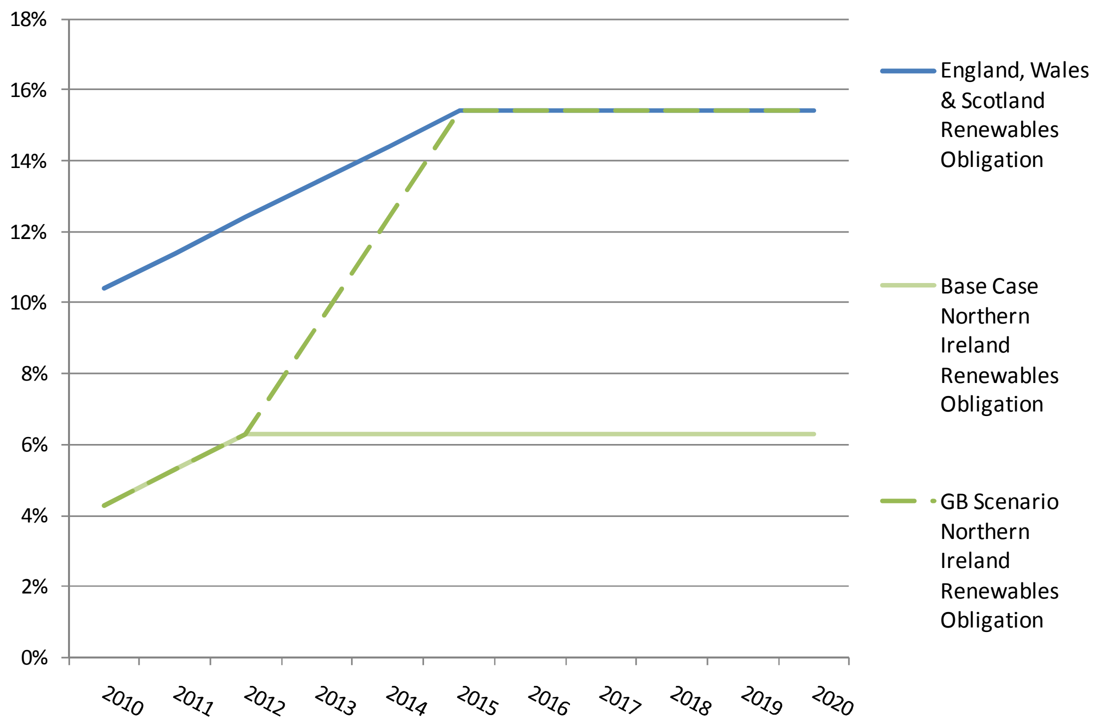
In this section, we investigate expected volume of renewable generation and NI consumer costs under a number of scenarios in which amendments are made to the future obligation levels of the NIRO and the banding of different renewable technologies. We discuss each of these amendments in turn.

4.4.1. Increasing the NI statutory obligation level

Currently, the NI statutory obligation for 2010/11 is 4.3 per cent of total electricity supplied, increasing to 6.3 per cent by 2012, consistent with the NIRO (Amendment) Order 2010. The analysis in the previous section assumed NI retains its concessionary statutory obligation level of 6.3 per cent until the NIRO end-date in 2033. Figure 4.2 below illustrates an alternative scenario (referred to as the "GB Obligation" scenario) where NI's obligation level is assumed to converge with the GB obligation level from 2015/16.

This scenario provides a useful comparison of what the expected level of investment and costs may be of supporting renewable generation in NI were the NIRO required to be consistent with other parts of the UK. Given the NI statutory obligation level affects NI consumer costs of supporting renewable generation, and the statutory obligation level in GB is likely to be maximum level of the NI obligation, the GB Obligation Scenario also provides the upper bound of the spectrum of consumer costs of supporting renewable electricity generation in NI under the NIRO.

Figure 4.2: NI Renewables Obligation under GB Scenario



Source: CEPA/PB

Table 4.3 shows projected renewable generation deployment and NI consumers costs (in 2020) of the continued operation of the NIRO under the two statutory obligation scenarios – the "Base Case" and the "GB Obligation" scenario.

Table 4.3: Comparison of consumer costs under Base Case "do-nothing" and GB obligation levels

Cost to consumers in 2020	**Base Case**		**GB Obligation Scenario**	
	NI	**GB**	**NI**	**GB**
Deployment of renewable generation in NI				
RES-generation deployment in 2020 in NI (TWh)	4.3		4.3	
Contribution of RES-generation to NI electricity demand (TWh)	42%		42%	
Subsidy cost to NI consumers				
Cost in 2020 (£m)	64.6	5,481.1	157.0	5,388.7
Consumer cost in 2020 (per unit of renew. electricity generated)	15.1	53.7	36.7	52.7
Consumer cost in 2020 (per unit of electricity demand)	6.4	15.8	15.6	15.6
Percentage change in consumer costs from Base Case scenario	-	-	143%	-2%
Subsidy and electricity cost to NI consumers				
Cost in 2020 (£m)	414.1	13,670.0	506.5	13,579.6
Consumer cost in 2020 (per unit of renew. electricity generated)	96.8	133.8	118.4	132.9
Consumer cost in 2020 (per unit of electricity demand)	41.0	39.5	50.2	39.2
Percentage change in consumer costs from Base Case scenario	-	-	22%	-1%

Note: All Costs NPV; Net Present Value

Source: CEPA / PB analysis

The analysis shows that increasing the level of the NI statutory obligation under the NIRO would be expected to have a minimal impact on the level of investment in renewable generation in NI, but would be expected to increase NI consumers costs under the scheme significantly. This is because the ROC price, which provides the incentive to invest under the NIRO, is set in relation to the supply and demand from ROCs in the UK. The size of the NIRO is comparatively small, relative to the total UK-wide obligation size, and so even if the level of NIRO and GB obligation were equal (in percentage terms) the impact on the ROC price would be expected to be negligible.

Under the GB obligation level, there is a 143% percentage change in NI consumer subsidy costs from a scenario of the NIRO in its current form, but this has no impact on the level of investment in renewable generation in NI by 2020. In contrast, although the costs to GB consumers of the RO are lower when NI's statutory obligation is increased to a similar level with GB, the fall in GB consumer costs is much smaller, in percentage terms, than the percentage increase in NI consumer costs. If the existing NI obligation rate were increased, NI consumer costs under the NIRO could be expected to increase significantly, but there would be minimal benefits to NI in terms of greater efficiency or level of investment in renewable generation.

Conclusions on the costs and impacts of a GB scenario

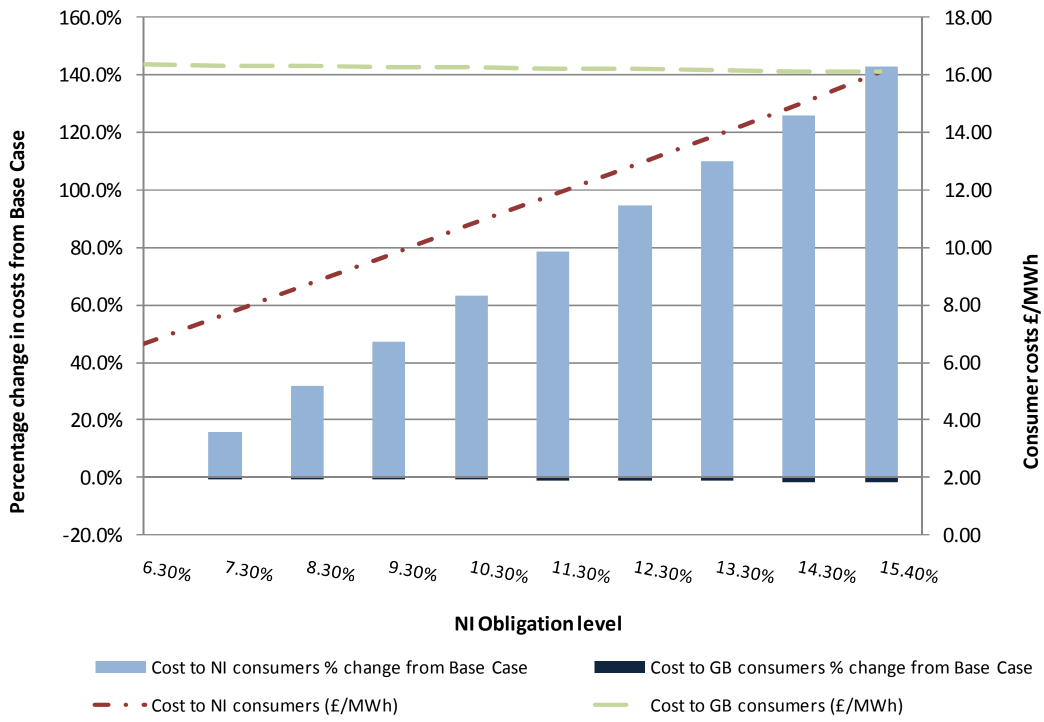
- Increasing the level of the NI statutory obligation under the NIRO would be expected to have a minimal impact on the level of investment in renewable generation in NI.
- However, there is a 143% percentage increase in NI consumer costs and only a marginal percentage decrease in costs to GB consumers.

4.4.2. Alternative levels of NI obligation

The discussions above outlined what can be considered a low (the "base case") and high ("GB Obligation") scenario. We now briefly consider levels of NI obligation between these two cases.

Figure 4.3 illustrates the impact on NI and GB consumer costs of a range of NI obligation levels. The primary horizontal axis shows the percentage change in GB and NI consumers subsidy costs (i.e. the excluding the wholesale electricity price) in 2020 from varying the obligation level. The secondary horizontal axis shows the subsidy cost per unit of electricity consumption, also for both GB and NI consumers. Consistent with the conclusions from the "Base Case" and "GB Obligation" scenario, the analysis shows that progressively increasing NI's statutory obligation level proportionately increases NI consumers costs. Although GB consumer costs fall as the NI obligation level increases, the percentage change in GB consumers costs is relatively small, relative to the percentage change in NI consumer costs.

Figure 4.3: Impact on consumer costs of NI obligation sensitivities



Source: CEPA / PB

Conclusions on varying obligation levels

- The NIRO in its current form, is projected to encourage a volume of renewable generation deployment sufficient to meet NI's 2020 renewable electricity target. It is also estimated that the NIRO (i.e. the subsidy cost of renewable generation) will lead to an increase in annual average NI household electricity bills of approximately £33 by the end of the investment period to 2020.
- Increasing the NI obligation would be expected to have a minimal impact on the level of investment in renewable generation in NI, but would increase costs to NI consumers significantly, while only marginally reducing costs to GB consumers.

4.5. Amendments to banding of the NIRO

As well as the costs to NI consumers, a key question for this study is the volume of renewable generation that may be expected to be delivered in NI by 2020. In this section we assess the ability of the NIRO and its banding structures to meet fixed targets for the proportion of energy sourced from different types of large-scale renewable generation, in particular, ocean based technologies such as tidal stream and wave power[12].

[12] Wave and tidal stream devices are emerging renewable electricity generation technologies and there is significant uncertainty around both underlying cost and feasible resource in NI (see DETI (2009): Strategic Environmental Assessment of Offshore Wind and Marine Renewable Energy).

The Scottish Executive has set clear targets for the generation of electricity from renewable sources – 18% of electricity generated in Scotland (as a proportion of consumption) is to be generated from renewable sources by 2010, rising to 40% by 2020 - and the ROS is the main legislative means through which this objective is being pursued. In 2008, the Scottish Executive introduced a banded ROS for different RES-generation technologies.

Under this policy, wave generation technologies receive five ROCs for every MWh of power produced, tidal devices receiving three ROCs per MWh of power produced, while more established technologies like onshore wind and hydro continue to receive one ROC for every MWh. We have investigated the impact on renewables deployment in NI, and the costs to consumers, if a similar level of support were provided to tidal and wave generators in NI via amendments to the banding of the NIRO[13].

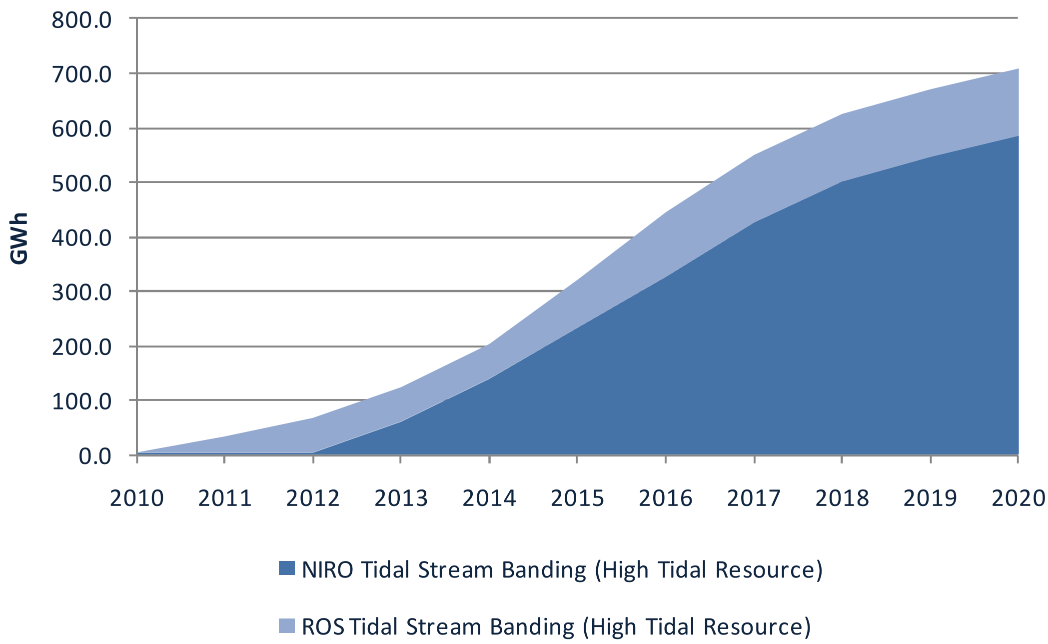
Figure 4.5 compares projected tidal stream deployment to 2020 under the Base Case tidal resource scenario and where a much larger quantity of tidal stream resource is assumed (both scenarios are based on tidal stream resource assessments presented in NI's 2009 Strategic Energy Framework). Since this assessment other studies, such as the SEA of NI ocean renewable energy resource, have found an even greater level of tidal stream resource in NI territorial waters.

The analysis shows that increasing the level of support available to tidal stream projects to similar levels as under the ROS makes a greater quantity of projects viable in the lead up to 2020. Under the cost and production assumptions adopted, these projects would not be viable under the existing system of banding for ocean based technologies.

A change to the banding of the NIRO would therefore be able to support more emerging technologies such as tidal stream and wave power generation, from a purely cost and expected revenue stream perspective. Correspondingly, banding could also be reduced in a situation where generation costs were much lower than expected – i.e. banding of the NIRO could be revised to eliminate excessive profits ("windfall gains") to investors in future projects if this were required. A banded NIRO can be a relatively flexible mechanism to influence the level and type of renewable generation deployment in NI in the investment period to 2020.

[13] All other assumptions under this scenario are consistent with the NIRO in its current form.

Figure 4.5: Deployment of tidal stream under tidal/wave sensitivity and high tidal resource



Source: CEPA

The impact on consumers, who are required to fund investment in incremental tidal stream projects in NI, from revised banding of tidal stream generation, is estimated to be relatively small (see Table 4.4 below).

Table 4.4: Banding analysis

Metric	NIRO (current)	NIRO (revised)
Deployment		
RES-generation (GWh) in 2020	3,442	3,566
Tidal stream (GWh) in 2020	585	709
Costs to NI consumers (NIRO as a whole)		
Subsidy cost (£m)	64.4	64.9
Subsidy and electricity cost (£m)	345.6	356.2

Source: CEPA

Key conclusions in respect of banding arey:

- A banded NIRO provides a certain level of support to each renewable generation technology. Banding gives some technologies more ROCs per MWh generated, and others less.
- Amending NIRO banding can provide both a route to supporting certain forms of renewable generation and eliminating windfall gains where costs have fallen or are expected to fall in future.
- Were policy makers to be concerned about the ability of the NIRO in its current form to deliver sufficient investment to meet 2020 targets or were they to wish to

incentivise a certain generation mix, amendments to banding levels provide a flexible mechanism to tailor revenues to the requirements of investors.

However, there are a number of important factors to bear in mind:

- Higher levels of banding will increase costs to GB and NI consumers (which may increase pressure to amend the level of the NI obligation).
- Banding amends the level of support to investors but does not eliminate wholesale price or ROC price volatility.
- State aid approval would be required to implement changes in the level of banding and it isn't clear that making frequent amendments would be feasible from a policy perspective.
- Frequent amendments in the parameters of a support scheme can create expectations of future changes which can influence investors' perceptions of risk and create disincentives to invest.

Conclusions on banding

- Banding can be used as a means of varying support (upwards or downwards) to different technologies and can hence increase the probability of meeting targets or be used to stimulate investment in certain technologies.
- However, increased levels of banding increase costs to customers in both NI and GB, pose implementation challenges and may alter perceptions of risk.

4.6. Summary

This section has assessed the effectiveness and efficiency of supporting renewable generation under the NIRO in its current form, and under a number of alternative scenarios in which amendments are made to the key design parameters of the scheme.

The key points to note from the analysis are summarised in the text box below.

Conclusions on identifying the costs and merits of the NIRO

- The NIRO in its current form, is projected to encourage a volume of renewable generation deployment sufficient to meet NI's 2020 renewable electricity target. It is also estimated that the NIRO (i.e. the subsidy cost of renewable generation) will lead to an increase in annual average NI household electricity bills of approximately £33 by the end of the investment period to 2020.
- Increasing the NI statutory obligation level would be expected to have a minimal impact on the level of investment in renewable generation in NI, but would increase NI consumers costs significantly, without any increasing the efficiency of the scheme or significantly lowering GB consumer costs.
- Banding provides a route to amend the level of support available to certain renewable technologies and can hence be used as a means of supporting certain technologies, avoiding windfall gains or increasing the likelihood that targets are hit. . However, banding increases costs to consumers and poses implementation challenges.

5. ASSESSING ALTERNATIVE FORMS OF SUPPORT

5.1. Overview

The previous section provided an assessment of the efficacy of the NIRO. The analysis highlighted that the NIRO could encourage a volume of renewable generation deployment sufficient to meet NI's 2020 renewable electricity target but this would require a relatively significant increase in NI electricity bills by 2020.

While this analysis also illustrated the merits of the NIRO as a renewable generation support mechanism (for example, the ability of a banded NIRO to increase the level of support available to certain renewable technologies and eliminate windfall gains to investors as technology costs and output change) it also highlighted some of the features of the NIRO which may constrain its effectiveness.

This section considers whether a more tailored level of support could be provided to NI generators through an alternative support mechanism, such as a system of FITs. We illustrate how a policy based on replicating the REFIT scheme in the RoI would influence costs and the ability to meet renewable generation objectives in NI, before considering alternative FIT designs, including those which ensure delivery of 2020 targets, on the basis of a set of assumptions.

We have also considered capital grants as an alternative approach to the NIRO of supporting large-scale renewable generation in NI. However, given the significant projected cost of such a scheme (the analysis shows that the discounted cost of providing 50 per cent of capital costs to new-build renewable generation as a standalone alternative to the NIRO is around £800m cumulatively to 2020) we do not consider capital grants to currently be a viable alternative to the NIRO or a FIT scheme in NI. Our assessment of the potential role of capital grants in supporting renewable generation in NI is therefore confined to the discussion on small-scale generation support regimes in Section 6. However, modelling results and discussion of a standalone capital grant scheme is provided as part of the analysis in Volume B of our report.

Before we consider the impact on NI consumer costs and deployment of renewable generation capacity from the introduction of a system of FITs, relative to the NIRO, we provide a short summary of the key features of FIT schemes, and their overall objectives. This provides background to the discussion and assessment of why policy makers in NI may wish to consider a FIT as an alternative to theNIRO.).

5.2. Feed-in-tariffs

A FIT is designed to provide a fixed revenue stream (as opposed to variable revenues via the wholesale market and a separate support mechanism) to renewable generators and to provide certainty about the total cost to consumers of meeting a given policy objective. Policy makers determine the level of support which a renewable generation technology requires on the basis of capital costs, operational costs, expectations of the return required by investors and predicted future falls in cost. Recognising that renewable generators receive revenues via the wholesale markets and other sources (though these revenues are insufficient to cover costs), an additional payment equal to the difference between the level of the wholesale price and the amount of revenue deemed to be required is then paid to generators. The level of this payment varies with movements in the wholesale price, thus eliminating volatility for investors and capping the total cost paid by customers. From an investors perspective, relative to the NIRO, a FIT converts two variable revenue streams into one fixed revenue stream. This reduction in risk is designed to incentivise investment at a lower required rate of return.

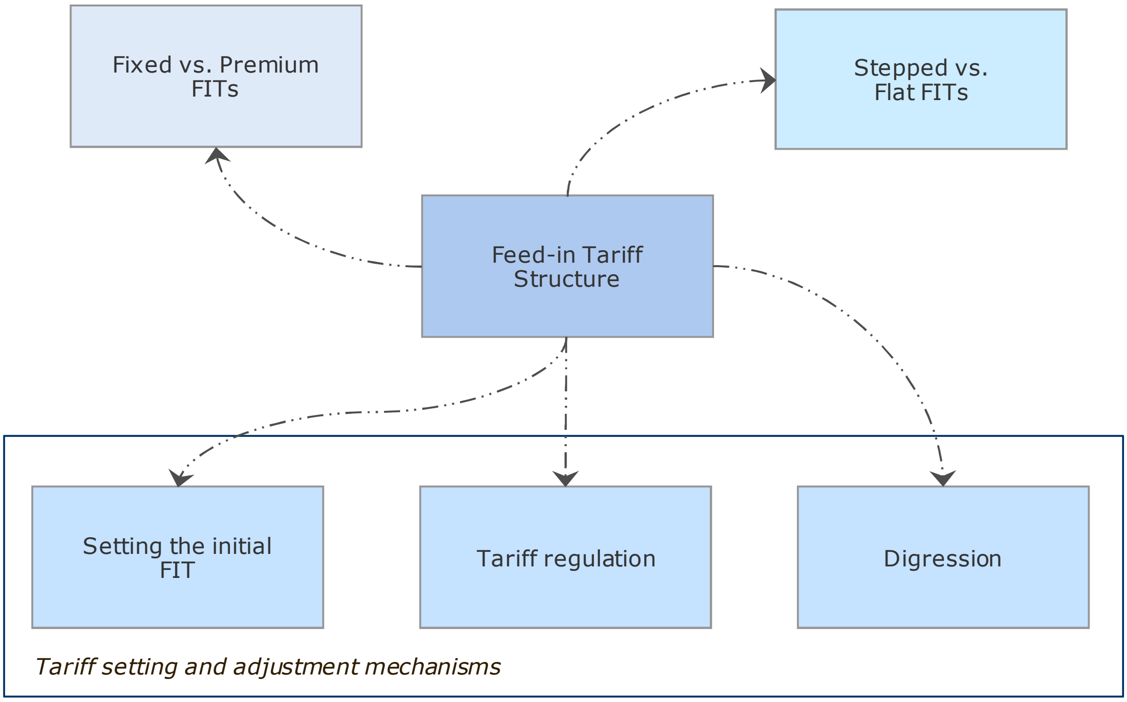
While a FIT is, intuitively, a simple way of support renewable generation, there are considerable complexities associated with designing an efficient scheme. Estimating capital costs and required returns is difficult, particularly for emerging technologies which are a long way from commercial viability.

There are number of possible solutions to these issues. One approach is the regulation of tariffs over the lifetime of the support mechanism, which allows a FIT to be tweaked to reflect changes in cost but increases an element of regulatory risk and arguably undermines the intention that a FIT acts like a long-term contract. . Alternatively, the initial FIT level can be set above average cost to encourage higher cost projects and a digression rate then applied to reflect expected decreases in renewable generation technology and installation costs over time. Another (simultaneous) approach to dealing with the problem of getting cost-reflective tariffs in an environment of cost uncertainty is be to use market mechanisms to award contracts. Auctioning or tendering a fixed number of projects (with the number determined based on policy aspirations) allows least cost providers to self-select and deliver aspirations at least cost.

In Figure 5.1 we summarise a number of the key choices about FIT design. In addition, to these choices, there are other subsidiary design choices which affect the characteristics and effectiveness of FITs, including the timeframe of guaranteed support to generators, the administration of the scheme (for example, how the cost of the FIT is recovered from electricity customers) and whether there is a purchase obligation on grid operators or suppliers to purchase electricity delivered to the network from RES-generation plant.[14]

[14] Poyry / Element Energy, 'Qualitative issues in the design of GB Feed-in Tariffs', June 2009

Figure 5.1: Feed-in tariff structure design



Source: CEPA / Poyry Energy

5.3. Replicating the REFIT

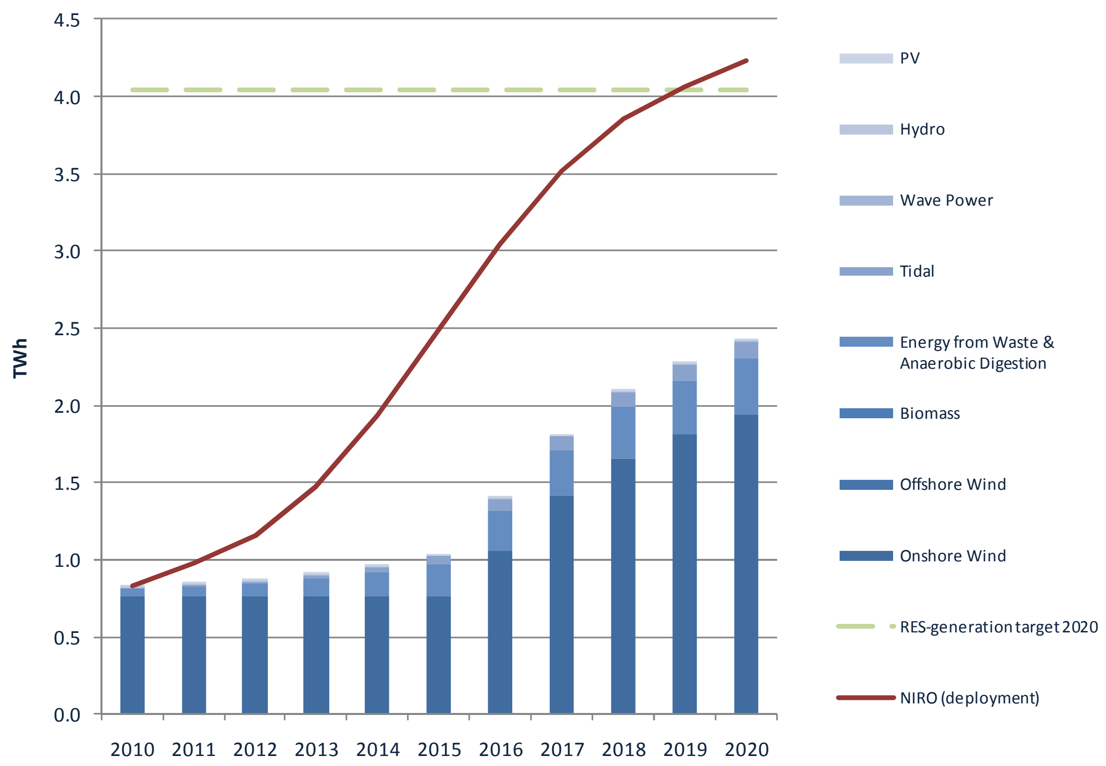
It would, in theory, be possible to support renewable generation in NI via various FIT. A number of existing FIT schemes in GB, the RoI and elsewhere in Western Europe provide possible models for setting tariff levels and for structuring a scheme to replace the NIRO for large-scale renewable generation.

One option, with is relatively intuitive given the presence of an All-Island market, would be to set the level of support in NI equal to the levels of support offered by the RoI REFIT. Under the REFIT a FIT is offered to renewable generators over the expected life of generation projects, with the level of support differentiated by technology.

Figure 5.2 shows the projected level of new-build generation deployment under the NIRO and REFIT scenarios[15].

[15] Our REFIT scenario is modelled based on NI generators receiving payments over the life of projects. Full details of modelling assumptions are contained in Volume B.

Figure 5.2: Renewable electricity deployment under REFIT tariff levels and NIRO



Source: CEPA

The key points to note from Figure 5.1 are as follows:

- A FIT modelled to replicate the level of support provided by the REFIT, results in lower incremental volumes of projected renewable generation than under the NIRO in its current form and design.
- The level of FITs fail to incentivise a quantity of renewable generation sufficient to meet NI's 2020 renewable electricity target.

REFIT tariff levels were set for a particular round of renewable generation investment in the RoI and do not reflect the levels of revenue required given the cost assumptions of prospective projects in NI. The tariffs under the REFIT were set to incentivise a set quantity of generation and the design of the scheme brought the lowest cost projects to market. In contrast, in the analysis, average renewable generation technology cost assumptions are used for different size categories of renewable generation. Costs for various renewable electricity generation technologies and scales, in particular onshore wind generation, are also likely to have increased since the previous round of investment under the REFIT.[16]

Table 5.1 compares NI consumer costs for a FIT scheme modelled to reflect the tariff levels under the REFIT with the costs of the NIRO under Base Case assumptions. The cost analysis shows both the cost of subsidy and the wholesale electricity price within

[16] See Renewables UK (2010): 'Wind Energy Generation Costs' and PB (2010): 'Powering the Nation Update 2010' for further details on recent rises in renewable generation costs.

consumer costs. The costs to NI consumers under FIT Structure A are much lower than the NIRO because a much lower quantity of renewable generation build is facilitated where investors are offered only the FIT as a source of revenue.

Table 5.1: Summary of cost-benefit outputs – feed-in tariffs

Cost metrics	**Unit**	**NIRO**	**FIT Structure A**
Costs of subsidy and electricity			
Consumer cost in 2020	£m	414.1	140.0
Consumer cost in 2020 (per unit of renew. electricity generated)	£/MWh	96.8	57.2
Consumer cost in 2020 (per unit of electricity consumptions)	£/MWh	41.0	13.9

Source: CEPA

The subsidy cost will vary under a FIT scheme such as the REFIT, as generators are required to pay into, or receive payment from, a mechanism similar to the Public Service Obligation (PSO) levy in the RoI[17] depending on the difference between the wholesale electricity price and the level of FIT set by policy makers. However, the *total cost* of the scheme, and therefore total costs of funding renewable generation to NI consumers (i.e. subsidy cost and wholesale cost of power) is fixed, unlike under the NIRO, where total consumer costs of funding renewable generation are uncertain and a function of changes in SEM prices. Under the REFIT, investors are provided with a fixed revenue stream, as the scheme concerts two uncertain revenue streams, the wholesale electricity and subsidy price, into one fixed revenue stream.

Conclusions on replicating the REFIT

- Setting a FIT at tariff levels equal to those under the REFIT would appear to incentivise insufficient investment to meet renewable targets.
- However, a FIT similar to the REFIT would cap total costs to consumers and provide certainty about levels of revenue to investors.

5.4. Setting a FIT to facilitate delivery of the 2020 target

In this section we assess expected deployment, costs and benefits under a system of hypothetical FITs tailored to ensure delivery of NI's renewable targets (in light of expectations about renewable generation resource, technology cost and production assumptions).

[17] The PSO requires ESB Customer Supply to purchase electricity from specified sources, including sustainable and renewable sources. The collection and payment for the REFIT (the FIT scheme in the Republic of Ireland) is recovered through the PSO levy annually.

CEPA has developed two sets of hypothetical tariff levels in order to project deployment and costs to NI consumers under a FIT scheme designed to meet NI renewables targets. Full details of both these approaches is described in Volume B of the study. The key difference between the two tariff levels if that one is set at a level sufficient to meet our central case technology cost assumptions, while the other is set to meet our high cost assumption (which may be considered a more realistic or less idealised assessment of potential costs and impacts).

Table 5.2 summarises renewable electricity generation deployment, and the impact on NI consumer costs, for each of the FIT mechanism scenarios, compared to the NIRO (Base Case) scenario.

Table 5.2: Summary of cost-benefit outputs – feed-in tariff options

Parameter	Base Case	FIT B	FIT C
Deployment			
Contribution of RES-generation to NI electricity consumption in 2020	42%	44%	44%
Additional renewable generation in 2020 (TWh)	3.4	3.6	3.6
Additional small-scale generation in 2020 (GWh)	0.1	0.2	0.2
NI consumer cost metrics (subsidy cost)			
Annual cost to NI consumers in 2020 (£m)	64.6	69.5	108.9
Annual cost to NI consumers in 2020 (£/MWh per unit of consumption)	6.4	6.9	10.8
NI consumer cost metrics (subsidy and cost of electricity			
Annual cost to NI consumers in 2020 (£m)	414.1	433.8	473.3
Annual cost to NI consumers in 2020 (£/MWh per unit of consumption)	41.0	43.0	46.9

Note: all costs are NPV, net present value.

Source: CEPA

The analysis suggests that under both modelled designs a FIT scheme would be expected to be comparatively expensive, relative to the NIRO. The *total subsidy cost* of funding new-build investment in renewable generation would need to be recovered solely from NI consumers, through a similar approach to the PSO levy in the RoI under the REFIT. In contrast, under the NIRO, GB suppliers provide a source for NI ROCs and funding of renewable generation in NI.

In the section which follows, we analyse if there is a point at which the NIRO, relative to a FIT, could no longer be the least cost renewable generation support mechanism for NI consumers, followed by a more qualitative assessment of a FIT as an alternative support mechanism to the NIRO.

Conclusions on setting a target compatible FIT

- While it is possible to set a FIT which would be expected to meet renewable energy targets, the costs to NI consumers would be expected to be higher than under the base case in both cases.

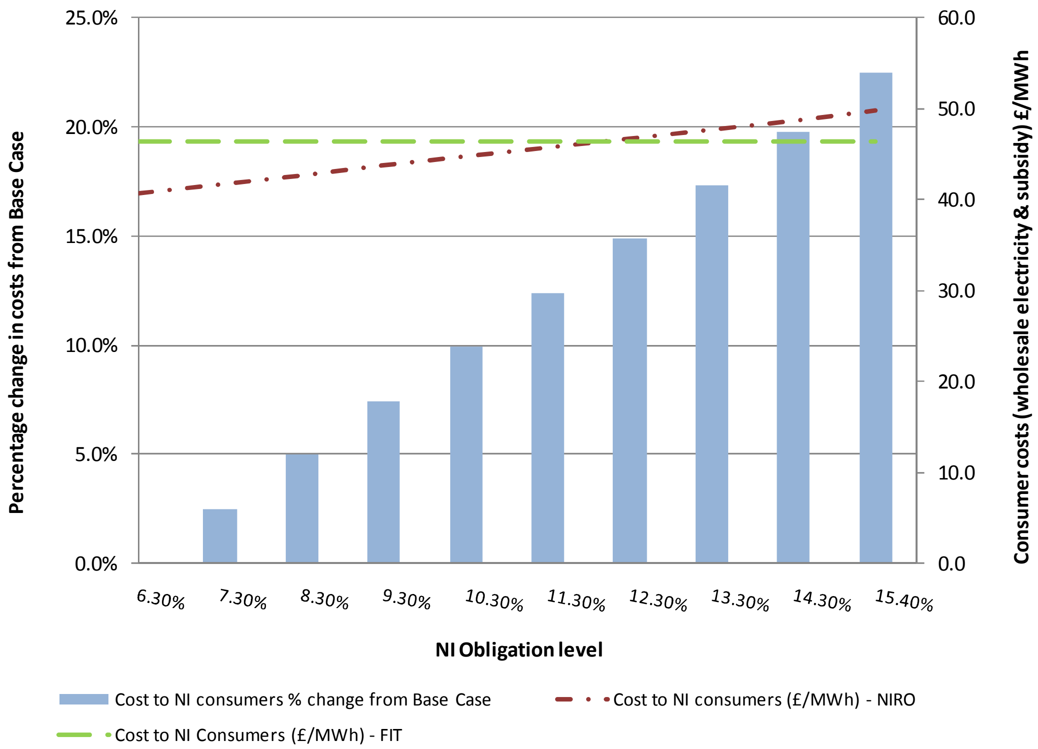
5.5. Comparison of NIRO and FIT options

In this section we further consider the NIRO and alternative FIT options as a means of supporting renewable generation in NI. In particular we explore whether there is likely to be a point at which the result above ceases to hold and it might be expected to be in NI's interests to switch away from the NIRO.

5.5.1. Quantitative assessment

In order to explore the effect on GB and NI consumer costs of increasing the NIRO from a "do-nothing" scenario, Section 4 presented an estimate of the costs to NI consumers under a set of statutory obligation levels. Figure 5.3 compares this analysis to the costs of FIT Structure C, but shows the total consumer cost per MWh (i.e. subsidy and wholesale electricity price) rather than solely the cost of the NIRO.

Figure 5.3: Comparison of FIT Structure C and NIRO costs under alternative NI obligation levels



Note: consumer costs are net present value

Source: CEPA

Figure 5.3 suggests that the economic case for maintaining the NIRO as NI's support mechanism rests on the expected future level of NI's statutory obligation level:

- Were the NI obligation to increase, so that it reaches a level closer to that in place in GB, our analysis suggests that a system of FITs may be a more cost effective approach for supporting renewable generation by 2020 (though this conclusion is clearly dependent on the design of the scheme, the ability to accurately predict costs, the level of conservatism adopted by policy makers when setting tariff levels and the impact of any additional uncertainty when moving between schemes).
- However, were NI's renewables obligation to increase, in line with GB's legislated statutory obligation level, but remain at a similar concessionary level (i.e. a fixed level below the RO) the analysis suggests there would be a case for retaining the NIRO .

This result is likely to have significant implications for policy makers. As discussed above, the economic case for NI retaining a concessionary obligation rate *may* (amongst other considerations) depend on the relative levels of fuel poverty and total expenditure on electricity (per unit of demand) in NI and GB, as well as how the GB RO is expected to develop out to 2020. Clearly the significant additional costs to NI customers of amending the level of obligation may also merit consideration.

5.5.2. Wider considerations

While the result above has potentially significant policy implications, there are a series of wider factors which would need to be considered were policy makers considering a move away from the NIRO as the principle mechanism of supporting renewable generation in NI. These issues are discussed below.

Flexibility

While there are considerable challenges involved in setting a FIT at the correct level, it is possible to tailor the tariff so that it reflects the costs faced by investors in different sizes and types of technology, and reduces over time in response to underlying changes in costs and subsidy requirements in NI. A FIT takes revenue volatility away from the investor and converts two uncertain revenue streams into one fixed revenue stream. Under a FIT, the *total costs* to NI consumers of funding renewable generation are also fixed: equal to required tariff levels (set in relation to expectations of renewable generation technology costs) multiplied by the quantity (volume of output) of renewable generation in NI.

A FIT scheme may therefore be favoured by investors in renewable generation and might be expected to offer a lower cost of capital due to lower revenue risk. Intuitively, a FIT option would also seem more likely to produce the least cost option for NI consumers who are required to fund investment in renewable generation.

However, the indicative analysis (summarised in the previous section) suggests that, given the current design of the NIRO (i.e. statutory level of the NI obligation) the annual costs to NI consumers of supporting renewable generation to 2020 under a system of FITs would be greater than under the existing NIRO regime. This is principally because, under a FIT, the total *subsidy cost* would need to be recovered solely from NI electricity suppliers and consumers.

Investor certainty and policy risk

The NIRO appears to be well understood by investors, has already stimulated considerable levels of renewable generation investment in NI. In addition, the price of NIROCs has stabilised due to the headroom mechanism and the small impact NI has on the GB scheme. Therefore, a move to a FIT framework with while providing some benefits, might also be expected to create regulatory and policy uncertainty for investors about the duration and form of support that would be provided under an alternative scheme.

As a result, although a FIT regime, under certain policy assumptions, may be projected to deliver renewable targets at a lower cost to the NI consumer, a change in the support regime may also increase the degree of uncertainty with regards the achievement of NI's RES target to 2020.

Administration

The RO, ROS and the NIRO were introduced by the Department of Trade and Industry (DTI), the Scottish Executive and DETI respectively, but are administered by the Gas and Electricity Markets Authority (whose day to day functions are performed by Ofgem). From 2010-11 onward (i.e. from the 2009-10 compliance period onward), Ofgem will be recovering its cost of administering the RO from the buyout funds, and from the late payment funds, if there are insufficient funds in the buyout funds, and from government if there are insufficient funds in both the buyout funds and late payment funds.

Ofgem forecasts administration cost for the RO to be £2,084,000 for 2010/11. This is roughly 0.15% of the anticipated overall cost of the programme in 2010/11. Within this budget, there are a number of administration activities and responsibilities that Ofgem is required to carry out for that year.[18] The NIRO is managed by the Utility Regulator although administered by Ofgem in London via an Agency Services Agreement (ASA) between both parties.

With the continued operation of the NIRO the costs of administering the UK-wide RO scheme would continue to be shared with GB customers under the ASA between NIAUR and Ofgem. As a result, the incremental administrative costs of the scheme to 2020 are expected to be relatively small. These low administration costs must be compared with any start-up/administration costs of an alternative support mechanism. As for the subsidy cost of FIT scheme, given a NI FIT would need to be administered solely by policy makers in NI, it would be expected that the administration costs of any form of FIT scheme would be much greater compared to the NIRO.

[18] These include: accreditation of generators as being capable of generating electricity from renewable sources; issuing of ROCs and Scottish Renewable Obligation Certificates (SROCs) for eligible generation; establishing and maintaining a register of ROCs and SROCs; publishing a list of accredited and pre-accredited generating stations; calculating annually the buy-out price and the mutualisation ceiling resulting from the adjustments made to reflect the changes in the RPI; receiving buy-out payments and redistributing the buy-out fund; and publishing the annual report on the RO.

Implementation

With regards legal issues, the primary powers to introduce a FIT in GB were taken in 2009 in the latter stages of the Energy Bill (now the Energy Act 2008) along with powers to introduce a Renewable Heat Incentive. However, NI, which has transferred responsibilities for energy matters, does not currently have equivalent powers and therefore would not be able to replicate the GB or RoI FITs without primary legislation. This may create further barriers to investment, increase administration (start-up) costs and as discussed above, potentially increase the degree of uncertainty with regards the achievement of NI's RES target to 2020.

5.6. Conclusions on alternatives to the NIRO

Table 5.3 summarises our assessment of the relative merits of the NIRO and a system of FITs as the principal support mechanism for RES-generation in NI.

In the table a tick indicates either that a policy mechanism is able to achieve the desired objective (if the issue is absolute) or that it is able to deliver a desired outcome more effectively (if an issue is comparable). A cross indicates the opposite (i.e. that an approach cannot deliver a policy objective or can do so less well than an alternative).

Table 5.3: Summary of qualitative assessment

Metric	NIRO	FIT
Projected achievement of NI target	✓	✓
Cost to NI consumers [1]	✓	✗
Cost to NI consumers [2]	?	?
Over-subsidy [3]	?	✓
Operation of the SEM	=	=
Cost of capital [4]	✗	✓
Support mechanism stability	✓	✗
Administration costs	✓	✗
Legal frameworks [5]	✓	✗

Note 1: Under "do-nothing" projected NI obligation level

Note 2: Under revised NI obligation level.

Note 3: A banded NIRO could be revised to eliminate excess profits for future projects.

Note 4: FIT removes volatility in wholesale electricity price and creates a fixed revenue stream.

Note 5: Based on required primary legislation for the introduction of a FIT

Source: CEPA

A summary of the analysis across each of the NIRO and FIT scenarios discussed in this section is provided in Table 5.4 overleaf. The key points from both the qualitative and quantitative assessment of the NIRO and FITs as options for an NI renewable generation support mechanism are as follows:

Table 5.4: Comparison of cost-benefit analysis and RES-generation deployment between Base Case and alternative support option scenarios

Metric	Base Case	GB Scenario	FIT A	FIT B	FIT C	Capital Grant
Deployment in 2020 (TWh)	4.3	4.3	2.5	4.5	4.5	4.1
Contribution of RES-generation to NI electricity demand (TWh)	42%	42%	24%	44%	44%	41%
Subsidy cost (production subsidy) (£m in 2020; NPV)	181.6	181.6	(59.4) [2]	69.5	108.9	N/A
Over subsidy (£m in 2020; NPV)	(126.8)	(126.8)	(19.0)	-	(39.4)	N/A
Cumulative Cost to NI public budget (£m to 2020; NPV)	-	-	-	-	-	818.8
Emissions savings (£m lifetime costs; NPV)	236.7	236.7	82.5	252.7	252.7	231.4
Social Economic benefits (£m lifetime costs; NPV)	104.4	104.4	36.8	113.5	113.5	100.4
Annual consumer subsidy & electricity cost in 2020 (£m in 2020; NPV)	414.1	506.5	140.0	433.8	473.3	N/A
Annual consumer subsidy & electricity cost in 2020 (£/MWh per unit of electricity consumption)	41.0	50.2	13.9	43.0	46.9	N/A
Expected impact of subsidy on average annual household bills (£s)	32.8	79.8	N/A [2]	35.3	55.4	N/A

Note 1: Resource cost net of capital grant

Note 2: Subsidy costs are negative as costs of funding particular renewable generation technologies (e.g. very large onshore wind) (per MWh) are less than wholesale power prices; impact of subsidy on consumer bills is as consequence negligible.

Source: CEPA analysis

Conclusions on assessment of NIRO and FIT options

- The NIRO appears to be well understood by investors, has already stimulated considerable levels of renewable generation investment in NI and the price of certificates has stabilised due to the headroom mechanism.
- Under the current design of the NIRO (statutory level of NI obligation) the annual costs to NI consumers of supporting renewable generation to 2020 under a system of FITs are estimated to be greater than under the existing NIRO regime as the total cost would need to be recovered solely from NI customers.
- Were the level of the NI obligation under the NIRO increased, there is a point at which a FIT could become a more efficient option. However, this is dependent on the design of the scheme, the ability to accurately predict costs, the level of conservatism adopted by policy makers when setting tariff levels and the impact of any additional uncertainty associated with moving between schemes

6. Assessing alternative approaches to supporting small-scale generation

6.1. Overview

Small-scale generation could, if appropriately promoted, make a contribution to the achievement of NI's strategic energy policy goals. In this section, we compare the costs of small-scale generation technologies to alternative means of generating renewable electricity. We then discuss measures to overcome the constraints to the development of the small-scale generation industry in NI, including the role of financial incentives such as the NIRO, FITs and capital grant schemes.

In the sections which follow, we discuss in turn:

- the costs and benefits of small-scale generation to NI's electricity sector;
- current small-scale generation policy and resource potential in NI;
- financial incentives, for small-scale generation;
- regulatory and contractual frameworks for small-scale generation;
- institutional and regulatory arrangements.

Under the discussion of financial incentives, we provide our qualitative assessment of the NIRO, FITs and capital grant schemes as a means of supporting small-scale generation. We also summarise the effectiveness and costs to NI of small-scale electricity generation deployment under each alternative mechanism. The discussion accompanies the more quantitative assessment of small-scale renewable generation costs and benefits presented in Volume B of the study.

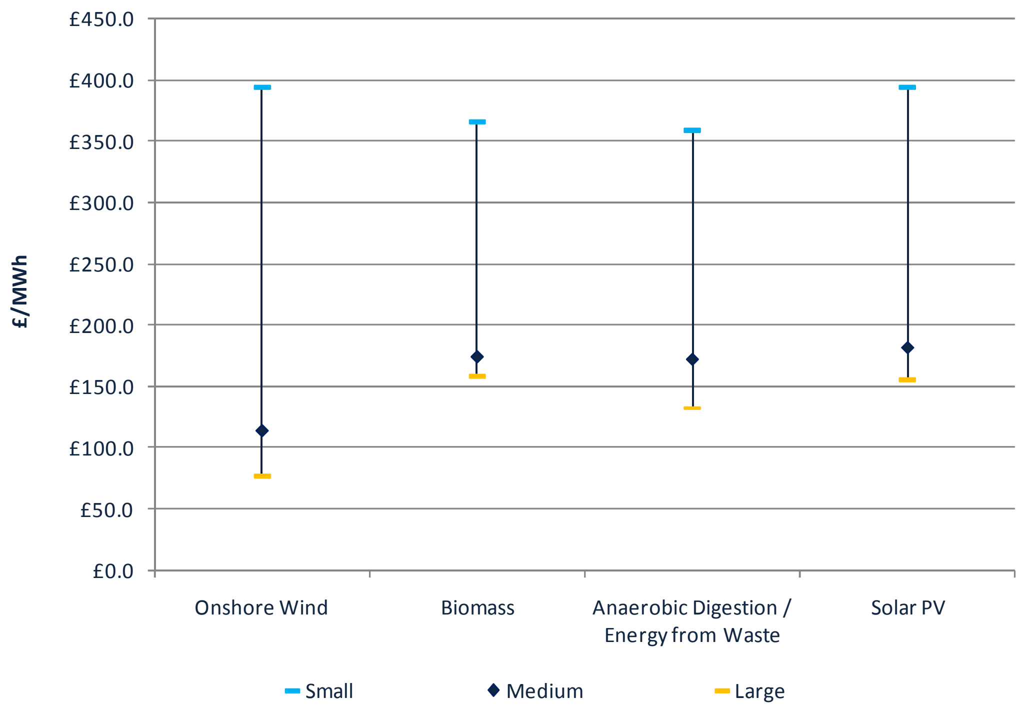
6.2. Cost and benefits of small-scale generation

In this section we assess the costs and benefits of renewable small-scale generation, and the potential for sub-5MW renewable electricity resource.

6.2.1. Costs of small-scale generation

Small-scale and micro-generation technologies are currently relatively expensive compared to larger-scale renewable generation. Figure 6.1 illustrates this diagrammatically, comparing the current levelised cost of a range of renewable generation technologies across small, medium and large-scale size bandings.

Figure 6.1: Renewable technology levelised costs



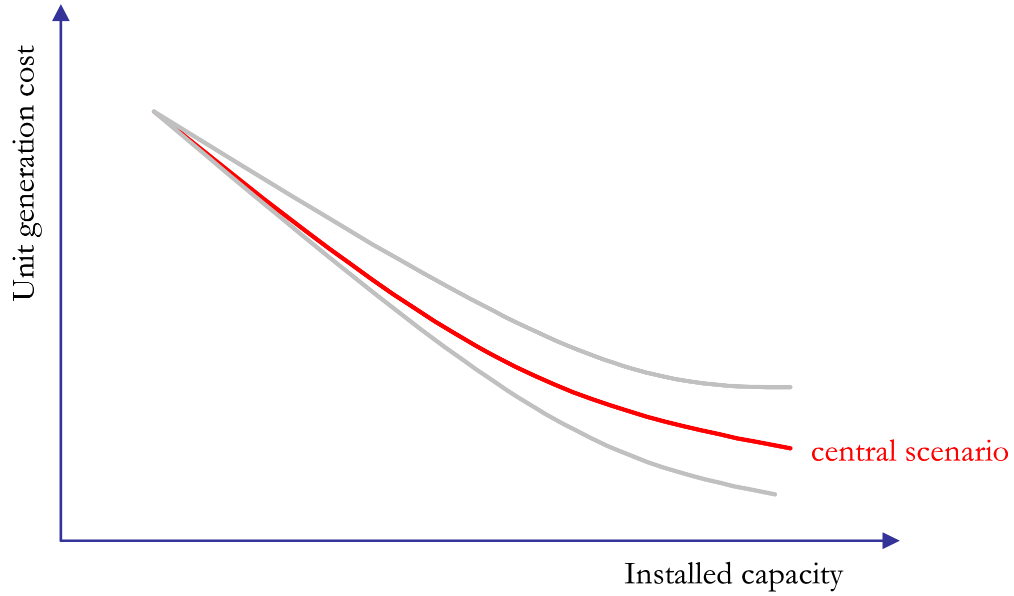
Source: CEPA

Fixed capital costs are typically a much a higher percentage of overall costs for smaller-scale systems and capital costs demonstrate scale economies. The energy output (load factor) of small-scale generation is also typically much lower, reducing the output from which capital and operational costs can be recovered.

For example, the energy output of a small-scale wind turbine is highly depended upon wind speed, as well as the location of the turbine (urban or rural locations) and the height of the turbine. Due to the lower load factor of small-scale onshore wind, a greater level of installed capacity, and therefore resource cost, is required for an equivalent contribution, in energy terms, to meeting NI renewables targets compared to large-scale onshore wind generation capacity.

Although small-scale generation costs are expected to fall by 2020, the rate of possible unit cost reductions achievable by each technology is uncertain, and a function of cumulative installed capacity increases both in the UK and internationally. Although progress curves (which describe a relationship between unit production costs and aggregate installed capacity for a technology (Figure 6.2)) can be used to assess the expected resource cost of small-scale generation in NI, and therefore the sector's potential subsidy requirement, progress curves are by definition subjective and create a range of issues for policy makers of small-scale generation support mechanisms (for example, how the initial level of subsidy is set and how level of payments should decline over time).

Figure 6.2: Estimated progress ratio for new technology



Source: CEPA

However, to the extent that small-scale renewable technologies may have the potential to be competitive in the long term (when environmental costs are taken into account) there is potential case for government intervention to foster investment to enable small-scale generation industries to reach a scale of deployment where their unit costs are commercially competitive with fossil fuel generation or larger scale renewable generation technologies. In addition, there may be a range of other benefits to NI's economy and electricity sector which further the economic case for providing support to small-scale generation, even thought unit costs may be greater than alternatives, such as more mature larger-scale renewable generation technologies. The potential benefits of small-scale generation are briefly outlined below.

6.2.2. Potential benefits

The economic value of small-scale generation is primarily the avoided costs that result from production of electricity on-site. If small-scale generation displaces a unit of conventional generation, there may be several environmental impacts and benefits:

- A saving in carbon emissions based on the differences in the emissions of the two technologies.[19]
- If losses are reduced, a saving based on the carbon content of the energy that would have been lost.
- A carbon saving based on deferring (or in some cases removing the need for) network upgrades.

[19] We note that there is also a possibility that small-scale generation could displace other renewable generation. While this may be unlikely at present, it would clearly negate the vast majority.

- A range of *potential* socio-economic impacts from the development of the small-scale generation sector, including job creation and growth in supply chain and installer sectors.

It can also be argued that small-scale generators provide diversity, both in terms of power sources and location, offering opportunities for households, small businesses and communities to become engaged more directly in the generation of the energy they use.[20] Small-scale generation delivers a dispersed supply to the power system, and could, therefore, be argued to enhance security of supply. The counter argument can be made that the absence of information about their operating patterns and the lack of certainty about the availability of some technologies can in fact endanger security of supply, or at least impose additional costs.

6.2.3. Resource potential

When considering whether to support a particular size or type of renewable energy it is clearly important to identify the resource potential in order to understand the expected cost and impact of the approach. It is also important to consider how resource potential is constrained by environmental and economic considerations that are wider than cost.

A number of sources of evidence are available on *potential* NI small-scale generation resource, based on historical investment in NI, and resource assessments of small-scale generation in NI and other parts of the UK. However, due to the infancy of the industry (both in NI and internationally) there is much greater uncertainty as to the *practical* renewable small-scale generation resource available in NI compared to larger-scale renewable generation.

Section 2 illustrates that, compared to current installed NI RES capacity of 312MW, small-scale generators (<5MW) already provide 39.8MW, or around 12.7% of the total installed capacity, with micro-generation providing a very small proportion of installed capacity (around 1%). This evidence suggests that small-scale generation might be able to practically contribute around 10%-15% of total RES-generation to 2020, although extrapolation of these historical trends must be treated with caution.

Ove Arup's study on NI renewable electricity targets highlighted certain renewable technologies as providing potential resource of small-scale generation capacity , as well as constraints which limited the contribution of other technologies to the small-scale generation supply mix. For example, small-scale biomass, already in operation in NI, has 13MW of capacity included in all five Ove Arup renewable scenarios. Energy from waste is also highlighted as a potential resource, using a number of feed stocks, including municipal solid waste, waste materials and animal waste.

NI micro-generation (as defined in Ove Arup's study) includes building-mounted photovoltaic electricity generation, build-mounted wind turbines and small-scale anaerobic

[20] There is some evidence that situating generation close to demand may also give consumers a greater awareness of their energy consumption, and thereby induce behavioural changes that futher contribute to reducing carbon emissions. See Ofgem/BERR (2007): 'Distributed Energy – Initial proposals for more flexible market and licensing arrangements'.

digesters producing biogas, typically used by gas engines to generate electricity and gasification of biomass. Ove Arup concluded that the theoretical maximum NI micro-generation resource to 2020 was likely to be less than 10MW, and for the purposes of their study analysis (recommended targets for the amount of electricity that could be generated by renewable means) the practical resource was assumed to be zero.

The evidence in the Ove Arup report suggests that, although NI may have a comparative advantage in certain technologies which can be developed on a relatively small-scale project basis, the potential for significant penetration of small-scale/micro-generation is likely to be small.

As part of the development work for the sub-5MW FIT in GB, DECC has estimated the potential for sub-5MW renewable generation to contribute to meeting 2020 renewables targets. Although the objectives of the GB FIT scheme are much wider than simply meeting a specific target,[21] DECC's FIT policy is projected to deliver approximately 6TWh (or 1.6%) of final UK electricity consumption in 2020.[22] With support for small-scale biomass maintained under the RO, overall small-scale low carbon generation is expected to contribute approximately 2% of final electricity consumption in 2020.

For the purposes of assessing the costs of the NIRO, FIT and capital grant systems in supporting small-scale renewable generation output, CEPA/PB has adopted a fixed target of a 3% contribution to NI final consumption by 2020 from small-scale generation. This assumes small-scale generation contributes around 7% of total RES-generation by 2020, including a small contribution from micro-generation.

Although this assumption is slightly higher than the contribution targeted by the GB FIT scheme, a 3% target, we believe, provides a realistic but conservative assumption for the modelling which reflects the pattern of historical investment in renewable generation in NI, the evidence provided in NI renewable electricity generation supply scenarios and the expected resource of small but commercially sized generation plant as part of agricultural land use.

6.2.4. Summary

This section has considered the resource costs and benefits of small-scale generation to NI's electricity sector. Small-scale generation is expected to offer a higher cost per unit of renewable generation deployment, relative to larger more established renewable generation technologies, even when possible unit cost reductions arising from increases in installed capacity are considered. From a purely unit cost perspective, given NI public sector and electricity consumer budget constraints, there may therefore be sound economic arguments for prioritising support to large-scale generation.

[21] The objective of the recent introduction of a small-scale FIT in GB is to drive uptake of a range of small-scale low carbon electricity technologies by a range of target groups in order to deliver a higher rate of deployment and contribute to the UK's 2020 renewable energy target. The scheme is also designed to pursue broader aims of engaging the general public in low carbon electricity generation.

[22] DECC (2010): 'Impact assessment of feed-in tariffs for small-scale, low carbon electricity'

Conclusions on the case for supporting small-scale generation

- Small-scale generation is expected to offer a higher cost per unit of renewable generation deployment, relative to larger more established renewable generation technologies, even when possible unit cost reductions arising from increases in installed capacity are considered.
- However, there may be wider social policy reasons for promoting this type of technology.

6.3. Assessing alternative approaches to support small-scale generation

In the section below we assess the effectiveness of the NIRO as a method of promoting small-scale generation in NI, before considering the likely effectiveness of alternative approaches and the non-cost issues which need to be considered alongside a decision about the type of support mechanism and level of which support for each technology is set.

The analysis in Volume B provides a more detailed assessment of the expected resource costs and required financial incentives for supporting small-scale renewable generation under the NIRO, capital grant and alternative FIT systems, as well as an assessment of the efficacy of these alternative support mechanisms in promoting the uptake of different technologies and size scales.

6.3.1. The NIRO

The NIRO is the existing mechanism for supporting small-scale generation in NI. As part of the recent Renewables Obligation (Amendment) Order (NI) 2010 the level of support to small-scale generation was significantly increased to replicate, so far as possible, the support levels provided to small-scale generation in GB under its small-scale generation FIT. This has been achieved by changes to the banding of the NIRO (which was approved following a request for EC State Aid approval).

Qualitative assessment

The NIRO (or a renewable obligation style scheme) asks small-scale generators to assume the risk associated with changes in wholesale power prices, changes in the level of support (which is derived by the complex interaction between increases in installed capacity, the annual target and the banding and headroom mechanisms) and changes in Government policy. As such, it is likely to be perceived as a more risky method of supporting renewable generation than other possible approaches.[23] It could be argued that the significant number of incremental changes which have been made to the RO, for example to introduce banding, to create and amend the level of headroom and the current proposals for a stabilisation mechanism, illustrate this point.

[23] Redpoint et al (2008): 'Implementation of EU 2020 Renewable Target in the UK Electricity Sector: Renewable Support Schemes'

The frequent amendments which have been made to the RO have also significantly increased its complexity. A number of government consultations on the RO have, in the past, suggested that for certain types of investor in renewable generation, in particular very small-scale commercial and domestic investors, there exist a number of administrative barriers under the RO which may act as a deterrent to investment. The uncertainty resulting from fluctuation in the value of ROCs can also have a detrimental effect on incentives to invest.[24]

For small-scale investors, for whom electricity generation is not their primary activity, the process of having to register to obtain NI ROCs and subsequently the need to find a buyer for the certificates may, in certain circumstances, be the primary constraint on investment because of a perceived 'hassle factor'.[25] Although the administrative burden of the NIRO for small-scale generation is somewhat mitigated by the recent introduction of agents (for example, generators can appoint NIE Energy to act as an agent on their behalf) [26] the burden of having to 'participate' in the electricity market is always likely to be greater under the NIRO than alternative support schemes.

However, the key design feature of a certificate based scheme such as the NIRO is the absence of a link between the level of support and the wholesale price. Because the scheme does not seek to influence total returns to generators but seeks to provide a premium over the wholesale price, it means that generators make excess profits (i.e. customers pay more than would strictly be required for a generator to meet their required rate of return) when the wholesale price rises above the expected level and that the level of support is insufficient to cover costs when the wholesale price falls. This represents a highly significant risk to investors who would be expected to value certainty and can lead to an increase in the level of return they require in order to invest.

For small-scale renewable generators and investors, this risk can be mitigated by offering a fixed export tariff additional to the subsidy provided by the NIRO. However, this requires such a product to be offered by suppliers or requires small-scale generators to participate in the SEM (which they would be highly unlikely to ever do).

While the RO is beneficial in that it is only paid for energy produced, creating incentives to maintain equipment and to seek to maximise output, it does not automatically flex to reflect underlying changes in cost. While amendments to the banding mechanism can be used to change the level of support, as has been put in place under the NIRO (Amendment) Order 2020, this is a relatively cumbersome process which essentially attempts to replicate the key features of a FIT.

However, the NIRO has been in place for a period of time, is relatively well understood and has stimulated investment in renewable generation (whether this is a function of subsidy design, level of support or a combination of the two is hard to say). From an NI, although not necessarily small-scale generation perspective, it has also been designed to reflect the total cost paid by NI consumers for energy and to support renewable generation

[24] BERR (2008): 'UK Renewable Energy Strategy: Consultation Document'
[25] BERR (2008) Ibid
[26] http://www.nie-yourenergy.co.uk/NIEEnergyGenerationTariffGuide.pdf

(i.e. the amount of support paid by NI customers is lower to reflect the greater amount they pay via wholesale energy prices) and could therefore be argued to be more appropriate from a social policy perspective than alternative approaches which would target the full cost of incentivising small-scale renewable energy deployment onto NI consumers.

Table 6.1 summarises our qualitative assessment of the existing NIRO regime as a support mechanism for small-scale generators in NI. We have used a series of standard criteria which, we consider, reflect the desirable features of a support mechanism. This allows a relatively high-level comparison of different approaches using a system of ticks and crosses.

Table 6.1: Summary NIRO assessment

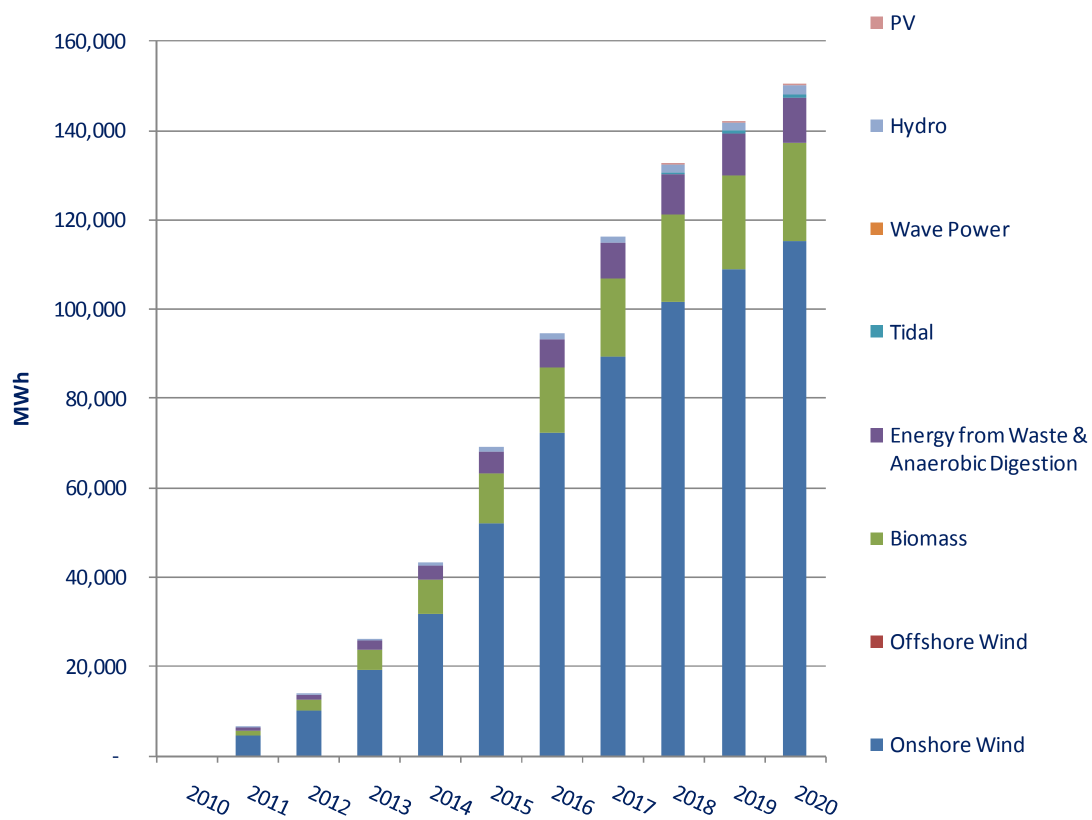
Criteria	Comment	Score
Consistency with legal obligations and market structure	Not immediately clear that it is inconsistent with market rules (though some concerns as discussed in Section 5).	✓✓
Ease of comprehension and administration	A complex scheme, particularly given banding, headroom and stabilisation. May be a concern for small-scale generators.	✓
Promotion of stability and investor confidence	For NI investors the NIRO is much more stable following the introduction of headroom. However the frequent changes in the mechanism are a concern, though the extension to 2033 is a benefit.	✓✓
Minimise distortions and perverse incentives	The NIRO is an output based subsidy which encourages output to be maximised.	✓✓
Economic Efficiency (Maximising impact, minimising costs)	Not linked to energy prices so may lead to excess or insufficient returns and costs to consumers. However, banding allows targeting of support. The NIRO involves a reduction in cost to NI consumers.	✓

Source: CEPA

Summary of quantitative analysis

The analysis presented in Volume B, shows that recent amendments to the banding of the NIRO could help to promote investment in small-generation (2.5% of electricity consumption by 2020) given practical resource assumptions for the sector. This is illustrated in Figure 6.3.

Figure 6.3: Small-scale generation deployment under Base Case NIRO scenario



Source: CEPA

Current banding of the NIRO - given cost assumptions and expected investor rates of return used in the analysis - is shown to provide an adequate level of support for a range of small-scale generation technologies and scales with a comparative advantage in NI, for example, medium size onshore wind and biomass.

The exceptions to this are as follows:

- Domestic onshore wind plant (<5kW) is likely to be uneconomic under current policies (i.e. export tariff and NIRO assumptions). This is partially because the energy output,(from which capital and operational costs must be recovered) is low.
- Small-scale biomass (50kW – 500kW) is also uneconomic under current policies, although larger more commercially sized installations are economical given the assumptions used in the analysis.
- Small-scale anaerobic digestion, under current NIRO policies, is only economicon a larger scale (500kW – 5MW). Banding for anaerobic digestions is consistent across all scales for this technology.
- PV is a mature but costly technology, mainly due to low output relative to capital costs. Under current polices, PV is only projected to be economical from 2017 assuming unit cost (learning rate) reductions.

The results from the Base Case modelling, including NI consumer costs, are summarised in Table 6.2. The indicative annual cost to NI consumers in 2020 of support provided to sub-5MW renewable generation under the NIRO is calculated by scaling the total cost of the NIRO in 2020 (NI obligation multiplied by the buy-out price) by small-scale generation's contribution to total RES-generation in 2020 (around 6%).

Table 6.2: Indicative NIRO costs for small-scale generation

Technology		**Banding (MWh)**	**Support (£/MWh)** [1]	**Projected deployment** [2]
New-build deployment				
Onshore wind	Up to 250kW	4	£162.76	116.4
	250kW – 5MW	2	£40.69	
Hydro	Up to 20kW	4	£162.76	2.1
	20kW – 250kW	3	£122.07	
	250kW – 1MW	2	£81.38	
	1MW – 5MW	1	£40.69	
PV	Up to 50kW	4	£162.76	0.2
	50kW – 5MW	2	£81.38	
Biomass	Up to 50kW	1.5	£81.38	22.4
	50kW – 5MW	1.5	£61.04	
AD	Up to 50kW	2	£81.38	10.1
	50kW – 5MW	2	£81.38	
Contribution to RES-generation				5.9%
Contribution to NI electricity consumption				2.5%
Consumer subsidy cost analysis				
Annual cost of NIRO to NI consumer in 2020			£m	64.6
Estimated annual cost of NIRO to NI consumer in 2020 of small-scale generation			£m	3.8
Small-scale generation cost of NIRO to NI consumer (2020) per unit of small-scale RES			£/MWh	15.3

Note 1: Assumes NIRO value of £40.69 per MWh from model analysis
Note 2: Deployment in GWh – assumes high-wind (Scenario 4) resource Ove Arup scenario

Source: CEPA

The analysis illustrates that the NIRO is a relatively low cost approach of tailoring and/or increasing the level of support to small-scale technologies in NI. The low volume of output from NI small-scale generation, even with increased NIRO banding has only a small impact on the total quantity of ROCs in circulation under the RO, and therefore NI and GB consumer costs.

The NIRO (Amendment) Order 2010 already allows for increased support for small-scale generation to 2020. However, to investigate the flexibility of a banded NIRO to further influence the level of small-scale generation deployment in NI, we have modelled a " Test " scenario (referred to in the table below as the small-scale diverse scenario) where small-scale generation is assumed to be able to practically make a more significant contribution to NI's RES targets under a high-wind resource mix. Under this scenario, banding of the NIRO is amended to ensure maximum resource is economic under the assumptions on wholesale electricity price revenues and generation cost and production assumptions. The results are summarised in Table 6.3.

Table 6.3: Small-scale banding analysis

Metric	Small-scale diverse resource scenario	
	Base case banding	**Revised banding**
Deployment		
Small-scale generation in 2020 (GWh)	755	1,012
Northern Ireland consumer subsidy costs		
millions (£) in 2020	64.6	65.5

Notes: all cost net-present value; NPV

Source: CEPA

The analysis in Table 6.3 illustrates that banding of the NIRO can be an effective approach of promoting a quantity target of small-scale generation, if desired and subject to State Aid approval. It is also a relatively is a relatively low cost approach of tailoring the level of support to small-scale technologies in NI. However, there is a cost to GB (and NI) consumers of amending NIRO banding as this policy increases the quantity of ROCs in circulation under the scheme.

Summary of assessment of the NIRO

In summary:

Assessment of the NIRO as a small-scale generation support mechanism

- The analysis suggests that current banding of the NIRO - given cost assumptions and expected investor rates of return used in the analysis - provides an adequate level of support for a range of small-scale generation technologies and scales given subsidy requirements.
- Were banding of the NIRO revised to provide increased incentives for small-scale generation, the change in NI consumer costs under the NIRO might be expected to be relatively low, although the consumer cost, per MWh of extra renewable generation, would still be expected to be relatively high.

6.3.2. Feed-in tariffs

In the sub-sections below we consider the merits of a system of FITs as the support mechanism for small-scale generation in NI.

Qualitative assessment

The most common form of FIT provides a fixed revenue stream by essentially topping up the revenue received via the energy market (or a contract) by a renewable generator to a set level. Hence the FIT takes revenue volatility away from an investor in small-scale generation and converts two uncertain revenue streams (the standard energy market price and the support mechanism) into one fixed revenue stream.

The appeal of a FIT (relative to the NIRO) for investors in small-scale generation is clear. Assuming the scheme is credible and long-term, it can provide certainty to investors, meaning that market entry and the installation of more capacity is likely, without causing customers to under- or over-subsidise producers based on changes in energy prices.

While there are considerable challenges involved in setting a FIT at the correct level, from a policy design perspective it is theoretically possible to tailor the tariff so that it reflects the costs faced by small-scale investors in different sizes and types of technology and reduces over time in response to underlying changes in costs and installed capacity. A system of FITs could therefore be a more efficient mechanism of providing support to foster investment in NI to enable the industry to reach of scale closer to commercial viability.

International experience of FITs, which have largely become the subsidy mechanism of choice in continental Europe, has increased their attractiveness and appeal to investors and supply industries of small-scale generation plant.

However, to implement a FIT in NI for small-scale generation would require primary legislation to introduce. While this would be feasible, it would mean the policy decisions which were taken when the NIRO was introduced would be unwound with, one would expect, a commensurate increase in costs to NI customers (this result is clearly brought out from the modelling in Volume B, discussed in more detail below).

A specific small-scale generation FIT for NI, either as a replacement for the NIRO, or as an additional form of support for specific types and sizes of generators, would also require policy makers to explore the implications of different design options, in terms of the expected effectiveness of RES-generation deployment and the administration and operation of the scheme within the SEM. Although existing schemes such as the GB small-scale generation FIT or the REFIT in the RoI provide two models for the administration of a NI small-scale generation scheme (Annex A summarises the key features of each model) introducing a new support mechanism would, by design, change the incentives for investors in small-scale generation and also create administrative and policy design issues that are not currently present under the NIRO.

Table 6.4 summarises our qualitative assessment of a FIT as a support mechanism for small-scale generators in NI.

Table 6.4: High-level assessment of FITs

Criteria	Comment	Score
Consistency with legal obligations and market structure	Would need legislation to introduce. System operates in RoI and a FIT could be argued to be consistent with REFIT (though the level would matter). Some concerns about SEM interaction.	✓
Ease of comprehension and administration	An intuitive scheme which is relatively easy to understand (depending on how the price is determined).	✓✓
Promotion of stability and investor confidence	Provides a stable revenue stream (equivalent to a PPA) which promotes stability and investor confidence.	✓✓✓
Minimise distortions and perverse incentives	Arguably minimises market distortions due to stability and clarity.	✓✓
Economic Efficiency (Maximising impact, minimising costs)	Limits scope for excess returns to generators (particular if tariffs set via competition), an output based subsidy so incentives production. However in NI introduction would involve removal of a current benefit to customers.	✓✓

Source: CEPA

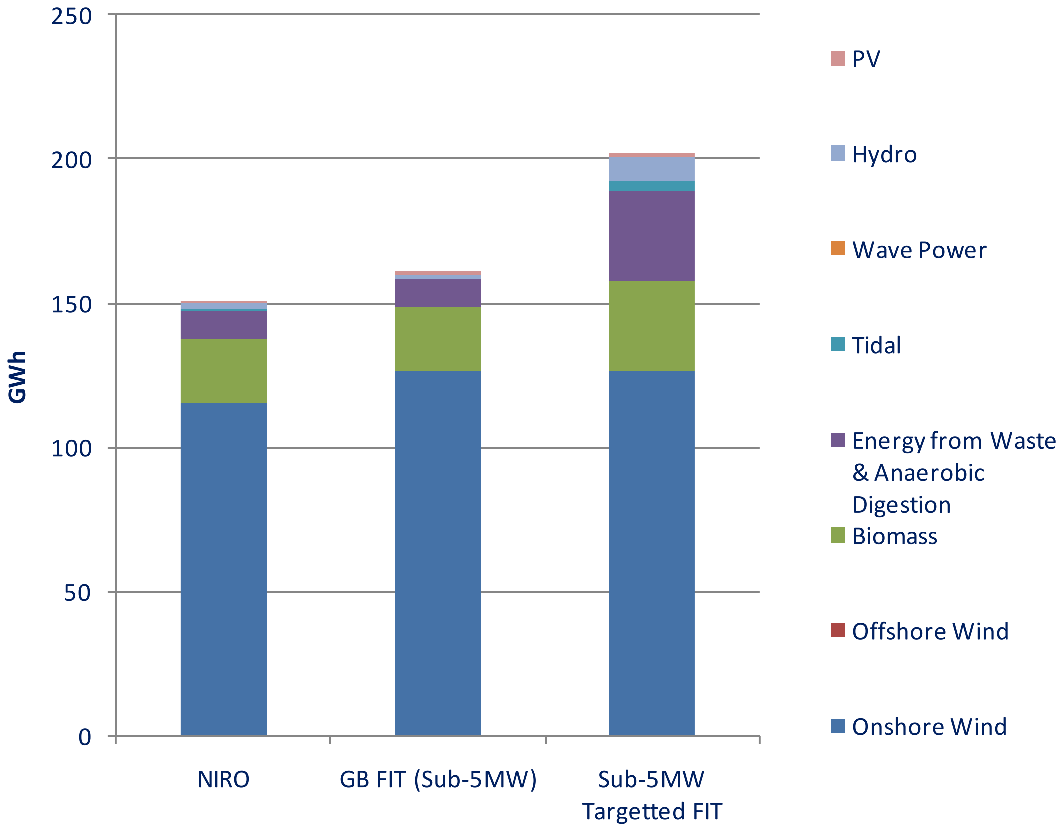
Quantitative assessment

Volume B investigates the projected costs of a series of hypothetical small-scale generation FIT schemes based on the cost and target small-scale generation resource assumptions discussed in Section 6.1. Expected deployment, and the costs to NI consumers, of a FIT modelled to replicate the eligibility and level of support provided by the GB FIT scheme were also investigated as part of the analysis.

Figure 6.5 summarises the analysis of projected level of new-build small-scale generation deployment by 2020 under the Base Case and replicated GB FIT scenarios. The third scenario shows projected deployment under a FIT designed to ensure delivery of a small-scale 2020 target (given assumptions of renewable generation costs and practical resource in NI to 2020).[27] Although both the GB FIT and a target consistent FIT incentivise greater volumes of renewable generation investment to 2020 than under the Base Case (i.e. the existing NIRO regime), the incremental volumes of small-scale generation deployment realised by 2020 are relatively small.

[27] This FIT design is similar to the approach adopted for the GB FIT where tariff levels and expected deployment was set based on resource constraints and targeted rates of return for different types of investors in small-scale generation technologies. However, in contrast to the GB FIT scenario where tariff levels are set with reference to the GB electricity market, the target consistent FIT levels are set based on resource potential and predicted generator costs in NI.

Figure 6.5: Small-scale generation deployment FIT scenarios



Source: CEPA

Table 6.5 summarises the estimated costs to NI consumers of introducing an NI small-scale FIT mechanism under the following size eligibility assumptions:

- *Small-scale FIT 1* - Small-scale generation FIT sub-5MW.
- *Small-scale FIT 2* - Small-scale generation FIT sub-2MW.
- *Small-scale FIT 3* - Small-scale generation FIT sub-0.5MW.

Under each scenario, a fixed quantity of small-scale generation eligible under the FIT is targeted, with a consistent sub-5MW small-scale generation resource assumption adopted throughout each scenario (3% theoretical contribution to NI electricity demand). Only a proportion of potential small-scale resource is targeted by each FIT scheme, depending on the eligibility assumption.

As an example, potential projects greater than 2MW, under Small-Scale FIT 2, would remain a part of the NIRO to 2020. In contrast, projects smaller than 2MW would be eligible for a FIT, with tariff levels, at the time of the scheme design, set to ensure delivery of the total number of projects sub-2MW which are assumed to be able to contribute to the total small-scale generation resource in NI.

Projected deployment of small-scale generation and NI consumer costs under the tariff levels set for the GB FIT scheme, are also illustrated in Table 6.5.

Table 6.5: Estimated cost of small-scale FIT schemes

Metric	**GB FIT**	**FIT 1 (<5MW)**	**FIT 2 (<2MW)**	**FIT 3 (<0.5MW)**
FIT resource target (% of electricity consumption)				
Contribution to NI electricity demand	N/A	3%	2%	1%
NI subsidy costs				
Indicative annual cost of FIT (£m) in 2020	17.3	18.3	14.8	13.6
Cumulative cost of FIT (£m) to 2020	77.6	86.7	68.9	62.9
Impact on household bills (£s) in 2020	8.8	9.4	7.6	7.0

Note: All costs are NPV, net present value.

Source: CEPA

The key points to note from Table 6.5 are as follows:

- The *annual costs* by 2020 to NI consumers of a small-scale FIT scheme, additional to the cost of the NIRO, are estimated to be in the range £13m – £18m, depending on the eligibility of the scheme, and the targeted contribution of small-scale generation to NI electricity demand.
- As this is the cost of a small-scale FIT (for the targeted FIT scenarios) applied to potential small-scale generation resource, the level of costs in any year in which this potential is not realised would be lower.
- The impact on household bills, depending on the eligibility of the scheme, is to add around £7-£10 to average annual household bills by 2020, additional to the added costs of the NIRO for household bills.
- Cumulatively to 2020, the indicative cost of an NI small-scale FIT (depending on resource and size eligibility assumptions) is £62m - £86m. Put in to perspective, at the lower end of this cost range, the cost of a NI small-scale FIT is comparable to the total *annual* cost of supporting all sizes of renewable generation in 2020 under the Base Case assumptions for the NIRO.

Within current design parameters of the NIRO, in particular NI's concessionary statutory obligation level, the analysis illustrates that a small-scale FIT mechanism is a relatively expensive option for supporting small-scale generation in NI to 2020. Given the current banding of the NIRO, incremental volumes of small-scale generation deployment from a FIT, given potential resource assumptions, are also likely to be relatively small. The implication of the analysis, where investment decisions in NI small-scale generation are solely influenced by expected cost and revenue streams, is that the NIRO already provides certain types of small-scale generation technologies and projects with sufficient support to strictly facilitate build.

Given the above, other issues, such as realising potential resource given non-cost barriers, may act as more of a constraint to the development of the industry and its contribution to NI 2020 renewable electricity targets.

Summary of FIT assessment

In summary:

Assessment of a FIT as a small-scale generation support mechanism
• International experience of FITs, which have largely become the subsidy mechanism of choice in continental Europe, has increased their attractiveness and appeal to investors and supply industries of small-scale generation plant. • The appeal of a FIT (relative to the NIRO) for investors in small-scale generation is clear. Assuming the scheme is credible and long-term, it can provide certainty to investors, meaning that market entry and the installation of more capacity is likely, without causing customers to under- or over-subsidise producers based on changes in energy prices. • Within current design parameters of the NIRO, in particular NI's concessionary statutory obligation level, modelling analysis (where investment decisions in NI small-scale generation are solely influenced by expected cost and revenue streams) illustrates that a small-scale FIT mechanism is a relatively expensive approach to supporting small-scale generation in NI to 2020.

6.3.3. Capital grants

Capital grants are a direct capital subsidy designed to incentivise consumers and investors to invest in a particular renewable technology. They act as "supply-side" subsidy to directly reduce the costs of investment in renewable generation. Capital grant schemes can be structured in a number of different forms, including as a percentage of capital costs or provided to cover costs over and above the costs of conventional electricity generation plant. Like FITs, capital grant schemes can also allow for variations across technologies and within a technology to be accounted for in the support provided to generators. Grant based schemes are typically funded from tax receipts, which means that their costs are borne by tax payers as a whole. Grants are already a feature of the NI market, as set out in the text box below.

Text Box 6.1: Renewable generation capital grant schemes in NI

NIE SMART Programme – Solar Photovoltaic

£1,200 per kWp or 20% of the relevant eligible costs, whichever is the lesser amount, up to a maximum of £6,000.

NIE SMART Programme – Small Wind

£900 per kWp or 30% of the relevant eligible costs, whichever is the lesser amount up to a maximum of £4,500.

Wind Turbines for Schools

This scheme has been developed to assist schools in NI with installing turbines. The turbines would be sized at 5 or 6kW and the Education Boards can also apply for funding through the Central Energy Efficiency Fund, or indeed supply their own funding. Smart funding is up to £5,000, or £1,000 per kW, whichever is lower, for each wind turbine installed.

Help with Hydro

This NIE programme is to help encourage the development of new small-scale hydro schemes in NI. NIE will fund a 1kWe upwards system at £500 per kWe, up to a maximum of £20,000, whichever is smaller.

Source: CEPA / NIE

As for the NIRO and FIT systems, in the sections which follow, we provide a qualitative assessment of the relative advantages and disadvantages of capital grant schemes as a small-scale renewable generation support mechanism. This is followed by an indicative assessment of the costs of a scheme to the NI budget (additional to the costs of the NIRO) based on modelling assumptions of theoretical small-scale renewable generation resource potential in NI.

Qualitative assessment

A significant appeal of capital grants, particularly to small-scale investors is their simplicity.[28] The idea of providing a sum of money to offset the capital costs which an investor faces is intuitive and easily understood.

It is also simple to alter the level of the grant to reflect the specific costs faced by different sizes and types of technology, meaning that more efficient tailored grants can be made and that the level of these grants can change over time in response to underlying changes in cost. Additionally, as the grant is normally paid once, there is no need to factor in the risk that a support mechanism will change or, at an extreme, by withdrawn.

However, the fact that the support is paid up-front and is not in any way linked to output (unless specific output measures are designed) could create risks that the money is used inefficiently or wasted and may mean that the level of support does not translate into an increase in the volume of installed small-scale generation capacity.

[28] Element Energy et al (2008): 'The growth potential of micro-generation in England, Wales and Scotland'

International experience suggests that capital grants can be a useful way of stimulating market development, particularly for smaller scale generation technologies. However, they tend to complement an output based form of subsidy and represent a relatively small proportion of the available support (this is illustrated by the results from the modelling in Volume B).

Importantly, a capital grant is more likely to be paid by Government than by energy customers. Therefore the cost of a small-scale generation capital grant support mechanism would fall on the NI exchequer (and hence tax payers) as opposed to energy customers. This is clearly undesirable where government budgets are tight but has the advantage of meaning the cost does not fall disproportionately on low income, high-energy users.

A grant scheme can also induce ("crowd-in") additional investment and support from the private sector, either by a matching funding requirement as part of a capital grant funding scheme, or because of reduced uncertainty and increased reputation of a project from provision of a grant.[29] However, support based on a limited, short-term funding capital grant pot can have limited impact in promoting a long-term market and in isolation, a short-term grant scheme can result in "boom and bust" activity in the market.

Furthermore, grants can provide little incentive to select the most efficient technology or ensure optimum installation and ongoing operation since grants are awarded for the installation of renewable technologies, rather than the generation of renewable energy (which is the ultimate aim of the support mechanism). A simple grant based support mechanism, without performance based payments, therefore provides no incentive for investors in small-scale renewable generation to ensure that their equipment is operational on an ongoing basis.

As for the NIRO and FIT systems, there is also the risk of deadweight costs from a capital grant scheme. The grant may be 'deadweight' in the sense that a project it was used to fund was commercially viable without additional public or consumer funding. The effectiveness of a capital grant scheme will depend on how administrators of a scheme can minimise over subsidisation and deadweight costs.

Compared to the NIRO and FIT systems, where investors are incentivised to select the most promising and cost efficient projects (as support is provided as a revenue to the generator), a capital grant scheme is likely to have greater informational problems, as administrators of the grant scheme will need to discriminate ("pick winners") between projects, and applicants for the grants are likely to have significantly more information than the administers (i.e. there is an asymmetry of information problem). Such informational problems can be mitigated, for example by varying the scale and timing of funding, implementing performance regimes and conditions placed upon the recipient of the grant, however, these types of policy also significantly increase the complexity of administering a capital grant scheme as well as simplicity of understanding by potential investors.

Perhaps most importantly, for a capital grants scheme to be effective in supporting small-scale generation in NI, the level of grants available, and the routes to access them, would

[29] Frontier Economics (2009): 'Alternative policies for promoting low carbon innovation – a report for the Department of Energy and Climate Change'

need to be clear and transparent. Table 6.6 provides a qualitative assessment of capital grants as a support mechanism for renewable generation in NI.

Table 6.6: High-level assessment of capital grants

Criteria	Comment	Score
Consistency with legal obligations and market structure	Would avoid any interaction with the SEM as there would be no opportunity cost of not generating.	✓✓
Ease of comprehension and administration	In principal, administering a capital grant scheme is relatively simple. However it can still involve a fair degree of cost and effort. Many administrative duties are common to all grant schemes: combining the "back office" functions of different grant schemes within a single body can reduce the administrative overhead	✓✓
Promotion of stability and investor confidence	Only in place for a limited period so certainty for those that are eligible.	✓✓
Minimise distortions and perverse incentives	Not output based so create concerns about moral hazard. May create fewer incentives for generators to minimise costs on an ongoing basis.	✓
Economic Efficiency (Maximising impact, minimising costs)	Grants can be geared to the level required to promote uptake, which is different for different technologies, and can be reduced over time as the market matures. However, support based on a limited, short-term funding pot can have limited impact in promoting a long-term market. A poorly designed scheme can promote technologies with lower immediate capital cost but which may have limited long term potential. In isolation, grants can provide little incentive to select the most efficient technology or ensure optimum installation and ongoing operation; grants are awarded for the installation of renewable technologies, rather than the generation of renewable energy (which is the ultimate aim of the support mechanism). The availability of grants can push up capital costs due to manufacturers or installers taking advantage of their existence to increase their prices.	✓

Source: CEPA

Quantitative assessment of capital grant schemes

Volume B presents detailed results from the quantitative assessment of alternative small-scale generation capital grant schemes. In Table 6.7, we summarise projected deployment, and an assessment of the relative costs to NI consumers, of supporting small-scale generation under a capital grant scheme as a standalone alternative to the NIRO. This assumes new-build small-scale generation (sub-5MW) is no longer eligible for the NIRO but receives a capital grant equal to 75% of capital costs.

Table 6.7: Indicative cost of small-scale generation capital grant scheme (75% capital cost grant)

Sample	NIRO (Base Case)	Capital Grant (75%)
Small-scale generation Deployment (GWh)	251	219
Cost to NI consumers (£m) in 2020	64.6	64.5
Cost to NI budget (£m) to 2020	-	53.5

Note: all costs NPV ; net-present value

Source: CEPA

The analysis shows that the combined costs to the NI budget and NI electricity consumers under a small-scale generation capital grant scheme could be significantly higher than under the NIRO. Expected deployment under a standalone capital grant scheme could also lower than under the NIRO.

Under a capital grant scheme, the NI budget would be required to fund small-scale generation investment, rather than electricity consumers, and this cost would be additional to the ongoing costs of the operation of the NIRO for large-scale generation. The effect of removing small-scale generation from the NIRO has only a small impact on the total supply of ROCs within the UK-wide RO, and so the costs to NI consumers remain unchanged from the Base Case scenario, even when small-scale generation investment is funded by the NI budget.

Summary

In summary:

Assessment of a capital grants as a small-scale generation support mechanism

- A significant appeal of capital grants, particularly to small-scale investors is their simplicity. The idea of providing a sum of money to offset the capital costs which an investor faces is intuitive and easily understood.
- However, the modelling shows that the combined costs to the NI budget and NI electricity consumers under a small-scale generation capital grant scheme could be significantly higher than under the NIRO. Expected deployment under a standalone capital grant scheme could also be lower than under the NIRO.

6.4. Non-cost barriers

As with large scale generators, when determining the form of support which is used to incentivise small-scale generation it is important to consider the full range of issues which contribute to stimulating investment; including non-cost barriers to development.

Many of the issues discussed in the previous section, such as network access constraints, planning delays and market rules are highly relevant for small-scale generators. Indeed it is likely that disproportionate or unclear policy frameworks could cause significant reductions in small-scale generation investment and hence considering wider constraints to development is arguably more important for small-scale relative to large-scale generators.

As a general rule, it is appropriate that market, regulatory and planning policies reflect the significantly smaller size of projects. However, in a significant number of cases, frameworks are well established and have been designed with larger projects in mind. A failure to update these policies can lead to increased cost, or unnecessary complexity for investors in small-scale generation and it is therefore necessary to ensure frameworks are sufficiently able to adapt.

In the RoI for example, an "inform, consent and fit" connection process has been introduced for small-scale generation where parties essentially self-certify projects and bypass otherwise complex planning and network connection processes (the scheme is summarised in the text box below).

Text Box 6.2: Inform, consent and fit

ESB Networks have developed an 'inform, consent, and fit' connection process for micro-generation connections. The arrangements apply to both residential and commercial installations that meet the relevant size thresholds with the objective of putting into place a process that is simple, straightforward and standardised for customers to follow. It also allows ESB Networks to assess the impact of increased micro-generation on its network and to reduce the likelihood of non-compliant units being connected which could have safety implications.

The connection process first requires a customer to submit a notification form which requests details on the type of micro-generator as well as its capacity rating, fuel source and protection settings. As part of this process, the customer must demonstrate that the generator complies with ESBN's technical requirements. Once the notification form has been submitted to ESB, if no instruction to suspend the installation is issued by ESB within 5 working days, then the installation of the micro-generator can proceed. The installation must be then carried out by a registered Electrical contractor to Electro-Technical Council of Ireland standards who will need to submit a Register of Electrical Contractors of Ireland (RECI) certificate to ESBN once the installation is complete.

Source: ESB Networks

Equally, in some countries, the absence of an export tariff which reflects the value of small-scale generation to electricity suppliers has disincentivised investment. NIE currently makes a series of export tariffs available to small Northern Irish RES-generators (<5MW).[30] The

[30] The 'NIE Generation Contract' is available to RE generators of 1MWe or less and CHP generators of 500kWe or less.

contract allows NIE to buy both the export electricity, and the associated NI ROCs, and helps to reduce the uncertainty and the difficulty of dealing in wholesale electricity markets for small and non professional renewable generators.

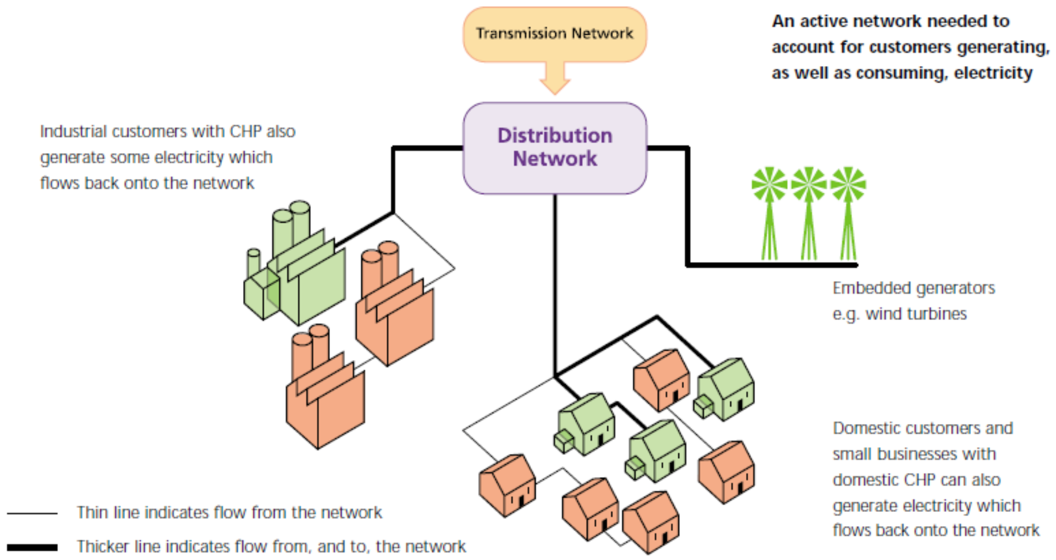
However, a guaranteed long term price for exports is not available for small-scale generators greater than 1MWe.[31] We note that under the GB FIT scheme, the level of support provided by the generation tariff (essentially the subsidy component of the FIT) is *additional* to the export tariff, adjusted to maintain a *total rate of return* to investors. In contrast, under the current arrangements for the NIRO, the level of support provided to small-scale generators is set *independently* of expected revenues provided by the NIE export tariff. Price support mechanisms for NI small-scale generation generators under the NIRO are not set to achieve a target required rate of return for investors.

While this is not necessarily a major concern presently, market driven changes to the level of support provided to generators from selling exported power may affect small-scale projects of a marginal nature. This suggests that total levels of return provided by banding of the NIRO and associated NI export tariffs for small-scale generators need to be kept under close review in the years to come.

One of the other key challenges which is perhaps hardest to address is the impact of small-scale generation on distribution networks. Unlike higher voltage networks these networks are typically not "actively managed" (i.e. they do not have a control room with staff actively increasing or reducing levels of demand and generation). The networks were often designed to allow power to flow in one direction (from large power stations to customers) and the reverse flows which small-scale generation creates can cause technical issues which can be complex to address. An illustration of an "active" distribution network under a model of small-scale generation is illustrated in Figure 6.6 below.

[31] Small-scale generators of this size can either enter into a contractual power purchase agreement (PPA) with an electricity supplier (the pros and cons of entering in bilateral contracts rather than participating in the SEM are summarised in Annex A) or participate directly in the SEM pool. Given the de minimis threshold for the SEM is 10MW the majority of small-scale generators would be expected to not participate directly in the SEM pool.

Figure 6.6: Distribution network with distributed generation



Source: Ofgem

The need for distribution operators to actively manage networks to account for customers generating, as well as consuming electricity, creates costs for electricity consumers and administrative issues additional to the production subsidy costs of supporting small-scale generation. As for large-scale generation, because the distribution networks in NI are regulated, NIAUR has an important role in ensuring that appropriate incentives are including in price controls for NIE T&D to connect small-scale distributed generation to its system. The forthcoming price control review, which as for the transmission network we understand commences next year, will be particularly important in ensuring this occurs, if promoting small-scale generation is considered an important policy objective.

Low carbon innovation funding for distributed generation has been introduced by a number of other sector regulators in the UK and RoI in response to government and EU renewables targets in the electricity sector. These types of scheme can arguably, be a more cost effective and targeted approach to supporting small-scale generation industries (with greater regulatory oversight) than capital grant or production subsidy schemes provided directly to investors and help to address cost and non-cost barriers to the development of the industry.

A second important technical issue to consider for realising small-scale generation potential is metering. In order to provide a subsidy (other than a capital grant) one must meter the output that is produced. Standard household meters flow one way and are unable to account for exported power. This can lead to issues in claiming the subsidy or require up-front investment to address. Upgrading metering creates further cost and administrative obstacles for the development of small-scale distributed generation.

Summary

In summary:

Key findings in respect of non-cost barriers to development

- When considering the case for supporting small-scale generation it is vital to consider non-cost barriers to development (rather than simply assuming providing financial support will lead to deployment).
- In particular the impact of small-scale generation on networks and the challenges large volumes can create for network operators need careful consideration.

6.5. Summary

The higher costs of small-scale distributed generation when compared to alternatives mean that financial incentives are necessary if one wishes to encourage investment. Policy to date for small-scale generation in NI has been based on the NIRO, with some amendments to reflect cost differences. In this section (supported by results from the modelling) we have compared the NIRO to alternative mechanisms for supporting small-scale generation, including a system of FITs and capital grant schemes.

In general, small-scale generation is expected to have higher costs per unit than larger more established renewable generation technologies, even when future reductions in cost driven by increasing in installed capacity are considered. Although the sector may provide a series of counteracting benefits to the electricity system, the value of these benefits remain uncertain. From a purely cost perspective, there may therefore be sound economic arguments for prioritising support to large-scale generation to achieve NI's renewables targets.

Our analysis suggests that inherent differences in the design between the NIRO, capital grant and FIT schemes would not lead to significant differences in terms of small-scale generation deployment. Although a FIT scheme (as illustrated by the approach adopted for the GB FIT scheme) could be an effective approach to promoting a fixed quantity target of small-scale generation output, a similar outcome could, if desired (and subject to State Aid approval) also be achieved by changing future banding of the NIRO, although this is likely to be more cumbersome approach than a structured small-scale generation FIT framework.

A small-scale FIT is also estimated to be a more expensive option to the NIRO for supporting small-scale generation. The indicative cumulative cost to 2020 of an NI small-scale FIT (depending on potential resource and size eligibility assumptions) is projected to be £62m - £86m. Put in to perspective, at the lower end of this cost range, the cost of a NI small-scale FIT is comparable to the *total annual* cost of supporting all sizes of renewable generation in 2020 under the Base Case assumptions for the NIRO.

While financial incentives ("price support mechanisms") are a key policy measure for supporting the uptake of small-scale generation in NI, there also exist a number of non-cost barriers to the uptake of small-scale distributed generation, which a number of studies of small-scale generation in other related markets, have shown to be as great a constraint on the potential contribution that small-scale or micro-generation could potentially make to EU 2020 renewables targets as the "price" of small-scale generation.[32]

As for large-scale renewable generation, these non-cost barriers should be considered alongside the design of a support mechanism for small-scale generation, to ensure the rates of deployment targeted under a financial incentive mechanism are realistic in engineering terms, and respond to planning and network constraints on the supply side of small-scale renewable energy developments.

In Table 6.8, we have summarised our qualitative and quantitative assessment of the NIRO, capital grant schemes and FIT systems as a support mechanism for small-scale renewable generation in NI. Given the level of support already provided to small-scale generators by the current banding of the NIRO, and the considerable fall in small-scale generation costs that would be required for the sector to be an attractive option for meeting NI renewable electricity targets, the NIRO is likely to continue to be optimal framework of support for small-scale generation in the context of NI public and electricity consumer budget constraints.

Table 6.8: Summary of small-scale generation support mechanism assessment

Metric	NIRO	FIT	Capital grants
Achievement of quantity targets	✓	✓	✓
Cost to NI consumers	Low	High	Low
Cost to NI budget	None	None	High
Operation of the SEM	=	=	✓
Support mechanism stability	✓	✓	✓
Ease of comprehension	✗	✓	✓
Legal frameworks [1]	✓	✗	✓
Minimise perverse incentives	✓	✓	✗
Economic efficiency	?	✓	?

Note 1: Based on required primary legislation for the introduction of a FIT

Source: CEPA

The key points to note from the analysis on small-scale generation are summarised in the text box below.

In summary:

[32] See Ofgem/BERR (2007): 'Distributed Energy – Initial proposals for more flexible market and licensing arrangements' and CEPA/SQW (2008): 'Commercial arrangements for small-scale generation in the Republic of Ireland – a report for SEI'

Assessment of alternative small-scale generation support mechanisms

- In general, small-scale generation is expected to have a higher cost per unit of deployment, relative to larger more established renewable generation technologies, even with possible future reductions in unit cost are considered.
- Within current design parameters of the NIRO, in particular NI's concessionary statutory obligation level, modelling analysis (where investment decisions in NI small-scale generation are solely influenced by expected cost and revenue streams) illustrates that a small-scale FIT mechanism is a relatively expensive option of supporting small-scale generation in NI to 2020.
- As for large-scale renewable generation, a banded NIRO as well as providing a mechanism for increasing the level of support available to certain renewable technologies, can also be revised by policy makers to eliminate windfall gains to investors as technology costs and output change in the future.

7. OPERATIONAL ISSUES FOR NI SUPPORT MECHANISM

7.1. Overview

The modelling analysis presented so far in this report has, necessarily, been based on a series of assumptions. Perhaps the most significant of these assumptions is that, assuming the revenues available to a generator are sufficient to allow that generator to at least meet their required rate of return, then renewable generation capacity will be built. In reality, there are a number of reasons to question this assumption: licensing or planning processes can cause projects to be delayed or cancelled; network infrastructure may be insufficient to facilitate connections; uncertainties about future market rules may deter investment; or sourcing the required components on international markets may be challenging. This section explores these issues in the context of the modelling results presented in Section 4.

In addition, and recognising that one of the drivers for this study were concerns about the interaction between the mechanism for supporting renewable generation and the operation of the SEM, this section assesses whether the choice of support mechanism creates issues for the efficient operation of the wholesale market.

The section is structured in two parts. Part A briefly outlines the market structure and discusses the way in which renewable generators participate in the SEM and explores the potential impacts of a rising volume of renewable generation on market operation. Part B then explores other factors which are relevant to the connection of large scale generation.

Part A: The impact of renewable generation on the Single Electricity Market

7.2. Market structure

The SEM went live on 1 November 2007, commencing the trading of wholesale electricity in the RoI and NI on an All-Island basis. The SEM is a gross mandatory pool, meaning that all electricity generation (above a 10MW *de minimis* threshold) and all imports must be sold to the pool, while all wholesale electricity for distribution or export must be bought from it. Generators submit bids based on their short-run marginal cost (in accordance with the Bidding Code of Practice) of energy production.

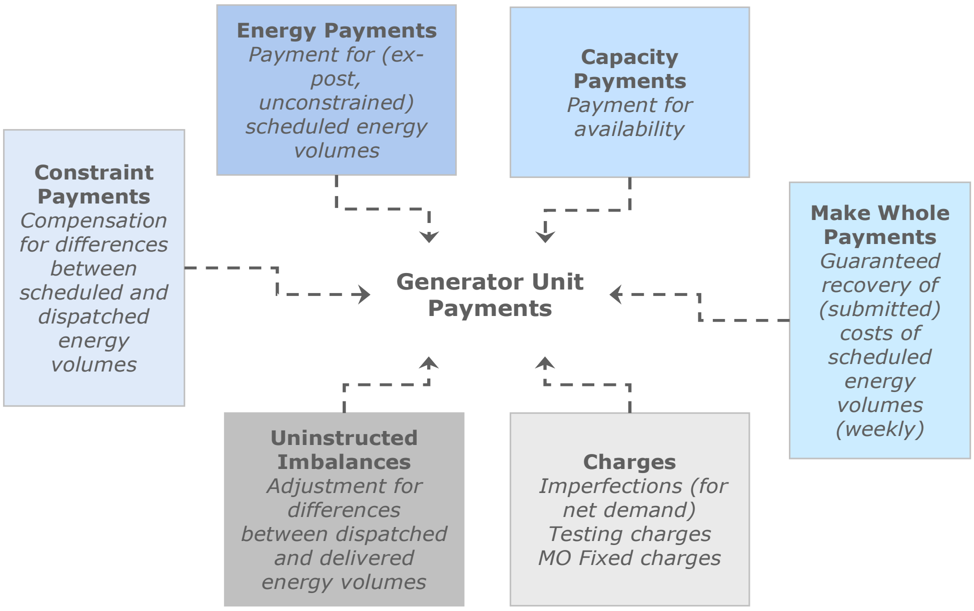
7.2.1. Participation options for renewable generators

Renewable generators, who benefit from priority dispatch within the SEM, have two options for participating in the market. They can either choose to be a price taker (which is subdivided into autonomous generation and variable price takers) or a price maker. The key distinction is that price makers are required to submit bids to determine their position in the market schedule and to reflect their willingness to be dispatched to a different level from that contained in the market schedule. Price takers are scheduled in dispatch ahead of price makers (which is achieved by netting the volume of price taking generation off demand).

7.2.2. Sources of revenue

Parties which operate in the SEM receive revenues through various sources, shown in Figure 7.1 below. However the most significant are energy payments and capacity payment revenues (though it is notable that a medium term review of the capacity payment mechanism is currently ongoing).

Figure 7.1: Rewards to generation projects via the SEM



Source: CEPA / PB

7.2.3. Market Governance

As noted above, the SEM is a separate energy and capacity market. In the energy market the Bidding Code of Practice (BCP) requires generators to only reflect short run marginal costs (SRMC) in bids. Generators must also comply with the Trading and Settlement Code (TSC) which contains the rules which govern market operation.

7.2.4. Market scheduling and market dispatch

There are two key parts of market operation – scheduling[33] and dispatch:

- Ex-post Scheduling is the process of considering the costs of all generators operating in the market, ranking those generators from least to greatest cost and determining the plant that will set the market price (which is the marginal cost of the generator which meets the last unit of demand). The key point is that the market is scheduled on an unconstrained basis. This means that no transmission constraints (for example) are reflected in the schedule.

- Dispatch is the process used by the Single Electricity Market Operator (SEMO) to tell generators when to run. Because generation and demand must match at all

[33] There are actually two market schedules, one ex-post and one ex-ante. The ex-ante schedule has not been included to aid clarity.

times, the market has to be dispatched on a constrained basis. Therefore if a transmission constraint means a volume of generation cannot be run, some generation needs to be constrained down (i.e. told not to generate and compensated) while other generation needs to be instructed to generate to replace the energy.

7.2.5. Arrangements for constraining generation

Under present market rules, price taking generators are assumed to have a bid price of zero. The current market rules also contain a methodology for compensating generators which appear in the market schedule but are not dispatched. The level of compensation is set equal to the difference between the System Marginal Price (SMP) and the bid price, in this case a constrained price taking wind generator would receive the SMP (their bid is calculated as zero). Therefore if a single MW of wind were constrained, there would be an additional cost equal to the SMP (to compensate the generator which is constrained) and the cost of replacing the MW. These costs will ultimately be passed on to customers.

7.2.6. Potential changes to the principles of SEM dispatch

In July 2009, the RAs published a consultation paper[34] considering whether changes t o the dispatch processes and associated aspects of the Trading and Settlement Code might be appropriate in the context of a high and rapidly increasing penetration of renewable generation in the all-island energy market.

The consultation paper highlighted a number of important issues for SEM market operations and the revenue streams deriving to renewable plant investors, including:

- the principles of dispatch and allocation of constraint and infra-marginal rent payments to variable/renewable price-taker generators in the SEM; and
- determination of SMP when demand is met by renewable price takers (including proposals for the continued use of a price floor during these "excessive generation events").

We understand that a series of approaches have been considered, though no final proposals have been submitted to the SEM committee and the nature of change is therefore uncertain.

7.3. Issues arising from a change in the treatment of variable generation

We understand that the RAs are, among other things, considering options which would result in what are currently classified as variable price taking generators becoming price making generators (i.e. being required to submit bids into the market). This change could have a number of impacts; some of which *may* be considered undesirable. These issues are discussed in more detailed below.

[34] 'Principles of Dispatch and the Design of the Market Schedule in the Trading & Settlement Code – A Consultation Paper', July 2009

7.3.1. Reflecting the opportunity cost of subsidy in bidding behaviour

Were the treatment of price taking generation amended, generators which are currently deemed to submit zero prices would move to a situation in which they were required to submit bids based on SRMC. Because many of these generators are subsidised, it would be rational for them to reflect the opportunity cost of subsidy in their bids. That is, because if they are unable to generate they will not be able to receive the price for their energy or the revenue associated with selling a NIROC (which is based on output) and will therefore wish to be compensated for both these losses. This would potentially lead to a series of negative bids being submitted.

This appears consistent with the Bidding Code of Practice and could be argued to be entirely consistent with the principles of marginal cost bidding. If prices in the market were to be determined on a truly cost-reflective basis, where a priority dispatch generator receives external subsidies, that generator would wish to be dispatched on an economic basis taking the external subsidy into account. The generator would continue to make an operating profit from generating so long as the price it received for doing so was greater than its avoidable costs of production less any external subsidy which, for plant with a low operating cost in the first place, such as wind, will typically be negative.

Under this option, the fact that different support schemes exist on the island will result in the market schedule being developed to reflect this fact. That is, if there is a need to constrain wind generation and a choice exists between two locations, the system operators would choose to constrain the one with the lowest subsidy (and hence the lowest bid price). Again, from an economic perspective this does not appear to be a problem. However it could be viewed as undermining the effectiveness of the support mechanism.

7.3.2. The approach to compensating generators

However, while arguably not a problem in themselves, the negative bid prices would have an impact on the costs of constraints (paid by customers). As explained previously, where a party needs to be constrained off, the constraint payment is equal to the difference between the SMP and the generator's bid price. Therefore a negative bid price implies that a generator would actually receive SMP plus their bid price.

This may raise questions about fairness and equity and lead to a view that some wind generation is making excessive returns. It would also create a situation where a generator was financially indifferent to whether it generated or not (assuming a persistent constraint), which could be argued to undermine the incentive created by the output based focus of the NIRO. Essentially customers would be paying for the subsidy to wind generation (albeit via a slightly different route), irrespective of whether that generation actually ran. It is interesting to note that there were several instances in GB during 2010 in which wind generators were paid for not generating. This led to substantial media coverage and a largely adverse reaction.

However, it could also be argued that this is a problem driven by the structure of market rules and not an issue associated with the NIRO. However, it is an issue which, if unaddressed, may be expected to increase in magnitude in future.

7.3.3. The floor price

An arguably less significant issue but something which could, in future, constrain the ability to band the NIRO is the presence of a floor price in market rules. At present generators are unable to submit a bid below -€100/kWh. This level was set at "a level sufficiently below zero to allow renewable generators to bid the opportunity cost of their ROCs and CHP plant at the opportunity cost of using their heat boilers".

This statement seems to reinforce the points made above regarding the consistency of negative bidding with the principles of SEM operation. It might also be expected to be a relatively simple problem to address via a small change to market rules.

7.4. An issue for subsidy or market design?

It is clear from the issues outlined above that there *could* be adverse impacts on the operation of a support mechanism and on costs to customers as a result of proposed changes to market rules. However it is less clear what the root cause of the problem is (or indeed if there is a problem given that negative bidding would seem economically sound): Is it the current approach to compensating variable generation that causes the adverse consequences or the form of subsidy chosen?

The most significant problem appears to be the method of paying for constraints which can raise costs to customers and possibly impact on the operation of the NIRO. However this approach is a function of the TSC and is therefore something which could, if so desired, be addressed via change to the TSC.

7.5. Conclusion

It is not clear that choosing a form of subsidy other than the NIRO would change this situation and it is notable that the presence of the REFIT in RoI would be expected to cause the same issues to arise. While changing the level of subsidy would alter the size of bids from price making generation, which might lead to it being placed in a different position within the market schedule, it would not seem to resolve the issue.

Part B: Potential impediments to the development of large scale generation

As noted above, while modelling is based on capacity responding to price signals, in practice, there are a series of other factors which can be important determinants of the amount of renewable capacity which is installed and the time at which that capacity is built. The extent to which these factors are present can have a bearing on the form of subsidy that may be appropriate (for example, the RO has arguably over-rewarded renewable generation in Scotland because planning delays and an inadequate transmission network have significantly reduced the volume of connections which are feasible) and, as such, understanding these issues and taking appropriate actions to remedy them is an important consideration in deciding on a support mechanism. These issues are discussed in turn in this section.

7.6. Certainty of SEM revenues

Our modelling has been based on an expectation that SEM prices and revenues received via the capacity payment mechanism remain relatively stable going forward. In turn this is based on an assumption that there will not be fundamental changes to market rules. If an investor considers that these changes are likely and factors them into their expectations, it is possible that they may require a higher cost of capital in future, which would be expected to reduce the amount of build or require a change in the level of support. We consider that there are two policy areas which could affect rewards to renewable generators.

The medium term review of the capacity payment mechanism

The All-Island market includes a Capacity Payment Mechanism (CPM) in order to avoid the chance that a system of marginal price based bidding would not sufficiently reward generators with plant that primarily provides services at shorter notice and for peak periods (generally referred to as mid-merit or peaking plant). The RAs were concerned that, without a CPM which ensured that parties could recover a significant proportion of the fixed costs of generation units, price signals could be insufficient to incentivise the development of new generation capacity. This could clearly have detrimental consequences for security of supply, might be expected to increase the volatility of prices (it is notably that energy prices in the SEM tend to be less volatile than bundled energy and capacity prices in the GB market) and could endanger renewable policy aspirations given the need for peaking plant to balance wind output.

While the capacity has been a feature of the SEM since it was introduced, there have been concerns about some elements of the mechanism, including the frequency with which the pot is reset, the parties which are eligible for payments and the timing at which payments are made. This has led to a medium-term review of the mechanism.

It is feasible that the review may reduce the period of time for which a renewable generator (and an intermittent renewable generator in particular) is eligible for capacity payments. Were this to occur, it would remove a substantial source of revenue and, without a counterbalancing increase in subsidy, could leave some generators with insufficient revenues to cover costs.

Targeting the costs of intermittent generation

The increase in intermittent renewable generation volumes which are likely to be required to meet the 2020 target (and beyond) are likely to alter the way in which the SEM operates. Greater levels of reserve generation are likely to be required, which may be expected to lead to more volatile wholesale power prices during some hours of the day (e.g. when there is relatively little wind generation and high demand) and much lower prices in others (e.g. when demand is low and wind output high). This may create a question about how the incremental costs of reserve generation are dealt with.

In GB there have been a number of debates about whether the costs which renewable generators cause should be targeted at those generators in order to ensure that the full costs of generation are reflected in decision making. Were market rules amended such that costs were targeted at those that caused them, there would be expected to be a further decline in the revenues earned by intermittent generators (though an increase to predictable renewable generation technologies).

7.7. The introduction of a wholesale price stabilisation mechanism

A further issue which investors may consider are DECC's proposals to introduce a wholesale price stabilisation mechanism, which are briefly discussed here.

The current RO requires renewable generators to assume the risk of changes in the ROC price and of changes in the price of wholesale power (by contrast, for example, a feed-in-tariff would provide certainty about the revenue available from support mechanisms and energy markets). While the headroom mechanism has been introduced to minimise volatility in RO prices, there is an ongoing concern about volatility of the wholesale price.

DECC has therefore consulted on various mechanisms for introducing a stabilisation mechanism. DECC's consultation on renewable electricity financial incentives states:

> "*Under the RO, generators are exposed to the risk and rewards of volatility in wholesale electricity prices and ROC prices. This results in revenue uncertainty and potentially harms investment, while affecting scheme efficiency. We are considering a mechanism to reduce or remove these price risks from generators, making the RO more efficient and less costly to consumers and more effective in raising renewable generation deployment rates.*"

Because the RO acts as a premium on top of the wholesale price, generators are exposed to both the risk and rewards of volatility in wholesale electricity prices. Periods of high wholesale prices tend to result in excess profits for generators, meaning that the cost of the RO scheme to consumers is higher than it needs to be. Conversely, when wholesale prices fall, generators' profit margins may be put under pressure and may affect the incentive to invest in new renewable generation. This could hamper the willingness of investors to invest and lenders to lend, and could lead to higher costs of capital than in a world of more stable revenue streams.

One of the mechanisms which DECC has considered is a contract for difference (CfD) approach which would allow generators to pass the risk of price fluctuations to suppliers. The mechanics of a CfD support mechanism around the wholesale price are presented at a relatively high-level in Box 5.1 below.

Text Box 7.1: Contracts for Difference.

A CfD is a contractual mechanism which allows for pricing risk to be transferred from one party to another by exchanging a floating price for a fixed price. It would work as follows:

- The Government would announce a reference price for wholesale power, set at a level to enable renewable investors to cover their costs.

- Generators would register for this stabilised power price for the duration of their participation in the RO.

- In years when actual wholesale prices exceeded the reference price, generators would pay back the difference; in years when the wholesale price was lower, generators would be paid the difference.

- The price and volume risk of CfDs would be passed on directly to suppliers and they would have to manage these.

- A Government agency would administer the scheme and pass the yearly cost or benefit on to suppliers through the regulatory regime.

A CfD scheme would leave the RO itself unchanged but instead would operate alongside it. The scheme would require the establishment of a new government-run agency to operate the scheme and administer the substantial cashflows involved. It would also require Ofgem to introduce amendments to supplier licences to allow for payments to and from suppliers.

Source: DECC

It is not immediately clear that the introduction of a stabilisation mechanism would have significant consequences for NI.

Since the implementation of a single electricity market there have been offerings of a substantial volume of 2-way CfDs (via the Directed Contracts, Non Directed Contracts and Public Supply Obligation processes) which have enabled generators and suppliers to manage and hedge the wholesale price risk inherent in the SEM. Therefore renewable generators which chose to do so (which is likely to be a function of the way in which Power Purchase Agreements are structured) can choose to mitigate wholesale price risk by participating in these processes. There is, however, a question about the extent to which these processes are understood and accessible to all types of generator.

As such, there would seem to be few impacts on NI generators from introducing a stabilisation mechanism in GB. While one could argue, at the margin, that if the scheme reduces risk for investors (without commensurately increases in costs) then it would increase the attractiveness of investment in GB (essentially removing a small advantage NI currently enjoys) or that increased volumes of installed capacity would be expected to lead to faster falls in capital costs, these factors are unlikely to be significant.

7.8. Adequacy of network infrastructure

Renewable generation, and intermittent/ non-dispatchable renewable generation technologies in particular, create new challenges for grid systems (particularly relatively small non-interconnected systems). The shift away from a centralised model based on a small numbers of large generators to a decentralised system with significant numbers of smaller market participants, located in remote (from an electrical perspective) locations with unpredictable operating patterns creates a need for a different approach to network management and often, as is the case in NI, a need for investment in new transmission and generation assets. This is reflected in the "Grid 25" process which has been taken forward by the systems operators and sets out a significant amount of investment during the next decade to facilitate the connection of new capacity.

If capacity constraints exist or arise, then a response to price signals cannot be guaranteed. Because the networks in NI are regulated, NIAUR has an important role in ensuring that investment is sufficient to facilitate connection. The forthcoming transmission price control review, which we understand commences next year, will be particularly important in ensuring this occurs. However, other factors can also lead to network constraints. Enough skilled engineers need to be available, it is necessary to be able to source the necessary components without delay and the build process has to be coordinated with the ongoing safe and efficient operation of the existing networks - all of which can prove challenging. In addition, the network upgrades need to be consented (discussed further below) without delay to avoid increases in congestion costs (because of the non-firm access arrangements in place in the SEM) or delays to projects.

7.9. Arrangements for planning and consenting projects

The arrangements for licensing and consenting generation also has an important bearing on the ability of installed capacity to increase in response to price signals.

In many jurisdictions, including NI, there is significant opposition to the development of renewable generation capacity and of the associated infrastructure. Local opposition can lead to significant delays (or termination) in projects, reduce the rate at which capacity is installed and, if they increase perceptions of risk, increase the return demanded by investors. For example, in Scotland almost 50% of projects which are submitted to the planning authorities have their applications rejected and lengthy public enquiries (which the Infrastructure Planning Commission was introduced to avoid) delayed the delivery of transmission infrastructure such as the Beauly to Denny transmission line which is required to facilitate the connection of renewable generation in northern Scotland.

While planning systems clearly need to be proportionate and balance the requirements of the local community, the environment and energy security, it is important that these processes are transparent, accountable and well understood.

7.10. Supply chain constraints

A further factor to consider alongside the design and level of subsidy is the extent to which the supply chain is sufficiently well developed to meet the demand for equipment which the subsidy will stimulate. If there is insufficient capability and delays in providing equipment progress towards targets will naturally be less rapid. It is notable that in many countries, particularly Germany and Denmark, governments have sought to use financial incentives to stimulate the development of a local supply chain as opposed or in addition to targeting financial incentives at generators.

It is also important to note that renewable energy deployment in NI, particularly of wind generation, will require parties to interact with the global market for turbines and components. At present, there is a shortage of capacity in the European market and long-lead times for securing manufacturing capacity and contracting vessels to transport and, in the case of offshore wind, install turbines.

7.11. Conclusion

This section has noted the importance, as we stressed for small-scale generation, of considering all the issues which contribute to an investor's investment decision when considering subsidy design. It has also noted some of the potentially undesirable consequences of failing to do so; most notably the risk of over-rewarding some generators while others are unable to respond to price signals and targets are jeopardised.

8. CONCLUSIONS

8.1. Overview

The UK has signed up to binding targets for the proportion of energy sourced from renewable generation technologies and is committed to reducing carbon emissions. NI has the potential to make a significant contribution to the achievement of the UK's renewable electricity targets. As set out in the 2009 Strategic Energy Framework, DETI has proposed that NI should adopt a strategic objective to increase the amount of electricity from renewable sources to 40 per cent by 2020.

NI has a series of unique characteristics which mean that there is significant potential renewable generation resource available to meet targets. There is potential for large-scale development of tidal stream resources, energy from agricultural bi-products and offshore wind, as well as other more emerging renewable generation technologies such as wave power generation. There is also significant available resource from onshore-wind, where the long term average capacity of existing wind farms in NI is higher than equivalent generation plant in other parts of the UK.

The primary tool for supporting the development of renewable electricity generation in NI is the NIRO which operates in parallel with the RO in England and Wales and the ROS to form the principal mechanism for incentivising the deployment of renewable electricity generation in the UK. The RO places a legal requirement on electricity suppliers to deliver a set and increasing proportion of their power from renewable sources or to pay a buy-out fee for any shortfall.

Recent amendments to the approach to supporting renewable generation in GB, through the introduction of a FIT for small-scale generation, and the presence of a FIT in the RoI (which is relevant given the presence of the SEM in NI and RoI) have led DETI and NIAUR to question whether the NIRO continues to be fit-for-purpose for all sizes and types of renewable generation in NI.

This report has provided an assessment of a range of alternative policy support options to the NIRO, and identified, through a combination of quantitative modelling and qualitative assessment, which support option would be expected to best facilitate the achievement of NI's policy goals for renewable energy to 2020.

8.2. Choice of support mechanism

The study has shown that, other things being equal, certain approaches to supporting renewable generation would be expected to be more 'efficient' (i.e. lead to appropriate levels of renewable deployment without over-rewarding renewable generation developers). In particular, approaches which are tailored to the costs of different technologies and are able to flex as the costs of those technologies fall, credible long term schemes which provide investors with revenue certainty and approaches which consider the total revenues earned by generators (by, for example, considering the revenues that are received via the support mechanism and the wholesale market) are likely to deliver benefits without requiring customers (in general) to face unnecessarily high costs.

However, the study also shows that alternative subsidy designs have differential impacts on the cost paid by NI consumers and highlighted the case for considering costs to consumers in the round. It is total expected revenue streams (i.e. the wholesale electricity and subsidy price) available to investors in renewable generation, funded by NI consumers, which matter to the design of an optimal system of renewable generation support in NI.

Were one considering the issue from first principles or were no support mechanism in place, it might be expected that some form of (tendered) FIT would deliver the most efficient outcomes. However, our assessment of alternative support mechanisms indicates that there are strong arguments for maintaining the NIRO in its current form. The NIRO appears to be well understood by investors, has already stimulated considerable levels of renewable generation investment in NI and the price of certificates has stabilised due to the headroom mechanism. Our analysis (summarised in Section 4) also suggests that returns would be sufficient to facilitate the achievement of the 2020 target. Perhaps most importantly, the NIRO leads to a materially lower level of cost to NI consumers (who currently pay more for energy than their GB counterparts) than alternative approaches, such as a system of FITs, under current design parameters.

However, under alternative future scenarios for the NI statutory obligation level, it is more ambiguous as to whether retention of the NIRO would continue to be the 'optimal' system of renewable generation support for NI. The way that the headroom mechanism operates to set the UK renewables obligation, and the way in which costs are allocated to electricity consumers in different regions of the UK, mean that the cost of supporting renewable generation in NI, and the incentives for investment created through the ROC price, largely reflect electricity market conditions in GB, as opposed to NI's single electricity market. If NI's obligation level were required to be on a more comparable level with the rest of the UK, the economic case for NI supporting renewable generation as part of a UK-wide, as opposed to a regional, scheme may be more ambiguous.

While we consider that the NIRO structure is likely to be most appropriate, given current design parameters, we consider that there may be arguments for seeking to more closely align the structure of the NIRO with NI's generation potential (recognising that this has already begun to happen by amending the levels of banding under the NIRO). NI has a comparative advantage in wind resource and appears to have considerable potential to develop significant levels of biomass and anaerobic digestion technologies. There may consequently be a case for further amendments to realise the potential of these technologies, particularly if they have beneficial impacts on employment and industrial competitiveness.

8.3. Wider issues for large-scale generation

Irrespective of the form of support mechanism chosen, we note the importance of considering wider barriers to the development of renewable generation. While providing sufficient returns to investors is clearly vital, issues such as planning processes, access to manufacturing capability and timely network access can have an important impact on the development of renewable generation technologies. In addition, perceptions that investments are risky or complex can have detrimental impacts, particularly at the small-scale level. Hence, we would stress the importance of considering the full range of factors which create potential risks for investors when assessing potential policy interventions.

Finally, we note the importance of ensuring that support mechanisms are consistent with the operation of the Single Electricity Market and that market rules create a stable investment climate. We have identified a series of potential issues for the operation of the Single Electricity Market which arise from a rising penetration of (intermittent) renewable generation, including negative bids and significant constraint volumes, though take the view that these issues arise as a consequence of the current market rules and note that processes are in place to amend those rules if required. We also note that the impact of several feasible changes to market rules on the economics of renewable generation may require further consideration.

8.4. Wider issues for small-scale generation

Small-scale generation could, if appropriately promoted and were policy makers to decide to do so, make a contribution to the achievement of NI's strategic energy policy goals.

However, in general, small-scale generation is expected to have higher unit than larger more established renewable generation technologies as output is typically lower and technologies at an earlier stage of developmentGiven NI public sector and electricity consumer budget constraints, there may therefore be arguments for prioritising support to large-scale generation, in order to achieve NI's renewables targets given that, under a range of scenarios, the costs of small-scale renewable generation are much higher compared to alternative means of generating renewable electricity in NI.

Our analysis also suggests that inherent differences in the design and level of support between the NIRO, capital grant and FIT schemes do not lead to significant differences in levels of small-scale generation deployment. Although a FIT scheme (as illustrated by the approach adopted for the GB FIT scheme) could be effective in promoting a fixed quantity target of small-scale generation output, a similar outcome could, if desired (and subject to State Aid approval) also be achieved by changing future banding of the NIRO, although this is likely to be a more cumbersome approach than a structured small-scale generation FIT framework.

A small-scale FIT is estimated to be a more expensive option than the NIRO for supporting small-scale generation. The indicative cumulative subsidy cost to 2020 of an NI small-scale FIT (depending on potential resource and size eligibility assumptions) is projected to be £62m - £86m. Put in to perspective, at the lower end of this cost range, the cost of a NI small-scale FIT is comparable to the *total annual* subsidy cost of supporting all sizes of renewable generation in 2020 under the Base Case assumptions for the NIRO.

8.4.1. Wider policy issues for NI

The UK RO has been designed within the context of the current structure of the UK electricity market. We note that DECC and HM Treasury are currently conducting a review ("Energy Market Assessment") of the UK energy market and options for its reform.[35] While NI is part of a single all-island electricity market structure were there significant changes to GB electricity market structures it is possible that changes would also be made to renewable generation support mechanisms. This study has assumed the RO in its current form will continue to be the principle support mechanism for renewable generation in the UK and we have not investigated the impact of the Energy Market Assessment for the NI renewable generation support mechanism. While we do not consider that a move away from the NIRO at this stage would be justified, DETI/NIAUR should continue to monitor any recommendations from the Energy Market Assessment and the implications this may have for NI consumers and the support mechanism for renewable generation in the region.

8.5. Recommendation

On balance, while there may be arguments for making minor amendments to the support mechanism in place in NI to improve its efficiency and more closely align levels of support with renewable generation potential, we consider it unlikely that moving away from the NIRO in its current form would provide benefits to NI consumers.

However, the design of the RO, means that the future level of NI's statutory obligation, relative to the statutory obligation level in GB, and what this means for the allocation of the costs of the scheme to UK electricity consumers, remains critical to the NIRO continuing to be the 'optimal' system of support for renewable generation in NI from a consumer cost perspective.

[35] DECC (2010): 'Energy Market Assessment'

ANNEX A: GLOSSARY OF TERMS

- **Resource cost –** equals total expenditure comprising capital and operating costs on generation plant under a given policy scenario.
- **Production subsidy cost –** equal to the total cost of the subsidy provided to renewable generators.
- **Deadweight costs – "windfall gains"** – defined as the level of subsidy cost over and above that which would strictly be required to make investment viable.
- **Annual subsidy cost to consumers –** this is the total annual subsidy cost to NI electricity suppliers which is assumed to be passed on to consumers.
- **Cumulative cost to consumers –** this demonstrates the cumulative cost to consumers to a specified date (for example, over the operating life of projects commissioned by 2020, or the cumulative cost to consumers to 2020).
- **Cost to the public purse in NI –** which is calculated as the value of any capital grants provided as incentives for investment in renewable generation[36].
- **Value of emissions savings –** which shows, based on an assumed fuel mix within the SEM, the benefits associated with displacing conventional carbon emitting generation with renewable generation.
- **Value of other economic benefits** – which is calculated as creation of direct and indirect employment from renewable generation in NI.

[36] Forgone revenues from the CCL are not included as a cost to NI public purse, as these are a cost to the UK exchequer as a whole.

ANNEX B: SUPPORTING MATERIAL

In this Annex we include various supporting material referred to throughout the main sections of the report on existing feed-in tariff schemes for renewable generation in Great Britain and Republic of Ireland.

Republic of Ireland Feed in Tariff (REFIT)

- The REFIT was launched in 2005 to replace the Alternative Energy Requirement (AER) mechanism with the stated purpose of stimulating sufficient capacity to meet Ireland's 2010 renewable energy targets under EC/2001/77.
- The REFIT system is designed specifically to encourage new capacity development and so applies to newly built projects only. In order to ensure that projects qualifying for support were in a position to build within a reasonable timeframe, the minimum conditions necessary to apply for support were also updated to include a requirement to have a valid grid connection offer in place.
- Since the REFIT support mechanism became operational, 609MW of renewable energy has qualified for the scheme.
- Once any supplier agrees to purchase all of the output from a renewable generator under contract for 15 years, it is entitled to a REFIT payment including:
    - a balancing payment intended to cover balancing costs associated with undispatchable generators;
    - a technology difference payment to promote diversity in renewable generation; and
    - an opportunity cost payment in relation to the cost to the supplier relative to what that supplier would have paid for that energy in the market.
- The levy is collected by suppliers from all final customers and paid to the distribution system operator or transmission system operator as appropriate.
- The REFIT programme establishes compensation payments to suppliers originally based on the calculated cost of Best New Entrant (BNE), but now in accordance with the CER Decision Number CER/08/236 of November 2008 entitled "Calculation of the R-factor in determining the Public Service Obligation Levy" and based on open market prices in line with the operation of the SEM.
- REFIT II now also supports the construction of renewable energy powered electricity for Anaerobic Digestion, high efficiency CHP, Ocean Energy (wave and tidal) and Offshore Wind. Projects must be built and operational by 2020 and the support for any particular project cannot exceed 15 years and may not extend beyond 2030.
- Adjustments to the payments are by way of annual indexation, by the annual change in the consumer price index in Ireland.
- The resulting reference prices (€/MWh) for the REFIT since inception for the qualifying technologies are provided in Table A1 below.
- While feed-in tariffs vary by technology, with the exception of onshore wind, feed-in tariffs offered under the REFIT are flat tariffs - i.e. the scheme does not offer different tariffs by scale of technology. The level of support provided to emerging technologies, such as ocean energy, is greater than more established technologies like onshore wind, hydro, biomass and landfill gas.

Source: DCENR

Table A1: REFIT reference prices by year per MWh and by qualifying technology

Technology group	2007	2008	2009	2010
Large wind	€60.762	€63.739	€66.353	€66.353
Small wind	€62.894	€65.976	€68.681	€68.681
Hydro and Biomass	€76.752	€80.513	€83.814	€83.814
Landfill	€74.620	€78.276	€81.486	€81.486
Biomass/anaerobic digestion CHP	-	-	€120.000	€120.000
Ocean energy	-	-	€220.000	€220.000
Offshore wind	-	-	€140.00	€140.00

Source: DCENR

Great Britain Small-scale generation feed-in tariff

Tariff levels in the Great Britain scheme are set through consideration of technology costs and electricity generation expectations at different scales, and are set to deliver an approximate rate of return of 5-8% for "well sited installations". This takes into account the risks associated with deploying the different technologies.[37]

The table below summarises the level of support provided to small-scale generators under the generator tariff component of the scheme. For the export tariff component of the scheme, if a small-scale generator opts to (a) export electricity, and (b) receive the export tariff, it is a guaranteed payment of 3p/kWh exported.

Table A2: FIT Generation tariffs under GB scheme (p per kWh)

Technology	Scale	2010	2015	2020	Lifetime
Anaerobic Digestion	<500kW	11.5	11.5	11.5	20 years
Anaerobic Digestion	>500kW	9	9	9	20 years
Hydro	<100kW	19.9 – 17.8	19.9 – 17.8	19.9 – 17.8	20 years
Hydro	>100kW	11 – 4.5	11 – 4.5	11 – 4.5	20 years
PV	<100kW	41.3 – 31.4	28.8 – 21.9	15.7 – 13.6	25 years
PV	>100kW	29.3	20.4	12.7	25 years
Wind	<500kW	34.5 – 18.8	27.5 – 18.8	20.7 – 18.8	20 years
Wind	>500kW	9.4 – 4.5	9.4 – 4.5	9.4 – 4.5	20 years
Existing micro-generators	transferred	9	9	9	to 2027

Source: DECC Feed-in tariffs: Government's Response to the Summer 2009 Consultation February 2010

[37] As the tariffs are linked to inflation, the nominal rate of return are approximately 7-10%.

Overview

The UK Government has retained a revised Renewables Obligation as the main support mechanism for large-scale renewable generation but from April 2010 has introduced a system of feed-in tariffs for small-scale renewable generation below 5MW. The motivation behind the introduction of the FIT is to create a mechanism which is easier to understand and more predictable than RO and delivers additional support required to incentivise smaller scale and more expensive technologies.

Form of FIT

There are two elements of payment made to generators under the GB FIT scheme:

- **A generation tariff**:
    - It differs by technology type and scale (banding)
    - Paid per kilowatt hour (kWh) of electricity generated and metered by a generator.
    - It is paid regardless of whether the electricity is used onsite or exported.
- **An export tariff**:
    - This is calculated in different ways, depending on the generator size.
        - Larger generators: Exported electricity is metered, and generator receives a guaranteed payment.
        - Smaller generators: Exported electricity assumed to be a proportion of the total generation in any period, so no additional metering required.[38]
    - From the generator's perspective, the export tariff is optional in two ways:
        - They can opt out of it and sell their electricity on the open market.
        - They can opt out of exporting their generation altogether, and instead use electricity generated onsite, thus avoiding having to purchase that electricity from their supplier (or a combination is possible).

All generation / export tariffs are linked to the Retail Price Index (RPI). The available tariffs for new installations will "degress" each year to reflect predicted technology cost reductions, such that new installations receive the same approximate rates of return as installations already supported through FITs. Once an installation has been allocated a generation tariff, that tariff remains fixed (though will alter with inflation as above) for the life of that installation or the life of the tariff, whichever is the shorter.

The FIT regime also includes a facility for revising tariff levels, based on reassessing the costs of technologies, electricity price forecasts and the appropriateness of the target rate of return, as well as reviews of other aspects of the scheme, including for exports, administrative and regulatory arrangements

Tariff payment mechanics

- FITs are primarily implemented through modifications to electricity supply licences

[38] For such domestic scale generators, DECC proposes (strictly as an interim measure) that "the amount of exports for the payment of export tariffs can be deemed". DECC states that they are "currently working with suppliers to finalise the arrangements and procedures for deeming, including the threshold at which it will apply".

(ESLs) which require holders of ESLs to make FITs payments to eligible generators.[39]

- Small suppliers will have the right to reject prospective generators where their installed capacity is greater than 50kW, but large suppliers will be obliged to accept any eligible generator that they supply and that approaches them for a FIT.
- FITs scheme costs are shared equitably amongst all holders of electricity supply licences in proportion to their share of the electricity supply market, creating "levelisation".
- Ofgem will act as the FITs scheme administrator, maintaining a central register of all FITs installations receiving support, referred to as the "Central FIT Register", and also receiving data from suppliers to enable it to operate the levelisation process.[40]
- Generators may, if they wish, assign the rights to their FITs payments to another body through a contractual arrangement.

Eligibility

- Specified maximum capacity will be set at 5 megawatts (MW).
- Initially it will support new anaerobic digestion, hydro, solar photovoltaic (PV) and wind projects, with differing generation tariffs proposed for different scales of each of those technologies up to that 5MW limit.
- It will also support the first 30,000 micro combined heat and power (mCHP) installations with an electrical capacity of 2 kilowatts (kW) or less, as a pilot programme.
- It will not initially support solid and liquid biomass technologies - these will continue to be supported under the Renewables Obligation at all scales.

Source: DECC

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[39] The draft electricity supply licence modifications will be laid in Parliament in February 2010. These modifications are subject to Parliamentary scrutiny and other approvals before they can be made by the Secretary of State.

[40] DECC recognise that "in the future, additional costs or benefits may arise because of unforeseen and large differences between the export tariffs paid to generators and the market value of that generation". Therefore, they "put in place the power for the Secretary of State to allow for these differences in the levelisation process. This will be subject to regular review".