June 2008

SC/07-08/EA273

National Grid's response to the House of Lords Economic Affairs Select Committee investigating the economics of renewable energy

nationalgrid

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Introduction

1. National Grid plc owns and operates the high voltage electricity transmission system in England and Wales, and as Great Britain System Operator (GBSO), we operate the Scottish high voltage transmission system. National Grid also owns and operates the gas transmission system throughout Great Britain and through our low pressure gas distribution business; we distribute gas in the heart of England, to approximately 11 million offices, schools and homes. In addition National Grid owns and operates significant electricity and gas assets in the US, operating in the states of New England and the state of New York.

2. In the UK, our primary duties under the Electricity and Gas Acts are to develop and maintain efficient networks and also facilitate competition in the generation and supply of electricity and the supply of gas. Our activities include the residual balancing in close to real time of the electricity and gas markets.

3. Through our subsidiaries, National Grid also owns and maintains around 18 million domestic and commercial meters, the electricity Interconnector between England and France, and a Liquid Natural Gas importation terminal at the Isle of Grain.

4. National Grid is pleased to have the opportunity to contribute to this inquiry. Our submission will focus on;

   - Projected costs of reinforcing and upgrading the transmission systems to accommodate the renewable sources needed for the 2020 target.
   - Challenges of connecting new renewable generation, including management of system access, existing regulatory regime particularly on proposals for managing offshore connections and planning delays.
   - Developing technologies that could serve to contribute towards meeting the target that include smart metering technologies and biogas injection.

5. With the significant increase in the proposed offshore generation, it is essential that a proactive approach to investment based on judgement of requirements is taken as opposed to developers' commitment. This will ensure that the infrastructure is in place when new renewables are ready to connect. Ongoing work investigating the level of investment required estimates the cost of onshore network reinforcement at about £3.5bn to meet the 2020 target. The offshore developments require co-ordination with the onshore work as it is clear that whatever is built offshore will have a significant impact on what is needed onshore. Along changes to the regulatory regime to facilitate investment, National Grid is also looking at ways to reform the way generators connect to the system to speed up renewables connections to the grid. We are committed to support the Government and BERR in the delivery of any regime that they choose.

The role of renewables in Britain's energy policy

6. National Grid welcomes and supports Government policies to facilitate investment in renewable energy and we take a proactive role in contributing to the debate on the subject amongst decision makers. The EU wide 20% target for all energy to be generated from renewable sources by 2020 is expected to translate to around 15% for the UK. To achieve that target, it is estimated that around 40% of electricity will need to be generated

from renewable sources in the UK by 2020. This is due to doubts over whether heat and transport can make a significant contribution in this timescale. The current GB generation mix is heavily reliant on carbon-based fuel of coal and gas which provide over 70% of the primary fuel source for electricity generation. Electricity sourced from renewables account for only around 2%, this highlights the magnitude of the challenge ahead.

7. The emphasis of Government policy is currently on promoting renewables from electricity generation. However, work on developing renewable heat and transport is required in order to meet the climate change targets in the future. This is particularly relevant to domestic and commercial heating which account for nearly 50% of the UK's total emissions. Policies around the decarbonisation of heat need to be developed in order to continue progress towards the UK Government's target of a 60% reduction in CO2 emissions by 2050.

8. National Grid has a key role to play as Great Britain System Operator and has a significant responsibility in delivering any offshore transmission regime, as well as many other key programmes which will be critical to the achieving the UK's renewable energy targets.

Investing in the transmission system to meet the UK renewable energy targets

9. If we are to have 40% of UK electricity coming from renewables by 2020, we will need to change the locations where electricity is generated. In other words, the locations where electricity needs to be transported from will change. In areas where renewables especially wind are most abundant, the network either does not exist, or has only been built to serve small amounts of generation, such as the Highlands and Islands of Scotland. Significant investment in the transmission system will be required, to both connect new generation and upgrade the wider system to accommodate larger flows to demand centres.

Transmission system investment costs

10. National Grid is undertaking a joint study with the Scottish transmission system owners to work out costs and options for achieving the 2020 target. Analysis on possible costs and energy flows discussed in this response is based on preliminary findings of this ongoing work.

11. The demand and supply profile in 2020 is likely to contain heavy flows from North Scotland through to Upper North England, high volume of offshore wind farms off the East Coast and potential contribution from Central Wales renewable generation as shown on the diagram in Appendix 1.

12. As stated in paragraph 25, National Grid believes that a regulatory regime needs to be put in place, in order to facilitate more strategic investment ahead of firm commitments from customers. National Grid estimates that capital investment to reinforce the onshore transmission networks across the GB market to accommodate the 40% target of renewable electricity will cost around £3.5bn[1].

[1] The amount quoted does not include local reinforcement costs on distribution networks.

13. Our analysis explores a number of strategic investment schemes to connect offshore wind on the East Coast, onshore windfarms in Wales and options for connecting Scottish renewables that would all together deliver the targets 2020 targets. See Appendix 2 for more details.

System operation costs

14. In addition to the network reinforcement costs outlined above, there are also system management costs to be taken into account especially as most renewables by 2020 will be wind. This is due to the fact that wind requires flexible generation with stored fuel to be available on standby for low wind days.

15. On a 'business as usual' case where the electricity market continues to maintain sufficient generation capacity to meet peak demand (including sufficient backup capacity for low wind days), we estimate the additional short-term balancing costs arising with wind providing circa 40% of electricity in 2020 to lie in the range £500m to £1000m per annum[2]. These balancing costs represent an additional £6 to £12 per annum on average consumer electricity bill of around £390[3].

16. The cheaper end of this range of balancing costs represents a scenario with reserve generation and balancing performed as today and with the market prices of the various balancing services remaining constant (despite the larger volumes required). The higher end of the cost range includes network constraint/congestion costs which might arise if there are delays in establishing network capacity or if there is significant network capacity sharing.

Barriers to the greater use of renewable energy

17. Since the introduction of the British Electricity Transmission and Trading Arrangements (BETTA) in 2005, unprecedented number of applications to connect to the system have been processed. National Grid, as Great Britain System Operator has made around 180 offers to connect to the system with connection dates to 2015 and beyond. Throughout Great Britain, we are currently managing 16GW of signed connection contracts for new renewable generation projects - 7GW of which is in England and Wales and 9GW is in Scotland. In total 49GW of new generation have signed connection agreements with National Grid compared with the 77GW of generation capacity currently connected to the transmission system.

Planning

18. Delays in securing planning consent are the most significant block to the timely connection of projects and the development of network capacity to enable this. Of contracted wind projects in Scotland, only 17% have consents. Across Great Britain, only 23% have consents. National Grid supports reform of the planning regime and in particular the Government's proposals to provide for greater certainty in reaching decisions.

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[2] For reference, current total balancing costs are circa £530m per annum.

[3] Source: EnergyWatch website

Transmission Access Review

19. Transmission access arrangements dictate the transmission capacity available for a generator to use. As wind in particular does not require access when the wind is not blowing, National Grid is committed to developing new transmission access arrangements to better facilitate the connection of renewable generation. The changes being proposed aim to make better use of existing capacity while incremental system reinforcements are underway by introducing options and flexibility for generators in the way they connect to the system.

20. We are playing a pivotal role in driving this forward with BERR and Ofgem within an industry wide discussion on reform of the current transmission access arrangements. There are three broad models of access reform which National Grid is leading the industry in developing.

21. The existing "invest then connect" system requires generators to make the required financial commitment but waits until full network reinforcement for the required capacity is complete before they can connect. Under the first of these referred to as "connect and manage", generators will be able to connect ahead of wider transmission system reinforcement to accommodate their required capacity.

22. The second proposal involves short-term access commercial arrangements that would allow for some reallocation of existing transmission capacity to new entrants. The third option aims to bring in a system of auctions for long-term capacity rights. In the period before additional long-term transmission capacity can be provided, long-term access rights could be obtained through the auction process. Given the support mechanisms in place for renewable generation, this could allow for the reallocations of existing capacity rights to renewable generators.

23. Consideration of these issues by the entire industry through the appropriate governance arrangements is essential. We have put forward modifications to the relevant industry codes, and final fully developed and assessed amendment proposals could be delivered to Ofgem for determination by the end of 2008, with the aim of implementing the selected reforms by April 2010. Such improvements to the access regime would allow for the more efficient use of the existing transmission system, and facilitate the connection of additional renewable generation. However, it is important to recognise that achievement of the very challenging targets for renewable generation will still require the delivery of significant additional transmission capacity.

Connection agreements and financial securities needed for grid connection

24. National Grid operates under a licence condition that ensures the company does not discriminate between individual generators or types of generation. At present we offer connection to generations in the order in which they approach us. Some projects at the front of the connection queue do not have planning permissions and are holding capacity which could be utilised more quickly by projects which do have permissions. We have implemented a more vigorous management of connection contracts in an attempt to weed out those projects which are not progressing as contracted via the use of project milestones, quarterly progress reporting and by taking a less flexible approach to project slippage. In order to reduce any barriers for small projects, we have also introduced changes which reduce the amounts of financial securities required from customers as well as giving them more choice in how they provide them.

25. National Grid recognises the level of commitment required from generators wishing to connect to the system under the current regulatory regime would be a barrier to renewables. Investment in the transmission system still needs to be carried out in the most economically efficient way to ensure that consumers are protected. This is especially relevant in light of other developments within the market – for example, wholesale energy prices are rising. However, given the scale of the challenge and the short time that the industry has to deliver solutions, new approaches are needed. One example could be "no regrets investment", whereby the Regulator and network companies consider what network developments are likely to be required ahead of definite and confirmed customer needs to upgrade and reinforce the network. Such an approach is rare but not without precedent. National Grid is in active discussions with Ofgem around different regulatory models to ensure that the required investment is made in order to help deliver renewables and ensure security of supply is maintained. One key issue to be worked through is the effect any changes may have on the risk and reward profile under new regulatory models and how this impacts upon the wider market and upon consumers.

Comparison of the current regime and proposed changes to allow for strategic network investment.

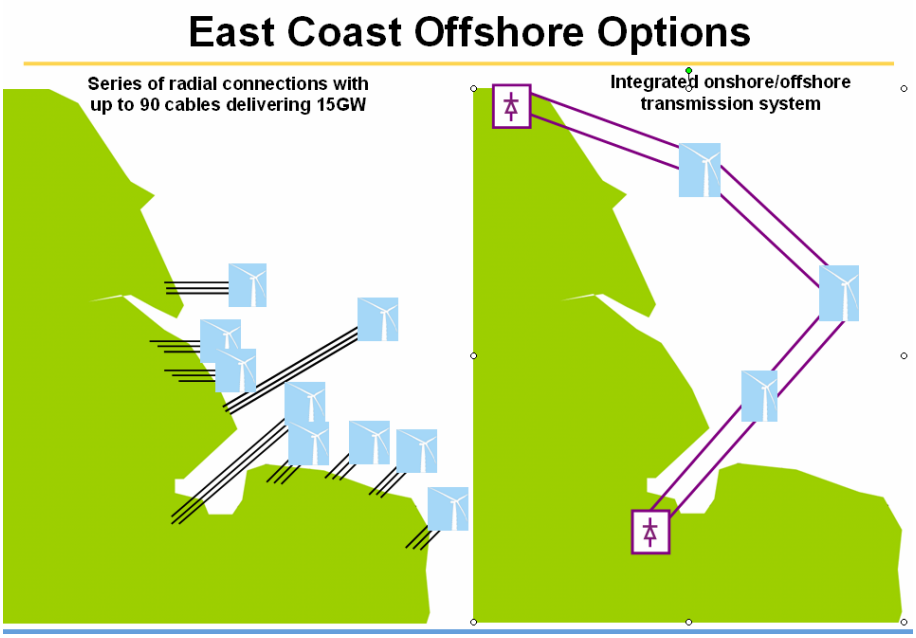
Current Regime		Proposed Regime
Developers' commitment particularly for renewables entrants might be difficult given the size, general characteristics and planning issues.	→	Invest to facilitate emerging requirement rather than individual developers commitment
Large risk and little reward for anticipatory investment in networks	→	Rebalance incentives to permit anticipatory investment while continuing to protect consumers

Offshore Transmission Regime

26. Due to limited space and planning considerations onshore, the bulk of the renewables needed to meet the EU target will need to be accommodated offshore. It is, therefore, critical that the Government get the offshore regime right. Ofgem and BERR have proposed a competitive tender approach to appoint Offshore Transmission Owners, i.e. the companies that will make investments and build transmission infrastructure to connect offshore windfarms. This approach aims to deliver a regulated solution that introduces competitive benefits to end consumers. This will encourage single radial links for windfarms, rather than co-ordinated offshore networks to develop. At the time this decision was made this was an appropriate solution and fit for purpose, however the need to develop renewables offshore has changed significantly since then, most significantly with the EU targets for c.40% renewable generation by 2020 and BERR's announcement of their aspiration for around 33GW of offshore renewables to be in place by 2020.

27. As Great Britain System Operator, National Grid is committed to support Government policy to facilitate connection of renewables. However, National Grid is not currently persuaded that the proposed regulatory regime for offshore transmission is the best way to deliver the UK Government's aspirations. The proposed regime appears overly complex with many areas of the regulatory arrangements still uncertain and undecided. There remains questions on the consumer benefits in terms of cost reductions that the proposed regime will produce. In National Grid's view, the deployment of simple, co-ordinated, regulated transmission build as demonstrated by the diagram below is a more effective approach to help meet the significant challenge which is ahead of us in the next 12 years. The quickest, simplest and most effective option is to extend the current regulated onshore transmission franchises offshore, but other options are available.

28. With the significant increase in the proposed offshore generation, it is essential that a strategic approach to investment is taken to ensure that the infrastructure is in place when new renewables are ready to connect. This should also be co-ordinated with the onshore developments as it is clear that whatever is built offshore will have a significant impact on what is needed onshore.



Technological Developments

Smart metering

29. National Grid strongly supports the roll out of smart metering. We believe that smart metering could deliver significant energy efficiency and carbon abatement savings. Smart meters are the next generation of electricity and gas meters. Through remote two-way communication technology, much like that used in mobile phones, they will bring about the end of estimated bills and meter reads, provide the platform for the development of a much greater choice in energy tariffs, and enable consumers to be informed to make choices about how much energy they use.

30. National Grid is currently assessing the potential contribution that a range of other smart technologies could make in facilitating renewable generation once smart metering is in place. For example, demand management technologies – that allow electric appliances, such as refrigerators and air conditioning units, to be automatically turned off or down in response to changes in supply and demand - are now becoming available. These technologies could provide a more efficient, and lower carbon, solution to the intermittency associated with renewable generation than the current approach of using conventional stand-by generation. Rather than calling on stand-by generation, National Grid could remotely and instantaneously reduce demand from these appliances in order to dynamically balance supply and demand.

Grid injected bio-methane

31. As stated in paragraph 7, heat is a key contributor to the UK's total emissions. Bio-methane is a renewable energy source with similar properties to natural gas produced from the anaerobic digestion or gasification of organic material including waste. Bio-methane has significant potential as a renewable energy source. Injecting bio-methane into the gas network effectively would reduce the carbon intensity of gas and can be used to convert existing gas fired power stations or domestic central heating systems to a renewable source of energy. As bio-methane is normally generated from locally sourced feedstocks it increases the diversity of fuel sources as well as the security of energy supply for the UK.

32. Due to Government subsidies in the form of Renewable Obligation Certificates (ROCs), the production of biogas from organic wastes is likely to expand significantly in the UK. However this economic support mechanism requires the biogas produced to be fed directly into an engine to qualify for ROCs. If instead, the gas distribution network is used to convey the equivalent amount of gas to a remote engine, this would not qualify for ROCs. Therefore, this incentive is likely, in many cases, to skew the market away from the optimum solution because it effectively discourages the option to purify the biogas to bio-methane, and move it via the gas grid to a more convenient location where the energy (heat as well as electricity) is actually required and can be used in the most carbon efficient manner.

    To address this issue, the Government could take one of two approaches:
    (i) It could be made easier for bio-methane producers to access mechanisms such as ROCs by making it possible to feed in a certain amount of bio-methane to the grid at one location and extract that same amount elsewhere to provide heat, power or transport fuel.
    (ii) A feed-in or production tariff could be paid directly to the bio-methane producers.

33. It is important that whichever approach is taken, that it appropriately rewards and incentivises grid-injected bio-methane producers in proportion to the reduction in carbon and methane emissions delivered by the technology relative to other technologies currently receiving support. For further details on some of the technical barriers to this technology, please see appendix 3.

Hydrogen Enriched Natural Gas (HENG)

34. Hydrogen Enriched Natural Gas reduces the carbon content of natural gas. National Grid is investigating a technology which converts methane into solid carbon and gaseous hydrogen. This is a form of pre-combustion carbon capture. The hydrogen produced can then be combusted to create energy with a sole by-product of water. The solid carbon can be used in various manufacturing processes.

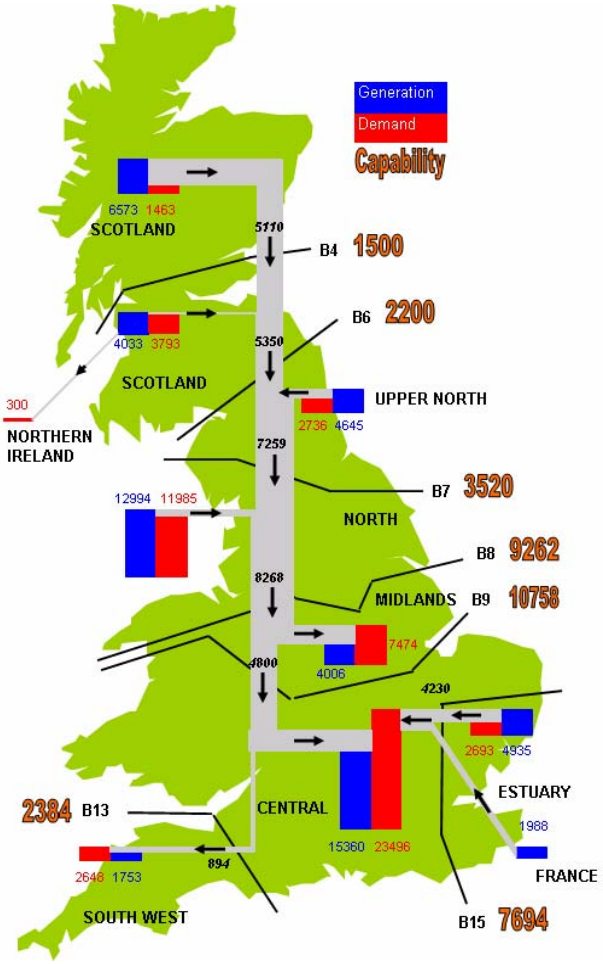
35. The technology is in its early stages of development and there are several challenges to overcome. However, National Grid envisages a number of potential applications of the technology including enriching natural gas to be used in electricity generation.

36. Although this technology is in the early stages of development, National Grid wish to highlight the potential of HENG to reduce the carbon intensity of gas in a similar way to other renewables reducing the carbon intensity of electricity.

Appendix 1

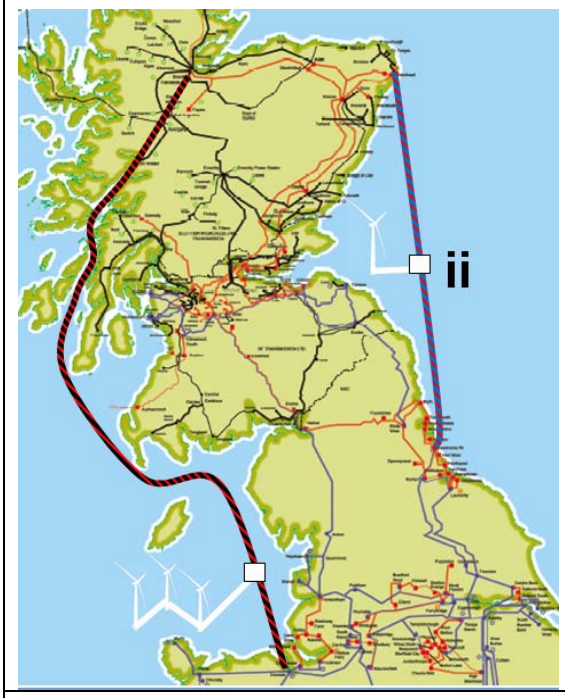
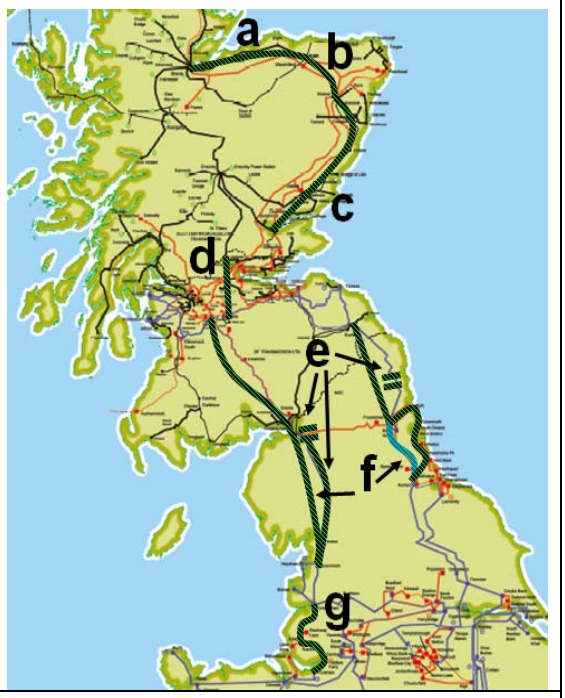
The diagram below illustrates a scenario for meeting the 2020 targets characterised by very heavy flows from North Scotland through to Upper North England, high volume of offshore wind farms off the East Coast and potential contribution from Central Wales renewable generation. Energy flows in this diagram are based on ongoing analysis of what the 2020 supply and demand profile will look like.

Projected energy flows in 2020

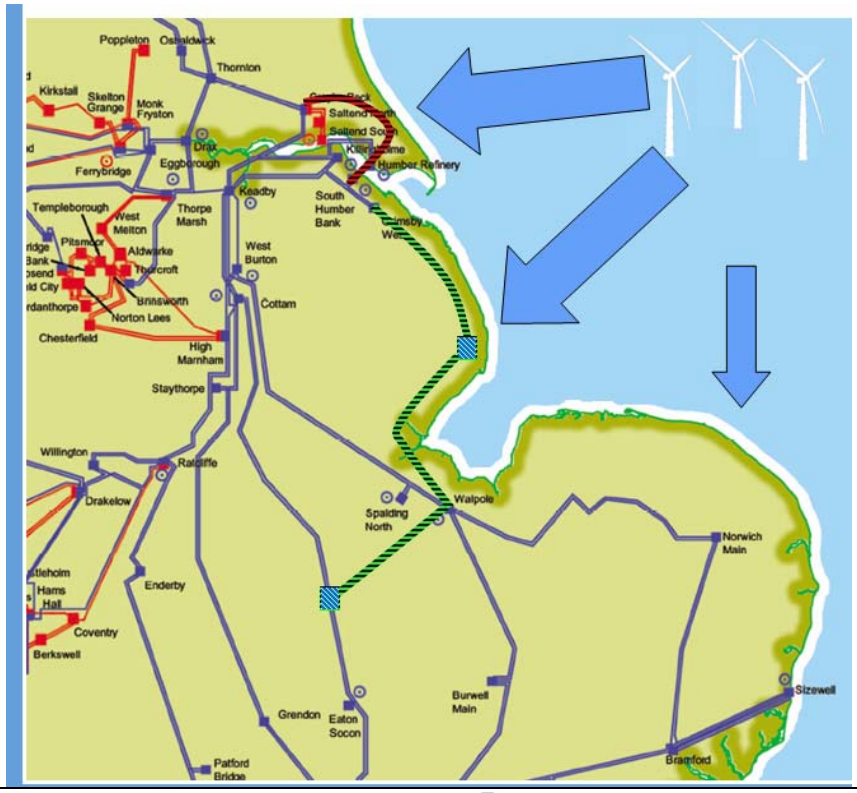


Appendix 2

Options for connecting Scottish renewables

Offshore Cable Routes	Incremental Onshore Reinforcement
	
• This can be delivered in stages to accommodate 10GW of renewables from Scotland • Estimated cost circa £1.7bn • Can be used to optimise the onshore network and avoid cost of replacing assets if the need does not materialise offshore. • Option of connecting offshore wind	• Estimated cost circa £1.3bn • Accommodate 10GW of renewables from Scotland • Additional costs associated with connecting additional offshore generation onshore
Please note that the viability of both of these two options depends on the Beauly – Denny line going ahead.	

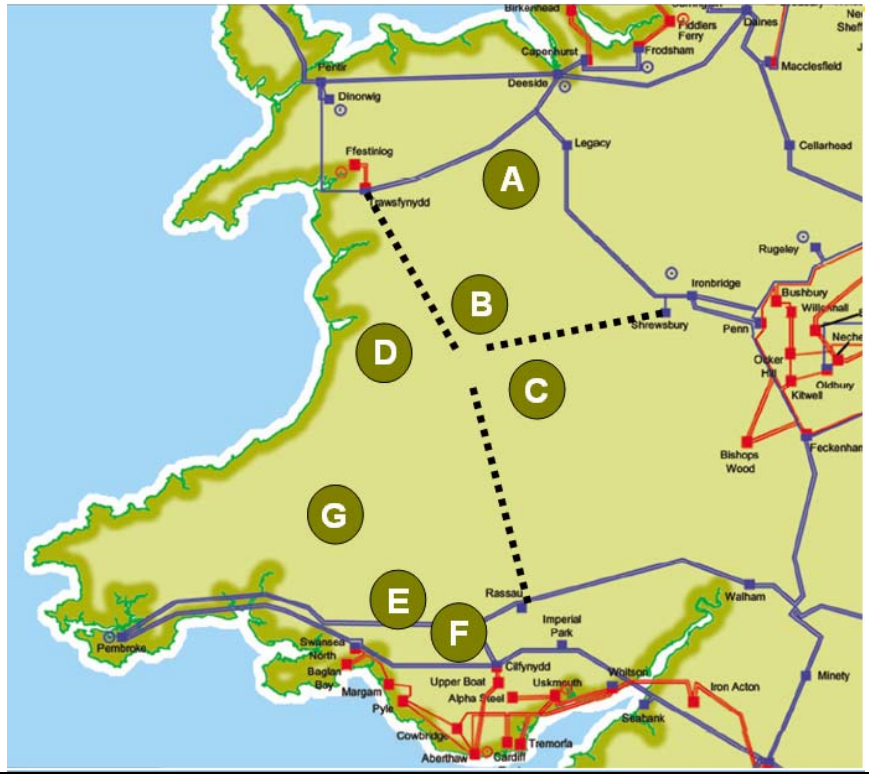
Onshore investment connecting East Coast offshore wind



- Facilitating large volumes of offshore wind generation on the East coast in an already congested part of the network
- 3 – 4GW of renewables connected to North of Humber at an estimated cost of £300m
- 10 – 12GW of renewables connected to South of Humber at an estimated cost of £500m[4]
- Cable connections between Sizewell and Bradwell with 2.5GW of renewables connected at an estimated cost of 500m

[4] The estimated £500m for the South of Humber connections includes both the cost of connecting renewables as well as boundary capacity.

Connecting onshore windfarms to deliver wind from Central Wales



- Estimated up to 1GW of onshore wind looking to connect in areas B,C and D
- Several new Over Head Lines options available at an estimated cost of £150m

Appendix 3

Grid Injected Bio-methane

37. Bio-methane is already being injected into the gas distribution and transmission networks in other parts of the world. Germany has a target to provide 10% of its natural gas supply from bio-methane by 2030, and has implemented feed-in tariffs to encourage production. In the UK there has been to date no bio-methane injection to the gas grid. National Grid has, for over 25 years, had experience of injecting biogas from Staten Island Municipal landfill site in New York into our gas distribution network. In the UK, other than the

commercial barriers highlighted in the main body of the response, there are two key technical barriers:

(i) Gas quality - Regulations in the UK have been focused on the injection of large quantities of natural gas from the North Sea and imports from Europe and will present some barriers to the entry of bio-methane which has different characteristics to those of natural gas. One solution might be for Ofgem to and the HSE to exempt renewable gas from obligation on certain criteria that bio-methane has to reach subject to safety considerations.

(ii) Equipment Requirements - The current requirements for monitoring and metering gas quality and volumes require very expensive equipment. The economies of scale needed to make this technology viable will require large plant deployment. National Grid would like to investigate the feasibility and assess the impact of less onerous monitoring and metering requirements for low volume injections.