(1)

[redacted]

From: [redacted]
Sent: 13 June 2012 12:22
To: [redacted]
Cc: Robson Hugo (Commercial); Griffiths Oliver (ShEx); [redacted]
Subject: Biomass power and the Green Investment Bank

Attachments: EU QUESTIONS - BIOMASS POWER 512146128_1.DOC; GIB biomass power paper (9).docx

[redacted] copy Hugo, Oliver, [redacted]

Last year you kindly helped prepare an evidence paper setting out the case for the GIB to operate in the area of biomass power.

The UK submitted its draft notification on the GIB on 30 November 2011. We were seeking scope for the GIB to invest in priority sectors on a state aided basis and in non priority sectors (including biomass power) only on a fully commercial basis. We provided evidence of a need for GIB involvement in a number of such non priority sectors on an illustrative basis as we were asking that the GIB should have discretion to invest on commercial (non-state aided) terms in the green economy as a whole rather than for its remit to be restricted to specific sectors.

The Commission has, however, concluded that the GIB's overall remit must be limited to specified sectors. For a sector to be within the GIB's scope, therefore, we will need to demonstrate there are specific market failures in that sector and clear evidence that the GIB is the appropriate measure to address these.

Over the next couple of weeks, we are reviewing our evidence base for non priority sectors and looking to reinforce it where possible.

I attach an evidence template prepared by our legal advisers that sets out the evidence we need to provide in relation to the biomass power sector. We would be grateful for any help DECC can provide in providing the fullest information possible. In particular, DECC is probably best placed to consider section 1 of the template concerning the detailed definition of the sector. But feel free also to comment on how best to evidence the need for the GIB to address market failures and on the funding gap.

Attached for reference is the evidence paper you provided last year which should provide a good starting point but please do consider whether there is any further or updated material that could be of use in convincing the Commission of the need for the GIB to operate in this sector.

If you could manage to provide material by the end of next week (22 June) that would be very helpful.

Many thanks for your continued assistance

[redacted]
GIB Team ShEx
[redacted]

EU QUESTIONS - BIOMASS POWER 5...

GIB biomass power paper (9).do...

GREEN INVESTMENT BANK

Proposed Templates for responding to Commission Level 1 questions

BIOMASS POWER

1. Detailed definition of the sector:[1]

(i) set out the scope of the technology the GIB intends to invest in (with reference to the specific different types of technology):

Biomass boilers generate heat energy through the burning of fuel including wood, straw, energy crops, manure and the biomass portion of municipal and commercial solid waste (Vivid I, para 2.5.2 and draft notification, para 4.145). [redacted]

and confirm the inclusion of any of:

(a) infrastructure

(b) ancillary/complementary technology (for example, radar for offshore wind projects)

[Please confirm. NB: Detail required below is required for all activities covered in this above section.]

(ii) details of the industrial structure of each sector and each specific subsector, including:

(a) supply chain overview; details of the components to the projects within the GIB scope [NB: Vivid does not cover this in any detail. We assume DECC or similar would have some off the shelf materials that could form the basis for this]

(b) details of the suppliers are active in the various aspects of the sector and technology (referenced back to (i) above)

---

[1] This needs to describe to the Commission exactly what is in and what is out of the sector scope, with reference to the various types of technology/projects.

2. Identification and provision of details of market failures:

(i) details of the type(s) of market failure(s) encountered in the sector and each subsector/technology[2]

[Drafting note: As these are MEIP sectors, the market failures should ultimately illustrate an insufficiency of capital]

The market failures that we have identified in relation to biomass power are the novelty of technology and risk aversion of investors which are leading to insufficiency of capital.[3]

[redacted]

(ii) details on the causes of such market failures

[redacted]

(iii) comparative analysis with non-green emerging sectors such as technology sectors with a similar growth and technology uncertainty profile

[redacted]

---

[2] The Commission require that market failures put forward are specifically linked to the sub-sectors of the sector that they can be evidenced for. For example, for biomass this might involve some market failures applying particular types of feedstock. If market failures actually apply across the sector then evidence to this effect is required. At present we have a short list of market failures for each of these sectors but they are not especially well substantiated.

[3] In cases where the Commission has requested details about sub-sectors, this will include all types of biomass projects and technologies. When evidence for each sector or technology differs please therefore provide evidence for each project.

[4] BIS should be clear whether the market failures identified manifest in projects in other Member States or just the UK.

(iv) assessment on whether those market failures are estimated to be temporary or not

[redacted]

3. Precise quantification of the current and expected funding gap and investment trajectory (with/without GIB intervention) for each sector and technology backed by data

Analysis set out in the Renewables Energy Roadmap indicates that in central range scenarios, the biomass heat and power sector has the potential to deliver 68-100 TWh, equivalent to 30-43% of the UK's renewable energy targets. The overall investment required to meet these targets by 2020 is likely to be approximately £3.8 billion. (Draft notification, para 4.146).

[redacted]

4. Compare the funding gap with other sectors and technologies with a similar growth profile (inter alia comparison growth rate/ growth rate of financing) and with other geographical areas, etc.

[redacted]

GREEN INVESTMENT BANK

Case for MEIP activities in the biomass power sector

Biomass power – Definition and technologies

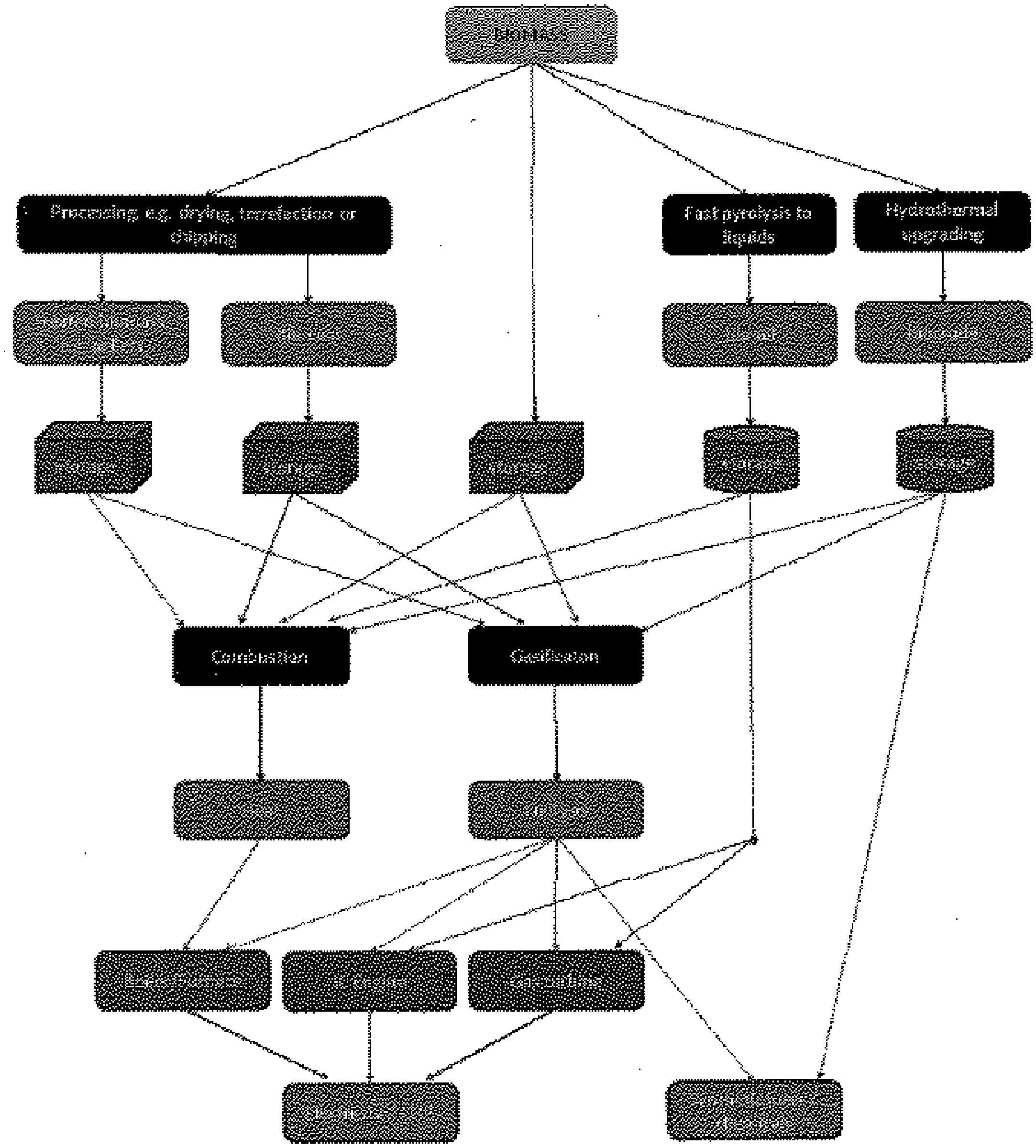
1. Biomass is defined as deriving from plant and animal matter. Sources include wood, straw, energy crops, manure and the biomass portion of municipal and commercial solid waste. It can be a highly versatile feedstock with great potential to contribute to all forms of renewable energy; transport biofuels, heat and power. It is also in demand for the renewable materials industry. However, the scope of this paper is limited to biomass used for power generation.

2. Biomass used in power generation has several important properties that distinguish it from most other renewable energy sources. It provides non-intermittent energy supply making it suitable for base load and peak load electricity. It can be used at any scale, and in most locations. It can be used in its pure form, or blended with fossil fuels where necessary. Depending on the technology used to convert biomass to power, it can be used in its solid raw form, undergo a preparatory treatment (such as drying or pelleting) or be processing to a energy carrying intermediate (such as pyrolysis oil) before being cleaned up and be processed into a liquid or gas fuel (such as biomethane, or biodiesel) before being converted in power. Fundamentally however unlike other renewable energies it has a fuel element which requires a subsidy given its relative high fuel cost in comparison with fossil fuels subsidies as well as the capital cost element.

3. Technologies that produce power from biomass vary greatly in their design and efficiencies depending on the form of the biomass being used and the stage of development the technology. The diagram below shows the possible routes for biomass to power from co-firing with fossil fuel, through to advanced conversion technologies (ACTs) such as gasification.

4. There are no doubts about biomass energy's potential however it remains to be fully capitalised and remains underdeveloped because it is largely unprofitable and is likely to remain so until it can achieve economies of scale and become cost-competitive on a large scale. This paper sets out how intervention by the Green Investment Bank could help support that development

Figure 1: Routes to biomass power[1]



5. The common commercially available applications include the standard combustion of dedicating biomass and the co-firing biomass with coal. The addition of coal into the fuel mix can increase the electrical efficiency of the station from 25-30% to around 40%, whilst the utilisation of fossil fuel means co-firing can achieve typical GHG savings of around 60% compared to coal power stations.

---

1 Image supplied by National Non Food Crops Centre (NNFCC)

6. In addition to standard combustion and co-firing some advanced conversion technology routes are also at near commercial stage such as gasification and pyrolysis. These provide a route which in future could use biomass to generate heat, power, fuels (including advanced biofuels and synthetic biomethane), and other renewable chemicals. Their potential to take a wide range of feedstock, such as wastes, algae and lignocellulosic material gives them the potential to be a key technology for meeting renewables and GHG (greenhouse gas) targets to 2050 and so reducing pressure to use wood and crops as the primary source of biomass.

7. All the technologies mentioned above are suitable for combined heat and power (CHP). CHP captures the heat from the electricity generation process and puts it to further use, such as industrial processes, space heating and hot water. This greatly increases the overall efficiency of the plant through maximising the energy potential of the fuel. Because of this CHP is a more optimum solution for thermal combustion of biomass than power-only applications.

8. Finally there is also the potential in future for standard biomass power stations to be fitted with Carbon Capture and Storage (CCS). If successful it could deliver negative carbon emissions across the fuel's lifecycle and could be a pivotal technology to deliver our GHG targets cost-effectively, while maintaining security of supply.

9. The focus of this paper is on the potential role of the Green Investment Bank (GIB) in the currently commercially available technologies of dedicated biomass, co-firing/conversions and CHP. However going forward the GIB could play an important role in also promoting biomass electricity with CCS. This should be an area that remains under review as the CCS technology develops.

Description of current UK biomass to power industry

10. At the end of 2010, biomass generated 2.5GW electricity capacity, contributing 12TWh of electricity; the single largest contribution to the renewable energy targets. An additional 4.2GW is estimated exist in the pipeline.

11. The majority of generation (62%) comes from waste (predominantly from landfill gas), although the cost effective portion has now largely been exploited and its use is set to decline to 2020. Co-firing and small to medium scale dedicated biomass plants (up to 50MW) are also significant (21% and 17% respectively). The biomass industry are moving towards larger scale plants, and conversion of coal power stations to dedicated biomass plants, which will be needed to sustain the increase of biomass to power.

12. Construction of the first biomass conversion plant has started, whilst plans for additional 100MW and 300MW dedicated biomass plants are in place. The latter would require a significant amount of investment and can take 5-8 years to build. Smaller scale biomass will continue to play a role, particularly where there is a demand for heat so CHP can be deployed. These plants will generally be reliant on indigenous supply of biomass.

13. Supply chains, both UK and global, for biomass are not yet well developed. The solid biomass currently used in the UK to produce power is from both indigenous sources (predominantly agricultural and forestry residues, wastes and perennial energy crops) and imported wood pellets and chips. As greater capacity biomass plants are built we expect imports to become the predominant source of feedstock.

14. The government has encouraged diversification of feedstocks, such as the growing of perennial energy crops (miscanthus and short rotation coppice) to help increase the total biomass resource available for energy use and minimise the impacts on other biomass using industries, for example the wood panel industry. Diversification also delivers security of supply benefits through increasing indigenous biomass resources as well as providing business opportunities to farmers and the nascent UK bioenergy supply chain.

15. The level of biomass deployed in the UK will be dependent on the availability of sustainable feedstocks, which in turn will be dependent on price and effort made to overcome constraints within the supply chain[2].

16. Although aspects of the industry such as feedstock supply chains and infrastructure are relatively immature, there is a desire within the UK to develop a cohesive framework which supports the various supply chains from crop through to port to skills, development and generation of energy.

17. According to Morgan Stanley biomass feedstock accounts for 50%-75% of the full generation costs. This large spread in costs arises from the fact that currently there is no stable supply chain set up; because biomass prices remain exposed to seasonality, location and availability of supplies. Furthermore there is no central and stabilised market equalising supply and demand across regions. As a result for developers, assessing future costs of biomass supplies continues to remain a problem and as a result, it is difficult for biomass developers/ generators to hedge their positions.

---

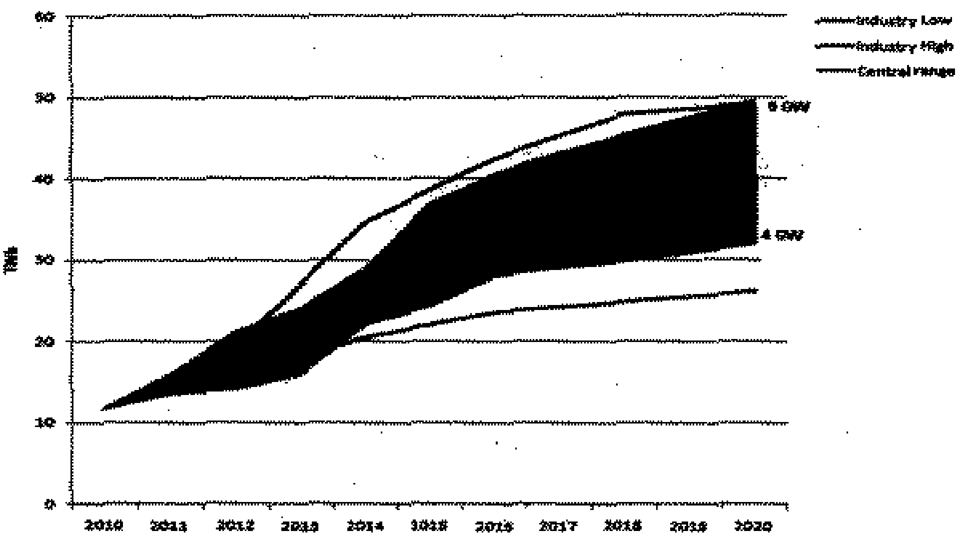
[2] UK and Global Bioenergy Resource – Final Report, AEA 2010

18. Biomass generators are likely to remain dependent on imports of biomass crops and be subject to increasing costs of transportation and FX exposure.

Policy aspiration

19. Biomass power is considered to be essential to delivering our obligation under Renewable Energy Directive[3] (RED) of 15% renewable energy by 2020 in the heat, power and transport sectors. This equates to 238TWh in 2020, [redacted] is expected to be delivered through renewable electricity. Analysis set out in the Renewables Energy Roadmap[4], indicates that under the central range, the biomass heat and power market has the potential to deliver 68-100TWh equivalent to 30-43% of our estimated 15% renewable energy target. If sufficient quantities of sustainable biomass could be sourced, ambitions could be even higher.

Figure 2: Deployment potential to 2020 for biomass electricity[4]



20. The white paper on electricity market reform published in this year is designed to improve the market's ability to finance the huge investment in low carbon electricity that is needed over the next decade and beyond. Included are proposals to introduce Feed-in Tariffs with Contracts for Difference (CfDs), which will provide support for all low-carbon technologies, including biomass. The first CfDs are due to be introduced in 2014, but to ensure a smooth transition, the Renewables Obligation (RO) will remain open until 31 March 2017, and developers will have a choice of scheme until that date.

---

[3] 2009/28/EC on the promotion of the use of energy from renewable resources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[4] UK Renewable Energy Roadmap, DECC 2011

21. The Government is developing a Bioenergy Strategy for publication by early next year. This will provide further clarity on our ambition for biomass electricity in the context of other uses for biomass, including non-energy uses. It will set out an expectation of sustainable biomass from domestic sources and imports, taking into account all available evidence on the full life cycle carbon impact of biomass, including Indirect Land-Use Change (ILUC) effects.

22. Looking to the medium and longer term, the Government is committed to achieving the transition to a green economy and delivering long-term sustainable growth. This policy aim is *supported* by a set of environmental objectives and targets – including the reduction of greenhouse gas emissions to 20% of 1990 levels by 2050. DECCs analysis which sets out possible routes for achieving this target across all sectors, suggests that it is nearly impossible to meet without the deployment of biomass technologies[6]. However, the extent to which biomass will be used in power as opposed to heat or transport, is dependent on a number of factors such as the availability of key technologies, and the availability of sustainable biomass. Analysis undertaken for the Bioenergy Strategy is likely to provide a clearer indication.

23. DECC is also in the process of identifying some key low carbon innovations or technologies that are considered to be key to delivering our targets to 2050 and will be prioritised for support.

Existing policies

24. Biomass for power has been supported under the Renewables Obligation (RO) since 1990; the primary instrument for incentivising renewable electricity in the UK. Obligated suppliers are largely the major energy companies which in 2011/12 are required to generate 0.158 ROCs per MWh of electricity supplied. ROCs are tradable certificates awarded for every megawatt of renewable electricity produced.

25. Since its inception the RO has undergone major changes, designed to improve the uptake of sustainable biomass in the RO. The introduction of bands in 2009, allows for additional support to be given to more expensive Renewables technologies. For example, dedicated biomass currently receives 1.5 Renewable Obligation Certificates (ROCs), with an additional 0.5 ROC if energy crops or CHP is used. Banding reviews occur every four years and ensure that as market conditions and innovation within sectors change and evolve, developers continue to receive the *appropriate* level of support necessary to maintaining

---

[6] 2050 Pathway Analysis, DECC 2010

investment in the renewables industry. The government is currently consulting on the latest proposed bands to be introduced in 2013.

26. The introduction of a mandatory renewable energy target under the RED has increased the ambition of biomass in the UK, as reflected in Coalition documents such as the Renewables Roadmap[4] and the National Renewable Energy Action Plan[6]. [redacted] Complimentary activities are being undertaken to increase the uptake of biomass in the heat and transport sectors.

[redacted]

[redacted]

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SUM	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

27. The UK places a high importance on the sustainability of biomass feedstocks and introduced mandatory sustainability standards set out in the RED for bioliquids in April 2011. Mandatory reporting on sustainability criteria is also in place for biomass, with the intention to prevent ROCs being awarded to unsustainable biomass by 2013. It will have the important benefit of ensuring that biomass power in the UK will deliver on our climate change and energy security goals.

Biomass Power Cost estimates

28. Analysis for DECC[8] suggests wide ranges for levelised cost of biomass electricity – £70-£170/MWh in 2020, down only slightly from £75-£194/MW in 2010. Ranges are wide due to the large number of

---

[6] National Renewable Energy Action Plan for the United Kingdom – Article 4 of the Renewable Energy Directive 2009/28/EC, DECC 2010

[7] Not yet pulished

[8] Review of the generation costs and deployment potential of renewable electricity technologies in the UK: Study Report, ARUP 2011

individual technologies considered[8] (co-firing is generally least expensive, followed by conversion, dedicated biomass and biomass CHP), uncertainty about AD, and the wide of range of project-specific factors affecting plant (fuel type, scale, the proportion of biomass used). Cost reductions of standard technologies are small due to minimal learning rates assumed for the relatively mature combustion technologies, although AD is projected to benefit from falling hurdle rates as the technology is shown to work.

29. Figure 3 above set out the central scenario projected for the Renewables Obligation banding review for the proposed bands. The costs of delivering the [redacted] is approximately [redacted] per year to the tax payer through the RO by 2020. The overall investment required is likely to be approximately [redacted]. The table below provides a breakdown of the investment requirements of the sector. It indicates that there will be a peak leading up to [redacted] on the investment required.

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SUM	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

30. Cost estimates are not provided for beyond 2020, because of the uncertainty over the contribution that biomass electricity will make to the grid, and the penetration of new technologies such as Biomass CCS. However it is noted that there is significant innovation and cost reduction potential for these advanced technologies that have not yet reached their full commercial potential, as well as agri-innovation to increase feedstock yields.

Barriers in the Biomass Power sector

---

[8] This range includes dedicated biomass, biomass co-firing, biomass conversion and AD of less than 5 MW. It does not include biomass CHP, bioliquids, landfill and sewage gas or the combustion of municipal solid waste.

31. Despite the improvements that have been made in the RO to incentivise renewable energy generation. Our analysis of deployment statistics and discussions with industry suggest that developers must overcome a number of challenges, depending on the scale and type of technology and the biomass type used.

Long-term investment certainty

32. The level and surety of long term financial support for the development of the plant is still a significant risk for the financial sector. In particular, developers have found it difficult to obtain project finance for plants which, given the relatively long lead times for biomass electricity projects of 4-6 years, may not be operational before new Renewables Obligation (RO) banding levels are introduced. Although DECC is trying to minimise the policy uncertainty around the RO there current delays are causing significant concern in the market and are expected to have an impact on the development of robust financing mechanisms that can support future projects in the sector.

33. Going forward the RO is set to be replaced by a system of contracts for difference (CfD) by 2017. Although these may provide more certainty over the lifetime of the projects, until the legislation is in place, it will remain unclear how lenders will view the new mechanism. Details about the way in which CfDs will apply to biomass, and how it will work for smaller scale projects, is still under development, but key for lenders will be ensuring that there is a proven route to market for the generator. Lenders will need to be persuaded that the economics are predictable given the large investments needed for biomass plant. Investors need to know biomass will be an important future source of energy and that there will be enough feedstock, at reasonable cost. If more biomass CHP plants are to be built, there will also need to be higher demand for district or industry heating and new infrastructure for distribution.

34. In addition the biomass power sector is subject to EU legislation such as the RED targets. Changes in EU legislation, particularly those arising from sustainability concerns[10] may give rise to additional requirements for biomass power, such as the implementation of EU wide mandatory criteria for biomass, or changes resulting from expected proposals on indirect land use change (iLUC) or the biofuel policy review in 2014. Although the risks associated with changes in these requirements are partly mitigated by the UK's higher sustainability standards against EU requirements which are being introduced for biomass power in the Renewables Obligation, the lack of grandathering of these standards under the RO is expected to lead to the market taking a cautious approach in the sectors. This could mean higher costs for securing the

[10] Opinion of the EEA scientific committee on greenhouse gas accounting in relation to bioenergy, European Environment Agency 2011.

required feedstocks as well as impacts on the ability of these to access long term finance (e.g. because the banks may not be willing to take on risks associated with changes in the requirements which could mean renegotiation of key supply contracts).

Uncertain Infrastructure Provision

35. Under current projections a significant rise is expected in biomass electricity capacity (from a baseline of 2.2GW to up to 6GW) will be required by 2020 in the context of the renewables targets. This will require a significant increase across the whole industry, but particularly in two key areas: supply chains for the import, storage and transport of sustainable feedstocks from port to generator and the infrastructure and skills necessary to manufacture, build and operate the new plant.

36. On infrastructure and skills currently generating technology (boilers, turbines and project engineering) is sourced from Scandinavia, Germany and Austria because UK manufacturing is not geared up to provide these services, despite the availability of transferrable skills. This leave the UK open to the risks of bottlenecks and delays due to due to competition for resource from other EU countries. Upscaling the bioenergy industry could bring considerable opportunities for growth in the UK construction and manufacturing sectors. The potential for inward investment to develop and service this generating infrastructure is also significant.

37. In order to deliver this significant increase in generation, investment in the provision of biomass and infrastructure including ports is also required. This needs to take place within the next 5 years if we are to meet our renewable energy targets, but so far there is little sign of investment. An industry report addressing the opportunities and economics of biomass concluded that there is a potential15% - 40% of upside in terms of cost reductions and efficiency gains throughout the biomass supply chain. The report goes onto say that 'if volumes are increased and these scale and learning effects materialize, biomass could become cost competitive in the not too distant future at a carbon dioxide price range that many organisations – for instance the European Commission – believe is likely for 2020. As a result biomass should be regarded as a proven but underdeveloped renewable energy technology in need of scale up rather than as a mature industry.'[11] In effect the issue for upscaling biomass is not around the technology but in creating a value chain that can support it.

38. In order to improve our understanding of the up scaling needs of the existing infrastructure in order to meet the projected growth of the sector DECC is planning on commissioning additional analysis that will assess

---

[11] European Climate Change Foundation, Biomass for Heat and Power, Economics and Opportunities

the state of the UK port facilities with respect to handling and storage as well as of the wider infrastructure that would be needed to service new inland plants. This work is expected to be completed in early 2012.

Immature biomass supply chain

39. Although supplies of indigenous biomass are increasing, through improved forest management, production, encouragement of energy crops plantings and leveraging of agricultural and waste arisings, there will not be enough economically viable biomass in the UK to meet needs of our biomass power sector in 2020. We therefore expect to require significant volumes of imports in addition to our domestic feedstocks.

40. The current lack of both spot and futures markets for biomass, means that investors are demanding a sufficient level of comfort that the required volumes of sustainable biomass can be sourced for the plant to operate at optimal capacity, which requires setting up multiple contracts of 5 - 7 year duration with bioenergy suppliers across different geographical regions.

41. Although there are well established markets for certain biomass feedstocks in other sectors (such as wood chips for the paper and pulp industry), the bioenergy sector is still relatively new and uncertain. Also some of the feedstock expected to be used in the sector face additional uncertainties and risks than exiting fossil fuel supplies due to the dependency of the production of the feedstock and associated prices on factors such as weather, diseases and fires. This exposes the bioenergy sector to risks more similar to the ones faced by the agriculture and food sectors rather than fossil fuel energy generation. Although there are signs the EU Renewable Energy Directive, and US actions to promote renewables will support this becoming an increasingly global market, hence helping to mitigate some of these risks. It is expected that it will take time before the financing market is sufficiently confident with the nature and risks of the biomass supply contracts that generators will have to enter.

As noted above the uncertainty related to the sustainability requirements that these plants will have to meet increases uncertainty of the supply chain, leading to higher risks for generating plants and difficulties in secreting long term financing for their activities.

Planning

46. The planning process can cause uncertainty for developers and have significant cost implications. Developers remain concerned about the time taken to decide applications, a lack of transparency, and apparent inconsistency across the UK in the way decisions are reached at the local planning authority level. For their part, communities may be concerned about the possible impacts of biomass plants (particularly

energy from waste or imported material such as palm oil) on global sustainability, landscapes and local amenity. Although the Government is taking actions to reform the planning system and reduce the barriers for the sector[12] confidence in the sector is expected to remain low until the new measures have been proven in practice.

Large scale construction of dedicated biomass

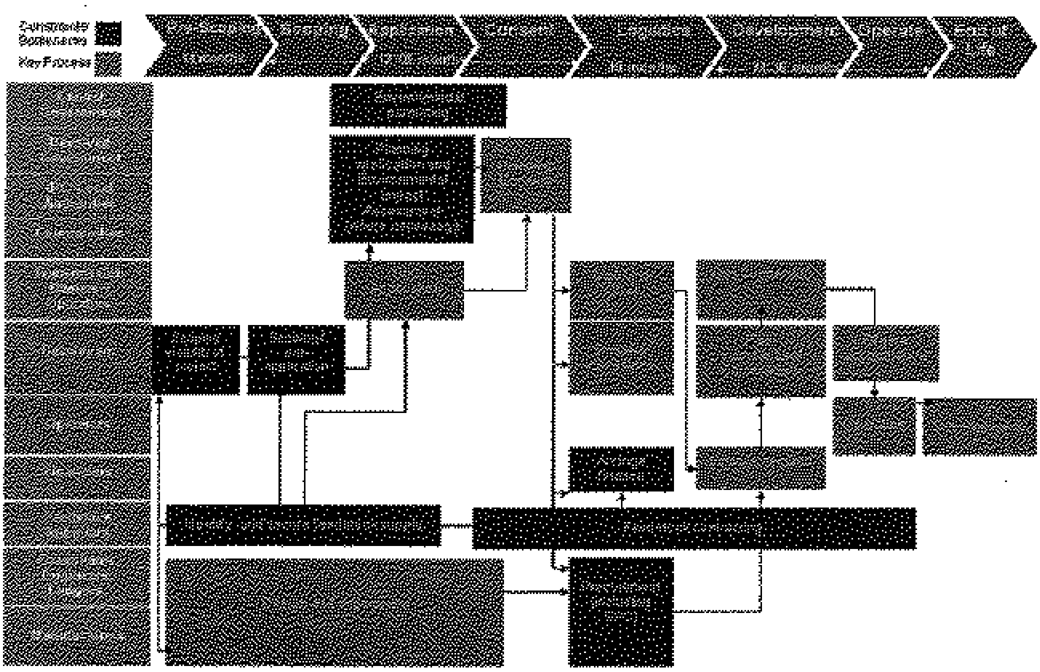
47. Long lead times and significant capital costs are a particular issue for larger scale biomass plants. The diagram below highlights in red the key risk areas for a typical biomass power project. There are some instances where the level of ROC support for a power plant cannot get pre-accreditation until the plant has planning permission, or full accreditation until 2 months prior to operation. This can creating a vicious circle where the finance cannot be secured as the ROC rate is often a key factor for the viability of plant. In addition although the RO support covers capital costs the support is spread through a 20 year period. Therefore generators still need to access significant upfront financing to complete the investment.

Figure 5: Developer journey map for new-build, dedicated biomass electricity projects[4]

---

[12] Measures include:

- Decision making framework for projects of nationally significant infrastructure in England and Wales, including renewables (over 50MW), through the ratification of the National Planning Statements
- Commitment to abolish the Infrastructure Planning Commission (IPC) and to return decision making powers from nationally significant energy infrastructure to the Secretary of State for Energy and Climate Change
- CLG proposals to allow local retention of business rates in England, including those relating to renewable energy projects. DCLG will publish details of a 'planning guarantee' with the intention that it will take no longer than 12 months to reach a final decision on planning applications including any associated appeal.



48. There are very few dedicated biomass power plants in the world that operate over 50MW, and none so far in the UK. Although the technology is not new, scaling up to the levels proposed in the UK (100-300MW) increases the risks to investors that there will be delays or additional costs involved. Investors indicate a willingness to invest once the initial construction has been carried out, seeing initial development as the key risk area.

49. CHP developers are faced by additional barriers on top of those described above due to the supply of heat. They face higher capital costs through the extra plant that is required e.g. heat recovery system, heat distribution network, etc. For CHP stations are dependent on heat customers i.e. they do not use the heat themselves onsite, there are risks around securing long-term contracts to justify the extra investment required, as it may take several years for the station to attract enough customers to do so.

50. A critical problem CHP developers can face is the difficulty attracting finance for their projects. Unlike long-term incentives such as the RO, heat sales are often considered high risk by lenders and are therefore excluded from investment decisions. This approach can mean that the economic case for CHP projects will end up looking uncertain, with the result that they are unable to be commissioned.

<u>Small scale construction of dedicated biomass (>50MW)</u>

51. Until potential biomass suppliers and power generators see a fixed long term commitment to biomass from government the sector is likely to continue to have problems in achieve economies of scale.

52. For small scale developers (of up to 50MW), raising finance can be particularly difficult given the need to have a cast iron route to market, fuel supply agreements, credit agreements, sustainability and infrastructure issues. These combined with the traditional issues facing renewable developers (planning and grid access for example) all add to the overall cost of capital for small scale biomass projects. They are subject to higher relative capital costs, have higher relative risk premiums and higher relative EPC (engineering, procurement and construction), costs. This is an issue common to all renewables projects because small scale projects are less likely to be able to fund "off-book" and have greater reliance on up-front debt and equity finance, including venture capital and may require re-capitalisation mid-project.

<u>Learning effects of the financial sector</u>

53. The combination of the above barriers means that there is a lack of completed projects which can be held up to potential investors as evidence of success is limited, and in the case of large scale, non - existent. Consequently, the financial sector has been cautious, looking to offset risk through increased requirements on EPCs, increased risk premiums and the requirement for long term feedstock contracts. Given the number of large scale electricity plants currently in planning or awaiting the outcome of the RO banding review (2.5GW MW), banks expect a rapid take up once there are one or two plants generating successfully.

54. One reason for the cautious approach by some financial institutions is a lack_of specialist knowledge within the sector in biomass electricity and forestry. This has lead to some perverse decisions and requirements placed on developers.

<u>Near commercial technologies</u>

55. In the case of biomass electricity, there is interest in whether, in the future, large –scale biomass CCS can become viable. In addition to the requirement for increased capital and operating expenditure, the risks of taking this technology from pilot, through demonstration to full commercialisation are similar to those of any new technology which is the first of its kind. Biomass CCS carried greater risk since boiler operation and efficiency, gas quality and emission control differ sufficiently compared to coal CCS, and require additional R&D.

56. With CCS, biomass electricity has the opportunity to go from being a low carbon technology to a carbon negative technology and so there is interest in how biomass CCS could play a part in decarbonising the

electricity grid from 2020 onwards. There is therefore an opportunity for the UK to become not only market leaders in coal CCS but biomass CCS. The Bioenergy strategy that is expected to be published around the turn of the year will give a better direction on the role of the technology and potential actions required now to help support its development going forward.

Scope for GIB MEIP investment in Biomass power activities

57. The wide range of barriers set out above indicate that there is a case for the GIB to support a wide range of bioenergy technologies to deliver power. However we propose it should focus support on the biomass supply chain which is integral to the whole industry as well as those technologies which we consider to be the most cost effective deployment routes to helping deliver UK renewable energy and GHG targets to 2020. These will include dedicated biomass plants and CHP, as well as the infrastructure required to support them.

58. The key areas for support of the biomass supply chain include ventures aimed at improving biomass production, transportation, processing and handling of the feedstock from UK farm or port to generator. There is also a need to support industry in their aim of developing UK infrastructure to support generation and the developing/transfer of the skills base to support the whole supply chain and improve UK capabilities. Strengthening the UK skills and manufacturing base will also have additional benefits to other sectors as currently most of the renewable industry relies on imported expertise and technology.

59. The Green Investment Bank could also play a role in bringing biomass CCS to the commercial stage, supporting pioneering projects as these develop over time.

60. We propose to maintain a close dialogue with BIS to understand the key areas where the GIB could add value in the biomass power sector. These discussions will be shaped by the ongoing work we are undertaking on the bioenergy strategy and wider infrastructure barriers that the sector could face going forward.

7. Distortion of competition and trade

[This is likely to be similar for all MEIP sectors. We are proposing to provide a one page summary of the points to cover in evidencing why and how MEIP interventions will not distort competition (or that any distortion will be de minimis), in respect of any of:

- *The financial sector and the relevant "buckets" within the financial sector;*
- *Competing projects within same sector/green sector; and*

- *Inter-State trade.*

Therefore, MEIP sectoral papers ought to cross-refer to main paper on distortion of competition.

[NB: We propose to provide this paper once we have discussed the approach to distortion of competition with Sally/Liz/Caroline].

Specific reference ought to be made to any sector specific issues, for example, specific forms of finance that might be more prevalent in that sector than others. Also, the paper should cover any sector specific aspects of exit strategies, namely any specific obstacles to detecting when MEIP intervention is no longer required and/or managing an orderly, yet swift, exit from the sector.]

Interventions by the GIB will be conducted on commercial/ MEIP basis only in this sector. Therefore, no distortion of competition or trade will arise. The more detailed arguments for this are outlined in a further paper which discusses MEIP and distortion to competition and trade and these will therefore, not be outlined here again.

With respect to specific finance products that could be provided and that might be prevalent, it is not possible to say more at this stage given that a market for financial products in this sector does not yet exist, given that it is still at a development stage.

The exit strategy for the GIB will depend on the uptake of interest in the private market to provide financial products as more CCS projects build up a track record of information. This will be (has been?) outlined in the document that outlined the operating principles of the GIB and will therefore, not be further discussed here.

[redacted] October 2011

Land Based Renewables Team, DECC

2

[redacted]

From: [redacted]
Sent: 21 June 2012 21:43
To: [redacted]
Cc: [redacted]; [redacted]; [redacted]; [redacted]); [redacted]; [redacted]
Subject: RESTRICTED: GIB Business case for biomass power
Attachments: GIB Biomass Power business case V5.doc

GIB Biomass Power business cas...

[redacted]

Please find attached what I consider to be the final version of the business case you requested. I'm sorry for the delay in completing the work. I have tried to make sure that we have a coherent story in relation to the recent developments in the biomass sector. I think the key things to note here is that the Government response to the RO banding review has not yet been finalised, but decisions taken as part of that process should be taken to be the best reflection of biomass power policy available. As well as the expected Government response we are drafting an additional follow-up consultation which relates to some of the key conclusions of the UK Biomass Strategy. This could include tightening sustainability standards, and restricting the use of dedicated biomass power. Nothing is set in stone yet, so I suggest that the document is updated in about 6 months time. This point will also hold true as the electricity market reform policy is rolled out.

As the Government response has not yet been agreed, we have not updated the numbers contained in the business case. Ben Marriott has left his post, but we may be able to update the numbers in this document as the RO Government response is finalised.

[redacted]

[redacted]
Area 4a, 3-8 Whitehall Place,
London SW1A 2HH

BIOMASS POWER: OVERVIEW AND RATIONALE FOR INTERVENTION

OVERVIEW OF SECTOR

What is it?

1. Biomass is defined as material of recent biological origin derived from plant or animal matter[1]. Examples include wood, straw, wheat grain, rape seed oil, rice husks, the biodegradable fraction of waste materials such as municipal solid waste.

2. Biomass is a very flexible power source that can take a solid, liquid or gaseous form. Used in a variety of technologies, it can be mixed with fossil fuels and used at virtually any scale and location. It can be stored and dispatched when needed. These factors differentiate it from most other renewable sources which are intermittent and location dependent such as on and off-shore wind. Some forms are suitable for generating base load and peak load electricity which can complement power generated from intermittent sources.

Technologies

3. Figure 1 below demonstrates some of the ways in which biomass can be converted into a fuel and used to generate power. Key technologies which are available at commercial scale or are near commercial are listed in Table 1 below.

Figure 1: Potential routes from biomass to power generation[2]

[1] UK Bioenergy Strategy, DECC April 2012, http://www.decc.gov.uk/en/content/cms/meeting_energy/bioenergy/strategy/strategy.aspx
[2] Source: National non-Food Crops Centre (NNFCC)

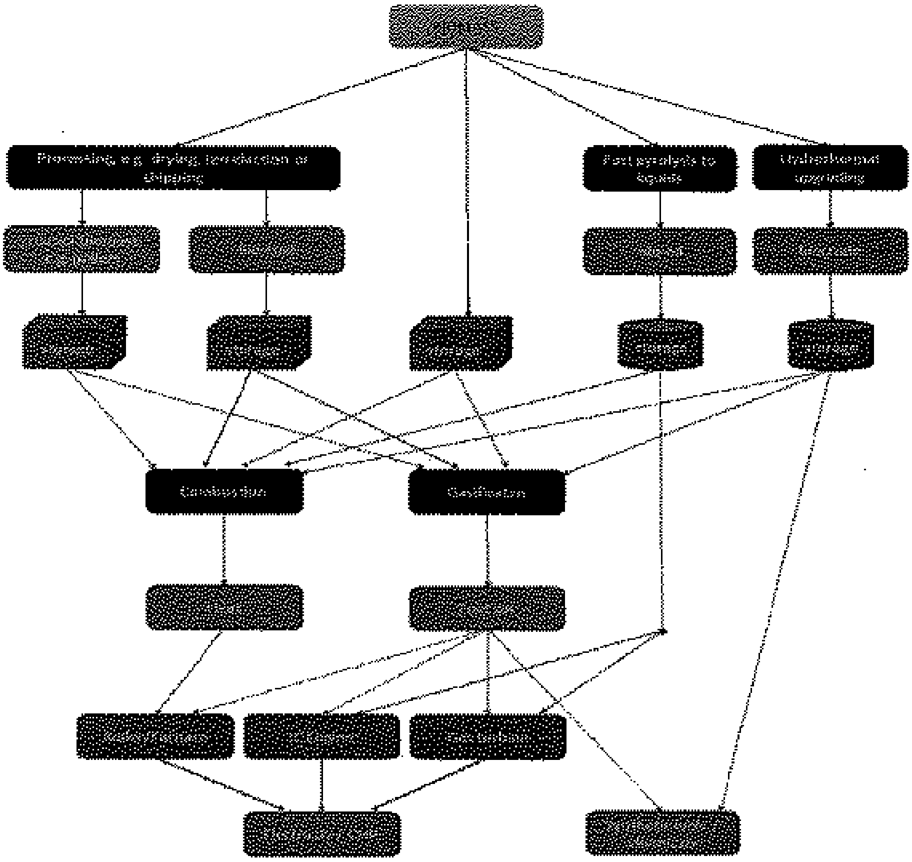


Table 1: List of key technologies for the biomass power sector

Stage of process	Technology	Purpose
Treatment and process of biomass	Harvesting Bailing	Specialist machinery needed during the production of some forms of biomass such as miscanthus and short rotation coppice.
	Chipping Pelleting Briquetting Torrefaction Drying facilities	These tend to be used to convert solid biomass such as wood and non-food energy crops into a form which is suitable for electricity generating stations.
	Crushers Filtration systems	These are normally associated with the production or treatment vegetable or used cooking of oil.
	Storage facilities Transport facilities Supporting infrastructure (e.g. biomass handling facilities at a port)	Safe transport and storage plays a key role to ensure the right quantity and quality of fuel (for example, to maintain the correct moisture content).
	Waste treatment plants* (that produce solid recovered fuel)	The biomass fraction of waste is a valuable feedstock for the bioenergy sector and can be isolated from other forms of waste into a form suitable for combustion.
Conversion into a fuel	Anaerobic Digestion* Gasification*	These technologies can be used to convert biomass into a gaseous form, which can be injected into the gas grid or burned for power.

Biomass is altered to make it more suitable to be used as a fuel	Pyrolysis (in gasification mode) and pyrolysis upgrading	
	Pyrolysis ** Hydrogenation plant** Hydrothermal upgrading** Biological processing**	These are typically associated with conversion of liquid fuels which may also be used in the transport sector and are not covered in detail in this paper.
Electricity generating stations Standard fossil fuel technologies using biomass fuel, or unique to the biomass sector	Cofiring stations	Direct combustion or steam cycle electricity generation is the biomass technology which makes the largest contribution to biomass electricity supply, suitable for baseload power and necessary to meet the Renewable Energy targets.
	Combined Cycle Gas Turbines Syngas fuelled engines Dedicated biomass stations (at all scales) Conversion of coal power station to biomass	These can be used at small or large scale. Some can provide dispatchable power directly and some provide baseload or peakload power to the electricity grid. Peakload power may increase in importance to balance the increasing proportion of intermittent renewable energy sources over time, particularly if used in combination with CCS.
	Combined Heat and power (at all scales)	These capture heat that can be put to good use, and tend to increase the overall efficiency of the engine. We see a key role for CHP plants to deliver efficient renewable heat and power in the medium to long term.

* Overlaps with support for waste technologies
** Overlaps with support for transport biofuels

4. Going forward, biomass electricity with carbon capture and storage (CCS) could play a pivotal role in reducing the emissions of large scale dedicated biomass stations[1]. *It should be an area that remains under review for support as CCS technology develops and is applied to the biomass sector. It is also expected that advanced conversion technologies such as gasification and biorefinaries will have an increasing role to play.* These will produce multiple products such as heat, power, transport fuels, chemicals and renewable materials and can achieve higher levels of efficiency than standard biomass technologies.

Feedstocks

5. There are many different sources and forms of biomass. Typical feedstocks for biomass power include:

- Conventional forestry management eg thinning, felling and coppicing of sustainabily managed forests, parklands etc;

- Non-food energy crops grown specifically for fuel uses such as miscanthus grass and short rotation coppice;
- Agricultural crops such as wheat and oil seed rape;
- Biodegradable wastes and residues such as those from wood processing, agricultural residues (straw, husks), sewage sludge, animal manure, waste wood from construction and food waste;
- Algae: both microalgae and macroalgae are a potential source of biomass and biofuels but their production is not yet viable on a commercial scale.

6. If used inappropriately, generating electricity from biomass can have negative outcomes for our goals on environmental protection and for greenhouse gas emissions reduction. To mitigate this risk, sustainability criteria are in place in the Renewables Obligation (RO) which we intend to formally link to the issuing of ROCs by 2014, and we intend to include in the Renewable Heat Incentive. This includes protection of land which has a high biodiversity or carbon stock, and it also requires that the life cycle emissions savings are at least 60% compared to the EU grid average.

CURRENT STATE OF THE BIOMASS POWER SECTOR

Energy generated[3]

7. Figures 2 and 3 below show the distribution of biomass power by installed capacity and generation in 2011. The discrepancy between the capacity and electricity generation is largely due to a co-firing station converting to a dedicated biomass station towards the end of the reporting year. In total, there was 3.4GW of biomass electricity capacity, contributing 13.3TWh of electricity; the single largest contribution to the renewable energy targets. An additional 5.4GW is estimated to exist in the pipeline.

Figure 2: Installed capacity of biomass technologies in 2011

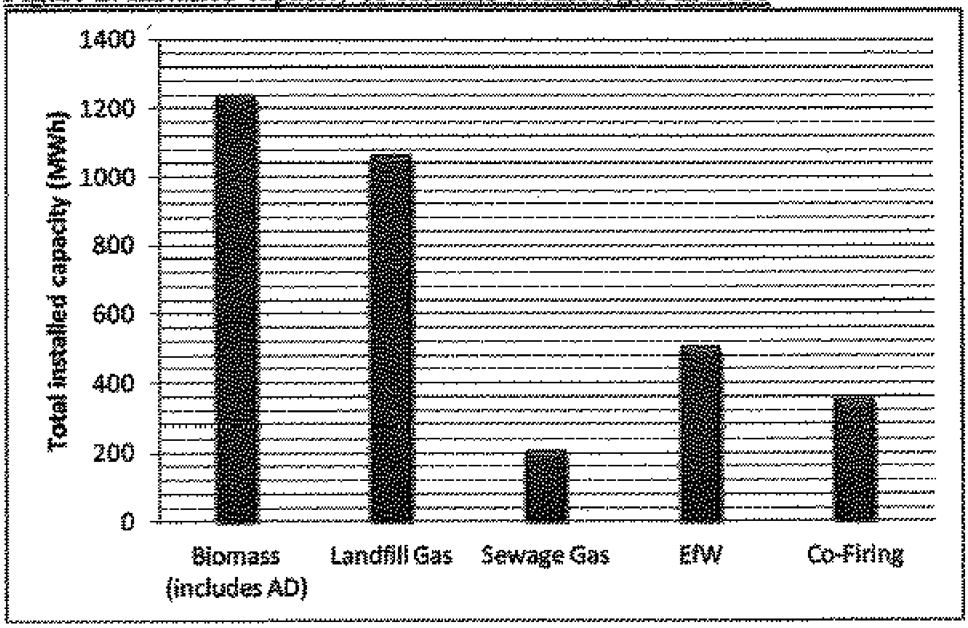
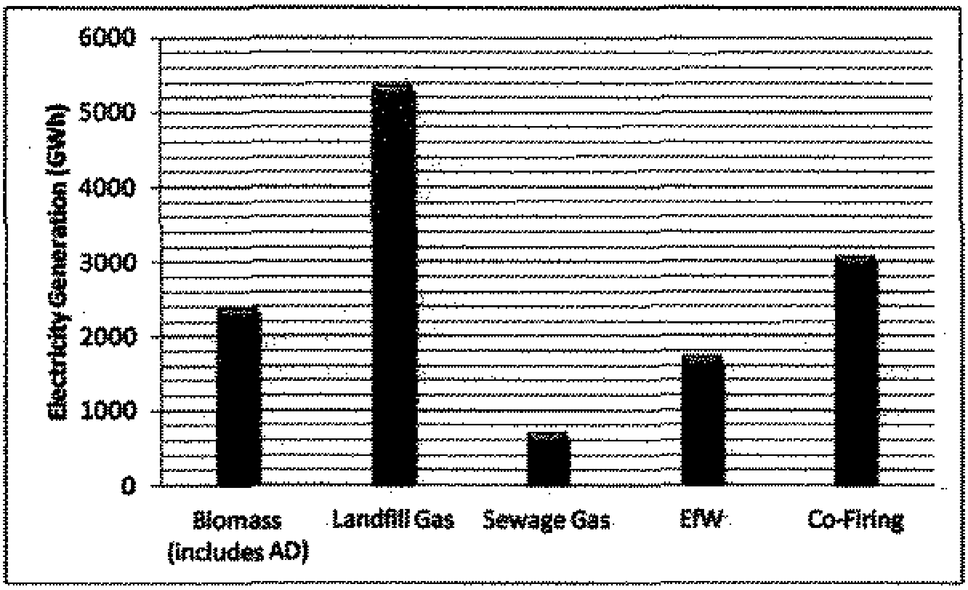


Figure 3: Electricity generation from biomass technologies in 2011

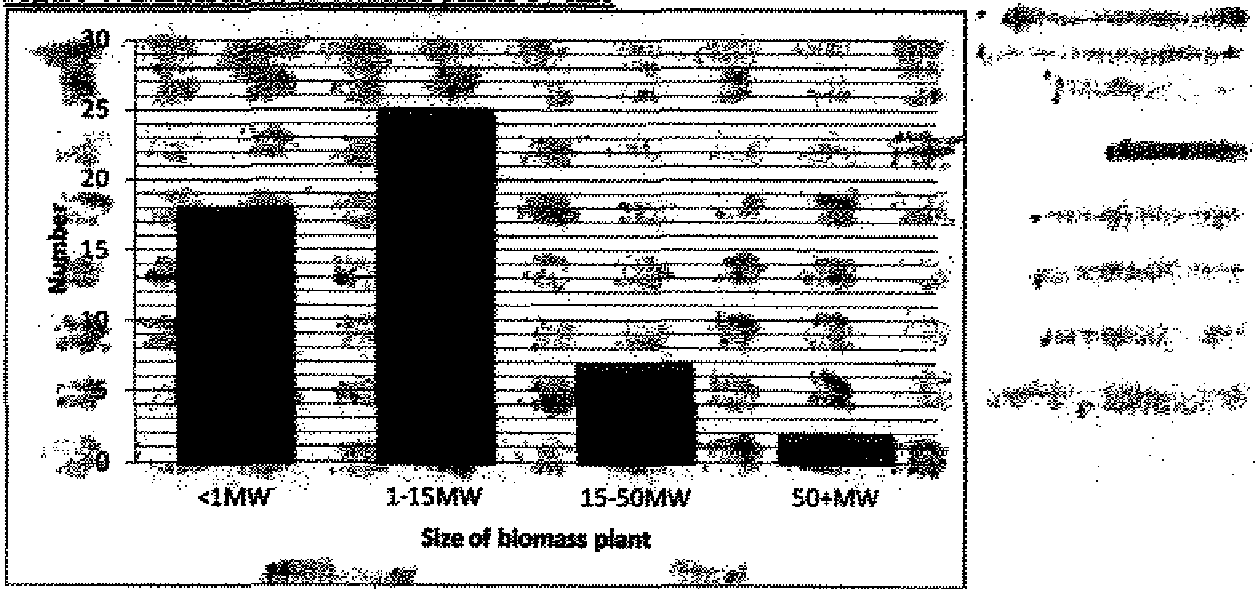
[3] Renewable Energy Planning Database, DECC April 2012



8. The majority of generation (58%) comes from waste (predominantly from landfill gas), although the cost effective portion has now largely been exploited and its use is set to decline to 2020. Co-firing accounts for 23% of electricity generation, and small to medium scale dedicated biomass plants (up to 50MW) are also significant (17%). The biomass industry are moving towards larger scale plants, and conversion of coal power stations to dedicated biomass plants, which will be needed to sustain the increase of biomass to power.

9. Figure 4 shows the distribution of power plants by size. There are currently 52 biomass plants accredited for electricity generation, 43 of which are under 15MW. There are 2 plants over 50MW.

Figure 4: Distribution of biomass plants by size



POLICY AMBITION

10. The Renewables Obligation (RO) is the key driver for biomass electricity generation. DECC are preparing the Government Response to the Renewables Obligation Banding Review,

which sets the levels of support for all eligible renewable electricity technologies, to apply from April 2013. The decisions taken will balance the need to deliver the Renewable Energy Directive[4] (RED) targets in a cost effective way; and the need to deliver bioenergy in a sustainable way which is consistent with the wider use of biomass. Key pieces of analysis that underpin these decisions are reflected in the Renewable Energy Roadmap[5] and the UK Bioenergy Strategy.

11. A follow up consultation to amend the RO is being prepared which includes additional proposals for biomass power, designed to reflect the principles set out in the Bioenergy Strategy. Proposals under consideration are to tighten sustainability standards over time, continue to support co-firing as an interim, cost effective replacement to coal fired power stations, and limit the development of large scale dedicated biomass. *Applications to the Green Investment Bank should be updated periodically to take into account the policies reflected in the Renewables Obligation to 2014, and in the Contracts for Difference (CfDs) policies thereafter.*

Growth needed

12. Support provided under the RO, and later CfDs, will heavily influence growth in the sector. Renewable Obligation Banding Review Consultation[6] analysis estimates that the proposed ROC regime could support [redacted] of capacity to generate biomass electricity by 2020 (central scenario). These figures are subject to change following the final decisions on support levels in the RO.

Table 2: Estimated deployment of key biomass technologies under proposed bands

[redacted]										
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]										

13. The costs of delivering the [redacted], is approximately [redacted] per year to the tax payer through the RO by 2020. The overall investment required is likely to be approximately

[4] 2009/28/EC on the promotion of the use of energy from renewable resources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
[5] UK Renewable Energy Roadmap, DECC 2011, http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/renewable-energy/2167-uk-renewable-energy-roadmap.pdf
[6] Not published

[redacted]. The table below provides a breakdown of the investment requirements of the sector. It indicates that there will be a peak leading up to [redacted] on the investment required.

Table 3: Investment requirements to achieve a capacity of [redacted]

[redacted]										
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]										

POLICY LANDSCAPE

The Bioenergy Strategy

14. The Government has recently published a UK Bioenergy Strategy. It sets out a framework for the use of sustainably produced biomass feedstocks to the UK in 2020 and up to 2050, across the heat, electricity and transport sectors. It considers the likely carbon impacts of bioenergy compared to possible alternative uses for biomass. It also responds to the Committee on Climate Change (CCC) Bioenergy Review[7].

15. The principles for future bioenergy policy development are:

- Policies that support bioenergy should deliver genuine carbon reductions that help meet UK carbon emissions objectives to 2050 and beyond
- Support for bioenergy should make a cost effective contribution to UK carbon emission objectives
- Support for bioenergy should aim to maximise the overall benefits and minimise costs across the economy
- Policies should be regularly monitored and assessed to respond to the impacts increased deployment may have on other areas such as food security and biodiversity.

16. The bioenergy strategy concludes that biomass electricity has an important role to deliver our renewable and GHG emission reductions obligations. Some key conclusions are:

---

[7] Bioenergy Review, CCC December 2011, http://www.theccc.org.uk/reports/bioenergy-review

- *Co-firing is identified as a cost effective way to reduce carbon emissions from current coal power generation.*
- *Large-scale dedicated biomass power stations should have a more limited role.*
- *Combined heat and power generation offers an efficient use of the biomass resources and should be promoted where possible.*
- *Wastes used for energy should provide a valuable contribution, but should be used consistent with the waste hierarchy.*
- *Biomass CCS could play a key future role in the reductions of greenhouse gas emissions to 2050.*
- *Advanced conversion technologies such as gasification are seen a key technology to hedge against the uncertainties of future bioenergy deployment, such as the development of CCS.*

__Contribution to the Renewable Energy Targets__

17. The introduction of a mandatory renewable energy target under the RED has increased the ambition of biomass in the UK, as reflected in Coalition documents such as the Renewable Energy Roadmap and the National Renewable Energy Action Plan[8]. Under the RED, the UK has an obligation to deliver 15% renewable energy from the heat, power and transport sectors, and biomass power is considered to be essential to achieving this. This obligation equates to 238TWh in 2020 of which 117TWh is expected to be delivered through renewable electricity. Analysis set out in the Renewable Energy Roadmap, indicates that under the central range, the biomass elecctricity has the potential to deliver 32-50TWh by 2020.

18. An update of the Renewable Energy Roadmap is expected to be published before the end of 2012.

__Renewable Financial Incentives__

19. Biomass is supported in a number of obligation and incentive schemes[9], the Renewables Obligation, is the key scheme expected to pull through renewable electricity technologies, which will be replaced by Contracts for Difference (CfDs) in 2017, with a transition period between 2014 and 2017.

__Renewables Obligation__

20. Biomass for power has been supported under the Renewables Obligation (RO) since 1990; the primary instrument for incentivising renewable electricity in the UK. Obligated suppliers are largely the major energy companies which in 2011/12 are required to generate 15.8% ROCs as a proportion of total electricity supplied. ROCs are tradable certificates awarded for every megawatt of renewable electricity produced.

21. The introduction of bands in 2009 allows for additional support to be given to more expensive renewables technologies. For example, dedicated biomass currently receives 1.5 Renewable Obligation Certificates (ROCs), with an additional 0.5 ROC if energy crops or CHP are used. Banding reviews occur every four years and ensure that as market conditions and

---

[8] National Renewable Energy Action Plan for the United Kingdom – Article 4 of the Renewable Energy Directive 2009/28/EC, DECC 2010

[9] Renewable Transport Fuel Obligation, Renewable Heat Incentive, Feed in Tariff

innovation within sectors change and evolve, developers continue to receive the appropriate level of support necessary to maintaining investment in the renewables industry.

22. Since 2010 biomass electricity generation has been grandfathered. Generating stations can apply for preliminary accreditation when they have received planning permission. Once the plant is in operation and eligible to receive ROCs, the level of support is guaranteed for 20 years thereafter.

23. The government has recently consulted on the latest proposed bands to be introduced in 2013, and the Government Response is expected shortly. An additional consultation is expected to develop policy proposals on biomass sustainability and support.

Contracts for Difference

24. The white paper on electricity market reform published in this year is designed to improve the market's ability to finance the huge investment in low carbon electricity that is needed over the next decade and beyond. Included are proposals to introduce Feed-in Tariffs with Contracts for Difference (CfDs), which will provide support for low-carbon technologies including renewable energy and nuclear. It is anticipated that long term contracts will be given to subsidise the additional cost of the low carbon electricity compared to the average electricity price. An administrative five year price setting will be put in place on the opening of the scheme. Prices will be reflective of the technology costs of delivering low carbon electricity, and it is anticipated that contracts will be auctioned as the scheme matures.

Renewable Financial Incentives for other renewable sectors

25. Biomass is also incentivised in other sectors such as transport through the Renewable Transport Fuel Obligation, and heat through the Renewable Heat Incentive (RHI). It will continue to be in demand from other sectors such as renewable chemicals and the paper industry.

Carbon Reduction Obligations

26. Looking to the medium and longer term, the Government is committed to achieving the transition to a green economy and delivering long-term sustainable growth. This policy aim is supported by a set of environmental objectives and targets – including the reduction of greenhouse gas emissions to 20% of 1990 levels by 2050. We are on track to deliver these emissions reductions through a variety of initiatives, such as the carbon budgets, EU emissions trading scheme and efficiency targets. DECCs analysis which sets out possible routes for achieving this target across all sectors, suggests that it is nearly impossible to meet without the deployment of biomass technologies[10]. However, the extent to which biomass will be used in power as opposed to heat or transport, is dependent on a number of factors such as the availability of key technologies, and the availability of sustainable biomass. The UK Bioenergy Strategy notes that provided the right mechanisms are in place to ensure sustainability, by 2050 12% of the UK's total primary energy demand (across heat, transport and electricity) could come from bioenergy without significant impacts on food production or the environment, although this figure is highly uncertain.

[10] 2050 Pathway Analysis, DECC 2010

RATIONALE: MARKET FAILURES IN FINANCING SECTOR

27. There is a case for the Green Investment Bank (GIB) to support biomass to power technologies, and key installations along the supply chain to address market failures associated with the industry. Figure 5 below shows the typical stages of development of a large biomass electricity project, with the key blocking points highlighted in red. These link to the financial market failures summarised in Table 4 below, which could be mitigated with support by the GIB.

Figure 5: Developer journey map for new-build, dedicated biomass electricity projects[4]

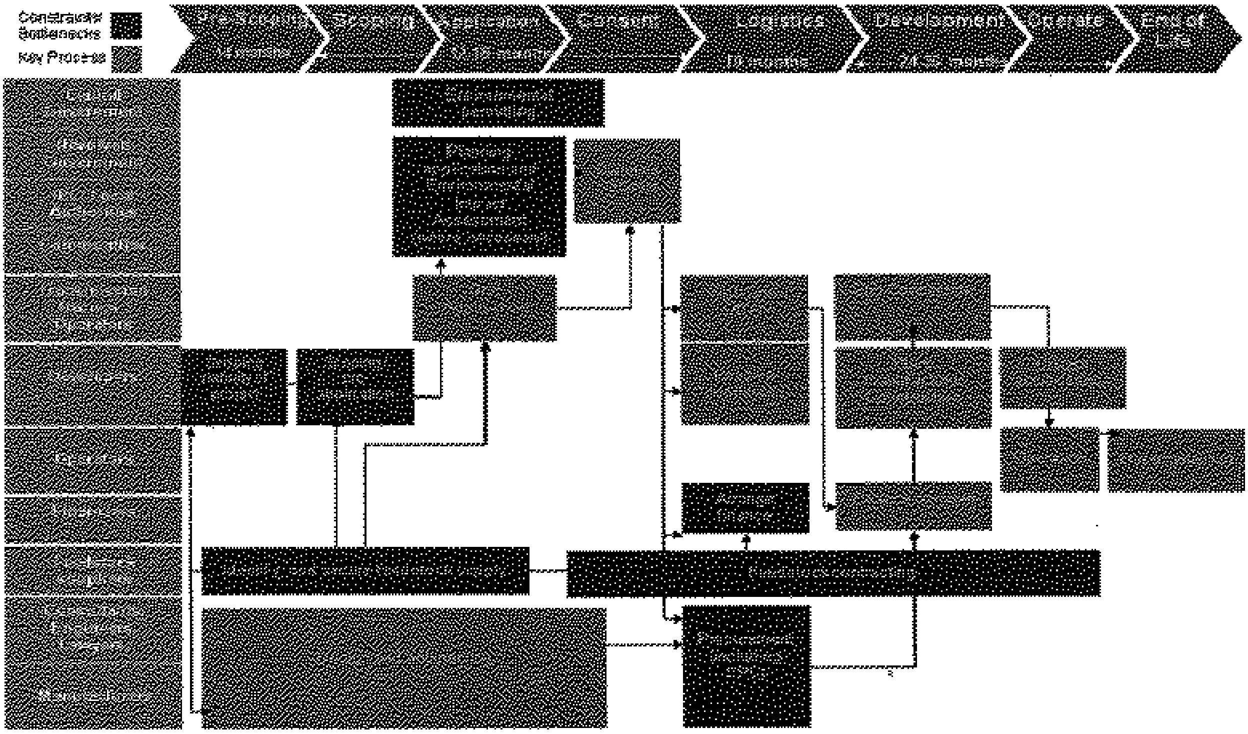


Table 4: Financial market failures of the biomass power sector

Type of financial market failure	Description of barrier	How GIB can mitigate
First Mover Disadvantage	Few examples of large scale (100MW and above) biomass power projects	Support early large scale projects.
	All links in the biomass supply chain (production, storage, transport and processing) need to be in place in advance of the electricity generating station.	Support projects which include elements to upgrade infrastructure, transport, processing and storage of biomass.
	Insufficient demonstration projects for innovative technologies such as gasification and pyrolysis plants.	Support demonstration and early commercial projects, recognising that they may have a lower rate of return.

Risk Aversion	Lack of specialist knowledge by financiers of the biomass industry or the agriculture industry has led to some potentially viable projects not being financed.	GIB to have a good understanding of the biomass industry, the regulatory environment and to recognise when typical risks are mitigated effectively by projects.
	Financiers insist on engineering, procurement and construction contracts and long term biomass supply contracts.	GIB to consider other proposals by projects to ensure risks are manageable.
High (perceived or real) transaction costs	Additional inherent uncertainties compared with the oil industry, associated with producing crops and immature global biomass market.	GIB to have a good understanding of lending arrangements for agricultural and forestry projects, and of the global biomass market. GIB investments should help to increase investor confidence in the sector
Imperfect or incomplete information	Since the financial viability of projects depend on Government incentives, uncertainty about policy creates uncertainty about returns. This policy uncertainty arises from the: - RO banding review - Transition of CfDs - Planning procedures where ROCs are not determined until planning permission has been granted.	GIB to have a clear understanding of Government policy objectives for biomass to power in the near and longer term and to be aware of what this might mean in terms of project flows which are timed to fit within periods of policy certainty.
Public goods in infrastructure	Ports, road and rail links may need to be improved to cater for an increased supply of (mostly) imported biomass, but we have seen little sign of investment. This infrastructure is likely to be useable for other goods/ activities.	GIB to support infrastructure projects designed to cater for higher quantities of biomass in the power sector.

First mover disadvantage

28. There are very few dedicated biomass power plants in the world that operate over 50MW, and none so far in the UK. Although the technology is not new, scaling up to the levels proposed in the UK (100-300MW) increases the risks to investors that there will be delays or additional costs involved. Investors indicate a willingness to invest once the initial construction has been carried out, seeing initial development as the key risk area. *Because the UK Bioenergy strategy has set out a more limited role for large scale dedicated biomass, GIB applications will need to consider the need for additional large scale biomass plants.*

29. The GIB could play an important role to ready the supply chain for higher volumes of biomass to the power sector; covered in more detail in the next section. Financing will be needed to support key requirements which will be dependent on the supply chain needed in individual cases. Most large-scale projects will be reliant on imported biomass which will need

to be transported (through ports, by rail or by road) and stored in very large quantities. Biomass will normally need to be within a particular fuel specification including parameters such as size, moisture content and calorific value. This can require specialist processing equipment to crush, pellet, briquette or convert to a powder through torrefaction. Some dedicated biomass production needs specialist harvesting or bailing equipment. The key market failure is the catch-22 whereby the biomass supply chain will not be invested in until there is a high level of certainty that demand will increase. On the other hand financiers are reluctant to supply large scale projects if there are risks to delivering the required supply of biomass.

30. Access to finance due to concerns about technology viability is a problem for investment in technologies which have been newly applied to biomass, such as gasification, pyrolysis, biorefinary and CCS projects. This is part due to lack of reference plants for investors to base key decisions upon. These projects can gain a lower rate of return and are higher risk than conventional biomass to power technologies, and are therefore more difficult to fund. GIB offers potential for development of demonstration plants and building confidence in the market.

Risk Aversion/ High (real or perceived) transaction costs

Learning effects of the financial sector

31. The combination of financial market failures and other barriers means that there is a lack of completed projects which can be held up to potential investors as evidence of success. Consequently, the financial sector has been cautious. The riskiest stage (in terms of additional costs/ delays to the project) is perceived to be the construction phase, so lenders are unwilling to invest or are looking to offset risk through increased requirements on EPCs (engineering, procurement and construction costs), increased risk premiums and the requirement for long term feedstock contracts. Given the number of large scale electricity plants currently in planning or awaiting the outcome of the RO banding review (approximately 2.5GW), banks expect a significant take up once there are one or two plants generating successfully.

32. One reason for the cautious approach by some financial institutions is a lack of specialist knowledge within the (financial) sector in biomass electricity and forestry. This has lead to some perverse decisions and excessive requirements placed on developers.

Small scale projects

33. These are subject to higher relative capital costs, have higher relative risk premiums and higher relative EPC (engineering, procurement and construction) costs. This is an issue common to all smaller scale renewables projects because small scale projects are less likely to be able to fund "off-book" and have greater reliance on up-front debt and equity finance, including venture capital and may require re-capitalisation mid-project. In order to win this type of funding they need a cast iron route to market, including fuel supply arrangements. The approach taken by some financiers may overestimate the risks.

Combined Heat and Power projects

34. CHP developers are faced with additional barriers on top of those described above due to the supply of heat. They face higher capital costs through the extra plant that is required e.g. heat recovery system, heat distribution network, etc. CHP stations are dependent on heat customers. If they do not use the heat themselves onsite, there are risks around securing long-term contracts

to justify the extra investment required, as it may take several years for the station to attract enough customers to do so.

35. Unlike long-term incentives such as the RO, heat sales are often considered high risk by lenders and are therefore excluded from investment decisions. This approach can mean that the economic case for CHP projects will end up looking uncertain, with the result that they are unable to be commissioned. Although the risk of losing heat customers is real, it may be that risks are overestimated.

Supply of biomass

36. Although supplies of indigenous biomass are increasing, there will not be enough economically viable UK sourced biomass in the UK to meet needs of our biomass power sector in 2020. We therefore expect to require significant volumes of imports in addition to our domestic feedstocks. Sectors such as the paper and wood panel industry compete for the same sustainable biomass sources which have a constrained supply.

37. The current lack of both spot and futures markets for biomass, means that investors are demanding a sufficient level of comfort that the required volumes of sustainable biomass can be sourced for the plant to operate at optimal capacity. This requires setting up multiple contracts of 5 - 7 year duration with bioenergy suppliers across different geographical regions, which can be very challenging for biomass produced for energy and for securing contracts for 'waste' biomass.

38. Some feedstock expected to be used in the sector face additional uncertainties and risks than lenders in energy markets expect from existing fossil fuel supplies. These are linked to the dependency of the production of the feedstock and associated prices on factors such as weather, diseases and fires. This exposes the bioenergy sector to risks more similar to the ones faced by the agriculture and food sectors rather than fossil fuel energy generation. It is expected that it will take time before the financing market is sufficiently confident with the nature and risks of the biomass supply contracts that generators will have to enter.

39. There will also be a risk aversion arising from seasonality linked to demonstrated and reliable technology as different biomass types are available more freely at different times of the year.

Imperfect or incomplete information

Policy uncertainty

40. There are safeguards in place to reduce the policy uncertainty experienced by the biomass power industry. The RO order prevents support levels being changed without a review. Support for biomass power projects is now grandfathered for a 20 year period, and a three year overlap between the RO and CfDs has been agreed to ensure a smooth transition between the two schemes. CfDs are long term contracts which should assist with financing in the longer term. However uncertainties remain which are listed below.

Renewables Obligation

41. Levels of support are subject to a review every four years to ensure that technologies receive an appropriate level of support. Developers of large scale projects have found it difficult to obtain project finance for plants which, given the relatively long lead times for biomass electricity projects of 4-6 years, may not be operational before new Renewables Obligation (RO) banding levels are introduced.

42. Long lead times and significant capital costs are a particular issue for larger scale biomass plants. There are some instances where the level of ROC support for a power plant cannot get pre-accreditation until the plant has planning permission, or full accreditation until two months prior to operation. This can create a vicious circle where the finance cannot be secured, as the ROC rate is often a key factor for the viability of plant. In addition, although the RO support covers capital costs the support is spread through a 20 year period. Therefore generators still need to access significant upfront financing to complete the investment.

Renewable Heat Incentive

43. The heat element of CHP is eligible for support under the RHI, and it is anticipated that this will be the key incentive in 2015, when support the 0.5ROC CHP uplift is proposed to end. Consideration is being given to whether a higher support level is justified from heat supplied by CHP projects as opposed to heat only projects. Proposals to amend the RHI may be put forward in a consultation this year.

Contracts for Difference

44. Going forward the RO is set to be replaced by a system of CfDs when the RO closes in April 2017. Although the transition phase from 2014 is intended to reduce uncertainty, there could be an impact on investment decisions for projects due to come on stream around 2017. Although CfDs may provide more certainty over the lifetime of the projects, it will remain unclear how lenders will view the new mechanism whilst the details are still under development.

Biomass sustainability

45. The Government considers that biomass must be sustainable if it is to be used for energy production. A consultation is planned this year with the intention of incentivising only sustainable biomass in the RO. Although developers of biomass power have cited this as un uncertainty, the overall effect of introducing mandatory sustainability standards may improve market confidence. The EU is a key driver of sustainability standards for biomass and are considering introducing biomass sustainability criteria similar to those set out in the Renewable Energy Directive for biofuels. The European Commission are also considering additional sustainability issues such as air, soil and water, and indirect land use change.

46. In the medium term the role for biomass electricity is uncertain and dependent on technologies to offset the carbon emissions associated with biomass power, such as the introduction of CCS. The bioenergy strategy is intended to clarify the principles by which we are likely to support biomass in the future to a longer term policy view for investors.

Planning

47. The planning process can cause uncertainty for developers and have significant cost implications. Developers remain concerned about the time taken to decide applications, a lack of transparency, and apparent inconsistency across the UK in the way decisions are reached at the local planning authority level. For their part, communities may be concerned about the possible impacts of biomass plants (particularly energy from waste or imported material such as palm oil) on global sustainability, landscapes, health and traffic generation and local amenity. Although the Government is taking actions to reform the planning system and reduce the barriers for the sector[11] confidence in the sector is expected to remain low until the new measures have been proven in practice.

Public Goods in infrastructure

48. Lack of port infrastructure seen to be an issue that will hinder rapid development of the bioenergy sector and should be considered for specific strategic investment. Investment is also needed for road and rail links, potentially with specialist biomass handling equipment. The market failure in financing these developments are similar to other supply chain failures. The generators are being hindered by the lack of suitable infrastructure and are unable to plan effectively for long term contracts with high volumes of biomass. The uncertainty in demand leads to an unwillingness to investment in the infrastructure until the supply of biomass is high.

DECC LBRT
June 2012

[11] Measures include:

- Decision making framework for energy projects of nationally significant infrastructure in England and Wales, including renewables (over 50MW), through designation of the energy National Planning Statements on 19 July 2011.
- Abolition of the Infrastructure Planning Commission (IPC) on 1 April 2012 and return of determination for development consent of nationally significant energy infrastructure to the Secretary of State for Energy and Climate Change.
- Local retention of business rates from new renewable energy projects in England, from April 2013 (subject to progress of Local Government Finance Bill). DCLG proposal for a 'planning guarantee' with the intention that it will take no longer than 12 months to reach a final decision on planning applications including any associated appeal. The final National Planning Policy Framework published on 27 March sets out among other policies, the Government's planning policy for England for renewable and low carbon energy development up to 50MW. The new policy is based on a presumption in favour of sustainable development, which includes appropriately sited renewable and low carbon energy developments.
- For EFW plants the waste Planning Policy Statement 10 and the existing National waste Strategy are due to be updated by DCLG and Defra by summer 2013 (with consultation later this year). The update of PPS10 will likely continue the general thrust of existing policy – such as delivering sustainable waste management solutions and communities taking more responsibility for their own waste - but also take into account new European and national legislation.

[redacted]

From: [redacted]
Sent: 28 June 2012 12:13
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

I have got two tables; broken down by technology, that show the expected deployment of biomass and the support the RO will provide, and the overall level of investment required (see text drafted below). I am trying to get an economist to confirm that the numbers I have put in are suitable to put in your form, and intend to send the form to you by the end of the day. These reflect the proposals set out in the banding review. Once the decisions have been taken on the RO, these figures may change.

[redacted]

Support provided under the RO, and later CfDs, will heavily influence growth in the sector. Renewable Obligation Banding Review Consultation analysis estimates that the proposed ROC regime could support [redacted] of capacity to generate biomass electricity by 2020 (central scenario). These figures are subject to change following the final decisions on support levels in the RO.

Table 2: Estimated deployment of key biomass technologies under proposed bands

[redacted]										
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]										

The costs of delivering the [redacted] is approximately [redacted] per year to the tax payer through the RO by 2020. The overall investment required is likely to be approximately [redacted]. The table below provides a breakdown of the investment requirements of the sector. It indicates that there will be a peak leading up to [redacted] on the investment required.

Table 3: Investment requirements to achieve a capacity of [redacted]

[redacted]										
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

From: [redacted]
Sent: 28 June 2012 11:53
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

Many thanks. Can we assume DECC will be able to provide information on the funding gap point - since you will presumably have had to provide figures on this in the context of the RO banding review notification?

[redacted]

From: [redacted]
Sent: [redacted]
To: [redacted]
Subject: EU template

[redacted]

Just to let you know we intend to send a draft template to you on Thursday. I hope that gives you enough time to consider it.

[redacted]

[redacted]
Area 4a, 3-8 Whitehall Place,
London SW1A 2HH

[redacted]

From: [redacted]
Sent: 28 June 2012 17:04
To: [redacted]
Cc: [redacted]
Subject: RE: EU template
Attachments: EU QUESTIONS - BIOMASS POWER.doc

EU QUESTIONS - IOMASS POWER.d..

[redacted]

Please find attached some suggested text for the EU Questionnaire on biomass power, that you may want to use for the state aids case. We have not been in a position to do the bespoke analysis asked in the question, but have set out figures which relate to the RO proposals bands. Note that these may change once the Government response to the RO banding review has been published.

I believe there is a wider discussion going on about the link between the state aids case for the GIB and the RO, which you will need to take into account.

[redacted]

From: [redacted]
Sent: 28 June 2012 11:53
To: [redacted]
Cc: [redacted] Duguid Bruce (ShEx)
Subject: RE: EU template

[redacted]

Many thanks. Can we assume DECC will be able to provide information on the funding gap point - since you will presumably have had to provide figures on this in the context of the RO banding review notification?

[redacted]

From: [redacted]
Sent: 26 June 2012 23:59
To: [redacted]
Subject: EU template

[redacted]

Just to let you know we intend to send a draft template to you on Thursday. I hope that gives you enough time to consider it.

[redacted]

GREEN INVESTMENT BANK

Proposed Templates for responding to Commission Level 1 questions

BIOMASS POWER

1. Detailed definition of the sector:[1]

(i) set out the scope of the technology the GIB intends to invest in (with reference to the specific different types of technology):

The scope covers technologies at all scales that generate electricity from biomass capable of meeting the sustainability criteria set out in the Renewables Obligation. This includes standard and early commercial stage installations. Technologies and installations along the supply chain that are considered necessary to support biomass power at a large scale are also in scope. The table below summarises these technologies. Carbon capture and biorefinaries are considered to be important future technologies to support, but are at an early stage of development so are not currently within the scope.

Stage of process	Technology	Purpose
Electricity generating stations Standard fossil fuel technologies using biomass fuel, or unique to the biomass sector	Cofiring stations	Direct combustion or steam cycle electricity generation is the biomass technology which makes a major contribution to biomass electricity supply, suitable for baseload power and necessary to meet the Renewable Energy targets.
	Combined Cycle Gas Turbines Syngas fuelled engines Conversion of coal power station to biomass Dedicated biomass stations (at all scales)	These can be used at small or large scale. Some can provide dispatchable power directly and some provide baseload or peakload power to the electricity grid. Peakload power may increase in importance to balance the increasing proportion of intermittent renewable energy sources over time, particularly if used in combination with CCS.
	Renewable combined Heat and power** (at all scales)	These capture heat that can be put to good use, and tend to increase the overall efficiency of the engine. We see a key role for CHP plants to deliver efficient renewable heat and power in the medium to long term.

[1] This needs to describe to the Commission exactly what is in and what is out of the sector scope, with reference to the various types of technology/projects.

Conversion into a fuel	Gasification* Pyrolysis* and pyrolysis upgrading*	These technologies can be used to convert biomass into a gaseous, solid or liquid form, which can be injected into the gas grid or burned for power.

As biomass can be used in a broad range of applications in the energy and non-energy markets, certain technologies overlap with other sectors, such as transport biofuels, and energy from waste* and heat**.

[redacted]

and confirm the inclusion of any of:

(a) infrastructure

As the use of biomass increases, our capability of handling, transport and storing biomass needs to improve in order to deliver the levels of biomass electricity expected. This includes facilities to import biomass, and to transport UK grown biomass to a wider range of locations, as the energy mix becomes increasingly distributed and diverse. Requirements for handling and storage predominantly for the use of biomass is therefore in scope.

Stage of process	Technology	Purpose
Safe movement of biomass to site of electricity generation	Storage facilities Transport facilities Supporting infrastructure (e.g. biomass handling facilities at a port)	Safe transport and storage plays a key role to ensure the right quantity and quality of fuel (for example, to maintain the correct moisture content).

(b) ancillary/complementary technology (for example, radar for offshore wind projects)

An increase in energy crops is envisaged to support the upscale of biomass feedstocks. These can require specialist equipment for the production or harvesting of the biomass. Woody biomass is converted into a form which is suitable for the electricity generation.

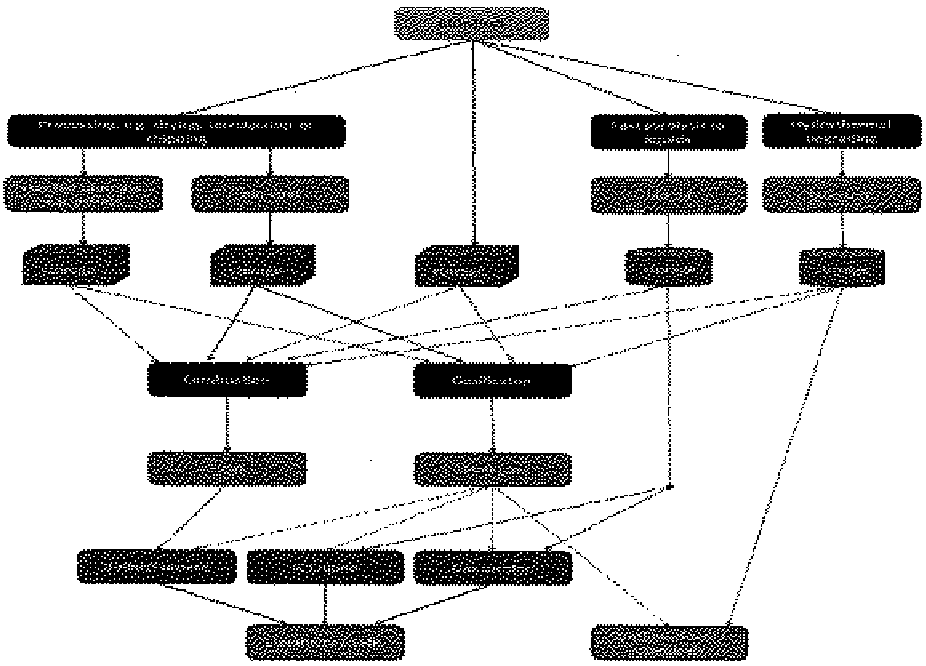
Stage of process	Technology	Purpose
Treatment and process of biomass	Harvesting Bailing	Specialist machinery needed during the production of some forms of biomass such as *miscanthus* and short rotation coppice.

	Chipping Pelleting Briquetting Torrefaction Drying facilities	These tend to be used to convert solid biomass such as wood and non-food energy crops into a form which is suitable for electricity generating stations.
	Crushers* Filtration systems*	These are normally associated with the production or treatment vegetable or used cooking of oil.
	Waste treatment plants* (that produce solid recovered fuel)	The biomass fraction of waste is a valuable feedstock for the bioenergy sector and can be isolated from other forms of waste into a form suitable for combustion.

(ii) details of the industrial structure of each sector and each specific subsector, including:

(a) supply chain overview; details of the components to the projects within the GIB scope

The figure below demonstrates some of the ways in which biomass can be converted into a fuel and used to generate power.



(b) details of the suppliers are active in the various aspects of the sector and technology (referenced back to (i) above)

Technology	Those active in the sector
Cofiring stations	Ownership of the UK coal fleet is between the vertically integrated energy utilities (VIUs) and large independent generators e.g. Drax Power Ltd and Eggborough Power Ltd Some are seeking to increase the proportion of biomass co-fired.
Conversion of coal power station to biomass	As above. Several of the major coal power station owners are considering converting their coal fired power stations fully to biomass. Tilbury (RWE NPower) was the first biomass conversion of its kind in the UK, which became operational at the end of 2011.
Renewable combined heat and power (at all scales)	The majority of biomass fuelled CHP units (operational and in development) are in the ownership of independent generators. SSE owns one medium scale plant and RWE and E.on are building new plant.
Dedicated biomass stations (at all scales)	Again, the majority of dedicated biomass plant in operational and in development are in independent ownership. A number of VIUs are developing new build projects. E.on own and operate the UK's largest dedicated biomass plant.
Advanced Conversion Technologies (Gasification and Pyrolysis)/ Combined Cycle Gas Turbines Syngas fuelled engines	A range of companies with expertise in making chemicals, or those with a high volume of available biomass feedstock seek to bring advanced conversion technologies to commercial realisation. Some see the generation of electricity as a first step to more valuable (but more technically challenging) markets such as chemicals and jet fuel. Leaders in this market include British Airways, Bioessence, TMO Renewables and INEOS Bio.

2. Identification and provision of details of market failures:

(i) details of the type(s) of market failure(s) encountered in the sector and each subsector/technology[2]

Type of financial market failure	Description of barrier	Sector/ Subsector

[2] The Commission require that market failures put forward are specifically linked to the sub-sectors of the sector that they can be evidenced for. For example, for biomass this might involve some market failures applying particular types of feedstock. If market failures actually apply across the sector then evidence to this effect is required. At present we have a short list of market failures for each of these sectors but they are not especially well substantiated.

First Mover Disadvantage	Banks are unwilling to lend money to scale-up operations because there are few examples of large scale (100MW and above) biomass power projects.	Large scale dedicated biomass, biomass conversion, CHP and co-firing (those looking to increase the proportion of co-firing higher than 15%)
	All links in the biomass supply chain (production, storage, transport and processing) need to be in place in advance of the electricity generating station. Banks may not invest until electricity generation station is in place.	All listed infrastructure and ancillary technologies.
	Insufficient demonstration projects for innovative near commercial or early commercial technologies. Investors consider projects too risky.	Pyrolysis, Gasification.
Risk Aversion	Lack of specialist knowledge by financiers of the biomass industry or the agriculture industry has led to some potentially viable projects not being financed.	All biomass technologies where a high volume of biomass needs to be sourced.
	Financiers insist on engineering, procurement and construction contracts and long term biomass supply as the only option, when companies may be able to demonstrate that they are mitigating their risk through other means.	Small and large scale dedicated biomass, CHP, .pyrolysis and gasification.
High (perceived or real) transaction costs	Additional inherent uncertainties compared with the oil industry, associated with producing crops and immature global biomass market. The lack of understanding leads to less willingness to take on the risks.	All technologies listed where a high volume of biomass needs to be sourced.
Imperfect or incomplete information	Since the financial viability of projects depend on Government incentives, policy uncertainty creates uncertainty over expected returns and leads to less willingness to invest. This policy uncertainty arises from the: - RO banding review - Transition of CfDs - Planning procedures where ROCs are not determined until planning permission has been granted.	All technologies listed.

Public goods in infrastructure	Ports, road and rail links may need to be improved to cater for an increased supply of (mostly) imported biomass, but we have seen little sign of investment.	All listed in the infrastructure section.

[Commission would like to see factual evidence backing up the market failures identified. This may include anecdotes/case studies illustrating these failures, reports and data (there must be some expert party reports?) and comparison with overseas projects.[3] Suggest raise with UKGI/Oxera/Vivid. (DECC/Defra might have access to reports?)]

Comment [c1]: Have UKGI/ Oxera/ Vivid found any examples to draw from?

(ii) details on the causes of such market failures

<u>First mover disadvantage</u>

There are very few dedicated biomass power plants in the world that operate over 50MW, and none so far in the UK. Although the technology is not new, scaling up to the levels proposed in the UK (100-300MW) increases the risks to investors that there will be delays or additional costs involved. Investors indicate a willingness to invest once the initial construction has been carried out, seeing initial development as the key risk area.

The GIB could play an important role to ready the supply chain for higher volumes of biomass to the power sector; covered in more detail in the next section. Financing will be needed to support key requirements which will be dependent on the supply chain needed in individual cases. Most large-scale projects will be reliant on imported biomass which will need to be transported (through ports, by rail or by road) and stored in very large quantities. Biomass will normally need to be within a particular fuel specification including parameters such as size, moisture content and calorific value. This can require specialist processing equipment to crush, pellet, briquette or convert to a powder through torrefaction. Some dedicated biomass production needs specialist harvesting or bailing equipment. The key market failure is the catch-22 whereby the biomass supply chain will not be invested in until there is a high level of certainty that demand will increase. On the other hand financiers are reluctant to supply large scale projects if there are risks to delivering the required supply of biomass.

Access to finance due to concerns about technology viability is a problem for investment in technologies which have been newly applied to biomass, such as gasification, pyrolysis. This is in part due to lack of reference plants for investors to base key decisions upon. These projects can gain a lower rate of return and are higher risk than conventional biomass to power technologies, and are therefore more difficult to fund. GIB offers potential for development of demonstration plants and building confidence in the market.

---

[3] BIS should be clear whether the market failures identified manifest in projects in other Member States or just the UK.

Risk Aversion/ High (real or perceived) transaction costs

Learning effects of the financial sector

The combination of financial market failures and other barriers means that there is a lack of completed projects which can be held up to potential investors as evidence of success. Consequently, the financial sector has been cautious. The riskiest stage (in terms of additional costs/ delays to the project) is perceived to be the construction phase, so lenders are unwilling to invest or are looking to offset risk through increased requirements on EPCs (engineering, procurement and construction costs), increased risk premiums and the requirement for long term feedstock contracts. Given the number of large scale electricity plants currently in planning or awaiting the outcome of the RO banding review (approximately 2.5GW), banks expect a significant take up once there are one or two plants generating successfully.

One reason for the cautious approach by some financial institutions is a lack of specialist knowledge within the (financial) sector in biomass electricity and forestry. This has lead to some perverse decisions and excessive requirements placed on developers.

Small scale projects

These are subject to higher relative capital costs, have higher relative risk premiums and higher relative EPC (engineering, procurement and construction) costs. This is an issue common to all smaller scale renewables projects because small scale projects are less likely to be able to fund "off-book" and have greater reliance on up-front debt and equity finance, including venture capital and may require re-capitalisation mid-project. In order to win this type of funding they need a cast iron route to market, including fuel supply arrangements. The approach taken by some financiers may overestimate the risks.

Combined Heat and Power projects

CHP developers are faced with additional barriers on top of those described above due to the supply of heat. They face higher capital costs through the extra plant that is required e.g. heat recovery system, heat distribution network, etc. CHP stations are dependent on heat customers. If they do not use the heat themselves onsite, there are risks around securing long-term contracts to justify the extra investment required, as it may take several years for the station to attract enough customers to do so.

Unlike long-term incentives such as the RO, heat sales are often considered high risk by lenders and are therefore excluded from investment decisions. This approach can mean that the economic case for CHP projects will end up looking uncertain, with the result that they are unable to be commissioned. Although the risk of losing heat customers is real, it may be that risks are overestimated.

Supply of biomass

Although supplies of indigenous biomass are increasing, there will not be enough economically viable UK sourced biomass in the UK to meet needs of our biomass power sector in 2020. We therefore expect to require significant volumes of imports in addition to our domestic feedstocks. Sectors such as the paper and wood panel industry compete for the same sustainable biomass sources which have a constrained supply.

The current lack of both spot and futures markets for biomass, means that investors are demanding a sufficient level of comfort that the required volumes of sustainable biomass can be sourced for the plant to operate at optimal capacity. This requires setting up multiple contracts of 5 - 7 year duration with bioenergy suppliers across different geographical regions, which can be very challenging for biomass produced for energy and for securing contracts for 'waste' biomass.

Some feedstock expected to be used in the sector face additional uncertainties and risks than lenders in energy markets expect from existing fossil fuel supplies. These are linked to the dependency of the production of the feedstock and associated prices on factors such as weather, diseases and fires. This exposes the bioenergy sector to risks more similar to the ones faced by the agriculture and food sectors rather than fossil fuel energy generation. It is expected that it will take time before the financing market is sufficiently confident with the nature and risks of the biomass supply contracts that generators will have to enter.

There will also be a risk aversion arising from seasonality linked to demonstrated and reliable technology as different biomass types are available more freely at different times of the year.

Imperfect or incomplete information

Policy uncertainty

Renewables Obligation

Levels of support are subject to a review every four years to ensure that technologies receive an appropriate level of support. Developers of large scale projects have found it difficult to obtain project finance for plants which, given the relatively long lead times for biomass electricity projects of 4-6 years, may not be operational before new Renewables Obligation (RO) banding levels are introduced.

Long lead times and significant capital costs are a particular issue for larger scale biomass plants. There are some instances where the level of ROC support for a power plant cannot get pre-accreditation until the plant has planning permission, or full accreditation until two months prior to operation. This can create a vicious circle where the finance cannot be secured, as the ROC rate is often a key factor for the viability of plant. In addition, although the RO support covers capital costs the support is spread through a 20 year period. Therefore generators still need to access significant upfront financing to complete the investment.

Renewable Heat Incentive

The heat element of CHP is eligible for support under the RHI, and it is anticipated that this will be the key incentive in 2015, when support the 0.5ROC CHP uplift is proposed to end. Consideration is being given to whether a higher support level is justified from heat supplied by CHP projects as opposed to heat only projects. Proposals to amend the RHI may be put forward in a consultation this year.

Contracts for Difference

Going forward the RO is set to be replaced by a system of CfDs when the RO closes in April 2017. Although the transition phase from 2014 is intended to reduce uncertainty, there could be an impact on investment decisions for projects due to come on stream around 2017. Although CfDs may provide more certainty over the lifetime of the projects, it will remain unclear how lenders will view the new mechanism whilst the details are still under development.

Biomass sustainability

The Government considers that biomass must be sustainable if it is to be used for energy production. A consultation is planned this year with the intention of incentivising only sustainable biomass in the RO. Although developers of biomass power have cited this as an uncertainty, the overall effect of introducing mandatory sustainability standards may improve market confidence. The EU is a key driver of sustainability standards for biomass and is considering introducing biomass sustainability criteria similar to those set out in the Renewable Energy Directive for biofuels. The European Commission are also considering additional sustainability issues such as air, soil and water, and indirect land use change.

In the medium term the role for biomass electricity is uncertain and dependent on technologies to offset the carbon emissions associated with biomass power, such as the introduction of CCS. The bioenergy strategy is intended to clarify the principles by which we are likely to support biomass in the future to a longer term policy view for investors.

Planning

The planning process can cause uncertainty for developers and have significant cost implications. Developers remain concerned about the time taken to decide applications, a lack of transparency, and apparent inconsistency across the UK in the way decisions are reached at the local planning authority level. For their part, communities may be concerned about the possible impacts of biomass plants (particularly energy from waste or imported material such as palm oil) on global sustainability, landscapes, health and traffic generation and local amenity. Although the Government is taking actions to reform the planning system and reduce the barriers for the sector[4] confidence in the sector is expected to remain low until the new measures have been proven in practice.

---

[4] Measures include:

- Decision making framework for energy projects of nationally significant infrastructure in England and Wales, including renewables (over 50MW), through designation of the energy National Planning Statements on 19 July 2011.
- Abolition of the Infrastructure Planning Commission (IPC) on 1 April 2012 and return of determination for development consent of nationally significant energy infrastructure to the Secretary of State for Energy and Climate Change.
- Local retention of business rates from new renewable energy projects in England, from April 2013 (subject to progress of Local Government Finance Bill). DCLG proposal for a 'planning guarantee' with the intention that it will take no longer than 12 months to reach a final decision on planning applications including any

Public Goods in Infrastructure

Lack of port infrastructure seen to be an issue that will hinder rapid development of the bioenergy sector and should be considered for specific strategic investment. Investment is also needed for road and rail links, potentially with specialist biomass handling equipment. The market failure in financing these developments are similar to other supply chain failures. The generators are being hindered by the lack of suitable infrastructure and are unable to plan effectively for long term contracts with high volumes of biomass. The uncertainty in demand leads to an unwillingness to investment in the infrastructure until the supply of biomass is high.

(iii) comparative analysis with non-green emerging sectors such as technology sectors with a similar growth and technology uncertainty profile

[This seems quite difficult. As an alternative way of establishing the same point, we suggest the GIB demonstrates that the market failures identified are not just common to all emerging sectors. Could we demonstrate how other Green sectors have received MEIP investment in the past to overcome 'Green' market failures?]

Comment [P2]: I am not able to do this. Can the UKGI team advise?

(iv) assessment on whether those market failures are estimated to be temporary or not

Those financial market failures that will quickly end are the first mover disadvantage of those seeking to put in place large scale dedicated biomass plants, biomass conversions and an increased proportion of co-firing. Once one or two examples have demonstrated success, similar technologies will be deemed lower risk. It may take longer for those seeking to use advanced conversion technologies on novel feedstocks such as waste, because there are very few examples globally of commercially viable demonstration and early commercial installations.

According to Morgan Stanley biomass feedstock accounts for 50% to 75% of the full generation costs. This large spread in costs arises from the fact that there is no stable supply chain set up: because biomass prices remain exposed to seasonality, location and availability of supplies. Furthermore there is no central and stabilised market equalising supply and demand across regions. As a result for developers, assessing future costs of biomass supplies continues to

---

associated appeal. The final National Planning Policy Framework published on 27 March sets out among other policies, the Government's planning policy for England for renewable and low carbon energy development up to 50MW. The new policy is based on a presumption in favour of sustainable development, which includes appropriately sited renewable and low carbon energy developments.

- For EFW plants the waste Planning Policy Statement 10 and the existing National waste Strategy are due to be updated by DCLG and Defra by summer 2013 (with consultation later this year). The update of PPS10 will likely continue the general thrust of existing policy – such as delivering sustainable waste management solutions and communities taking more responsibility for their own waste - but also take into account new European and national legislation.

remain a problem and as a result, it is difficult for biomass developers/ generators to hedge their positions. An increasing knowledge of the risks associated with the supply of biomass will increase in the energy sector, therefore reducing the market failure over time.

There are safeguards in place to reduce the policy uncertainty experienced by the biomass power industry. The RO order prevents support levels being changed without a review. Support for biomass power projects is now grandfathered for a 20 year period, and a three year overlap between the RO and CfDs has been agreed to ensure a smooth transition between the two schemes. CfDs are long term contracts which should assist with financing in the longer term. However uncertainties remain until the detail is developed and the mechanism has been shown to be effective.

[redacted]

[redacted]

3. **Precise quantification of the current and expected funding gap and investment trajectory (with/without GIB intervention) for each sector and technology backed by data**

Support provided under the RO and later CfDs will heavily influence growth in the sector. Renewable Obligation Banding Review Consultation[5] analysis estimates that the proposed ROC regime could support [redacted] of capacity to generate biomass electricity by 2020 (central scenario). These figures are subject to change following the final decisions on support levels in the RO.

Table 2: Estimated deployment of key biomass technologies under proposed RO bands

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[5] RO Banding Review Consultation, October 2011

[illegible]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The costs of delivering the [redacted] approximately [redacted] per year to the tax payer through the RO by 2020. The [illegible] [redacted] The table below provides a breakdown of the investment requirements of the sector. It indicates that there will be a peak leading up to [redacted] the investment required.

Comment [illegible]

Table 3: Investment requirements to achieve a capacity of [redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SUM	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

Comment [illegible]

4. **Compare the funding gap with other sectors and technologies with a similar growth profile (inter alia comparison growth rate/ growth rate of financing) and with other geographical areas, etc.**

[illegible]

Comment [illegible]

(5)

[redacted]

From: [redacted]
Sent: 28 June 2012 17:24
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

DfT lead on transport biofuels, so we would not hold information like that. I am copying in Sarah Sheridan (Head of biofuels policy) and Michael Humphries (lead economist on biofuels) who may in a position to help.

I think the economics may not work in the same way because biofuels are a globally traded commodity and can be imported, whereas electricity generation from biomass will all originate in the UK. The RTFO mechanism accepts any biofuel that passes the Renewable Energy Directive sustainability criteria, regardless of whether it was produced in the UK or not. There are advantages to encouraging biofuel production facilities in the UK; these tend to have sustainability embedded in their business models and UK produced fuels tend to have a high environmental performance. We have also identified (as part of the bioenergy strategy) that advanced conversion technologies (such as gasification and pyrolysis) are likely to play an important role supplying transport biofuels to 2050.

[redacted]

From: [redacted]
Sent: 28 June 2012 17:04
To: [redacted]; [redacted])
Cc: [redacted]
Subject: RE: EU template

[redacted]

In a similar way, do DECC happen to have similar funding requirement information for biofuels? Any help on this would also be much appreciated.

Many thanks,
[redacted]

From: [redacted] (DECC)
Sent: Thursday, June 28, 2012 12:13 PM
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

I have got two tables; broken down by technology, that show the expected deployment of biomass and the support the RO will provide, and the overall level of investment required (see text drafted below). I am trying to get an economist to confirm that the numbers I have put in are suitable to put in your form, and intend to send the form to you by the end of the day. These reflect the proposals set out in the banding review. Once the decisions have been taken on the RO, these figures may change.

[redacted]

Support provided under the RO, and [redacted] sector. Renewable [redacted] ROC regime could support [redacted] of capacity to generate biomass electricity [redacted]. These figures are subject to change following the final decisions on support levels in the RO.

Table 2: Estimated deployment of key biomass technologies under proposed bands

[redacted]										
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]										

The costs of delivering the [redacted], is approximately [redacted] per year to the tax payer through the RO by 2020. The overall investment required is likely to be approximately [redacted]. The table below provides a breakdown of the investment requirements of the sector. It indicates that there will be a peak leading up to [redacted] on the investment required.

Table 3: Investment requirements to achieve a capacity of [redacted]

[redacted]										
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]										

From: [redacted]
Sent: 28 June 2012 11:53
To: [redacted]
Cc: [redacted]

Subject: RE: EU template

[redacted]

Many thanks. Can we assume DECC will be able to provide information on the funding gap point - since you will presumably have had to provide figures on this in the context of the RO banding review notification?

[redacted]

From: [redacted]C)
Sent: 26 June 2012 23:59
To: [redacted]
Subject: EU template

[redacted],

Just to let you know we intend to send a draft template to you on Thursday. I hope that gives you enough time to consider it.

[redacted]

Tel [redacted]
Area 4a, 3-8 Whitehall Place,
London SW1A 2HH

6

[redacted]

From: [redacted]
Sent: 29 June 2012 11:48
To: [redacted]
Cc: [redacted]
Subject: RE: EU template
Attachments: EU QUESTIONS - BIOFUELS 512148128_1.DOC

[redacted]

Thank you for your email.

We are preparing materials for the GIB's state aid notification. In this context, we are collating evidence for the biofuels sector using the attached template as a guide. At this stage, we seem to have adequate information on Q1 & Q2. Any assistance your team can provide on Q3 and Q4 would be much appreciated.

Please call / email Bruce Duguid or myself if you have any questions.

Many thanks,
[redacted]

[redacted]| UK Green Investments | Department for Business, Innovation & Skills |
[redacted]| Orchard 1, UG1, 1 Victoria Street, London SW1H 0ET| Direct Line
[redacted] | www.bis.gov.uk/ukgi
[redacted]

From: [redacted]
Sent: Friday, June 29, 2012 11:32 AM
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

Happy to have a look at what we can provide.

Afraid I wasn't too clear from the email chain exactly what it is you are after and what it will be used for though so if you could provide some context I can forward this to the right person.

thanks

[redacted]

[redacted]
Head of Biofuels Strategy

Low Carbon Fuels
Greener Transport & International Directorate – Department for Transport
Zone 1/32, Great Minster House, 33 Horseferry Road, London SW1P 4DR
[redacted]

From: [redacted]

Sent: 28 June 2012 17:24
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

DfT lead on transport biofuels, so we would not hold information like that. I am copying in Sarah Sheridan (Head of biofuels policy) and Michael Humphries (lead economist on biofuels) who may in a position to help.

I think the economics may not work in the same way because biofuels are a globally traded commodity and can be imported, whereas electricity generation from biomass will all originate in the UK. The RTFO mechanism accepts any biofuel that passes the Renewable Energy Directive sustainability criteria, regardless of whether it was produced in the UK or not. There are advantages to encouraging biofuel production facilities in the UK; these tend to have sustainability embedded in their business models and UK produced fuels tend to have a high environmental performance. We have also identified (as part of the bioenergy strategy) that advanced conversion technologies (such as gasification and pyrolysis) are likely to play an important role supplying transport biofuels to 2050.

[redacted]

From: [redacted]
Sent: 28 June 2012 17:04
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

In a similar way, do DECC happen to have similar funding requirement information for biofuels? Any help on this would also be much appreciated.

Many thanks,

[redacted]

From: [redacted]
Sent: Thursday, June 28, 2012 12:13 PM
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

I have got two tables; broken down by technology, that show the expected deployment of biomass and the support the RO will provide, and the overall level of investment required (see text drafted below). I am trying to get an economist to confirm that the numbers I have put in are suitable to put in your form, and intend to send the form to you by the end of the day. These reflect the proposals set out in the banding review. Once the decisions have been taken on the RO, these figures may change.

[redacted]

Support provided under the RO, and later CfDs, will heavily influence growth in the sector. Renewable Obligation Banding Review Consultation analysis estimates that the proposed ROC regime could support [redacted] of capacity to generate biomass electrici[redacted]ral scenario). These figures are subject to change following the final decisions on support levels in the RO.

Table 2: Estimated deployment of key biomass technologies under proposed bands

[redacted]

SUM (MW) [redacted]

The costs of delivering the [redacted], is approximately [redacted] per year to the tax payer through the RO by 2020. The overall investment required is likely to be approximately [redacted] The table below provides a breakdown of the investment requirements of the sector. It indicates that there will be a peak leading up to [redacted] on the investment required.

Table 3: Investment requirements to achieve a capacity of [redacted].

[redacted]

SUM [redacted]

From: [redacted]
Sent: 28 June 2012 11:53
To: [redacted]
Cc: [redacted]
Subject: RE: EU template

[redacted]

Many thanks. Can we assume DECC will be able to provide information on the funding gap point - since you will presumably have had to provide figures on this in the context of the RO banding review notification?

[redacted]

From: [redacted]

Sent: 26 June 2012 23:59

To: [redacted]

Subject: EU template

[redacted]

Just to let you know we intend to send a draft template to you on Thursday. I hope that gives you enough time to consider it.

[redacted]

Tel: [redacted]

Area 4a, 3-8 Whitehall Place,

London SW1A 2HH

7

[redacted]

From: [redacted]
Sent: 11 July 2012 22:23
To: [redacted]

Cc: [redacted]

Subject: RE: RESTRICTED: GIB Sector evidence text

Attachments: GIB - Biomass Biofuels section from draft notification 512487870_1 KH comments.DOC

GIB - Biomass Biofuels section...

[redacted]

I think the biomass power bit looks good, but I have made a few comments. A couple of things you may want to be aware of:

- You have included some heat only references in the biomass power section, so there is a bit of duplication with the heat section.
- I have highlighted some areas that are slightly inconsistent with the policies that will be forthcoming in the RO Government response to the banding review consultation, and the planned additional consultation on biomass sustainability. I am not suggesting you necessarily change the text for the state aids rules, but when you consider projects, you need to take these into consideration.

On the transport biofuels bit:

- I notice that there was not a DfT representative on the copy list, so I have copied in [redacted] as it is important that DfT signs of that section. DECC does not lead on the biofuels policy but I have been involved in biofuels policy from a DECC perspective. It surprises me that the focus is on first generation biofuels; particularly that of biodiesel. DfT have highlighted the sustainability risks of biodiesel made from vegetable oils, and DfT have not yet signalled to industry that they intend to increase the biofuel obligation from its current level.
- There is however a high level of consensus that advanced biofuels will continue to play a role in the medium to long term, and is key to achieving the kind of carbon savings necessary to achieve our 2050 greenhouse gas reduction targets. For this reason I am really surprised that the GIB is not intending to support them. Some of these technologies are near commercial; much more so than marine and CCS technologies, and the UK is investing time and money to supporting the industry to move towards commercial realisation, through the bioenergy strategy work, TINAS (technology needs innovation assessment), and all the work we are doing to leverage EU money for advanced bioenergy (ERANET+etc).

I am not in tomorrow, but happy to discuss on Friday if there is anything you want me to expand on.

[redacted]

From: [redacted]
Sent: 11 July 2012 15:51
To: [redacted]

[redacted]
Cc: [redacted]

[redacted]
Subject: GIB Sector evidence text

Dear all

I attach draft text for inclusion in the GIB state aid notification setting out the case for GIB investment in the following sectors:

- Biomass power
- Low Carbon heat
- Marine energy
- CCS
- Biofuels

A bit more work to do but this is largely what we plan to say in the state aid notification on these sectors. Could you all review the relevant part of the text and let me have any comments **by midday tomorrow**. Silence will be taken for consent.

Mathew, can you answer the query at para 1.31 (ii) as to the date of the HMG meeting with potential CCS financiers (2011 rather than 2001?).

Thanks for all your help with this process.

[redacted]
GIB Team ShEx
[redacted]

<< File: GIB - Biomass Biofuels section from draft notification 512487870_1.DOC >>

GREEN INVESTMENT BANK

Proposed Templates for responding to Commission Level 1 questions

BIOFUELS

1. Detailed definition of the sector:[1]

(i) set out the scope of the technology the GIB intends to invest in (with reference to the specific different types of technology):

Biomass boilers generate heat energy through the burning of fuel including wood, straw, energy crops, manure and the biomass portion of municipal and commercial solid waste (Vivid I, para 2.5.2 and draft notification, para 4.145). [redacted]

and confirm the inclusion of any of:

(a) infrastructure

(b) ancillary/complementary technology (for example, radar for offshore wind projects)

[Please confirm. NB: Detail required below is required for all activities covered in this above section.]

(ii) details of the industrial structure of each sector and each specific subsector, including:

(a) supply chain overview; details of the components to the projects within the GIB scope [NB: Vivid does not cover this in any detail. We assume DECC or similar would have some off the shelf materials that could form the basis for this]

(b) details of the suppliers are active in the various aspects of the sector and technology (referenced back to (i) above)

---

[1] This needs to describe to the Commission exactly what is in and what is out of the sector scope, with reference to the various types of technology/projects.

2. Identification and provision of details of market failures:

(i) details of the type(s) of market failure(s) encountered in the sector and each subsector/technology[2]

[Drafting note: As these are MEIP sectors, the market failures should ultimately illustrate an insufficiency of capital]

The market failures that we have identified in relation to biomass power are the novelty of technology and risk aversion of investors which are leading to insufficiency of capital.[3]

[redacted]

(ii) details on the causes of such market failures

[redacted]

(iii) comparative analysis with non-green emerging sectors such as technology sectors with a similar growth and technology uncertainty profile

[redacted]

---

[2] The Commission require that market failures put forward are specifically linked to the sub-sectors of the sector that they can be evidenced for. For example, for biomass this might involve some market failures applying particular types of feedstock. If market failures actually apply across the sector then evidence to this effect is required. At present we have a short list of market failures for each of these sectors but they are not especially well substantiated.

[3] In cases where the Commission has requested details about sub-sectors, this will include all types of biomass projects and technologies. When evidence for each sector or technology differs please therefore provide evidence for each project.

[4] BIS should be clear whether the market failures identified manifest in projects in other Member States or just the UK.

(iv) assessment on whether those market failures are estimated to be temporary or not

[redacted]

3. Precise quantification of the current and expected funding gap and investment trajectory (with/without GIB intervention) for each sector and technology backed by data

Analysis set out in the Renewables Energy Roadmap indicates that in central range scenarios, the biomass heat and power sector has the potential to deliver 68-100 TWh, equivalent to 30-43% of the UK's renewable energy targets. The overall investment required to meet these targets by 2020 is likely to be approximately £3.8 billion. (Draft notification, para 4.146).

[redacted]

4. Compare the funding gap with other sectors and technologies with a similar growth profile (inter alia comparison growth rate/ growth rate of financing) and with other geographical areas, etc.

[redacted]

Biomass

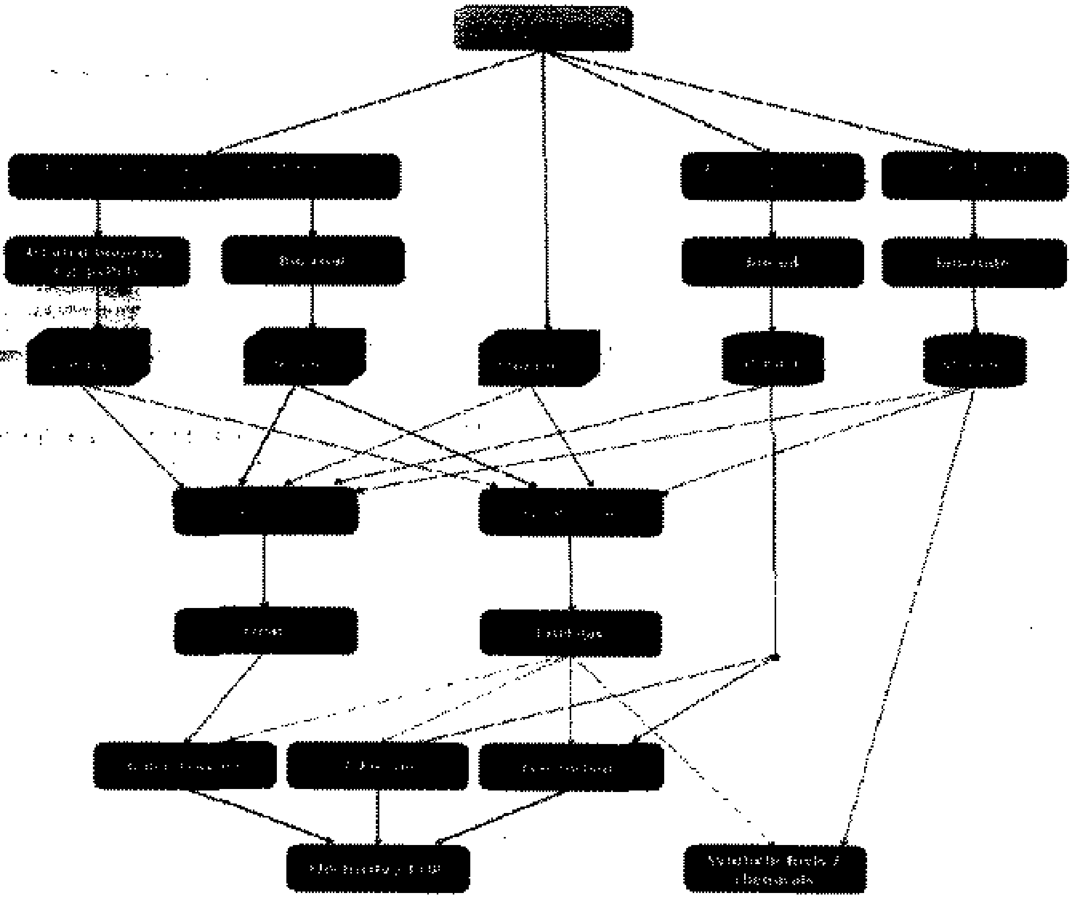
Overview of UK biomass sector

1.1 Biomass boilers generate [redacted] through the burning of organic matter. Sources include wood, straw, energy crops, manure and the biomass portion of municipal and commercial solid waste; such fuel can be obtained domestically or imported. Biomass feedstock can be highly versatile with considerable potential to contribute to all forms of renewable energy; transport biofuels, heat and power. At the end of 2010, biomass generated 2.5 GW of electricity capacity, contributing 12 TWh of electricity; the single largest contribution to the renewable energy targets.

[redacted]

1.2 The figure below demonstrates some of the ways in which biomass can be converted into a fuel and used to generate power:

Figure 1.1: Biomass supply chain



Source: DECC paper 29 July 2012

Deleted: 110712:2159

Deleted: 110712:1205

1.3 Broadly speaking, [redacted] for the biomass heat/power sector comprises four stages:

(i) **Fuel sourcing and preparation:** processing raw biomass matter for the production of feedstock (typically pellets) for use as fuel in the heat / power generation process.

(ii) **Fuel transportation:** transportation of biomass pellets or chips from the production site to generation facilities. National and international logistics companies typically provide these services. Dedicated train wagons, trucks and ships may be required for large scale operations. The Committee on Climate Change's Bioenergy Review of 7 December 2011 anticipates that approximately 90% of all biomass feedstock used in the UK will be imported.

(iii) **Fuel storage:** Biomass pellets have a lower energy density than coal and biomass heat/power generation facilities therefore require significantly larger fuel storage facilities, which have high operating costs.

(iv) **Combustion:** The primary combustion methods used for power and heat generation from biomass rely on well-established technology. However, although technology is established, large scale commercial operation has not yet taken place. With the exception of RWE's 750MW converted plant completed at [redacted] plants built to date in the UK have all been relatively small scale (up to 50MW capacity). Biomass combustion can be undertaken in three different ways:

(a) [redacted] combustion of a small amount of biomass materials (initial co-firing trails used about 5-10% biomass) with coal in an existing coal-fired power station. This practice is used by certain coal-fired generators in the UK such as Drax, RWE and E.On;

(b) Conversion of existing coal-fired plants to biomass: several major coal power station owners are considering converting their coal fired power stations to biomass. Tilbury (RWE NPower) was the first biomass conversion of its kind in the UK, which became operational in early 2012;

(c) [redacted] (capacity greater than 50MW) which are likely to be heavily dependent on imported biomass. A number of VIUs are developing new dedicated biomass stations - E.On owns and operates the UK's largest dedicated biomass plant. The UK Government is aware of a number of projects currently in development; Scottish and Southern Energy (SSE) owns one medium scale renewable combined heat and power plant and RWE and E.On are each building new biomass CHP plants; and a range of companies with expertise in making chemicals, or those with a high volume of available biomass feedstock are seeking to bring advanced [redacted] (such as advanced Conversion Technologies (Gasification and Pyrolysis) and Combined Cycle Gas

[redacted]

Deleted: a

Deleted: a number of VIUs

Deleted: are developing new dedicated biomass stations -

Deleted: E.On owns and operates the UK's largest dedicated biomass plant

[redacted]

Deleted: 110712:2159

Deleted: 110712:1205

Turbines and Syngas fuelled engines) to commercial realisation, for use by firms including British Airways, Bioessence, TMO Renewables and INEOS Bio.

Scope of GIB biomass intervention

1.4 The scope of GIB's investment in biomass power will include technologies which use biomass materials as the primary fuel for heat or power generation, or the co-firing of biomass materials with conventional fossil fuels, including:

(i) Harvesting/bailing: specialist machinery is needed during the production of some forms of biomass such as miscanthus and short rotation coppice;

(ii) Chipping, pelletising, briquetting, torrefaction and drying facilities: convert solid biomass such as wood and non-food energy crops into a form which is suitable for electricity generating stations;

(iii) Crushers, filtration systems: used in the production and treatment of vegetable or used cooking oil;

(iv) Waste treatment plants: produce solid recovered fuel;

(v) Cofiring stations: direct combustion or steam cycle electricity generation;

(vi) Combined Cycle Gas Turbines, Syngas fuelled engines, Conversion of coal power station to biomass;

(vii) Dedicated biomass stations (at all scales): provide dispatchable power directly or provide baseload or peakload power to the electricity grid. Peakload power may increase in importance to balance the increasing proportion of intermittent renewable energy sources over time, particularly if used in combination with CCS.

(viii) Renewable combined Heat and power (at all scales): capture "usable" heat and tend to increase the overall efficiency of the engine.

(ix) Gasification, Pyrolysis and pyrolysis upgrading: convert biomass into a gaseous, solid or liquid form, which can be injected into the gas grid or burned for power.

(x) Milling; and

(xi) Combustion.

1.5 As the use of biomass increases, the UK will require investment in plants and ancillary facilities. This will likely include facilities to import and transport biomass to a wider range of locations (such as road and rail links and biomass wagon rolling stock), as well as supporting infrastructure (such as biomass handling facilities at a port). Further port infrastructure is outdated and is seen to hinder rapid development of the bioenergy

Comment [c14]: See comment ?

Comment [c15]: Suggest you add milling up at the top either with harvesting/ bailing, or with crushing/ filtering.

Comment [c16]: I am not clear what this means as all of these will involve combustion in some form or another. Do you mean internal combustion engines (as opposed to steam cycle)?

Deleted: 110712:2159

Deleted: 110712:1205

sector. These facilities are capital intensive; they are larger than that required for a coal power plant with similar output, need to be covered and require special fuel handling safety equipment and practices. **[BIS/UKGI to confirm inclusion in GIB remit and provide evidence of market failures if included].**

Comment [c17]: The key market failure is the unwillingness to invest in the infrastructure until a high volume of biomass is being used in power stations, creating a catch 22 situation. See point VII below.

Market failures affecting biomass

1.6 There are a number of market failures that affect the supply of capital for large scale biomass infrastructure projects:

(i) Limited balance sheet capacity by traditional investors: traditionally, development and construction of large scale power facilities in Europe has largely been financed either by utilities, using internal and external sources, or by independent power project developers providing equity and securing long term financing from banks and insurance companies. As set out below, independent power producers and utility companies are no longer able to raise significant amounts of capital due to the credit rating constraints on their balance sheets:

> *"Strong business risk profile offset by a significant capex program (...) [one-third of which] has been earmarked for renewables projects (...) We believe that the capex program will result in negative discretionary cash flows through the period, and consequently, higher debt levels."*[1]

> *"[SSE's] large investment programme of £8bn over the 2010-2015 period, with significant focus on renewables (...) carries execution and financial risks. (...) Moody's sees no potential for upward pressure on ratings given the group's limited financial flexibility."*[2]

This issue is exacerbated by information asymmetries leading to principal-agent distrust; despite the potential for significant returns from biomass, shareholders or debt providers are concerned about potential investors' motives to raise capital. This creates the need to introduce new investors, such as the GIB.

(ii) Structural changes in bank and insurance markets leading to a lack of long term financing: the infrastructure sector has largely been financed by long term debt (up to 20 years), typically in the form of project finance from commercial banks. However, entrenched changes to financial markets has had the effect of a semi-permanent systematic tightening of credit worldwide. The introduction of the Basel III bank regulations, has also reduced liquidity and banks are required to de-lever, or at least to not increase their lending. As a result, few banks will now provide medium to long-dated debt i.e. debt with terms longer than seven years.

---

[1] S&P on E.ON, 28 July 2010

[2] Moody's on SSE, 19 December 2011

Deleted: 110712:2159

Deleted: 110712:1205

Additionally, regulators may be introducing incentives, through the EU's Solvency II, for insurers in Europe to reduce their exposure to banks and impose higher capital charges for lower-credit-quality and longer-dated financial instruments. With banks no longer providing the scale of financial intermediation required between such asset owners and investment projects, the dramatically increased investment needs of the Green economy (as detailed in §Error! Reference source not found: an increase from £9 billion of annual investment in 2010 to £30-50 billion by 2020) mean that in the Green sector more than others new intermediaries are required. However, market failures are preventing the formation of such new intermediaries at the scale and pace required.

Comment [c18]: Need to add ref

It should be noted that as this market failure affects the Green sector across the board, it is applicable to each of the GIB's sectors, all of which are competing with a range of investment opportunities to secure vastly increased amounts of finance.

(iii) Risk aversion due to limited commercial development: there are currently only a small number of fully operating dedicated biomass power generation plants globally and few of these are large scale; only very few dedicated biomass power plants operate over 50MW globally, and none so far in the UK. Construction is considered to be the riskiest stage in a project (in terms of additional costs or delays to the project) so lenders are unwilling to invest or are looking to offset potentially over-priced investment risk through increased requirements on EPCs (engineering, procurement and construction costs), increased risk premiums and the requirement for long term feedstock contracts

These conditions can render it almost impossible to obtain sufficient finance, in particular for smaller projects which are subject to higher relative capital costs, have higher relative risk premiums and higher relative EPC costs, leading some financiers to overestimate the risks. Further, banks are unwilling to lend sufficient money on viable terms to scale-up operations because there are few examples of large scale (100MW and above) biomass power projects including large scale dedicated biomass, biomass conversion, CHP and co-firing (those looking to increase the proportion of co-firing higher than 15%). These conditions are currently inhibiting the development of pyrolysis and gasification technologies. However, given the number of large scale electricity plants currently in planning or awaiting the outcome of the RO banding review (approximately 2.5GW), banks expect a significant take up once there are one or two plants generating successfully. The injection of GIB capital on commercially viable terms would therefore be likely to act as a catalyst to further private investment.

(iv) Risk aversion, due to technology uncertainty: although there is some private investment in the sector, investors' lack of understanding of the technologies used in the sector is leading to a mispricing of risk which is constraining the injection of sufficient capital into the sector. Concerns about technology viability are particularly problematic for investment in technologies which have been newly applied to biomass, such as early stage combustion technologies

Comment [c19]: May want to re-label this to say advanced thermal conversion (conversion of biomass to syngas or pyrolysis products). Or do you mean combustion of the syngas that is produced from advanced thermal conversion?

Deleted: 110712:2159

Deleted: 110712:1205

including gasification and pyrolysis. This is in part due to a lack of reference plants for investors to base key decisions upon. These projects can gain a lower rate of return and are higher risk than conventional biomass to power technologies, and are therefore more difficult to fund. Funding offered to the sector is therefore insufficient to allow the sector to grow to meet renewable energy targets. The GIB offers potential for funding the development of plants which would allow for the development of track record in the sector. This should have the effect of overcoming potential investor's misperceptions of the risk which will fuel further private sector investment.

(v) Risk aversion due to concerns around fuel pricing: feedstock accounts for 50% to 75% of the full generation costs[3] and concerns over price fluctuations may therefore deter investment in the sector. These may result from foreign exchange risk (for imported biomass) and because biomass prices remain exposed to seasonality, location and availability of supplies. As a result, it is difficult for biomass developers and generators to hedge their positions. Combined with little correlation between fuel costs and power prices, this can subject developers to significant feedstock price risk. This market failure affects all technologies which require a high volume of biomass that needs to be sourced. It is expected that it will take time before the financing market is sufficiently confident about the nature and risks involved in biomass supply contracts to support significant investment in biomass power projects.

Deleted:

Deleted: with

Deleted: of

Deleted: the

(vi) Risk aversion due to concerns around security of fuel supply: as there is no central, stabilised market equalising supply and demand across regions, the uncertainties and risks related to biomass supply are larger than lenders in energy markets expect from existing fossil fuel supplies. As a result of constrained supply, prospective investors have demanded multiple contracts of five to seven year duration with bioenergy suppliers across different geographical regions. This has been challenging to achieve and has affected investment in small and large scale dedicated biomass, CHP, pyrolysis and gasification. Oxera notes that, smaller, non utility developers may, in particular, find it harder to obtain long term-feedstock contracts:[4]

> *The availability of a viable, long-term, bankable wood fibre supply contract for non-utility takers is by no means certain.*

There is therefore a role for the GIB to provide commercial funding to enable the development of early supply.

Oxera notes that if a supply chain contains small players, or is sufficiently immature that there is a limited number of such counterparties, project

---

[3] Morgan Stanley [redacted]

[4] Reuters (2012), 'Analysis: UK bets on biomass in move away from coal', May 25.

Deleted: 110712:2159

Deleted: 110712:1205

development may only be possible with vertical integration into feedstock supply. This would restrict project development to large VIU players with sufficient financial strength to invest. For example, EDF has acquired its first biomass pellet manufacturing plant in Germany. In these circumstances, there would be a role for the GIB to invest into projects where such large players are capital constrained, namely due to their constrained balance sheets.

(vii) Risk aversion due to uncertainty of demand: Banks, which are experiencing a constrained ability to lend, have demonstrated a reluctance to invest until electricity generation stations are in place. However, all links in the biomass supply chain (production, storage, transport and processing) need to be in place in advance of the electricity generating station and the biomass supply chain will not be invested in until there is a high level of certainty that demand will justify such investment. Specifically, generators are being hindered by the lack of suitable infrastructure and are unable to plan effectively for long term contracts with high volumes of biomass. This has lead to a lack of willingness to invest in infrastructure until the supply of biomass is significant. The failure affects all listed infrastructure and ancillary technologies.

(viii) The lack of a track record in long-term consistent government policies in the biomass sector: As Green investments generally rely on government policies, which must be in place long-term to ensure a return to the project, uncertainty in future policy support has lead to a perceived risk to investors. Eventually, market failures affecting information asymmetry of the technology and market for biomass and the associated policy uncertainty should reduce as the technology is further deployed, markets scale-up and policy stabilises. The UK Government believes that GIB investment in biomass technologies will accelerate investment in the sector by demonstrating that Government policy is strongly in support of biomass and commercial investments in biomass are now viable on a long term basis.

1.7 As demonstrated by the market failures above, there is an acute need for additional sources of capital on market terms to meet renewable energy targets. GIB investment could contribute to these objectives in the following ways:

(i) from a purely financial perspective, GIB commercial investment in the sector could replace funding previously provided by traditional investors but which is no longer available due to long term structural changes in the market; and

(ii) a number of the additional failures broadly arise from a lack of information or imperfect information and are expected to be cured reasonably quickly; once one or two examples have demonstrated commercial success, similar technologies will be deemed lower risk. GIB investment in early-stage projects would demonstrate the commercial success of preliminary projects. This would have the effect of overcoming potential investors' misperceptions of risk and would therefore accelerate long term capital intermediation from new classes of private sector investors in the sector.

Deleted: ing

Quantification of market failures affecting Biomass

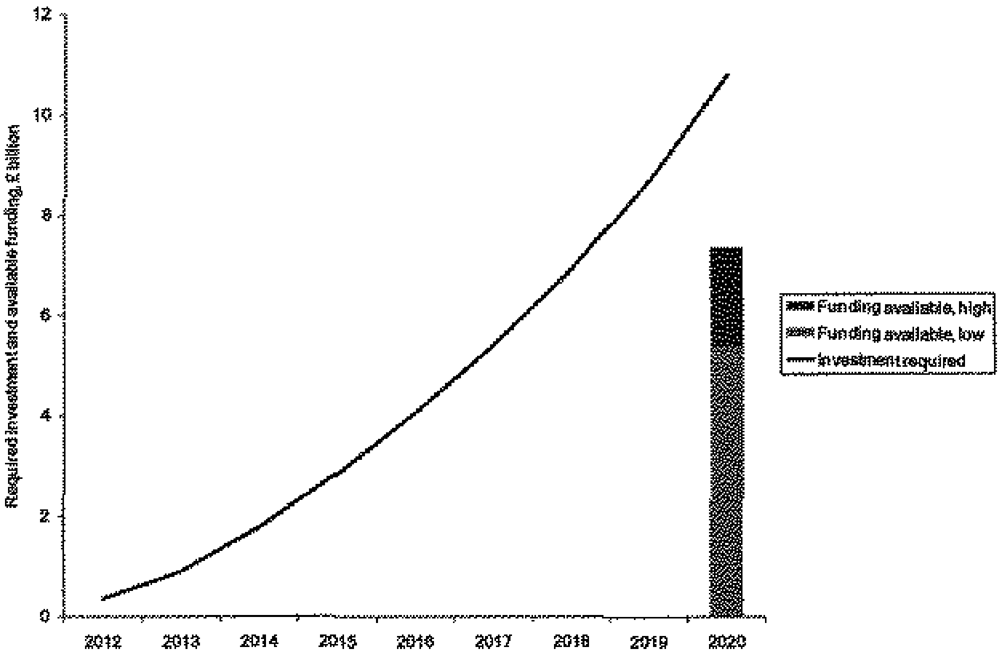
Deleted: 110712:2159

Deleted: 110712:1205

1.8 Substituting grid electricity and heating oil for biomass stands to make a significant contribution to decarbonising energy and heat generation. Biomass power is considered essential to meeting renewable energy targets. The UK Bioenergy Strategy of April 2012 indicates scenarios for the biomass power sector with the potential to deliver, by 2020, 20-40TWh, equivalent to 5-11% of the UK's total power generation. Analysis set out in the Renewables Energy Roadmap indicates that in central range scenarios, the biomass heat and power sector has the potential to deliver 68-100 TWh, equivalent to 30-43% of the UK's renewable energy targets. Oxera has calculated that the finance gap could lie in the range of £3.4 billion - £5.4 billion by 2020 (and as illustrated at Figure 1.2, below):

Comment [c20]: I think this is OK because you talk about potential. However, you should be aware that under the RO proposals we expect less, and if the RO does not support 100TWh it is unlikely to come on stream.

Figure 1.2: Funding gap in the biomass sector (2011/12 prices)



Source: Vivid Economics (2011), 'The Green Investment Bank: Policy and Finance Context', October, p.57 and Oxera analysis.

1.9 The current pipeline of potential projects exceeds the UK's Renewable Energy Roadmap target to build an additional 750 MW to 2,750 MW of biomass capacity by 2020, primarily though the conversion of existing coal plants and the building of Greenfields plants. However, the majority of projects are subject to investor approval and only a small proportion have reached financial close. Oxera estimates that the overall pipeline of plants currently being considered by developers is around 3,300MW;

Deleted: 110712:2159

Deleted: 110712:1205

however only 400MW have either reached financial close or is expected to reach financial close shortly.[5]

1.10 To date at least five dedicated biomass power project developers with 600MW projects under development have approached the UK Government seeking funding assistance. These projects are estimated to require over £1 billion for construction. Similarly, sponsors of 4GW of operating coal power capacity have approached the UK Government for funding assistance for the conversion to biomass plants or increased levels of co-firing of biomass. These projects are likely to require £1.2 billion of funding. Given that £2.2 billion of financing is at risk without GIB intervention, against an approximately £3.8 billion investment gap, it could be estimated that at least 50% of the required target investment could manifest as a "finance gap" requiring GIB intervention to mobilise further private finance into Biomass.

Renewable and low carbon heat generation

Overview of renewable and low carbon heat generation sector

1.11 The production of heat (both heat in buildings and heat in industry) currently accounts for approximately 40% of UK CO_2 emissions. There are a number of technologies which can produce low carbon or renewable heat, including, for example, heat pumps, biogas, condensing boilers and district heating. The development of such projects is essential if the UK is to meet targets to decarbonise its economy; however, current deployment levels are low.

Scope of GIB's renewable and low carbon heat generation intervention

1.12 The UK Government intends that GIB investment in the sector will primarily involve district heating. District heating is the distribution of heat to a number of buildings or homes from a central heat source, or multiple heat sources, through a network of pipes carrying hot water or steam. Some local authorities and businesses have already established heat networks and are realising the benefits of such investment; better resource efficiency, creation of new jobs, lower energy bills and a reduction in "fuel poverty".

1.13 There are a number of types of heat sources compatible with heat networks:

(i) Fossil fuel Combined Heat and Power (CHP): Gas CHP is currently the most cost-effective means of developing a heat network. There are strong synergies between district heating and gas CHP; gas-CHP engines can be employed quickly to serve existing or new district heating networks, delivering relatively low carbon heat as well as electricity as a revenue stream.

---

[5] [Oxera to provide reference]

Deleted: 110712:2159

Deleted: 110712:1205

(ii) Bio-CHP: CHP that utilises renewable fuels such as biomass, biogas, bioliquids and the bio-element of waste allows for low carbon generation of heat and electricity, however it is more expensive to develop than conventional gas CHP.

(iii) Biomass boiler: Boilers running on woodchips and wood pellets are being used in heat networks in the UK at present.

(iv) Biomass co-firing: this involves supplementing existing fossil fuel based CHP plants with biomass feedstock.

(v) Conventional gas boilers: Boilers fired by natural gas.

(vi) Deep geothermal: Geothermal energy originates from heat retained within the earth from radioactive decay of minerals. Heat is extracted via wells roughly 1500 meters deep.

(vii) Large heat pumps: Heat pumps utilising one larger heat pump or multiples of smaller controlled heat pumps.

(viii) Heat recovered from industrial processes: heat which has been used once and is expelled through a chimney or cooling tower. This is especially the case for high temperature industry, whose discarded heat can provide a low-carbon alternative to the direct use of heating fuels for low temperature users. In Gothenburg and Rotterdam for example, recoverable heat from industrial processes (rather than from electricity generation) provides the main source for the local district heat networks.

(ix) Heat recovered from thermal power generation: these can include thermal power stations which use coal, gas (i.e. fossil fuel CHP), nuclear, energy from waste and biomass. In the future this could include power stations fitted with carbon capture and storage.

(x) Heat from incinerating non-recyclable waste.

(xi) Conversion of electricity to heat when electricity is in plentiful supply: the future electricity generation mix is expected to result in more occasions when the electricity price is low, such as when the wind is blowing and demand is also at a low level. At these times of high supply, electricity can be stored as heat in a tank or in the system and used when needed in order to take advantage of the lower electricity price.

Market failures affecting renewable and low carbon heat generation intervention

1.14 Several market failures are constraining the provision of sufficient finance for the development of renewable and low carbon heat technologies, including as follows:

(i) Risk aversion due to concerns around security of fuel supply: As set out at paragraph 1.6(vi) security of fuel supply is a key hurdle to sufficient investment in the green sector. This is due to market concerns that low carbon heat

Deleted: 110712:2159

Deleted: 110712:1205

sources may not be available in the long term. Unless security of supply concerns can be addressed, potential investors will invest in alternative projects for fear of investing in a stranded asset. As a pre-requisite to providing funding, investors are commonly requiring a project to have secured long term supply contracts with suppliers with strong credit ratings. Some companies are working to overcome these hurdles to ensure sufficient commercial investment in the sector. For example, Drax's strategy is to:[6]

> *Contract with suppliers where a robust operational plant and logistics infrastructure is already in place…[and] work with new suppliers to help develop such infrastructure.*

Oxera has advised the UK Government that there is a role for GIB funding to invest in the development of large and experienced credit-worthy feedstock suppliers. GIB investment may also accelerate and help establish a track record in equipment supply and downstream project developers which utilise such equipment. GIB commercial investment in technologies throughout the supply chain would allow large operators to vertically integrate to ensure security of supply.

(ii) Disincentives to invest in capital intensive projects: although renewable energy will lead to long term cost savings, there is evidence that energy efficiency receives little management attention within businesses, due to shorter term performance measurement and reward incentives, and that capital budgets are diverted towards output capacity, rather than reduction in costs via energy efficiency. There is therefore little short term incentive for businesses to invest in the sector. Landlords are similarly disincentivised from making capital investments in the energy performance of a building given that operating benefits accrue to tenants. The GIB may overcome this failure by demonstrating the long term savings that will accrue from initial capital injections. This would have the effect of overcoming a misperception by potential investors and their stakeholders that short term capital costs outweigh the medium to long term benefits of such an investment.

(iii) Risk aversion due to uncertainty in demand: as above, renewable heat projects require significant upfront capital.[7] These costs make the district heat business model particularly sensitive to volume (or off-take) risk which could potentially

---

[6] Drax Group plc (2012), 'Preliminary results for the year ended 31 December 2011', February 21st.

[7] A scheme of similar size to that in Vienna, serving over 270,000 people, may cost in the region of £1.5bn to construct and connect, in addition to any costs of the heat plant itself - Poyry (2009), 'The potential and costs of district heating networks', report prepared for the Department of Energy and Climate Change, April, p.43.

Deleted: 110712:2159

Deleted: 110712:1205

leave the asset under-utilised and stranded. Off-take risk inherent in district heating schemes may be sufficient to deter investment:[8]

> *In order to procure private sector investment, the revenue stream of the project will need to be secure as possible... Achieving a satisfactory base load demand will be risky if it relies upon securing commitments from a large number of private sector users (both residential and commercial) to switch from their current heating systems to a district heating network. With the exception of large new private sector developments, there will be high costs of marketing and substantial inertia to overcome.*

Commercial investment by the GIB in this sector would demonstrate that the projects are commercially viable based on current levels of demand. It would also demonstrate a strong UK Government commitment to the sector, which should encourage further investment by private sector investors.

(iv) A lack of information or imperfect information leading to risk aversion: some heat technologies (such as deep geothermal heat) are yet to be commercially deployed. Such technologies are likely to require additional commercial investment in the early stages of deployment, during which they are likely to be regarded as high risk due to their novelty and lack of commercial track record. In particular, renewable heat technologies which only produce heat intermittently and in a source that cannot be stored are perceived as "high risk".

1.15 The GIB could become involved in addressing market failures by supplying funds in circumstances which would tip the balance between a viable project proceeding and halting where financing is nearly in place but additional financing is sought. The GIB could additionally become involved in the supply chain; it could simultaneously invest in the supply of feedstock to help develop large and experienced creditworthy suppliers, and accelerate and help establish a track record in equipment supply and the downstream project developers involved in the various stages of the supply chain. Its involvement in this respect would allow alternative lenders to gain experience while freeriding on the GIB's sectoral experience. The GIB could then later withdraw, leaving the banks to provide a full service to the supply chain.

Quantification of market failures

1.16 Analysis by DECC estimates that £112 billion of investment may be required in the UK across heat and electricity sectors by 2020.[9] Oxera estimates that, if the £55-75 billion

---

[8] Poyry (2009), 'The potential and costs of district heating networks', report prepared for the Department of Energy and Climate Change, April, p.45.

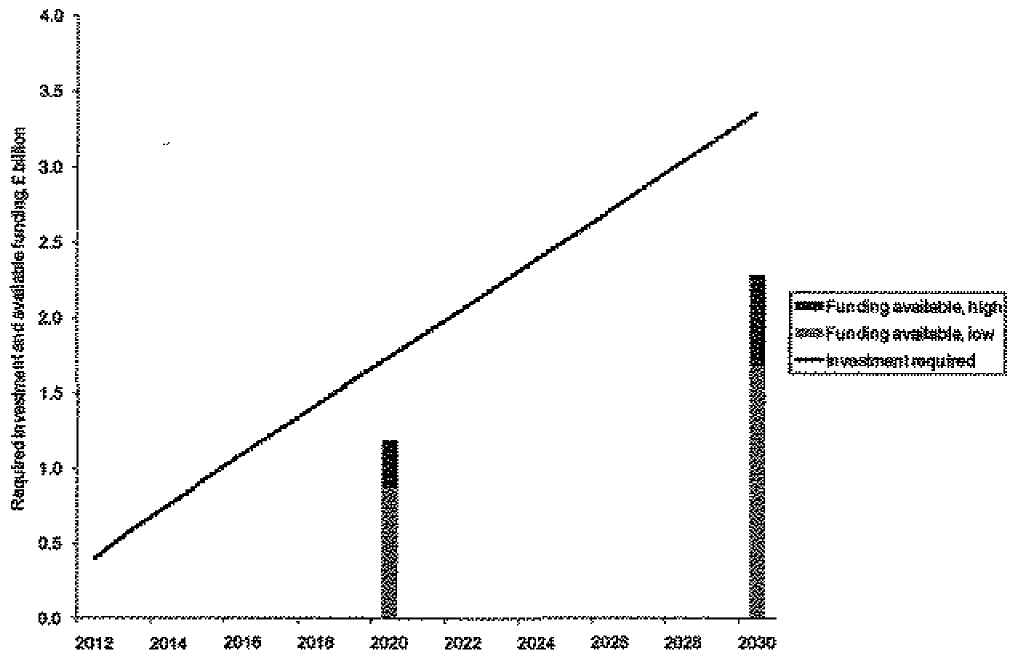
[9] Department of Energy and Climate Change (2011), 'Planning our electric future. A White Paper for secure, affordable and low-carbon electricity', July.

Deleted: 110712:2159

Deleted: 110712:1205

finance that may be available[10] were allocated across sectors in proportion to sector requirements, this would imply that the funding gap in the renewable heat (non-domestic) sector could lie in the range £0.6—0.9 billion by 2020, increasing to £1.1—1.7 billion by 2030, as set out at Figure 1.3, below.[11]

Figure 1.3
Funding gap in the renewable heat (non-domestic) sector (2011/12 prices)



Source: *Vivid Economics (2011), 'The Green Investment Bank: Policy and Finance Context', October, pp. 58-59 and Oxera analysis.*

Marine energy generation

Overview of marine energy sector

1.17 The main marine energy generation technologies are:

(i) wave power, which is generated by harnessing the energy produced as the wind passes the sea surface;

---

[10] Vivid Economics (2011), 'The Green Investment Bank: Policy and Finance Context', October, p.40.

[11] The domestic sector has not been considered because Vivid Economics states that the GIB is likely to finance non-domestic investments only. See Vivid Economics (2011), 'The Green Investment Bank: Policy and Finance Context', October, p.59.

Deleted: 110712:2159
Deleted: 110712:1205

(ii) tidal stream (shallow and deep) power, which uses the energy of water flows; and

(iii) tidal range (barrage) power, which extracts the energy produced by the changes in the height of the tide.

1.18 Vivid reports that, in 2010, there were 33 companies active in the UK marine energy sector:[12]

(i) There are a number of firms involved in the development of marine technologies in the UK including Acquamarine Power Ltd, Pelamis Wave Power Ltd, OpenHydro Sit Development Ltd, Atlantis Resources Corporation Pte Ltd, Neptune Renewable Energy Ltd and Marine Current Turbines Ltd;

(ii) Utilities involved in marine energy include SSE, Scottish Power (Iberdrola), E.ON, Npower, Statkraft, EDF and International power; and

(iii) Large technology suppliers include ABB, BAE Systems, Rolls Royce and Siemens.

1.19 Utilities and large technology providers have become increasingly involved in the wave and tidal stream sector over the last few years. Their involvement has caused a number of consortia to form and these consortia are taking low costs steps now to position themselves advantageously for future deployment opportunities, for example:

(i) Siemens is now the majority shareholder of MCT, one of the most advanced tidal companies in the UK. MCT has two pre-commercial tidal stream array projects (c.10MW capacity each) planned in the UK (Kyle Rhea in Scotland and Skerries in Wales) for which it is looking to raise the necessary finance. MCT has also secured a lease for a fully commercial 100MW tidal array in the Pentland Firth;

(ii) Rolls Royce owns TGL, which is one of the two suppliers of technologies planned to be used for the MeyGen project (which is financed by a consortium including International Power and Morgan Stanley). MeyGen has secured a lease for a 400MW tidal array in the Pentland Firth;

(iii) ABB and SSE are shareholders in Aquamarine Power. SSE has secured a lease for a 200MW wave farm using an aquamarine Oyster device in Orkney.

(iv) Vattenfall, E.On and Scottish Power are looking at developing wave projects using Pelamis device in the North of Scotland. Leases have been secured by E.on (100MW) and Scottish Power (50MW);

[12] Vivid I, pp. 57-58

Deleted: 110712:2159

Deleted: 110712:1205

(v) Alstom has 40% equity share in AWS Ocean Energy. It is working with SSE and has secured a lease for a 200MW wave project in Orkney;

(vi) Scottish Power Renewable are planning a pre-commercial (c.10MW) tidal array project in Islay although it is not yet known whether funding has been secured.

1.20 Although low cost investment is currently taking place in the sector, the UK Government believes that GIB investments would lead significantly to accelerated investment and a greater ability to meet renewable energy targets.

Scope of GIB's marine energy intervention

1.21 The GIB would invest in the development and operation of small arrays of the most promising and well progressed marine technologies. In particular, the UK Government intends that the GIB would invest in companies which develop complete marine energy devices, and marine energy projects at pre-commercial and the first true commercial scale. Pre-commercial projects would typically involve installing devices generating 5-10MW in the sea and generating a return through energy sales. The first commercial projects are likely to install 100-400MW.

1.22 In addition, it will be within the GIB's remit to invest in ancillary infrastructure and technology including:

(i) the development of vessels designed to handle marine energy devices: the UK Government considers that investment is required, particularly to support tidal stream devices. Existing vessels are not designed to operate in the extremely high energy tidal streams where tidal stream energy generation is most cost effective. Although GIB investment in developers and in early deployment projects will lead to private investment in vessels, the UK Government considers that GIB investment in the infrastructure would accelerate that process and lead to accelerated marine energy deployment; and

(ii) improving port and harbour facilities and increasing the capabilities of the existing marine renewable testing facilities (EMEC, WaveHub, NaREC, etc): The UK Government considers that such investments will support more rapid development of the sector. However, investment in ancillary infrastructure and technologies is lower priority than investing in marine energy projects.

Market failures affecting marine energy

1.23 A number of market failures, which affect the green sector generally, apply to marine energy:

(i) <u>A lack of information or imperfect information leading to risk aversion</u>: the novelty of the technology and a lack of data in relation to these new technologies (most are still only at a trial stage) have resulted in traditional lenders demonstrating very little interest in lending large amounts of capital. This is largely due to an inability to assess the probability and severity of downside risks. This has particularly affected small to medium sized

Deleted: 110712:2159
Deleted: 110712:1205

companies. With smaller companies having constrained or non-existent capital budgets, the sector has, for a number of years, therefore been reliant on grant aid for development. However, as the technology moves past demonstration phase, the UK Government believes that GIB investment will play an important role in demonstrating the commercialisation of such technologies, demonstrating the commercial viability of such projects, leading to further private sector investment.

(ii) High capital costs: high industry fragmentation has meant that lending into the sector in an effective manner is difficult for traditional lenders. Small projects have particularly little appeal to traditional investors due to high capital costs and limited short term returns. For example, as venture capital funds have a lifetime of around ten years, investments will not be long-term enough to realise profits on a typical wave or tidal stream project. Forecasts for at least the next few years indicate that marine energy production will lack scale and unit costs will remain high. Until technological advancements allow for wider projects, traditional lending is therefore unlikely to provide a suitable alternative to the GIB. Given that high capital costs will not be met by the limited finance anticipated to be made available by the private sector, it is clear that there will be scope for the GIB to provide additional commercial finance.

(iii) An historic lack of track record of consistent policies: the level of revenue support for marine energy generation is currently under review; support may be increased from 2 ROCs to 5 ROCs per MWh. Whilst the industry welcomes the potential increase in revenue funding support, there is a perception that, even if ROCs support is increased in 2013, the Government may drop revenue support back to a level equivalent to 2 ROCs in 2017 under EMR proposals. There is also a perceived concern that the Government may levelise revenue support for low carbon technologies before marine energy can achieve the cost reductions needed to compete with wind power. As large scale projects will take some time to come on stream, perceived uncertainties over future levels of support are a significant barrier to investment. For example, the Scottish Marine Energy Action Plan recognised that:[13]

> *A positive and timely outcome on EMR, at least comparable with existing Renewable Obligation provisions, is critical – UK Government needs to ensure by 2013 that EMR outcome continues to incentivise investment in marine and does not create a hiatus within the industry.*

(iv) High (perceived or real) transaction costs: The process for planning and consenting marine energy arrays is not clear as no arrays have yet gone through the process. There is therefore a market concern that conservation

---

13 [redacted]

Deleted: 110712:2159

Deleted: 110712:1205

bodies may require first movers to collect substantial environmental data (including the requirement to assess and monitor a very wide range of potential impacts), at high cost, until they are satisfied that they have identified which environmental variables are likely to be met.

(v) <u>Risk aversion due to technology uncertainty:</u> As marine energy is still relatively immature, very few designs have been in the water for long enough to develop a track record on performance. The few designs that have been in the water for longer periods (the SeaGen device in Strangford Loch has been deployed since 2008) are not perceived as similar enough to other designs to give potential investors comfort to provide sufficient investment. This lack of information means that investors perceive a risk that devices may fail or maintenance costs may be higher than expected. Furthermore, the scale of finance needed for small arrays (project costs of £40m-£80m) put these projects outside the scope of typical venture capital investors. For example, the Energy and Climate Change Select Committee commented that:[14]

> *The costs and risks involved with developing wave and tidal technologies are currently too high for private investment to bear alone. Governments can help to reduce the risk by agreeing to take on some of the costs involved, for example through the provision of capital grants or infrastructure such as testing sites. This approach has worked successfully in the past for marine renewables; trade body RenewableUK estimated that every £1 spent by the public sector on marine renewables leverages a further £6 of private sector investment.*

1.24 The 'Future of Marine Renewables in the UK' report states that the UK's grid connected capacity grew from 2.9MW in 2010 to 5.6MW in 2011, an increase of over 90 per cent.[15] It is anticipated that 2012 will see the grid connection of seven new devices at the European Marine Energy Centre ("**EMEC**") and the first deployment in Ramsey Sound (Wales). If it is anticipated that the latter will double grid connected capacity to reach a total capacity of over 11MW. However, these deployments have largely been supported by public sector grant funding. It is therefore clear that capital investment will accelerate the development and deployment of commercial scale marine energy arrays which will otherwise struggle to break through the initial more costly phase into larger scale commercially viable arrays. An investigation by the industry has suggested that future GIB investment will unlock both private sector investment and enable utilities to take an equity stake in projects.[16] Although the sector is currently experiencing significant

[14] 'The Future of Marine Renewables in the UK' (2012), para 20

[15] 'The Future of Marine Renewables in the UK' (2012), p. 10

[16] The Marine Energy Programme Finance Group - Why the Green Investment Bank should support the UK's wave & tidal energy

Deleted: 110712:2159

Deleted: 110712:1205

market failures leading to insufficiency of finance, it is clear that commercial investment can effectively address these failures.

Quantification of market failures

1.25 Marine energy technologies remain, in general, at an early stage in development and not yet commercially deployed. While the short-term contribution of marine technologies is likely to be limited, there is potential for it to make a significant contribution in the medium to long term (and in particular from 2030-2050).

1.26 As marine generation technology moves to commercial deployment, it will be crucial to attract sufficient initial commercial investment to demonstrate the viability of the technology as a commercial proposition. Development costs are relatively high; the deployment costs of a 5-10 MW farm are between £50 and £80 million. Total capital investment required to reach the scale up to 200-300 MW of generation by 2020[17] is therefore likely to exceed £1 billion.

1.27 Oxera analysis concluded that, if available finance were allocated across sectors in proportion to sector requirements, this would imply that the funding gap in the marine sector could equal the following:[18]

(i) Tidal range: The funding gap could lie in the range £0.6 to 1 billion by 2020, and in the range £3.9 to 6.2 billion by 2030 based on the assumption that 800 MW of capacity is required by 2020 if the UK is to remain on the path for meeting its 2050 carbon budgets. It also assumes that a further 3.6GW of capacity is required in the Severn estuary by 2030. Figure 1.4, below, sets out long term funding projections.

(ii) Wave power and tidal stream: The funding gap could lie in the range £0.7 to 1.1 billion by 2030 assuming that 4.8 GW of wave capacity and 9.4 GW of tidal stream capacity is required. Figure 1.5, below, sets out long term funding projections.

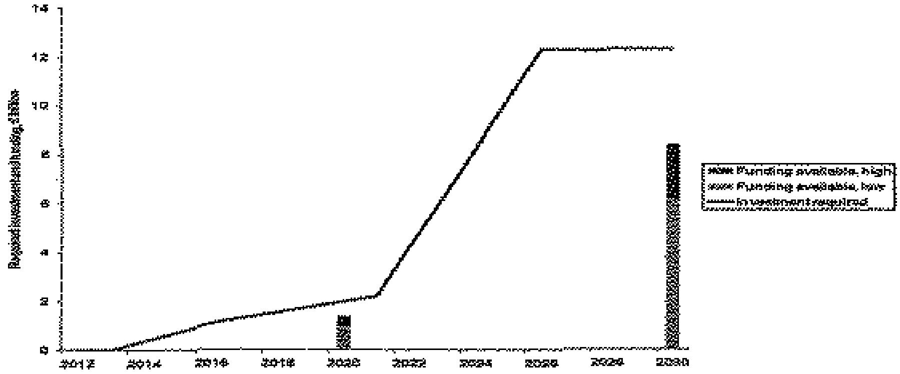
[17] DECC, *UK Renewable Energy Roadmap*, July 2011

[18] The investment requirements in the sector are based on the DECC 2050 Pathways Level 3 capacity scenario presented in Vivid Economics (2011), 'The Green Investment Bank: Policy and Finance Context', October, Annex.

Deleted: 110712:2169

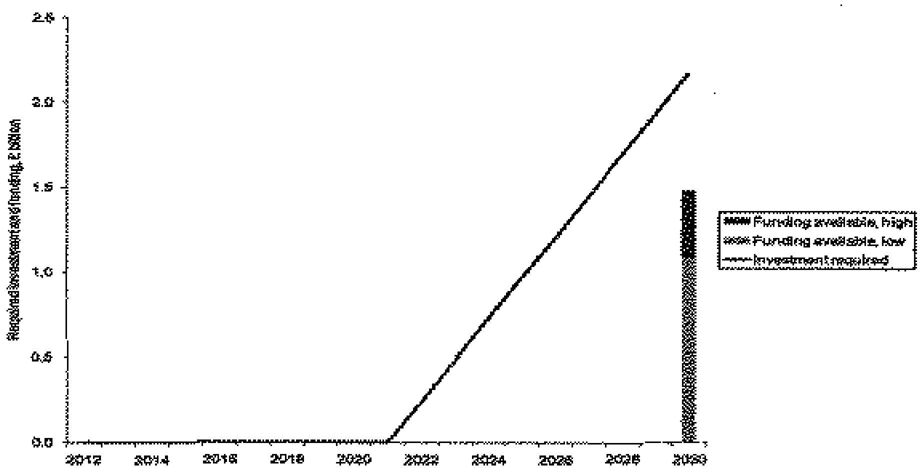
Deleted: 110712:1205

Figure 1.4
Funding gap in the tidal range sector (2011/12 prices)



Source: *Vivid Economics (2011), 'The Green Investment Bank: Policy and Finance Context', October, pp. 61-62 and Oxera analysis.*

Figure 1.5
Funding gap in the wave and tidal stream sectors (2011/12 prices)



Carbon Capture and Storage

Overview of CCS sector

1.28 CCS is a technology intended to prevent the release of large quantities of CO_2 into the atmosphere from fossil fuel use in power generation and other industries. The three main components of the CCS process include extracting carbon dioxide from a fuel or exhaust gas, transporting it to where it can be stored and pumping it into underground geologic storage facilities to securely store it away from the atmosphere.

Deleted: 110712:2159
Deleted: 110712:1205

1.29 A typical CCS supply chain will include the following key components and suppliers:

(a) CO_2 emitter: CCS is potentially suitable for any large combustion plants; typically either a power generator (i.e. coal or gas power station) or an industrial plant (i.e. cement, aluminium, steel plant production plant). Power generators which are investing in CCS development include companies such as Vattenfall, SSE, RWE NPower and E.On. Companies in the industrial sector who are investing in CCS include Tata Steel and Total (oil refining);

(b) CO_2 capture technology provider: The capture process is the most capital intensive CCS process, however, it may also offer the greatest opportunity for cost reduction through innovation. Technology developers understood to be active in this area include Alstom, Aker Clean Carbon, Doosan Power Systems and Mitsubishi Heavy Industry;

(c) CO_2 transportation/pipeline developer and operator: This portion of the supply chain is well understood. In 2009, there were 2,400km of pipelines transporting CO_2 to more than 70 EOR projects across the world.[19] Within the UK, the main developer is National Grid; and

(d) CO_2 injection and storage developer and operator: This process is also reasonably well understood with CO_2 having been pumped underground since the 1970s. Storage developers include Shell, Statoil, National Grid, and Petrofac.

Scope of GIB CCS intervention

1.30 The GIB's investments in CCS may include highly efficient combustion plants, CO_2 capture facilities, transport pipeline infrastructure, particularly "trunk" or "oversized" pipelines which would have capacity to transport CO_2 from multiple emitters, and/or injection and storage facilities. Installation of monitoring and measurement technology relating to the storage site would also be included in the GIB's investment remit.

Market failures affecting CCS

1.31 A complete CCS project is not currently commercially deployed in the UK. It is perceived as a novel, capital intensive sector, not because the technologies which it encompasses are individually new, but because their application and commercial packaging is new.[20] For example, it is not yet known how well the technologies will perform when attached to power stations and other large combustion plants, nor the

---

[19] [redacted]

[20] Vivid Economics, *The Economics of the Green Investment Bank: costs and benefits, rationale and value for money*, report prepared for the Department for Business, Innovation and Skills, August 2011, §3.12.1.

Deleted: 110712:2159

Deleted: 110712:1205

best way to structure commercial arrangements. Further, it is unclear how the three parts of the CCS process will fit within a single business model.[21] This novelty has the potential to constrain finance since all three parts must be in place for the project to operate and be commercially successful. Uncertainty around this issue and investors' lack of familiarity with these models may deter investment or lead to an over-pricing of the risk. CCS therefore suffers from the same difficulties as many other Green technologies, namely:

(i) Perception of high risk investment due to construction risk: CCS on power plants is 'at an early pre-commercial stage in its development'. Given that there has been no large-scale deployment of CCS, there is significant uncertainty associated with the costs of power plants with CCS.[22]

> *Since there is no commercial scale application of CCS on power generation plant anywhere, estimates of costs, build time and plant performance are based on small pilot plants, engineering studies and experience from comparable technologies.*

The UNEP/SEFI guide on financing of renewable energy states that initial and secondary rounds of venture capital funding are likely to be utilised (alongside public funding and R&D grants) in order to reach commercialisation, after which private equity and bank debt may become available. The term the 'valley of death' is often used to describe the difficulties of accessing commercial finance between the initial VC investment and demonstration; or from demonstration to commercial roll-out.[23] Oxera has advised that the difficulty in quantifying and pricing these risks causes problems in identifying investment payback periods and internal rates of return (IRR), and can result in finance providers being unwilling to invest. The number of stages within the CCS supply chain, and the associated technology risks within them, can exacerbate investor caution and require commercial lenders to require performance and credit guarantees across the supply chain that limit the number of potential suppliers.

(ii) A requirement for experienced commercial partners: A meeting between the UK Government and potential financiers in 2001 found that there was an interest in financing CCS, but the participants would need reassurance and clarity before making financing decisions. They expressed a preference to lend to projects which included oil majors, utilities and other large companies. This is because investors perceive that these companies would be more likely to have the capability to manage the risk associated with CCS. Similarly, a survey of 30

Comment [A21]: Should this be 2011?

Deleted: ;

Deleted: t

[21] CCS consists of three distinct processes which first extract carbon dioxide from a fuel or exhaust gas, then transport it to where it can be stored, and finally pump it into a secure geological storage facility.

[22] Mott MacDonald (2011), 'Costs of low-carbon generation technologies', May, Chapter 3, p.70.

[23] UNEP/SEFI/Bloomberg NEF/Chatham House (2010), 'Private financing of renewable energy – A guide for policymakers', January.

Deleted: 110712:2159

Deleted: 110712:1205

private sector capital providers operating in Europe carried out by the Climate Group and the Ecofin Research Foundation (ERF) on behalf of the Global CCS Institute highlights that debt would be provided only if certain prerequisites are met, including that major sponsors who have successfully managed large and complicated construction projects must be involved.[24]

Deleted: likely

IGCC power stations expressed the view that it was important that serious industrial players were involved to fix problems when things went wrong. They therefore placed a premium on the involvement of the oil majors, utilities and National Grid. They stated that they would need evidence that the engineering challenges were manageable at commercial scale, stability around the long-term structure of the energy market, a mature risk allocation position with big credible companies, a joint and several liability position that gave confidence that integration risk was well managed and confidence that the economics and longer term market opportunities existed for CCS and fossil fuel plant in the future. They perceived that large utility companies could provide such security. However, as set out at §[redacted] below, the GIB will have deep institutional knowledge and experience in green investments. Commercial funding by the GIB in the sector should, therefore, demonstrate that banks are able to build sufficient know-how to invest in the sector with confidence.

Deleted: ;

Deleted: t

Deleted: confidentially

(iii) Uncertainty around the operational performance of the assets: In the event of a technical failure, the CCS plant has no means of recouping the capital cost of the chain. Further, there is a risk that malfunctioning technologies may create liabilities for investors. For example, an operator of a transport system or storage site could incur new liabilities as a result of a failure in containment of CO_2. There is no cap on the potential costs if such a liability were to materialise. While a total CCS technological failure is unlikely, there is still considerable uncertainty over the levels of reliability and efficiency of a plant at commercial scale. In particular, there are considerable risks associated with the commissioning phase, where achievement of full operation levels could be delayed, or where it may be necessary to operate outside commercially viable parameters. GIB investment in early commercial projects will demonstrate that such risk is currently misperceived and consequently over-priced. Successful commercial ventures by the GIB will lead to greater confidence in the sector and have a multiplier effect on investment.

(iv) A lack of information from previous projects leading to an inability to quantify and price risks: The fact that an integrated, commercial-scale CCS chain has not yet been demonstrated means that projects are subject to high levels of risk, making it hard for projects to attract the necessary levels of investment. Currently, there is no mechanism in the electricity generating market through

---

[24] The Climate Group and Ecofin Research Foundation (2010), 'Carbon Capture and Storage: Mobilising Private Sector Finance'.

Deleted: 110712:2159

Deleted: 110712:1205

which additional costs (both capital and operational) associated with the operation of a full CCS chain can be recovered. As yet, the carbon price is not sufficiently high to mitigate these funding issues. The UK Government has therefore concluded that additional support is required to bring forward projects capable of delivering sufficient contribution to development in the sector.

(v) Balance sheet constraints: A number of potential investors are experiencing significant, long term balance sheet constraints. For example, despite initial high levels of interest in the UK's re-launched CCS competition, prospective projects are not yet at the stage of making final investment decisions, and one developer has pulled out citing difficulties in the ability to secure finance:

> *We cannot proceed with the significant risk that the current power station design and fuel mix could not be funded and built in the necessary timetable following the grant of consent.*[25]

The GIB may address this failure by providing funding on market terms. Such funding may temporarily replace funding from traditional, capital constrained, investors. However, in the longer term, it is envisaged that alternative intermediaries will be encouraged by GIB success to enter the sector.

1.32 Although in time, market failures ought to remedy themselves, the need for immediate investment to achieve the required scale-up and application of CCS means the UK cannot wait for this process to take place gradually as investors come forward over time.

Quantification of market failures

1.33 Forecasts by DECC and others assume CCS capacity in the UK could reach 20 GW by 2030 and 40 GW by 2050. These estimates suggest a low or mid-point estimate of 10 GW of capacity by 2030, requiring approximately seven commercial CCS coal and gas fired plants (dependent on size) to be constructed. Estimates also suggest that 38 plants will be required to reach the forecast capacity of 40 GW by 2050, as set out below:

[25] Ayrshire power press release (2012), 'Ayrshire Power puts power station with CCS on hold', June 26.

Deleted: 110712:2159
Deleted: 110712:1205

Table 1.1
Cumulative capacity of CCS installed according to scenarios presented by Poyry and DECC

Scenario	2021	2025	2030	2050
Poyry - Low[26]	2.6	4.5	10	-
Poyry - High[27]	2.6	6.5	20	-
DECC – Central Scenario[28]	-	-	10	40
Demonstrations only	1.7	1.7	1.7	-

Source: Poyry (2009), DECC (2010).

1.34 CCS projects are relatively capital intensive; the total estimated costs for a retrofit project of a relatively small plant, covering each of the three phases of retrofitting CCS are £1.3 billion. Assuming moderate cost reduction from learning, the capital requirement per 1GW plant will be approximately £1 billion. Reaching the 10 GW capacity targeted for 2030 will therefore require around £10 billion in investment capital.

1.35 ERF estimates that around EUR 5 billion would be available for funding commercial CCS across Europe within the current investment cycle. However, initial analysis undertaken prior to now-cancelled Demonstrator One project, suggested that if left purely to market forces (i.e. the EU ETS market price for carbon), commercial CCS projects would not be deployed until the 2040s.

1.36 There is some evidence that, whilst certain companies may be willing to finance small scale CCS pilots/specific component development, they are unwilling and unable to singularly finance commercial scale projects given the quantum involved – around £1.8 billion capital investment for a c300MW CCS project, not including subsequent operating costs.

Comment [vl22]: How was this number calculated and how does it tie in with the above analysis suggesting £1 bn cost for a 1 GW plant?

1.37 Even significant global operators would struggle to make sufficient investment in the sector; Oxera estimates that, to invest in a 500 MW project, a utility would need an asset base greater than EUR500 billion, which is available to only around four of the

[26] In the Low scenario the study by Poyry assumes that the size of individual projects grows from 1GW each to up to 1.5GW due to greater commercial viability and general growing confidence in CCS operations (Poyry, 2009, p. 25).

[27] The High scenario would require the construction of two 1 GW plants per year between 2021 and 2023, and two 1.5 GW plants per year between 2024 and 2027, of which Poyry assesses as only 'just plausible, especially when the 'dash for gas' delivered 2.8 GW per year of CCGT capacity at its peak' (Poyry, 2009, p.27).

[28] Supply and demand assumptions used to derive the capital expenditure requirements were provided by market consultant Nexant. Supply going forward has been assessed according to UK current capacities (including new Ensus and Vivergo pipeline projects), capacities under construction and plants due to come online (having been announced by financially strong sponsors) taking into account some reasonable operating assumptions to allow for construction time and ramp-up. Capital expenditure price assumptions were derived from the actual capital expenditure of the UK Vireol Bioethanol project whose construction will be starting in October 2012.

Deleted: 110712:2159

Deleted: 110712:1205

European Utilities. Alternatively, if investment in a 500MW project were carried out by a consortia of three developers, the asset base requirement would be approximately EUR 25 billion, which is held by a limited number of large utilities.

1.38 An insufficiency of funding in the sector is not unique to the UK: no operational commercial-scale CCS projects currently exist in Europe and all proposed projects, such as the ROAD project in Netherlands led by E.On, are seeking support from either or both of Government and European Commission sources.

Biofuels

Overview of Biofuels sector

1.39 Biofuels are any liquid or gaseous fuels obtained from vegetable or animal matter used in the transport sector. The most commonly used Biofuels are "Biodiesel" and "Bioethanol". Biodiesel can be produced from rapeseed, sunflower, palm oils, animal fat and waste oils. Bioethanol can be produced from corn, wheat, sugar beet and other crops (commonly known as feedstocks).

Comment [C23]: We use the term Biofuel as for transport only. This is consistent with the Renewable Energy Definitions

1.40 Biofuels use well known and relatively simple production processes and technologies which have been in place for over two decades of utilisation. Biodiesel and Bioethanol produce between 50-95% and 10-100% less CO_2 respectively than their respective mineral fuel equivalents, depending on blends. Both are blended with fossil fuels:

(i) European Bioethanol is most commonly blended with gasoline in a proportion between 2% to 5% (E98-E95 on account of the gasoline component being between 95% and 98%) as an oxygenate additive (octane enhancer). Bioethanol can be blended with gasoline to create E10 or higher Bioethanol blends. However, blends above E10 (more than 10% Bioethanol) require modified car engines and infrastructure (fuel pumps).

(ii) Biodiesel can be used alone or mixed in any ratio with fossil diesel. If the blend contains less than 20% Biodiesel (i.e. at least 80% fossil diesel) then it can be used to fuel a standard diesel engine without the need for any modification.

1.41 The adoption of a Directive in 2003 set up guidelines for adopting Biofuels in all transport fuels used in the EU. These targets - a 2% inclusion rate by the start of 2006 and 5.75% by 2011 - were voluntary. More recently, as noted in §**Error! Reference source not found.**, the adoption of the Renewable Energy Directive ("**RED**") in 2009 replaced aspirational targets with a mandated commitment for at least 10 percent share of transport fuels to be renewable transport fuels by 2020.

[redacted] The introduction of increased EU import tariffs, a removal of tax subsidies for US exports and burgeoning domestic demand has created an opportunity to significantly decrease the volume of imports flowing into the EU and create a self-sustainable market opportunity in the EU and UK. The involvement of the GIB in the UK Bioethanol market would stimulate investors' interest in the sector which is seen as essential to meet the forecasted capital expenditure requirements for the UK market to be self sufficient over the period to 2020.

Deleted: 110712:2159

Deleted: 110712:1205

1.43 In terms of production:

(i) Biodiesel is made through a chemical process whereby the glycerine is separated from the fat or vegetable oil through a chemical reaction using methanol as a catalyst. For biodiesel the process starts with the crushing of rapeseed (or other oilseeds) to extract the oil. Subsequently the oil is refined and transformed into biodiesel via a process called transesterification. The by-product from the oil extraction process is rapeseed meal, primarily used in animal feed. During the transesterification process, the glycerine alcohol in the oil is replaced by methanol in order to decrease the viscosity of the fuel. Biodiesel can be distributed in various forms either through truck fleets, independent petrol stations or through oil companies' distribution network.

Deleted: called transesterification

(ii) Bioethanol is produced by fermentation and distillation of starch crops. The production process for ethanol comprises 3 steps: fermentation (transforming sugars to alcohol), distillation (concentrating the alcohol to 45% by removing water) and rectification (transforming the alcohol to pure alcohol and removing any remaining water and other impurities). Specific pre-treatment may be required for extracting the sugars from certain raw materials, in the case of starchy crops like maize and wheat, an enzyme is required to transform the starch into glucose. Sugar rich crops like sugar cane and beet are treated to produce a sugar reach fluent that can be further concentrated

1.44 Both types of Biofuels are produced at refineries dedicated to the production of either Biodiesel or Bioethanol. However, technology specificity to feedstock-input is considered low; current Biofuel refineries are largely designed to run interchangeably on a variety of feedstocks (i.e. all oils and seeds) and the choice of feedstock is mainly based on price/cost.

1.45 Refineries typically utilise unused "brownfield" sites and comprise a main central processing area and smaller satellite areas to provide Biofuel storage and road tanker loading facilities. The sites are typically joined by interconnecting pipelines and cables. Further pipelines are required to connect the site to necessary utilities such as gas, electricity and water. As an illustration, the main functions in the main process area of a Bioethanol refinery typically include: wheat unloading and storage; wheat milling; an ethanol processing area (comprising liquefaction, fermentation, distillation, dehydration, evaporation and DDGS drying, pelletising and storage).

1.46 Biofuel plants have an average capacity of 150 million litres p.a., although they range in size between 50-400 million litres p.a.. Average construction costs are in the range of c. £0.65-0.75/litre, resulting in a construction cost of between £97.5 million and £112.5 million for an average capacity plant. The average construction period is one and a half to two years and a Biofuel plant has an average asset life of between 20 and 25 years.

Deleted: between

Scope of GIB intervention in Biofuels

1.47 The scope of the GIB's commercial investments in Biofuels will cover both Biodiesel and Bioethanol. In terms of infrastructure, the GIB's scope will be limited to Biofuel refineries projects and not ancillary infrastructure such as Biofuels distribution (to filling

Comment [c24]: Has DfT had an input into this? If not I strongly advise that you get DfT's sign off before this is final

Deleted: 110712:2159

Deleted: 110712:1205

stations etc). It is not intended that the GIB will make investments in second Generation Biofuels that are being developed to run on cheaper and more abundant feedstocks such as cellulose. These technologies are still very much in development.

Market failures affecting Biofuels

1.48 There are a number of market failures that affect the production (and therefore use) of Biofuels in the UK:

(i) Limited balance sheet capacity by traditional investors: traditionally, development and construction of large scale power facilities in Europe has largely been financed either by utilities, using internal and external sources, or by independent power project developers providing equity and securing long term financing from banks and insurance companies. Biofuel projects have high capital intensity and independent power producers and utility companies are no longer able to raise significant amounts of capital due to the credit rating constraints on their balance sheets.

The combined effect of the limited finance available from both commercial lenders and industrial players has seen biofuels projects struggle to obtain financing. By way of example, a mid-sized project in the UK known to the Department for Business which benefits from conservative gearing and ECA backed commercial and political risk insurance for a substantial portion of the senior debt funding requirement is currently having difficulty gaining traction in the market.

(ii) Perceived risks around scale-up of technology to meet increased demand: Despite the relatively well proven underlying technology, scaling up the technological solutions to meet the levels of production required by the RED has resulted in increased production costs and other significant operational challenges. For example, the Ensus bioethanol plant opened in Teesside in March 2010 closed in May 2011 – albeit temporarily – with its operator citing difficult market conditions (the plant remains closed as at July 2012 but is set to reopen in the near future). This, coupled with historical losses incurred by Biofuel refineries, has led to investor caution, with only a limited number of investors understanding the risks to the extent that they are prepared to invest in Biofuel refinery projects.

(iii) Risk aversion due to concerns around security of fuel supply: A number of investors are deterred by uncertainty of supply of feedstocks. There is a reduced number of large international and a large number of small local feedstock suppliers. The former provide short-term, volume and price fixed contracts but long-term fully fixed contracts are not common. Particularly in the case of bioethanol, as the vast majority of feedstocks are imported into the UK, even if long-term supply arrangements can be secured, these remain subject to the risk of exchange rate fluctuations.

Comment [c25]: This surprises me because there are a some are near commercial and I would have expected GIB to play a role in derisking these sorts of projects in the same way as is set out in the biomass power section for gasification and pyrolysis (as some of them will basically be the same technologies).

It also seems inconsistent with your willingness to support marine and CCS technologies, which are much further away from commercial reality than some advanced biofuel technologies.

As part of the biomass strategy we have clearly identified that these technologies are key meeting our greenhouse gas reduction targets, and we have an ambitious research programme in train to bring these technologies to commercial reality.

I really think this needs more consideration.

Comment [c26]: I suggest you check with DfT whether they agree with this.

Deleted: 110712:2159

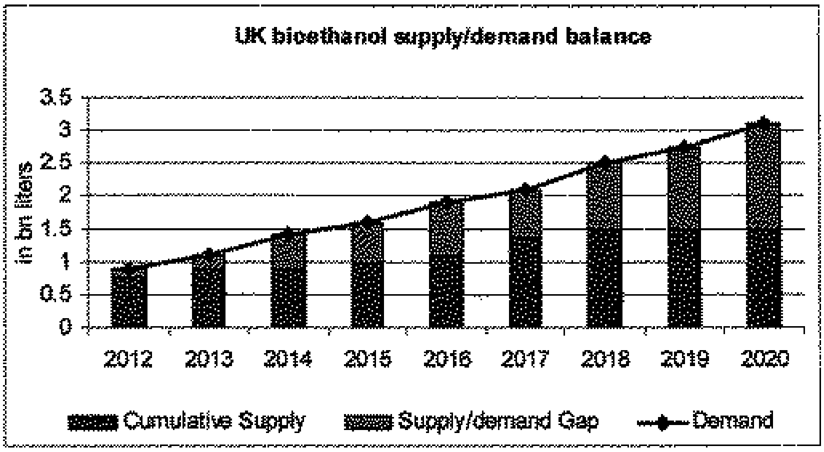
Deleted: 110712:1205

Quantification of market failures

1.49 The UK does not currently produce enough Bioethanol to meet present demands and imports nearly all of its Bioethanol needs. Absent GIB intervention, over the period to 2020 this situation is only likely to become more pronounced; there have not been any new UK plant announcements made due to difficulties in obtaining sufficient finance and, at the same time, demand, driven by the EU 2020 mandate, will continue to increase.

1.50 The following chart illustrates the possible UK Bioethanol supply/demand gap over the period to 2020. It shows that UK would need to invest approximately an additional £5 billion by 2020 in Bioethanol to make up the gap between anticipated supply and demand to be self sufficient. This is therefore the finance gap that would otherwise occur without additional stimulation of investment by the GIB.[29]

1.51 [redacted]



[29] Specifically Articles 308 and 309 TFEU

Deleted: 110712:2159

Deleted: 110712:1205

Page 2: [1] Comment [c7] **chalter** **11/07/2012 22:01:00**

(confidential until the release of the banding review) I wanted to make you aware that we intend to cap the amount of dedicated biomass coming forward. It should not affect any of the projects you have cited, as we intend to allow these to go through. The reason for the cap is to preferentially support more cost effective carbon savings (such as co-firing and conversions).

Page 2: [2] Comment [c8] **chalter** **11/07/2012 22:02:00**

This statement is true if mean of the dedicated biomass plants expected to come through, most capacity will be provided by larger plants. Co-firing and biomass conversions are expected to be the largest contributor of biomass renewable electricity.

Page 2: [3] Comment [c12] **chalter** **11/07/2012 16:19:00**

If you want to mention any independent companies you could mention Eco2 who are building a 40MW CHP plant.

Page 2: [4] Comment [c13] **chalter** **11/07/2012 16:09:00**

These processes are exothermic, and can produce heat and power, as well as a fuel that could be used for energy or as a feedstock for the chemicals industry.

8

[redacted]

From: [redacted]
Sent: 13 July 2012 12:42
To: [redacted]
Subject: TRIM: RE: Relative cost of a biomass boiler

Attachments: BIOMASS_AUG2010.pdf
TRIM Dataset: M1
TRIM Record Number: D13/313811
TRIM Record URI: 13967221

BIOMASS_AUG2010.pdf (245 KB)

[redacted]

I have emailed the heat team about your quote, as I assume it comes from the heat sector. I have asked for a response by the end of today.

[redacted] think I have found the reference re: Morgan Stanley:

European Utilities; Biomass: Right technology, wrong economics?; Morgan Stanley Research Group, August 24, 2010; Found on p6.

I googled it but didn't get a direct web link, I only had the option to download it straight from google.

[redacted]

From: [redacted]
Sent: 13 July 2012 12:15
To: [redacted]
Subject: FW: Relative cost of a biomass boiler

[redacted]

Sorry to further burden you but in addition to that query about details of the Morgan Stanley report reference re biomass fuel, would you also able to address the question below re costs of a biomass boiler being 3 times as much as a traditional gas boiler? Graham is out of the office and in any case thought the information may have been sourced by you from the economists team.

Many thanks

[redacted]
GIB Team ShEx
[redacted]

From: [redacted]
Sent: 13 July 2012 12:00
To: [redacted]
Subject: Relative cost of a biomass boiler

[redacted]

In our state aid notification text, we include the following statement:

> "whilst a traditional industrial gas boiler may cost £300,000 per MW, a biomass boiler with associated fuel handling and storage could cost up to 3 times as much."

Not sure quite where it came from originally, but could you provide a source for the statement to support it? With apologies, we need to finalise this text today.

[redacted]
GIB Team ShEx
[redacted]

Morgan Stanley

MORGAN STANLEY RESEARCH
EUROPE

Morgan Stanley & Co. International plc
Nicholas J Ashworth, CFA
Nicholas.Ashworth@morganstanley.com
+44 (0)20 7425 7720
Bobby Chada
Emmanuel Turpin
Antonella Bianchessi
Sean Lee
Igor Kuzmin
Arsalan Obaidullah
Carolina Dores

August 24, 2010

Industry View
Cautious

European Utilities

Biomass: Right technology, wrong economics?

Primer

We look at biomass generation in detail across Europe – who is doing it, what subsidies are on offer, and why it is not wholly economic at present.

Catch-22. Until potential biomass suppliers and power generators see a fixed, long-term commitment from policy makers, the industry will have difficulty achieving economies-of-scale synergies; at the same time, until biomass proves itself as a cost-competitive alternative to conventional fossil fuels, policy makers will remain reluctant to commit more funds.

A lot of biomass generation remains uneconomic: In many European markets it is often cheaper today to burn coal and pay for carbon allowances than it is to burn biomass. In some countries it is economic to co-fire biomass with coal, but it is broadly uneconomic to build a dedicated plant in most. Without better subsidies (or in some cases stronger power markets), biomass will remain an underused resource.

Biomass does offer many positives as a renewable source of power: It is reliable — this is critical for economies building lots of wind power. It should tick the security-of-supply box, which is becoming an increasingly important theme. And potentially (a long way) in the future, it could be fitted with CCS to remove CO_2 from the atmosphere, creating negative emissions to offset parts of the economy where it will be uneconomic to do so.

But equally a number of challenges: Biomass has a fuel element other renewables do not have, and requires subsidy for this as well as capital costs to be able to compete with thermal generation. Longer term, there is a question mark over the sustainability of biomass crops for generation, developing a viable supply chain, and whether the land used could be put to better uses.

Sources of biomass

Energy crops	Non-energy crops
Short rotation coppice (SRC) willow	By-products from agriculture: straw, oat husks etc
Miscanthus grass	By-products from food production: cocoa shells, olive cake etc
Canary grass	Other industrial & commercial residues
Switch grass	Forest & forestry residues: tree tops, branches, bark etc
Eucalyptus	Wood waste & forest wood fuel
	Sewage sludge

Source: Morgan Stanley Research

Biomass: The Pros and Cons

PROS	CONS
Cost effective amongst RES peers	Not yet cost competitive
Reliable power generation	Remains to be proven on a larger scale
Proven technology	Underdeveloped technology
Potential for substantial cost reductions	High supply costs subject to volatility; remains difficult to hedge
Great scope for improvements in supply chain	Logistically challenged supply chain infrastructure
A source of clean energy	Sustainability issues with supply chains
Potential for build-up of domestic supply	Competing land uses and limited availability of land
Scope for effective sourcing of supplies from abroad	Import dependency: sustainability issues and FX exposure
EU Biomass Action Plan and national subsidy frameworks	Most subsidies still not sufficient to incentivise further scale-up
Scope for economies of scale	National subsidies skewed towards small-scale biomass capacity
Abundant source with many potential applications	Potential distortion of market prices for raw materials
Attractive market growth potential	Remains small-scale due to logistics and difficulty of securing stable supplies

Source: Morgan Stanley Research

The potential of biomass

Biomass generation has made a lot of headlines in the sector in recent times. Many utilities across Europe are burning biomass in many different countries. This primer looks at what biomass is and the way it can be burned to generate electricity. It examines the subsidies on offer in different EU countries, and the companies that have embarked on this type of generation.

Biomass is a renewable energy source...
Biomass generation is deemed renewable generation given its closed carbon cycle (see Exhibit 1). And like other renewable technologies, it is not cost competitive with thermal generation without subsidies. Many European countries provide a subsidy for biomass generation, either through a form of green certificate, or a more direct feed in tariff.

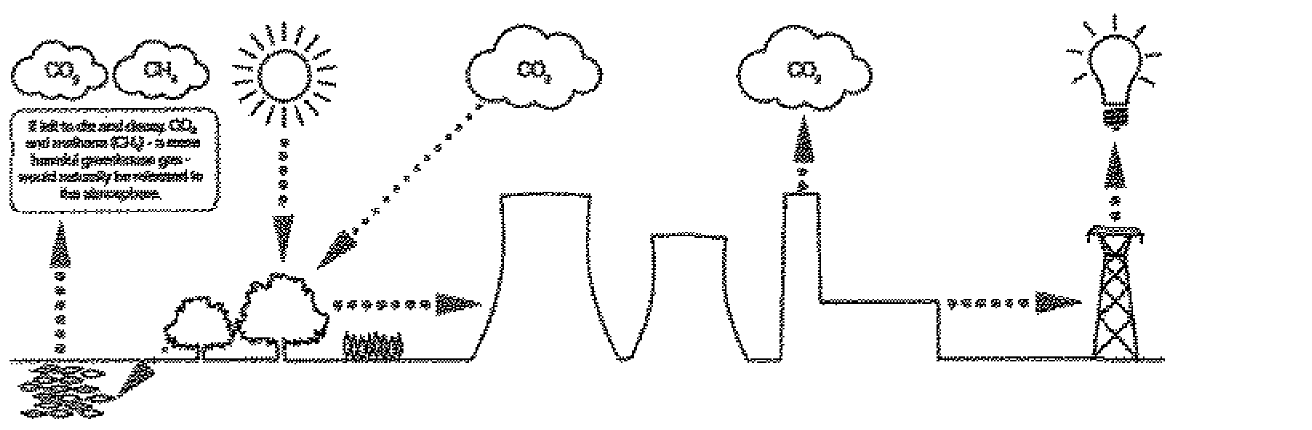
...but has a cost of fuel, unlike most
However unlike many other renewable sources that require subsidies to cover the high cost of capital expenditure up front with little O&M (operational and maintenance) costs, biomass presents a different challenge with relatively high levels of capital cost for new dedicated biomass plants (although not necessarily for co-firing alongside coal), as well as a high fuel cost relative to thermal generation. The challenge is to set a subsidy that covers enough of the fuel cost to help it be competitive with other thermal generation, without being so generous that governments create a windfall.

Big advantage – it is reliable
One big positive that biomass has in its favour is its reliability. It can be despatched when necessary, and importantly at times of high demand, unlike wind, for example, where during peak demand, it can only be hoped that the wind will blow.

Biomass could help lower CO_2 emissions in the long term
It also has the potential in the very long run to provide a negative carbon offset against carbon emissions elsewhere in the economy. If governments are serious about targeting economies with very low carbon levels in 2050, then negative emissions will be very important to offset areas where reductions to zero are hard to achieve (certain forms of transport, for example). Given the biomass cycle is carbon neutral (the carbon it gives off when burned is offset by the carbon the material takes in whilst growing), CCS (carbon capture and storage) technology, when fitted to a biomass station, has the potential to remove carbon from the cycle. However CCS technology is still in its infancy, and is a long way from being demonstrated on an industrial scale.

Supply chain remains a risk area
One risk area remains the supply chain infrastructure. The land requirement for biomass could be large, and generators and producers need to work together to overcome supply hurdles. An industry report addressing the opportunities and economics of biomass concluded that there is a potential of 15-40% upside in terms of cost reductions and efficiency gains throughout the supply chain (European Climate Foundation, Södra, Sveaskog & Vattenfall (2010): Biomass for Heat and Power). In such a scenario, biomass would become increasingly cost-competitive with conventional fossil fuel.

Exhibit 1
The Biomass cycle is carbon neutral, so could be used to remove carbon with CCS further down the line



Source: Drax, 'Biomass: the fourth energy source'

BIOMASS: WHAT YOU NEED TO KNOW / GLOSSARY

1. **RES = Renewable Energy Source**, of which biomass is one sort, along with wind / solar etc.

2. Biomass feedstock can be termed **energy or non-energy crop**, depending on whether it has been grown specifically for the use in power generation or not.

3. Biomass generation has a carbon neutral cycle, and is **deemed renewable energy**. A subsidy is earned for burning it.

4. Biomass however is different from most other renewables in that there is a large **fuel cost element**.

5. A **dedicated biomass plant** is one that will run solely on biomass material.

6. **Co-firing biomass** involves burning biomass alongside coal in the boiler, and has lower capital cost. Not every country in Europe differentiates subsidies between dedicated biomass burn and co-firing, with exceptions being UK and the Netherlands.

7. Biomass generation **receives subsidies** from many EU countries, either in a green certificate form to subsidise the underlying power price revenue, or FIT.

8. **FIT = Feed-in-Tariff**, a guaranteed stream of revenue per unit of electricity produced.

9. **ROC = Renewable Obligation Certificate**, the subsidy earned by renewable power generators in the UK.

10. **Supply chain matters**. The land needed to grow biomass material could be large indeed – and there needs to be a consideration of the cost of substituting land that could be put to other uses.

11. **CCS = Carbon Capture and Storage**, technology in its infancy that could be used to *capture carbon emissions from* power stations and store it underground at some point in the future.

12. **Conclusion:** Biomass burn as a technology to produce electricity is proven, and is also (importantly) reliable – it can be turned on when demand is high. But it requires subsidy, and therefore the support of government. In that respect it needs to be able to compete with other technologies, and so the outlook for biomass remains a little uncertain.

Exhibit 2

Biomass: The Pros and Cons

PROS	CONS
Cost-effective amongst RES peers	Not yet cost-competitive
Reliable power generation	Remains to be proven on a larger scale
Proven technology	Underdeveloped technology
Potential for substantial cost reductions	High supply costs subject to volatility: remains difficult to hedge
Great scope for improvements in supply chain	Logistically challenged supply chain infrastructure
A source of clean energy	Sustainability issues with supply decisions
Potential for build-up of domestic supply	Competing land uses and limited availability of land
Scope for effective sourcing of supplies from abroad	Import-dependency: sustainability issues and FX exposure
EU Biomass Action Plan and national subsidy frameworks	Most subsidies still not sufficient to incentivise further scale-up
Scope for economies of scale	National subsidies skewed towards small-scale biomass capacity
Abundant source with many potential applications	Potential distortion of market prices for raw materials
Attractive market growth potential	Remains small-scale due to logistics and difficulty of securing stable supplies
National advantages in terms of access to supplies	No integrated market coordinating prices of supplies: prices vary depending on region and type of biomass

Source: Company data, Morgan Stanley Research

There is great scope for significant improvements in the supply chain infrastructure as well as in the conversion technologies as the use of biomass is still at an early stage. The potential offered in terms of mitigating CO_2 emissions will become ever more important in light of the European economic recovery. The expected increase in the price of carbon and decrease in free carbon allowances will improve the competitive cost-benefit balance between RES and conventional fossil fuels.

Biomass is attracting government interest

Despite its higher fuel costs and lower energy content, biomass has attracted much interest from policy makers. In 2005, the European Commission formulated a Biomass Action Plan, encouraging member states to devise national biomass action plans. The goal was to reduce perceived risks associated with the sourcing and burning of biomass for power generation.

Whilst there is much to be very positive about with biomass generation, there still remains much risk, with the industry at a relatively early stage. It will require continued government support in the years ahead, there remains technology risk as well, and whether another "better" renewable technology can come along and usurp its place.

We kindly acknowledge the contribution of Anna Frogner to this report

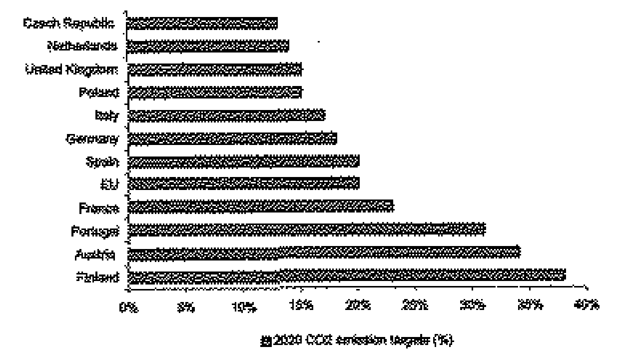
Biomass: Right technology, wrong economics?

Setting the scene on renewable generation

The EU debate: CO_2 emission targets
European ministers have recently proposed a toughening of the EU's greenhouse gas emissions target to ensure that it remains at the forefront towards a sustainable low-carbon future. The proposed target of a 30% reduction in emissions by 2020 from 1990 levels would replace the current target of 20%. The aim is to incentivise further innovations and investments in renewable energy sources (RES) while creating more certainty for potential investors and reducing import dependency of fossil fuels.

As part of the EU 2020 targets, each member state is required to present a National Renewable Energy Action Plan. Each plan sets out a national emission target and the strategy to fulfil this. Exhibit 3 provides an overview of selected national emission targets.

Exhibit 3
The current 2020 national emission target reductions from selected member states



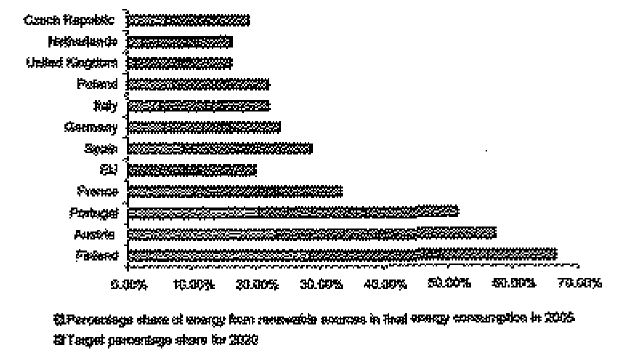
Source: Morgan Stanley Research

Changing the generation mix
RES should represent a targeted 20% of the EU's total energy consumption in 2020. Exhibit 4 includes the national targeted percentage share of RES for selected member states by 2020 compared to 2005 levels.

To reach the overall EU target of 20%, a 33% share of RES in the electricity sector by 2020 is necessary. It is estimated that the EU will obtain a 19% RES share of electricity in 2010, failing to meet its stated target of 21% (European Union Committee, COM 192 (2009): Report on progress in renewable energy).

Increasing the RES share in the EU electricity sector from 19% to 33% over the next 10 years will demand substantial changes to the existing generation mix. Many of the RES technologies, however, are costly and remain largely unproven on a greater scale of clean energy production. Increasing the generation of cleaner energy thus requires favourable policy frameworks and subsidy schemes. The EU emphasises the need to develop all types of RES. In recent years, focus has turned increasingly towards the potential of biomass, which represents an abundant, yet largely untapped energy source.

Exhibit 4
The RES share of total energy consumption in selected member states compared to their 2020 national targets



Source: Morgan Stanley Research

The Crop: What is biomass?

Biomass is biological material derived from plant or animal matter. It represents a renewable and potentially sustainable energy source capable of producing electricity, heat and fuel. When burned, it emits CO_2. Nonetheless, it is characterised as a source of clean power generation. This is because biomass from plant material is part of a carbon neutralising cycle: the carbon it captures during its growth offsets the carbon it emits when burned (see Exhibit 1).

It is highly diverse. Overall, two main categories of biomass crops exist: energy and non-energy. Energy crops are grown specifically for their purpose as biomass fuel. Non-energy crops, on the other hand, represent everything from agricultural by-products to sewage sludge. Exhibit 5 highlights examples of both categories. In certain countries generators are awarded different subsidies for burning energy crops over non-energy crops given that energy crops tend to be more expensive.

Exhibit 5
Sources of biomass

Energy crops	Non-energy crops
Short rotation coppice (SRC) willow	By-products from agriculture: straw, oat husks etc.
Miscanthus grass	By-products from food production: cocoa shells, olive cake etc.
Canary grass	Other industrial & commercial residues
Switch grass	Forest & forestry residues: tree tops, branches, bark etc.
Eucalyptus	Wood waste & forest wood fuel
	Sewage sludge

Source: Morgan Stanley Research

Energy crops

Due to the wide range of types of biomass, there are considerable differences in price and quality. Typically, energy crops are more expensive than the non-energy crops. Energy crops carry more risk for growers as they have limited alternative uses. It has proved difficult for many power generators looking into biomass to convince local farmers of the economic potential and feasibility in initiating production of biomass energy crops.

Wide range of calorific value...

On average, biomass has an energy content, calorific value, of 18 Gigajoule per oven-dried tonne (odt) — 72% that of coal (see Exhibit 6). Thus, 1.39 times more biomass than coal is required to generate the same amount of electricity. The energy content of biomass ranges from around 10 to 22 Gigajoule per tonne. This wide range is due to differences in moisture content. For instance, when energy crops are initially harvested their energy content is low (approximately 10 GJ/t) due to their high moisture content. Once dried, however, their energy content rises significantly (to approximately 18 GJ/odt).

Exhibit 6
Energy content: coal compared to biomass

Coal (GJ/t)	25
High moisture content biomass (GJ/t)	10
Dry biomass (GJ/odt)	18

Source: UK Biomass Strategy 2007 Working Paper', Morgan Stanley Research

...with potential for significant land area needed

Significant amounts of biomass are therefore needed to generate the same amount of electricity as coal. To put this in to context, we use here Drax's long-term view of converting its coal station in to a biomass plant. It has announced an aspiration for a potential conversion in the very long term of its 3960MW coal-fired plant into a dedicated biomass plant, with a potential capacity of around 2400MW (each 660MW coal unit to a corresponding 400-500MW biomass unit). Exhibit 7 provides an estimate of the amount of supplies — and hence the amount of farmland needed — if this were to happen. If Drax were to source the biomass crops domestically, it could potentially require farmland amounting to 3.44% of the total UK area — assuming the plant fires energy crops as biomass fuel. To put this number into perspective, a 2006 report from the European Environment Agency estimated that the available farmland for biomass in the UK could be as much as 3.00% of the total UK area in 2010. This highlights the prevailing concerns over how to establish a stable and cost-effective biomass supply chain. Moreover, the availability of land affects the extent to which biomass can be sourced domestically versus a scenario of high import-dependency. (EEA Report no. 7 (2006): How much bioenergy can Europe produce without harming the environment?).

But whilst the area needed for crops will indeed be large if biomass becomes a prominent source of power supply, there have been studies to show that on a global scale there is a large sustainable supply. The Swedish University of Agricultural Sciences puts the current global sustainably managed bioenergy supply at 270bnGJ, equivalent to generating 27,000TWh of electricity. To put this in to context, this equates to c.45x the entire annual power output generated in Germany.

Exhibit 7
Biomass supplies — and amount of land needed to grow these to fuel a 2,400MW power plant

Plant capacity (MW)	2,400
Average load factor (%)	80
Electricity generated (TWh)	16.8
Plant efficiency (%)	40
Energy content of yearly supply (TWh)	42.048
- in GJ	151,372,800
Energy content of biomass (GJ/odt)	18
Required amount of biomass (t)	8,409,600
Typical crop yield (odt/ha/yr)	10
Hectares of land needed for production of biomass crops	840,960
- in square miles	3,247
Expressed as percentage of total UK area (%)	3.44

Source: Morgan Stanley Research

Non-energy crops

A feasible alternative to energy crops is the use of non-energy crops. At a cost-level of about 2-3 times the price of coal, non-energy crops are considerably less expensive than the 3-4 times premium of energy crops over the cost of coal. However, even though non-energy biomass crops, in general, require less land, there are significant challenges in terms of sourcing.

Non-energy crops offer great potential as biomass fuel as they most often represent cheap biodegradable wastes and residues. The problem is the lack of links throughout the supply chain that would enable the capturing of these. For instance, in many countries agricultural residues are simply burnt on the fields, bypassing the opportunity to use them as fuel to generate power. Setting up the facilities to capitalise on this potential requires significant investment and coordination.

It is unusual, still, for biomass generators to set up a fully integrated supply chain. However RWE is one company making headway here, with a pellet-making factory it is developing in the US state of Georgia. This is helping to drive it to its target of co-firing 5TWh by 2020, up from the 1.7TWh it delivered in 2009.

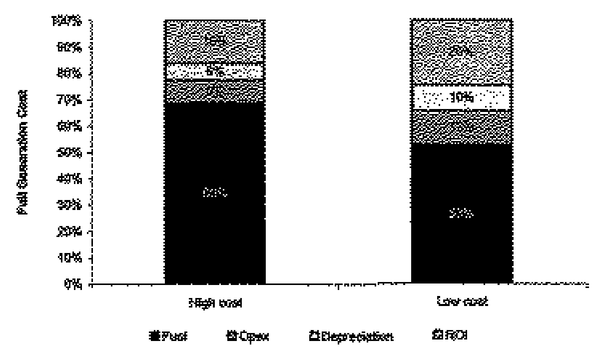
But the problem of managing the sourcing of supplies and incentivising others to take part in the supply chain remains for most players in the market. Non-energy crops often vary much more in terms of quality and energy content than energy crops, which also provides issues to resolve. For instance, if a generator decided to burn biodegradable sewage sludge, instead of dry energy crops, it would need almost double the amount of supplies (amounting to approximately 14 million tons sewage sludge a year in the example shown in exhibit 7). This is because the average energy content of sewage sludge is much lower (around 11 GJ/t).

Supply chain needs

Biomass feedstock currently accounts for 50-75% of the full generation costs on a per MWh basis. This large proportional spread is due to significant differences in costs of biomass supplies. Since there is currently no stable supply chain set up, biomass prices remain exposed to seasonality, location and availability of supplies. There is no central, stabilised market equalising supply and demand with similar prices across regions, such as there is for coal and gas. As a result, assessing future costs of biomass supplies continues to pose problems. Likewise, it is difficult for potential biomass power generators effectively to hedge their position in terms of supply costs.

Exhibit 8

Fuel costs dominates full generation cost



Source: Morgan Stanley Research   High/Low cost = biomass at 4/2x cost of coal 2011 cost

Another issue concerns the sourcing of biomass supplies. Many of the European member states currently lack the supply chain infrastructure needed to gather and channel especially the non-energy biomass crops directly from their original source to the power generators. For example, while agricultural residues could become a key source of biomass supplies, Denmark is currently the only country capitalising on this potential having established links in the supply chain to collect a large proportion of these residues. Other biomass power generators remain dependent on imports of biomass crops increasing the cost of transportation and FX exposure. Likewise, the material handling for some types of biomass affects their energy content and hence efficiency.

Concern over the effects of an increasing demand for biomass supplies if the industry expands over the next few years has fuelled talks on biomass driving up costs of raw materials such as wood. The Wood Panel Industries Federation (WPIF) has recently published a report stating that the current UK biomass ROC subsidy framework is distorting the wood price equilibrium contributing to a significant rise in wood prices over the past few years (WPIF: Wood Panel Industry in the UK 2010). Similarly, there is concern over the build-up of biomass supplies, such as the farming of energy crops, lagging behind and therefore resulting in supply shortages and competing uses for land.

However, there are opposing effects from the demand- and supply-side. Biomass prices, as argued by the WPIF, may rise due to an increase in demand or shortage of supply; on the other hand, an increase in biomass production and farming with the potential of economies of scale coupled with an intensified supply side competition may lower the price of biomass.

Burning biomass: co-firing or dedicated biomass

Two main options are available for converting biomass into power. The choice is between constructing a new dedicated biomass-fired power station and co-firing biomass at an existing combustion plant. Clearly constructing an entirely new power station solely dedicated to biomass requires a larger initial capital investment.

Co-firing biomass at an existing coal-fired power plant is advantageous in that it requires less capital investment and carries less commercial risk while reducing the amount of coal fired in the furnace. Still RWE says that new co-firing will need better subsidies in some countries. Often, co-firing represents a more effective way of utilising biomass. Efficiency levels at existing coal-fired plants remain higher and therefore achieve a larger overall relative reduction in CO_2 emissions.

Three basic options for co-firing, ranked in terms of required level of investment, are available:

- *Direct co-firing* which implies mixing biomass directly with the coal and burning them together. This is a low-cost option requiring little modification to existing plant equipment.
- *Indirect co-firing* converts the biomass into a gaseous fuel and then injects into the furnace of the boiler. This method requires considerably more plant- and equipment modifications. In return, however, it is gentler on existing furnace tubes and avoids contaminating the ash generated from the coal and resold.
- *Parallel co-firing* entails the construction of a separate biomass-fired boiler. This method requires the largest scale of investment but also represents the most efficient utilisation of biomass.

To take into account the varying levels of required capital investment, policy makers often tailor the subsidy frameworks accordingly.

Subsidy schemes: Not a strong enough signal for dedicated...yet

Biomass is different from most RES as it has a cost of fuel. It is not a cost-competitive source of power generation compared to conventional fossil fuels. At a current price range of 2-4 times the cost of coal, substantial incentives are needed in order to promote the use of biomass, and dedicated biomass stations in particular look broadly uneconomic.

FITs versus Certs

The policy instruments in place to support power generation from biomass vary across the member states. There appears to be a convergence towards the employment of either feed-in tariffs (FITs) or quota obligations with tradable green certificates.

Exhibit 9

EU countries tend to have FIT or GC subsidies

Country	Subsidy
Austria	FIT
France	FIT
Germany	FIT
Holland	FIT
Italy	GC
Poland	GC
Portugal	FIT
Spain	FIT
UK	GC

Source: Morgan Stanley Research
FIT = Feed in Tariff, GC = Green Certificate

Supply-side support based on FITs is regarded as one of the most effective policy instruments in encouraging RES investments. Power generators are guaranteed a fixed price for their electricity above the market price. The price is set according to the type of technology, the environmental benefits accruing and the level of capital investment required. FITs create long-term stability and improve the predictability of revenues – key factors for attracting investors. Other supply-side support schemes involve investment subsidies and taxes. Tax incentives are either in the form of exemption from environmental taxes – such as landfill taxes or carbon taxes – or tax reductions for particular RES investments.

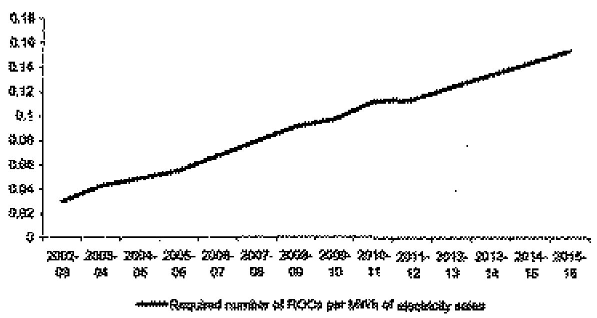
The most important demand-side instrument is the use of quota obligations and green certificates. Quota obligations establish a minimum proportion of RES in electricity generated and sold. Electricity suppliers then have to meet this quota by buying green certificates from RE power generators. For the RE power generators, the green certificates act as a premium on top of the market price they receive for their electricity.

The UK subsidy regime: underpinned by ROCs

The current UK subsidy regime is based on a quota obligation support scheme termed Renewable Obligation (RO). The RO scheme obliges electricity suppliers in the UK to source an increasing amount of their electricity sales from RES. Suppliers must present a stated number of Renewable Obligation Certificates (ROCs) per MWh of their electricity sales. This is set at 0.111 ROCs per MWh for the period 2010-11 (see Exhibit 10) amounting to around 11% renewable electricity of total electricity sales. The amount of required ROCs is set to increase annually up to a total share of 15.4% in 2015-16 and onwards. This is to encourage investments in RES technologies whilst penalising suppliers sourcing their electricity solely from fossil fuels. If the suppliers fail to comply, they have to pay the equivalent value of the ROCs. This amount then feeds back to those suppliers that have met their obligations.

Exhibit 10

Required number of ROCs per MWh of a UK electricity supplier's sales years 2002-2015



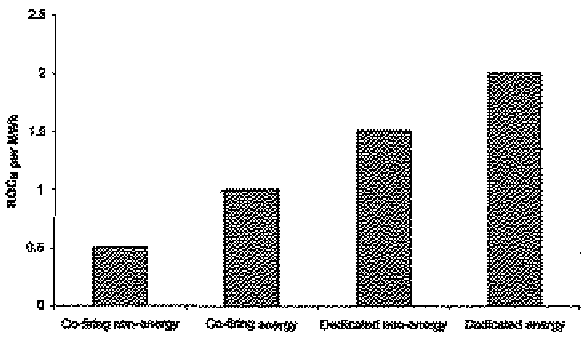
Source: Morgan Stanley Research

Suppliers buy the ROCs from RE electricity generators. The current value of one ROC is approximately £49.16. The generators receive differing levels of ROCs per MWh of electricity generated to take into account the type of technology and, in the case of biomass, the level of capital investment required. Exhibit 11 provides an overview of the current ROC banding for biomass. Generators co-firing biomass receive 0.5 ROC per MWh for firing non-energy crops and 1 ROC per MWh for energy crops. Dedicated biomass generators receive 1.5 ROC per MWh for firing non-energy crops and 2.0 ROC per MWh for energy crops.

Furthermore, the UK places a cap on the level of electricity generated from co-firing for any UK power generator. This is currently set at 12.5%.

Exhibit 11

Current UK biomass subsidies: number of ROCs received per MWh



Source: Morgan Stanley Research

Grandfathered subsidy in the UK, but timing remains unclear

The UK government recently announced its intention to grandfather the support for dedicated biomass. This implies that dedicated biomass power generators will received a fixed number of ROCs per MWh for a guaranteed period of 20 years. However, dedicated biomass will not be grandfathered until accredited and the definition around accreditation remains unclear. If it means that the biomass plant needs to be nearly operational, it leaves generators little time to get a new plant up and running before the current ROC banding system runs out at the end of March 2013. Furthermore, the subsidy, whilst grandfathered, is still not high enough to make dedicated biomass economic given today's commodity cost.

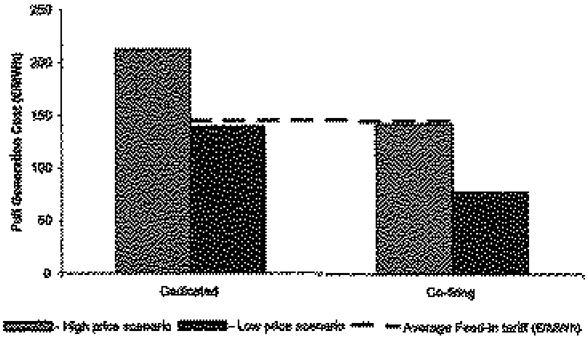
Further to this, it has been confirmed that the 0.5 ROC uplift for the use of energy crops will not be grandfathered. It remains unclear as to the future support measures for co-firing biomass beyond March 2013.

Subsidy regimes elsewhere across the EU

Subsidy regimes in support of biomass-fired power generation vary significantly across the member states. Broadly speaking, the support measures are based on either feed-in tariffs or quota obligations with tradable green certificates (see Exhibit 9). The adoption of support measures is skewed towards the feed-in tariffs. The differences in support levels make it more economic to burn biomass in some countries than others.

Exhibit 12

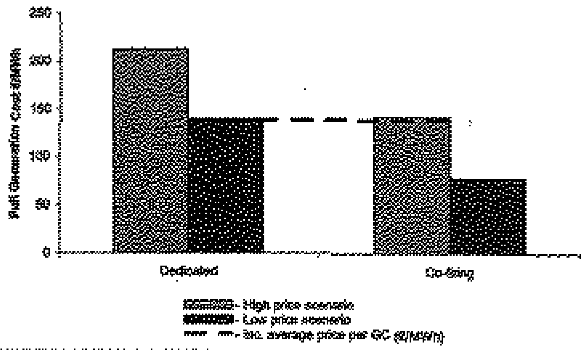
The French FiT subsidy just covers full generation costs for low cost biomass in a dedicated station, but covers all co-firing costs even at high cost



Source: Company data, Morgan Stanley Research
Assumptions: Cal 11 curves, Biomass at 2x and 4x the cost of coal, 10% return on capital

Exhibit 13

In Italy the GC subsidy about covers full generation costs for a low priced biomass burn in a dedicated station, but all co-firing costs, even with high costs



Source: Company data, Morgan Stanley Research
Assumptions: Cal 11 curves, Biomass at 2x and 4x the cost of coal, 10% return on capital

What do current commodity prices mean for biomass generation?

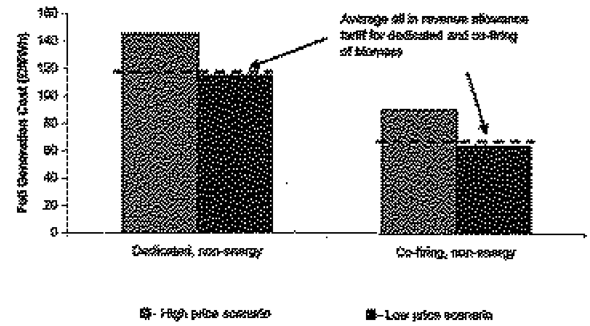
We have looked at the current subsidy systems across certain European geographies to see how the economics of biomass stack up today (see pages 13-23 for more granular details on a country by country basis). We have looked at dedicated biomass plants and co-firing of biomass separately. All analysis has been based on the current calendar 2011 forward curves.

We have looked at full generation costs for dedicated biomass and co-firing under two scenarios – a high cost of commodity, and a low cost of commodity. In the high cost, we assume the cost of biomass fuel is 4x the calendar 2011 cost of coal, whereas in the low cost scenario, we have assumed a 2x coal cost for biomass. With fuel making up between one half and two thirds of the full generation cost, this is clearly sensitive to the high current cost of coal on the forward curves.

We have included opex costs based on current running costs at Drax as a proxy for co-firing, and something higher for dedicated. As for capital cost assumptions, we have assumed a £2bn spend for a 900MW dedicated station (again as per Drax), and used a £80m for 400MW assumption for co-firing spend (as spent at Drax).

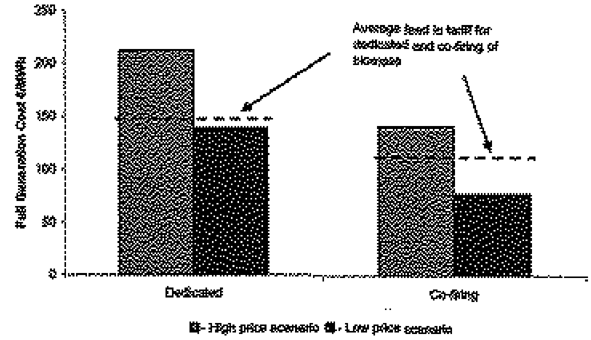
Dedicated looks uneconomic, co-firing broadly economic
Putting this altogether shows that dedicated biomass is broadly uneconomic when we look at the subsidies (and power prices where necessary) on offer versus the full generation cost. We have assumed a return on capital of 10% when making these calculations. However given the relative lower cost of co-firing, it appears that co-firing is an economic investment in most European countries with the subsidies on offer. But this remains dependent on the cost of fuel, and co-firing (on a full generation basis) in some European countries is only economic if biomass can be sourced towards the low end of the cost range (refer to pages 13-23 for all the analysis).

Exhibit 14
In the UK, dedicated and co-firing of biomass is economic only at low levels of biomass cost…



Source: Company data, Morgan Stanley Research
Assumptions: Cal 11 curves, Biomass at 2X and 4x the cost of coal, 10% return on capital

Exhibit 15
…whereas in the Netherlands, co-firing in particular remains economic at higher levels of biomass cost



Source: Company data, Morgan Stanley Research
Assumptions: Cal 11 curves, Biomass at 2x and 4x the cost of coal, 10% return on capital

And this is important. As Drax has stated, in the UK, with biomass at a relatively high cost, it is not economic — and at present in the UK it is cheaper to burn coal and pay for the carbon allowances than to burn biomass. This demonstrates the need for a robust supply chain.

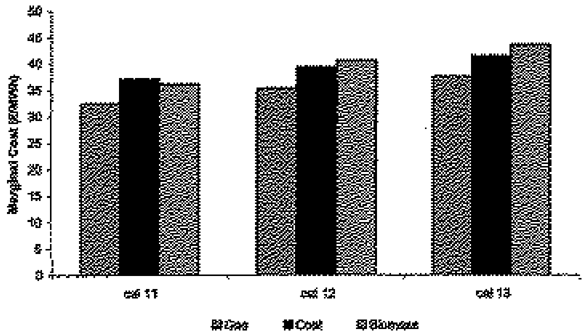
What can make biomass more competitive?

Clearly higher direct subsidies can make biomass generation more competitive with thermal generation. But another way would be to increase the carbon obligations on thermal generators. This would do two things, 1) increase the cost base of the thermal generator to pay for higher carbon emission allowances, thus making biomass more competitive, and 2) increase the power price for the pass-through of the increased carbon cost of the marginal producer, thereby increasing the cost of electricity and the revenue earned by biomass producers (in countries where the subsidy is paid on top of the power price).

This scheme is set up to reward those investing in clean energy while discouraging the use of conventional fossil fuels. The carbon allowances are meant to place a burden on heavy polluters such as coal-firing power generators. At the moment, however, the price of carbon is only about c.€15 per tonne. Given current coal, gas, and therefore power prices, it is cheaper for power generators to buy the allowances than to invest in and create power using RES technologies.

Exhibit 16

Even taking the subsidy in to account, in the UK at present, the marginal cost of gas and coal is lower than co-firing biomass in the forward years



Source: Morgan Stanley Research
Assumptions: Co-firing non-energy crops (0.5x ROC). Cal 11 curves

A carbon floor would continue to promote cleaner energy vis-à-vis thermal generation

Given the need to meet the long-term target of a 20% reduction in emissions by 2020, policy makers are considering ways to reduce this risk of investing in RES technologies. The introduction of a carbon price floor, as proposed by the UK government, could be one solution. The carbon price floor sets a minimum fixed carbon price above the current price. This mechanism, if priced correctly, could help support investments in RES technologies by leveling the playing field with fossil fuel power generation. For instance, if the carbon price floor is set within the range of €25-40 per tonne, the full generation cost (on a per MWh basis) of coal-firing would balance with the cost of co-firing coal with biomass crops at today's commodity prices. The carbon price leveling the full generation cost of dedicated biomass firing with that of coal is much higher – underlining the need for additional support measures.

For instance, if the carbon price floor is set within the range of €25-40 per tonne, the full generation cost (on a per MWh basis) of coal-firing would balance with the cost of co-firing coal with biomass crops at today's commodity prices.

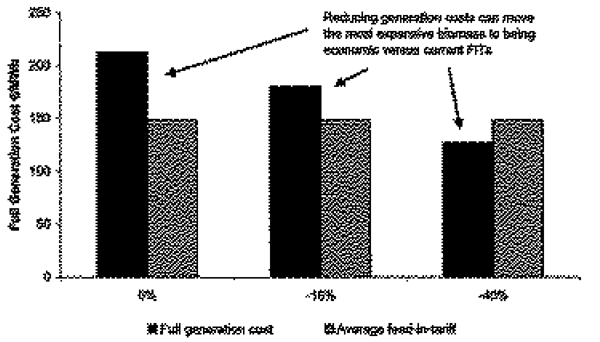
Waiting for the learning curve effects to kick in

As biomass generators continue to scale up and move along the learning curve, significant improvements could be made in terms of costs.

An industry report addressing the opportunities and economics of biomass concluded that there is a potential of 15-40% upside in terms of cost reductions and efficiency gains throughout the supply chain (European Climate Foundation, Södra, Sveaskog & Vattenfall (2010): Biomass for Heat and Power). In such a scenario, biomass would become increasingly cost-competitive with conventional fossil fuel applications. Combined with increasing prices of carbon allowances and/or increasing prices of fossil fuels, the competitive playing field would become more favourable towards biomass. The entry barriers and perceived risks of biomass power generation would be lowered, creating scope for additional economies of scale.

Exhibit 17

A reduction in the cost of delivery would make dedicated biomass stations economic



Source: Company data, Morgan Stanley Research
Assumptions: Netherlands FIT for dedicated biomass

However, realising cost reductions of up to 40% from current levels poses a great challenge to biomass generators. Links between the different stages throughout the supply chain need to be established and effectively coordinated – and funds invested to ensure gains from technological progress.

There are no doubts about the potential residing in biomass. It is an abundant source of energy, yet it remains to be fully capitalised upon.

There are no doubts about the potential residing in biomass. It is an abundant source of energy, yet it remains to be fully capitalised upon. It continues to be an underdeveloped and underinvested RES technology despite its many advantages and opportunities. The key question, therefore, is whether there really is realistic scope for making biomass cost-competitive with conventional fossil fuels as well as with other RES technologies.

Why are we still waiting?
Biomass is not a new RES technology. Yet, the EU is lagging behind its targeted build-up of biomass capacity. As a result, biomass remains a small-scale technology stuck in its infancy.

A possible explanation to the flattening rate of biomass build-ups concerns the economic framework. At current price levels, even when taking into account the subsidies and exemption from carbon allowances, biomass is still largely unprofitable.

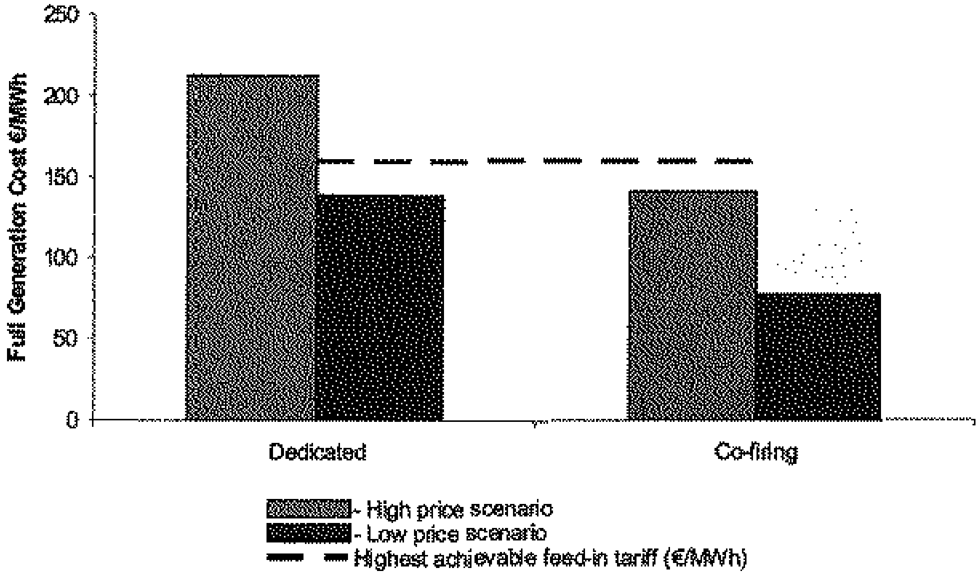
Until potential biomass suppliers and power generators are confident of a fixed and favourable long-term commitment from policy makers, it will remain difficult for the industry to achieve economies of scale and become cost-competitive on a large scale.

Blue Sky Scenario: Why Biomass could really matter

Mitigating emissions altogether: CCS-biomass
Carbon capture and storage (CCS) technology enables the reduction of CO_2 emissions of up to 90% at conventional fossil fuel power stations. The market for the CCS technology has increased dramatically over the past few years but we remain a long way away from being able to demonstrate on a large industrial scale. Nevertheless, the technology could offer a prominent method of large-scale reduction of CO_2 levels without demanding major changes to the current generation mix.

An attractive opportunity lies in combining biomass with the CCS technology at power stations. Firing biomass is carbon neutral; biomass absorbs CO_2 throughout its growth offsetting the CO_2 it releases when burned. When the emitted CO_2 is captured and stored the result is therefore overall negative emissions. Applying CCS to biomass firing therefore poses great opportunities for mitigating CO_2 emissions altogether. It skews the competitive advantage of cost-effective, decarbonising technologies towards CCS-biomass applications. Furthermore, the negative emissions resulting from deployment of CCS-biomass could offset emissions that are more costly to mitigate such as in the transport sector. However, this is for further out in the future as it has to be proved that biomass can be an effective fuel source first.

Austria

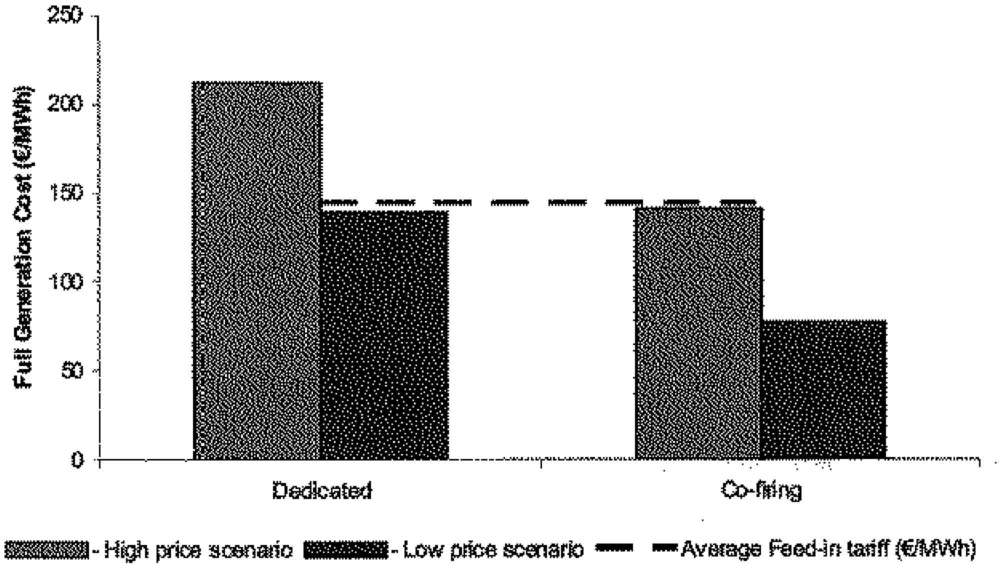


[redacted]

Companies	VERBUND
Current biomass capacity	Sewage sludge biomass plants
	13,643 t of biomass was used in thermal power plants in 2009
	19,186 t in 1997

Source: Company data, Morgan Stanley Research

France

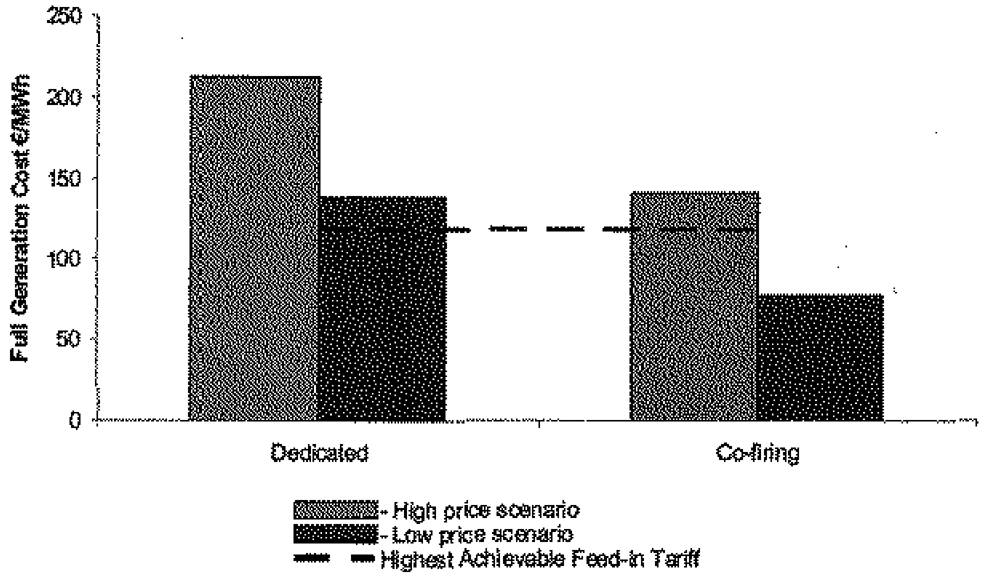


- France:
  - Feed in tariff: €145/MWh
- Assumptions:
  - Cost of biomass: 2-4x cost of calendar 2011 coal
  - Return on capital: 10%

Companies	EDF	GDF SUEZ
Current biomass capacity	3% of total current generation (all countries) 0.35TWh of biomass-fired electricity generation Many biomass projects in Poland	Biomass represents 1% of 65GW installed capacity Biomass sites in Europe, US & Brazil
Future biomass capacity	EDF-EN planning 20MW plant in France	Conversion of Dutch plant to allow 25% co-firing by 2010 Construction of new Dutch co-fired (50%) power plant Dedicated biomass plant in Brazil (33MW), using sugarcane

Source: Company data, Morgan Stanley Research

Germany

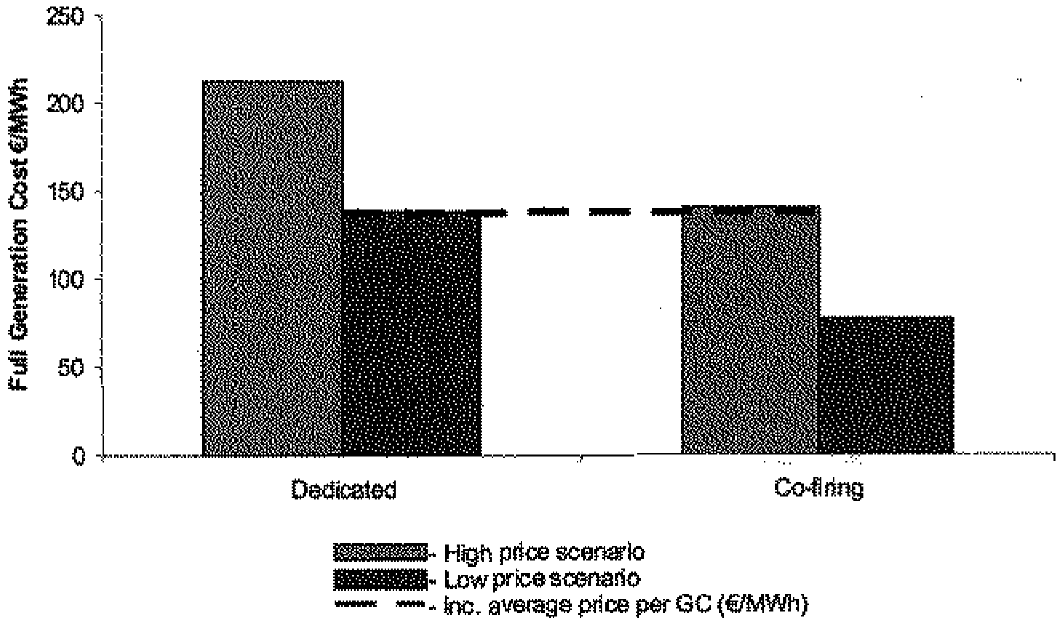


[redacted]

[redacted]

Source: Company data, Morgan Stanley Research

Italy

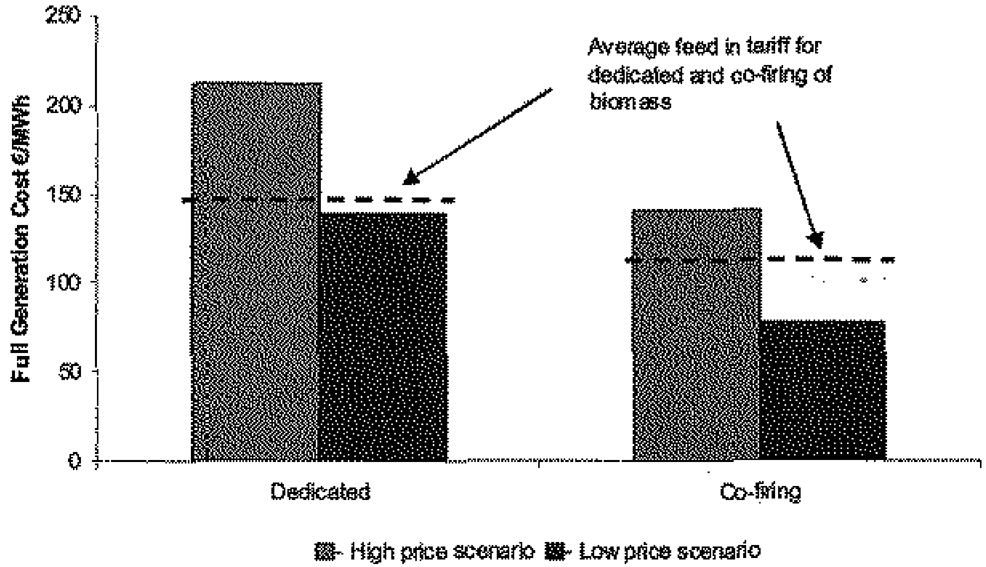


[redacted]

[redacted]

Source: Company data, Morgan Stanley Research

The Netherlands

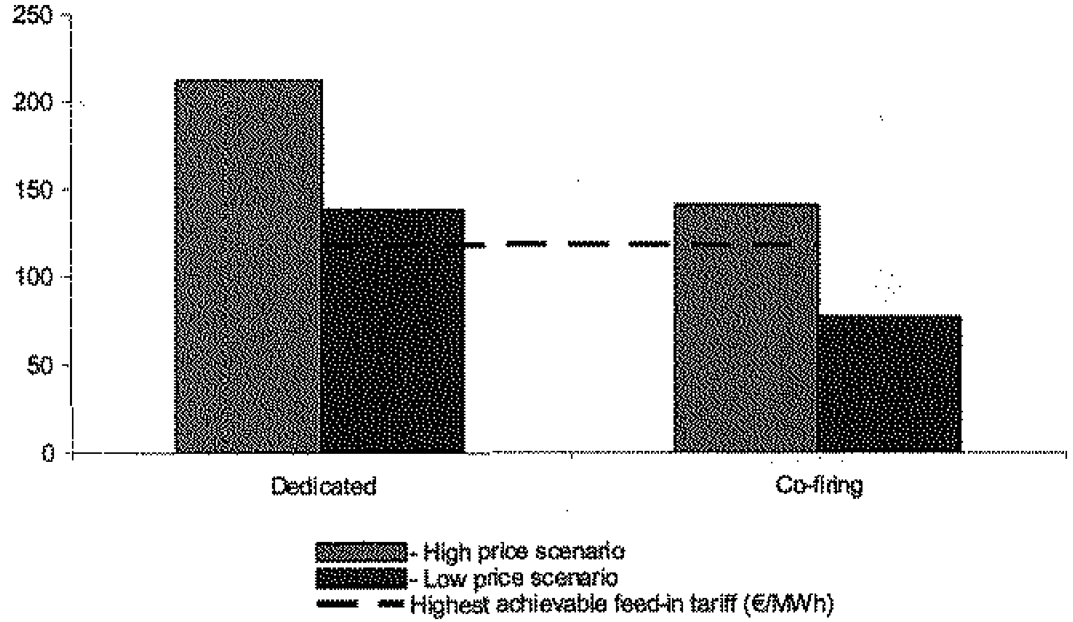


- Holland:
  - Dedicated biomass feed in tariff €/MWh
  - <10MW: 131-177
  - >10MWh: 134-152
  - **Co-firing premium over power price €63/MWh** for 10 years, but now closed to new investments
  - **Future:** expectations that co-firing subsidy will be extended, and that the SDE tariffs will be renewed 12 years from now.
- Assumptions:
  - **Cost of biomass:** 2-4x cost of calendar 2011 coal
  - **Return on capital:** 10%

Companies	RWE - ESSENT	GDFSUEZ	E.ON
Current biomass capacity	€130mn invested over 10 years 295MW of co-firing 29MW of biomass installed	563MW Gelderland plant can co-fire up to 25% biomass	
Future biomass capacity	2013/14: Eemshaven, 1560MW hard coal/biomass	Conversion of Dutch plant to allow 25% co-firing by 2010 Construction of new Dutch 50% co-fired power plant	1070MW Maasvlakte coal plant with co-firing

Source: Company data, Morgan Stanley Research

Poland



- **Poland:**
  - **Certificates, guaranteed set electricity price €/MWh:**
  - Guaranteed electricity price: 45.75
  - Tradable Certificate: 63.38
  - FX PLN/EUR: 0.24
- **Assumptions:**
  - **Cost of biomass:** 2-4x cost of [illegible] coal
  - **Return on capital:** [illegible]

Source: Company data, Morgan Stanley Research

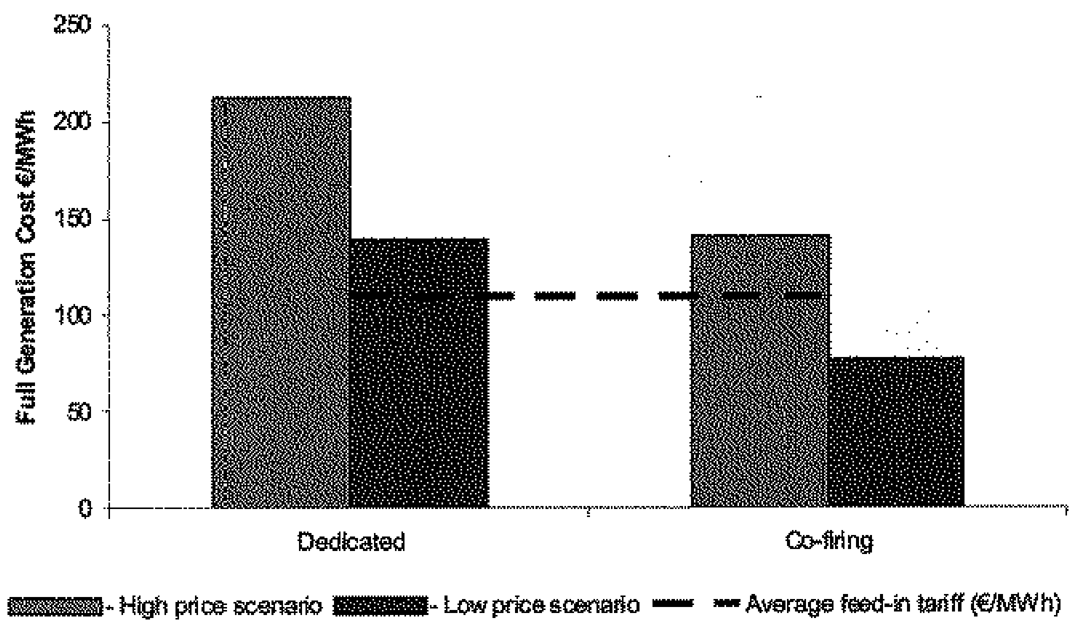
Poland

Companies	EDF	PGE	GDF SUEZ
Current biomass capacity	10% of fuel supply for EDF Polish Plants Co-firing facilities	Co-firing facilities, unit conversions In 2009, 2.2% of electricity generated came from biomass	Polaniec 1654MW coal/biomass co-fired 2009: 9.7TWh output, 0.68TWh from biomass
Future biomass capacity	Full conversion of coal-fired plant in Kogeneracja Recycling 200 000 tonnes of wet biomass Avoiding emissions around 250 000 t CO_2/yr Benefiting from European support	Co-firing Dedicated CHP plants PLN 8.9bn for investment in renewables of which biomass is part ZEC Bydgoszcz: Construction of separate biomass unit Generating up to 400GWh/yr EC Rzeszow: Construction of biomass co-firing unit Generating 150-190GWh/yr EC Kielce: Construction of co-firing unit Generating 200GWh/yr	

Companies	CEZ	TAURON
Current biomass capacity	Co-firing facilities 149.3 GWh power production from biomass	
Future biomass capacity		Czestochowa: Co-firing CHP plant with 65MW electricity and 120MW heat installed

Source: Company data, Morgan Stanley Research

Portugal

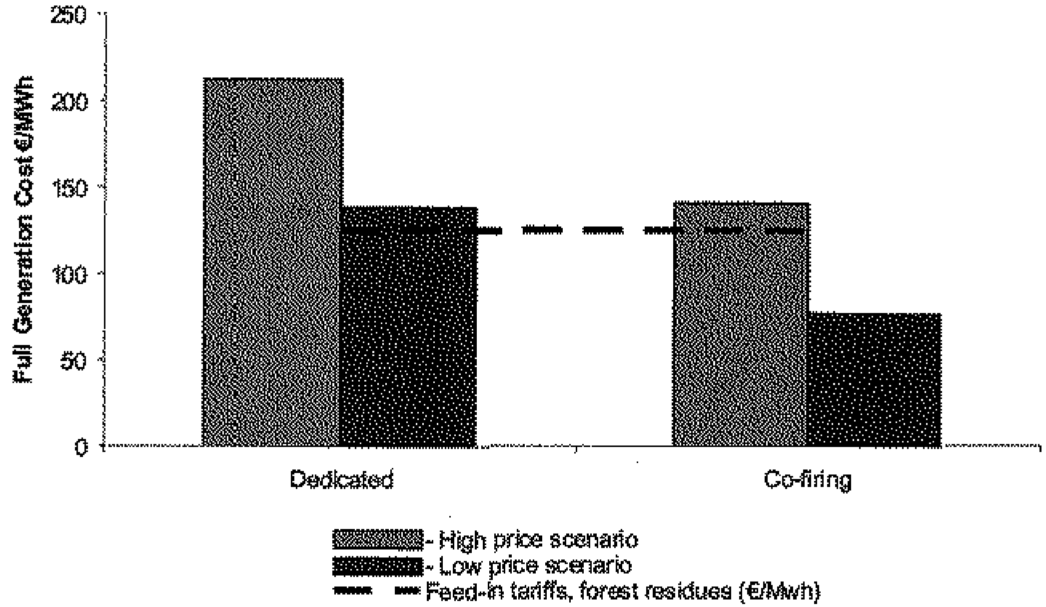


- **Portugal:**
  - **Feed in tariff:** €110/MWh
  - **Duration:** 15 years
- **Assumptions:**
  - **Cost of biomass:** 2-1x cost of calendar 2011 coal
  - **Return on capital:** 10%

Companies	EDP
Current biomass capacity	32MW installed capacity for dedicated biomass 111MW installed capacity for co-firing

Source: Company data, Morgan Stanley Research

Spain



Spain:

- **Feed in tariff (€/MWh)**
  - Energy Crops < 2MW = 158.036
  - Energy Crops > 2MW = 139.064
  - Agricultural Res < 2MW = 134.914
  - Agricultural Res > 2MW = 110.97
  - Forest Residues < 2MW = 132.094
  - Forest Residues > 2MW = 125.142
- **Future:** Currently RES under revision for future investment

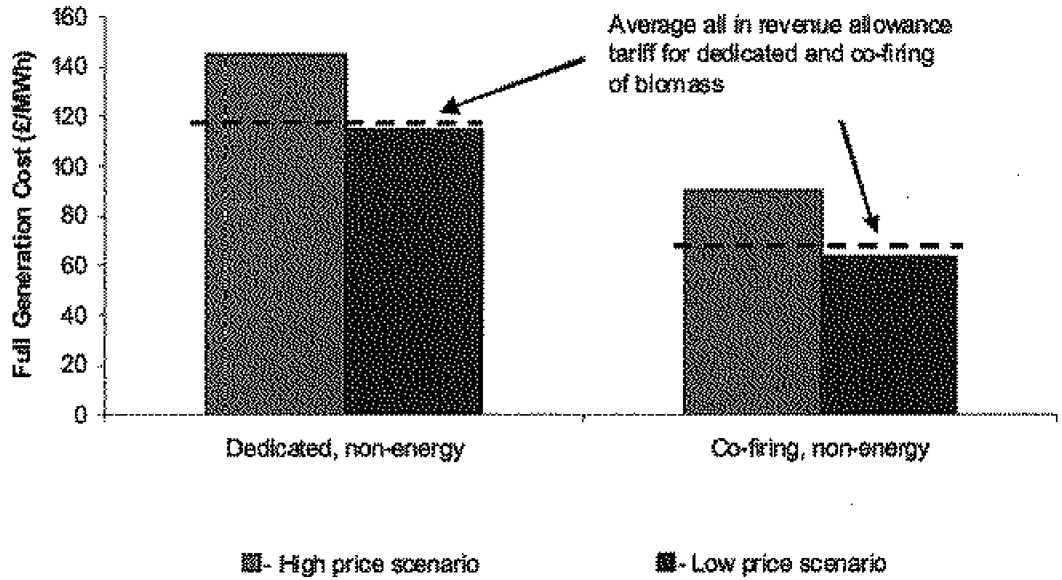
Assumptions:

- **Cost of biomass:** 2-4x cost of calendar 2011 coal
- **Return on capital:** 10%

Companies	ENDESA	IBERDROLA	ACCIONA	EDP
Current biomass capacity	Biomass and biogas capacity of 57MW	Three forest biomass plants (25MW) One forest waste plant (2MW)	3 installations - a total of 33MW capacity for 0.4% of total capacity installed (7.4GW)	7MW installed capacity for dedicated biomass 65MW installed capacity for co-firing
Future biomass capacity	Developing 3 plants totaling 55MW €140mn total investment cost Expected to generate 440mn kWh Reducing emissions by 423,000 tonnes			

Source: Company data, Morgan Stanley Research

UK



[redacted]

[redacted]

Source: Company data, Morgan Stanley Research

Many utilities are already burning biomass in many countries

COMPANY	CURRENT BIOMASS CAPABILITIES	FUTURE PLANS
DRAX	Co-firing facility at Drax (500MW)	3x 290MW dedicated
		Plans of converting 1 full unit at Drax
E.ON	44MW dedicated biomass plant in Scotland	Blackburn Meadows biomass power plant (30MW)
	Reducing CO_2 emissions by around 140,000 tonnes/yr	Portbury Dock, North Somerset biomass plant (150MW)
	30MW installed capacity in Germany	1070MW Maasvlakte coal plant with co-firing
RWE	5% of current installed generation capacity (all countries) of 2.2GW	Stallingborough (65MW)
	99MW biomass capacity installed in Germany	Markinch (53MW)
	20MW co-firing capacity in Czech Rep.	18MW biomass capacity under construction in Germany
ESSENT (RWE)	€130mn invested over 10 years	2013/14: Eemshaven, 1560MW hard coal/biomass
	295MW of co-firing	
	25MW of biomass installed	
EDF	3% of total current generation (all countries)	EDF-EN planning 26MW plant in France
GSZ	Biomass represents 1% of 68GW installed capacity	Conversion of Dutch plant to allow 25% co-firing by 2010
	Biomass sites in Europe, US & Brazil	Construction of new Dutch co-fired (50%) power plant
	590MW Gelderland plant can co-fire up to 25% biomass	Dedicated biomass plant in Brazil (33MW), using sugarcane
VERBUND	Sewage sludge biomass plants	
	13,643 t of biomass was used in thermal power plants in 2009	
	19,186 t in 1997	
ENDESA	Biomass and biogas capacity of 57MW	
IBERDROLA	Three forest biomass plants (25MW)	
	One forest waste plant (2MW)	
ACCIONA	3 installations - a total of 33MW	Developing 3 plants totalling 55MW
	accounts for 0.4% of total capacity installed (7.4GW)	€140mn total investment cost
	accounts for 1% of total production (13.6TWh)	Expected to generate 440mn kWh
		Reducing emssions by 423,000 tonnes
EDP	7MW installed capacity for dedicated biomass	
	63MW installed capacity for co-firing	
	32MW installed capacity for dedicated biomass	
	111MW installed capacity for co-firing	
A2A	Co-firing facilities	
ENEL	135MW installed capacity of co-firing & dedicated facilities	Conversion of Mercure thermal plant to biomass
	0.5 TWh of electricity produced from co-firing & dedicated biomass	Waste biomass plant: Sulcis
EDISON	1 biomass plant in Castellavazzo	
FORTUM	2% of its total European generation of 49.3TWh from biomass	2 new co-firing CHP plants due in 2010 in Parnu, Estonia and Czestochowa, Poland
	22% of its European heat production of 23.2TWh from biomass	Industrial waste plant in Klaipeda, Lithuania
	CHP biomass plant in Tartu, Estonia	Investments in existing Swedish plants, conversion of units
	CHP co-firing plant in Stockholm, Sweden	Waste CHP plant in Brista, Sweden with 20MW electricity and 60MW heat
CEZ	CHP Biomass plant in Czech Rep.	
	Co-firing facilities in Czech Rep.	
	344,229MWh power production from biomass	

Source: Company data, Morgan Stanley Research

Disclosure Section

Morgan Stanley & Co. International plc, authorized and regulated by Financial Services Authority, disseminates in the UK research that it has prepared, and approves solely for the purposes of section 21 of the Financial Services and Markets Act 2000, research which has been prepared by any of its affiliates. As used in this disclosure section, Morgan Stanley includes RMB Morgan Stanley (Proprietary) Limited, Morgan Stanley & Co International plc and its affiliates.

For important disclosures, stock price charts and equity rating histories regarding companies that are the subject of this report, please see the Morgan Stanley Research Disclosure Website at www.morganstanley.com/researchdisclosures, or contact your investment representative or Morgan Stanley Research at 1585 Broadway, (Attention: Research Management), New York, NY, 10036 USA.

Analyst Certification

The following analysts hereby certify that their views about the companies and their securities discussed in this report are accurately expressed and that they have not received and will not receive direct or indirect compensation in exchange for expressing specific recommendations or views in this report: Nicholas Ashworth.

Unless otherwise stated, the individuals listed on the cover page of this report are research analysts.

Global Research Conflict Management Policy

Morgan Stanley Research has been published in accordance with our conflict management policy, which is available at www.morganstanley.com/institutional/research/conflictpolicies.

Important US Regulatory Disclosures on Subject Companies

As of July 30, 2010, Morgan Stanley beneficially owned 1% or more of a class of common equity securities of the following companies covered in Morgan Stanley Research: E.ON, Enagas, Iberdrola, International Power, National Grid plc, Red Electrica, RWE AG, Scottish & Southern, Snam Rete Gas, Verbund.

Within the last 12 months, Morgan Stanley managed or co-managed a public offering (or 144A offering) of securities of EDF, EDP, GDF SUEZ, National Grid plc, Scottish & Southern.

Within the last 12 months, Morgan Stanley has received compensation for investment banking services from E.ON, EDF, EDP, Endesa, ENEL, Fortum, Gas Natural, GDF SUEZ, Iberdrola, International Power, National Grid plc, PPC, RWE AG, Scottish & Southern, Veolia Environnement, Verbund.

In the next 3 months, Morgan Stanley expects to receive or intends to seek compensation for investment banking services from A2A SpA, ACEA, Centrica, CEZ, Drax, E.ON, EDF, Edison, EDP, Enagas, Endesa, ENEL, Fortum, Gas Natural, GDF SUEZ, Iberdrola, International Power, IREN S.p.A., National Grid plc, Northumbrian Water Group, Pennon Group, PGE Polska Grupa Energetyczna S.A., PPC, Red Electrica, RusHydro, RWE AG, Saudi Electricity Company, Scottish & Southern, Severn Trent, Snam Rete Gas, Suez Environnement, Terna, United Utilities, Veolia Environnement, Verbund.

Within the last 12 months, Morgan Stanley has received compensation for products and services other than investment banking services from CEZ, E.ON, EDF, EDP, Endesa, ENEL, Fortum, Gas Natural, GDF SUEZ, Iberdrola, National Grid plc, RWE AG, Scottish & Southern, Veolia Environnement.

Within the last 12 months, Morgan Stanley has provided or is providing investment banking services to, or has an investment banking client relationship with, the following company: A2A SpA, ACEA, Centrica, CEZ, Drax, E.ON, EDF, Edison, EDP, Enagas, Endesa, ENEL, Fortum, Gas Natural, GDF SUEZ, Iberdrola, International Power, IREN S.p.A., National Grid plc, Northumbrian Water Group, Pennon Group, PGE Polska Grupa Energetyczna S.A., PPC, Red Electrica, RusHydro, RWE AG, Saudi Electricity Company, Scottish & Southern, Severn Trent, Snam Rete Gas, Suez Environnement, Terna, United Utilities, Veolia Environnement, Verbund.

Within the last 12 months, Morgan Stanley has either provided or is providing non-investment banking, securities-related services to and/or in the past has entered into an agreement to provide services or has a client relationship with the following company: A2A SpA, Centrica, CEZ, E.ON, EDF, Edison, EDP, Enagas, Endesa, ENEL, Fortum, Gas Natural, GDF SUEZ, Iberdrola, International Power, National Grid plc, PPC, Red Electrica, RusHydro, RWE AG, Scottish & Southern, Terna, Veolia Environnement, Verbund.

Morgan Stanley & Co. International plc is a corporate broker to International Power, National Grid plc, Severn Trent.

The equity research analysts or strategists principally responsible for the preparation of Morgan Stanley Research have received compensation based upon various factors, including quality of research, investor client feedback, stock picking, competitive factors, firm revenues and overall investment banking revenues.

Morgan Stanley and its affiliates do business that relates to companies/instruments covered in Morgan Stanley Research, including market making, providing liquidity and specialized trading, risk arbitrage and other proprietary trading, fund management, commercial banking, extension of credit, investment services and investment banking. Morgan Stanley sells to and buys from customers the securities/instruments of companies covered in Morgan Stanley Research on a principal basis. Morgan Stanley may have a position in the debt of the Company or instruments discussed in this report. Certain disclosures listed above are also for compliance with applicable regulations in non-US jurisdictions.

STOCK RATINGS

Morgan Stanley uses a relative rating system using terms such as Overweight, Equal-weight, Not-Rated or Underweight (see definitions below). Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold and sell. Investors should carefully read the definitions of all ratings used in Morgan Stanley Research. In addition, since Morgan Stanley Research contains more complete information concerning the analyst's views, investors should carefully read Morgan Stanley Research, in its entirety, and not infer the contents from the rating alone. In any case, ratings (or research) should not be used or relied upon as investment advice. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations.

Global Stock Ratings Distribution

(as of July 31, 2010)

For disclosure purposes only (in accordance with NASD and NYSE requirements), we include the category headings of Buy, Hold, and Sell alongside our ratings of Overweight, Equal-weight, Not-Rated and Underweight. Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold, and sell but represent recommended relative weightings (see definitions below). To satisfy regulatory requirements, we correspond Overweight, our most positive stock rating, with a buy recommendation; we correspond Equal-weight and Not-Rated to hold and Underweight to sell recommendations, respectively.

	Coverage Universe		Investment Banking Clients (IBC)		
Stock Rating Category	Count	% of Total	Count	% of Total IBC	% of Rating Category
Overweight/Buy	**1095**	**42%**	**380**	**44%**	**35%**
Equal-weight/Hold	**1123**	**43%**	**388**	**45%**	**35%**
Not-Rated/Hold	**14**	**1%**	**4**	**0%**	**29%**
Underweight/Sell	**362**	**14%**	**93**	**11%**	**26%**
Total	**2,594**		**865**		

Data include common stock and ADRs currently assigned ratings. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months.

Analyst Stock Ratings

Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Not-Rated (NR). Currently the analyst does not have adequate conviction about the stock's total return relative to the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.
Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

Analyst Industry Views

Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.
In-Line (I): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be in line with the relevant broad market benchmark, as indicated below.
Cautious (C): The analyst views the performance of his or her industry coverage universe over the next 12-18 months with caution vs. the relevant broad market benchmark, as indicated below.
Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index.

Important Disclosures for Morgan Stanley Smith Barney LLC Customers

Citi Investment Research & Analysis (CIRA) research reports may be available about the companies or topics that are the subject of Morgan Stanley Research. Ask your Financial Advisor or use Research Center to view any available CIRA research reports in addition to Morgan Stanley research reports.

Important disclosures regarding the relationship between the companies that are the subject of Morgan Stanley Research and Morgan Stanley Smith Barney LLC, Morgan Stanley and Citigroup Global Markets Inc. or any of their affiliates, are available on the Morgan Stanley Smith Barney disclosure website at www.morganstanleysmithbarney.com/researchdisclosures.

For Morgan Stanley and Citigroup Global Markets, Inc. specific disclosures, you may refer to www.morganstanley.com/researchdisclosures and https://www.citigroupgeo.com/geopublic/Disclosures/index_a.html.

Each Morgan Stanley Equity Research report is reviewed and approved on behalf of Morgan Stanley Smith Barney LLC. This review and approval is conducted by the same person who reviews the Equity Research report on behalf of Morgan Stanley. This could create a conflict of interest.

Other Important Disclosures

Morgan Stanley & Co. International PLC and its affiliates have a significant financial interest in the debt securities of ACEA, Centrica, CEZ, E.ON, EDF, Edison, EDP, Endesa, ENEL, Fortum, Gas Natural, GDF SUEZ, Iberdrola, International Power, National Grid plc, PPC, RusHydro, RWE AG, Scottish & Southern, Severn Trent, Suez Environnement, United Utilities, Veolia Environnement.

Morgan Stanley produces an equity research product called a "Tactical Idea." Views contained in a "Tactical Idea" on a particular stock may be contrary to the recommendations or views expressed in research on the same stock. This may be the result of differing time horizons, methodologies, market events, or other factors. For all research available on a particular stock, please contact your sales representative or go to Client Link at www.morganstanley.com.

Morgan Stanley Research does not provide individually tailored investment advice. Morgan Stanley Research has been prepared without regard to the individual financial circumstances and objectives of persons who receive it. Morgan Stanley recommends that investors independently evaluate particular investments and strategies, and encourages investors to seek the advice of a financial adviser. The appropriateness of a particular investment or strategy will depend on an investor's individual circumstances and objectives. The securities, instruments, or strategies discussed in Morgan Stanley Research may not be suitable for all investors, and certain investors may not be eligible to purchase or participate in some or all of them.

The fixed income research analysts or strategists principally responsible for the preparation of Morgan Stanley Research have received compensation based upon various factors, including quality, accuracy and value of research, firm profitability or revenues (which include fixed income trading and capital markets profitability or revenues), client feedback and competitive factors. Fixed Income Research analysts' or strategists' compensation is not linked to investment banking or capital markets transactions performed by Morgan Stanley or the profitability or revenues of particular trading desks.

Morgan Stanley Research is not an offer to buy or sell or the solicitation of an offer to buy or sell any security/instrument or to participate in any particular trading strategy. The "Important US Regulatory Disclosures on Subject Companies" section in Morgan Stanley Research lists all companies mentioned where Morgan Stanley owns 1% or more of a class of common equity securities of the companies. For all other companies mentioned in Morgan Stanley Research, Morgan Stanley may have an investment of less than 1% in securities/instruments or derivatives of securities/instruments of companies and may trade them in ways different from those discussed in Morgan Stanley Research. Employees of Morgan Stanley not involved in the preparation of Morgan Stanley Research may have investments in securities/instruments or derivatives of securities/instruments of companies mentioned and may trade them in ways different from those discussed in Morgan Stanley Research. Derivatives may be issued by Morgan Stanley or associated persons.

With the exception of information regarding Morgan Stanley, Morgan Stanley Research is based on public information. Morgan Stanley makes every effort to use reliable, comprehensive information, but we make no representation that it is accurate or complete. We have no obligation to tell you when opinions or information in Morgan Stanley Research change apart from when we intend to discontinue equity research coverage of a subject company. Facts and views presented in Morgan Stanley Research have not been reviewed by, and may not reflect information known to, professionals in other Morgan Stanley business areas, including investment banking personnel.

Morgan Stanley Research personnel may participate in company events such as site visits and are generally prohibited from accepting payment by the company of associated expenses unless pre-approved by authorized members of Research management.

The value of and income from your investments may vary because of changes in interest rates, foreign exchange rates, default rates, prepayment rates, securities/instruments prices, market indexes, operational or financial conditions of companies or other factors. There may be time limitations on the exercise of options or other rights in securities/instruments transactions. Past performance is not necessarily a guide to future performance. Estimates of future performance are based on assumptions that may not be realized. If provided, and unless otherwise stated, the closing price on the cover page is that of the primary exchange for the subject company's securities/instruments.

Morgan Stanley may make investment decisions or take proprietary positions that are inconsistent with the recommendations or views in this report.

To our readers in Taiwan: Information on securities/instruments that trade in Taiwan is distributed by Morgan Stanley Taiwan Limited ("MSTL"). Such information is for your reference only. Information on any securities/instruments issued by a company owned by the government of or incorporated in the PRC and listed in on the Stock Exchange of Hong Kong ("SEHK"), namely the H-shares, including the component company stocks of the Stock Exchange of Hong Kong ("SEHK")'s Hang Seng China Enterprise Index; or any securities/instruments issued by a company that is 30% or more directly- or indirectly-owned by the government of or a company incorporated in the PRC and traded on an exchange in Hong Kong or Macau, namely SEHK's Red Chip shares, including the component company of the SEHK's China-affiliated Corp Index is distributed only to Taiwan Securities Investment Trust Enterprises ("SITE"). The reader should independently evaluate the investment risks and is solely responsible for their investment decisions. Morgan Stanley Research may not be distributed to the public media or quoted or used by the public media without the express written consent of Morgan Stanley. Information on securities/instruments that do not trade in Taiwan is for informational purposes only and is not to be construed as a recommendation or a solicitation to trade in such securities/instruments. MSTL may not execute transactions for clients in these securities/instruments.

To our readers in Hong Kong: Information is distributed in Hong Kong by and on behalf of, and is attributable to, Morgan Stanley Asia Limited as part of its regulated activities in Hong Kong. If you have any queries concerning Morgan Stanley Research, please contact our Hong Kong sales representatives.

Morgan Stanley Research is disseminated in Japan by Morgan Stanley MUFG Securities Co., Ltd.; in Hong Kong by Morgan Stanley Asia Limited (which accepts responsibility for its contents); in Singapore by Morgan Stanley Asia (Singapore) Pte. (Registration number 199206298Z) and/or Morgan Stanley Asia (Singapore) Securities Pte Ltd (Registration number 200008434H), regulated by the Monetary Authority of Singapore, which accepts responsibility for its contents; in Australia to "wholesale clients" within the meaning of the Australian Corporations Act by Morgan Stanley Australia Limited A.B.N. 67 003 734 576, holder of Australian financial services license No. 233742, which accepts responsibility for its contents; in Australia to "wholesale clients" and "retail clients" within the meaning of the Australian Corporations Act by Morgan Stanley Smith Barney Australia Pty Ltd (A.B.N. 19 009 145 555, holder of Australian financial services license No. 240813, which accepts responsibility for its contents; in Korea by Morgan Stanley & Co International plc, Seoul Branch; in India by Morgan Stanley India Company Private Limited; in Canada by Morgan Stanley Canada Limited, which has approved of, and has agreed to take responsibility for, the contents of Morgan Stanley Research in Canada; in Germany by Morgan Stanley Bank AG, Frankfurt am Main and Morgan Stanley Private Wealth Management Limited, Niederlassung Deutschland, regulated by Bundesanstalt fuer Finanzdienstleistungsaufsicht (BaFin); in Spain by Morgan Stanley, S.V., S.A., a Morgan Stanley group company, which is supervised by the Spanish Securities Markets Commission (CNMV) and states that Morgan Stanley Research has been written and distributed in accordance with the rules of conduct applicable to financial research as established under Spanish regulations; in the United States by Morgan Stanley & Co. Incorporated, which accepts responsibility for its contents. Morgan Stanley & Co. International plc, authorized and regulated by the Financial Services Authority, disseminates in the UK research that it has prepared, and approves solely for the purposes of section 21 of the Financial Services and Markets Act 2000, research which has been prepared by any of its affiliates. Morgan Stanley Private Wealth Management Limited, authorized and regulated by the Financial Services Authority, also disseminates Morgan Stanley Research in the UK. Private U.K. investors should obtain the advice of their Morgan Stanley & Co. International plc or Morgan Stanley Private Wealth Management representative about the investments concerned. RMB Morgan Stanley (Proprietary) Limited is a member of the JSE Limited and regulated by the Financial Services Board in South Africa. RMB Morgan Stanley (Proprietary) Limited is a joint venture owned equally by Morgan Stanley International Holdings Inc. and RMB Investment Advisory (Proprietary) Limited, which is wholly owned by FirstRand Limited.

The information in Morgan Stanley Research is being communicated by Morgan Stanley & Co. International plc (DIFC Branch), regulated by the Dubai Financial Services Authority (the DFSA), and is directed at Professional Clients only, as defined by the DFSA. The financial products or financial services to which this research relates will only be made available to a customer who we are satisfied meets the regulatory criteria to be a Professional Client.

The information in Morgan Stanley Research is being communicated by Morgan Stanley & Co. International plc (QFC Branch), regulated by the Qatar Financial Centre Regulatory Authority (the QFCRA), and is directed at business customers and market counterparties only and is not intended for Retail Customers as defined by the QFCRA.

As required by the Capital Markets Board of Turkey, investment information, comments and recommendations stated here, are not within the scope of investment advisory activity. Investment advisory service is provided in accordance with a contract of engagement on investment advisory concluded between brokerage houses, portfolio management companies, non-deposit banks and clients. Comments and recommendations stated here rely on the individual opinions of the ones providing these comments and recommendations. These opinions may not fit to your financial status, risk and return preferences. For this reason, to make an investment decision by relying solely to this information stated here may not bring about outcomes that fit your expectations.

The trademarks and service marks contained in Morgan Stanley Research are the property of their respective owners. Third-party data providers make no warranties or representations of any kind relating to the accuracy, completeness, or timeliness of the data they provide and shall not have liability for any damages of any kind relating to such data. The Global Industry Classification Standard ("GICS") was developed by and is the exclusive property of MSCI and S&P.

Morgan Stanley Research is disseminated and available primarily electronically, and, in some cases, in printed form.

Additional information on recommended securities/instruments is available on request.

Morgan Stanley

MORGAN STANLEY RESEARCH

The Americas	Europe	Japan	Asia/Pacific
1585 Broadway	20 Bank Street, Canary Wharf	4-20-3 Ebisu, Shibuya-ku	1 Austin Road West
New York, NY 10036-8293	London E14 4AD	Tokyo 150-6008	Kowloon
United States	United Kingdom	Japan	Hong Kong
Tel: +1 (1) 212 761 4000	Tel: +44 (0) 20 7 425 8000	Tel: +81 (0) 3 5424 5000	Tel: +852 2848 5200

Industry Coverage:Utilities

Company (Ticker)	Rating (as of)	Price* (09/23/2010)
Nicholas J Ashworth, CFA		
Drax (DRX.L)	E (10/13/2009)	402p
Pennon Group (PNN.L)	U (01/22/2010)	566p
Saudi Electricity Company (5110.SE)	O (06/22/2010)	SAR13.85
United Utilities (UU.L)	O (07/22/2010)	567p
Antonella Bianchessi		
A2A SpA (A2.MI)	E (08/06/2010)	€1.09
ACEA (ACE.MI)	O (01/27/2010)	€8.7
EDP (EDP.LS)	E (11/28/2008)	€2.41
ENEL (ENEI.MI)	O (04/26/2010)	€3.74
Edison (EDN.MI)	E (10/13/2009)	€.9
Enagas (ENAG.MC)	E (08/13/2009)	€13.61
Endesa (ELE.MC)	O (04/26/2010)	€18.71
Gas Natural (GAS.MC)	U (05/07/2009)	€11.72
IREN S.p.A. (IREE.MI)	NA (10/29/2008)	€1.2
Iberdrola (IBE.MC)	U (02/09/2010)	€5.45
PPC (DEHr.AT)	E (03/26/2009)	€12.62
Red Electrica (REE.MC)	E (08/13/2009)	€33.07
Snam Rete Gas (SRG.MI)	O (07/01/2010)	€3.64
Terna (TRN.MI)	E (04/07/2010)	€3.11
Bobby Chada		
Centrica (CNA.L)	O (02/09/2010)	322p
E.ON (EONGn.DE)	U (02/09/2010)	€22.56
International Power (IPR.L)	++	370p
National Grid plc (NG.L)	NA (05/20/2010)	537p
Northumbrian Water Group (NWG.L)	U (01/22/2010)	319p
RWE AG (RWEG.DE)	U (06/28/2010)	€53.43
Scottish & Southern (SSE.L)	E (02/09/2010)	1,126p
Severn Trent (SVT.L)	O (01/22/2010)	1,308p
Igor Kuzmin		
CEZ (CEZP.PR)	E (05/29/2009)	CZK840
Federal Grid Co of Unified Energy System (FEES.RTS)	U (08/21/2010)	US$.01
PGE Polska Grupa Energetyczna S.A. (PGEP.WA)	O (08/04/2010)	PLN22.5
RusHydro (HYDR.RTS)	E (12/15/2008)	US$.05
Sean Lee, CFA		
Fortum (FUM1V.HE)	E (05/21/2010)	€18.2
Verbund (VERB.VI)	NA (06/30/2010)	€28.1
Emmanuel Turpin		
EDF (EDF.PA)	O (10/13/2009)	€31.8
GDF SUEZ (GSZ.PA)	++	€25.02
Suez Environnement (SEVI.PA)	E (02/19/2010)	€12.89
Veolia Environnement (VIE.PA)	++	€19.17

Stock Ratings are subject to change. Please see latest research for each company.
* Historical prices are not split adjusted.

[redacted]

From: [redacted]
Sent: 17 July 2012 11:57
To: [redacted]
Cc: [redacted]

Subject: GIB state aid - Biomass power

Attachments: 20120716_Biomass power section.doc

[redacted] good to speak earlier concerning input on the biomass power section of the GIB state aid application.

As discussed, we want to bolster further the case for the sector to cover not only biomass power plants (co-firing, conversion and dedicated new-build), but to also cover key elements of "ancillary infrastructure" - i.e. investment in fuel preparation, transportation and storage.

The attached case is the latest submitted to the EC this Monday 16th. We've amended it somewhat to put the focus more precisely on key elements of ancillary infrastructure.

Key questions on which you could help us are the following:

- Is the scope of ancillary infrastructure correctly described? Is anything obvious missing?
- What evidence is there to support market failures constraining finance in the ancillary infrastructure - I could imagine we could include:
  - Supporting commentary in other DECC publications that investment in supply chain could be significant (i.e. beyond capacity of current players)
  - A sense of who would typically invest in such infrastructure - is this a burden that would usually fall on the utilities?
  - Any further wording to support the case qualitatively that there will need to be major investment in ancillary infrastructure (i.e. making the case that most biomass will be imported, that the increase in imported biomass will go from X-Ym tonnes, representing annual growth of Z%, that it is less dense and has greater volume per unit CV than coal, and therefore requires greater transportation/ storage logistics. Re investment in fuel preparation, presumably we need to focus on the expansion of the UK domestic market - what evidence can we bring in here?
  - Any information on costs - do we have any estimates of the cost of investment in supply chain e.g. £ per unit investment and quantum of investment?

If you could assist us with this information by end Thursday this week (19th July), that would be very helpful. We are not looking for large volumes of data or wording - just a few key additional paragraphs to insert to bolster the case.

Many thanks

[redacted]

20120716_Biomass power section...

[redacted] UK Green Investments | Department for Business, Innovation & Skills | Orchard 1, UG1, 1 Victoria Street, London SW1H 0ET |Direct Line +[redacted] | Mobile [redacted] |www.bis.gov.uk

Biomass power

Overview of UK biomass sector

1.1 Biomass boilers generate heat energy (which is subsequently converted into power or combined heat and power ("**CHP**")) through the burning of organic matter. Sources include wood, straw, energy crops, manure and the biomass portion of municipal and commercial solid waste; such fuel can be obtained domestically or imported. Biomass feedstock can be highly versatile with considerable potential to contribute to all forms of renewable energy, including transport biofuels, heat and power.

1.2 This section focuses on the Biomass power sector, with Biomass for heat covered under renewable heat and biomass for liquid transport fuels covered under Biofuels. At the end of 2010, biomass generated 2.5 GW of electricity capacity, contributing 12 TWh of electricity; the single largest contribution to the renewable energy targets.

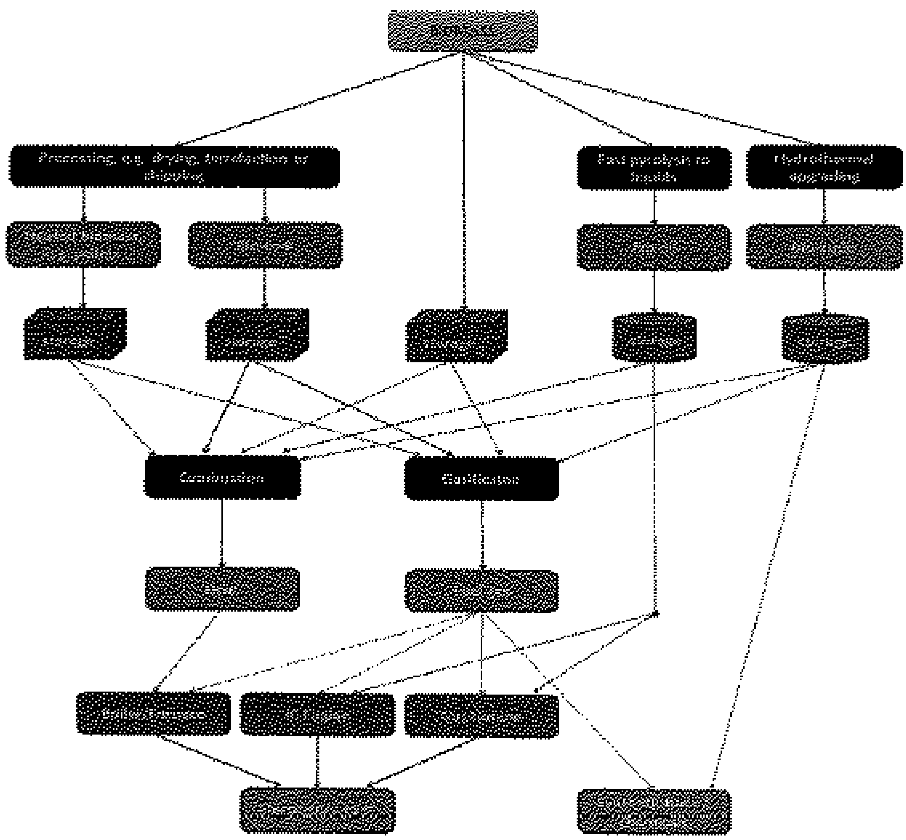
1.3 The figure below demonstrates some of the ways in which biomass can be converted into a fuel and used to generate power:

Figure Error! No text of specified style in document..1

Biomass ancillary infrastructure

Deleted: 3

Deleted: 3



Source: *DECC paper 29 July 2012.*

1.4 Broadly speaking, the ancillary infrastructure chain for the biomass power sector comprises four stages:

(i) Fuel production: feedstock grown or waste arises.

(ii) Fuel preparation: processing raw biomass matter for the production of feedstock (typically pellets) for use as fuel in the power generation process. This includes chipping, pelletising, briquetting, torrefaction and drying facilities by which to convert solid biomass into a form which is suitable for electricity generating stations

Deleted: sourcing and

(iii) Fuel transportation: transportation of biomass pellets or chips from the production site to generation facilities. National and international logistics companies typically provide these services. Dedicated train wagons, trucks and ships may be required for large scale operations (coal trucks cannot be used due, *inter alia*, to the much higher combustibility of biomass). The CCC's Bioenergy Review of 7 December 2011[1] anticipates that current levels of UK feedstock production will only supply 10% of the total 2020 biomass target, thus requiring a significant amount of imports (supported by the UK Government's Bioenergy Strategy of April 2012). However, they go on to estimate that, with sufficient development of the ancillary infrastructure, by 2050 the UK could produce between 38% and 100% of the UK's bioenergy supply.

(iv) Fuel handling and storage: Biomass fuel has a lower energy density than coal and biomass heat/power generation facilities therefore require significantly larger fuel storage facilities, which have high operating costs. In addition, many biomass products must be carefully handled to avoid spontaneous combustion. Biomass dust is highly flammable and many forms of biomass, if wet, can start to ferment, increase in temperature and then combust.[2]

(v) Combustion: The primary combustion methods used for power and heat generation from biomass rely on well-established technology. However, although technology is established, large scale commercial operation has not yet taken place on a dedicated basis. With the exception of RWE's 750MW converted plant completed at Tilbury in early 2012, plants built to date in the UK have all been relatively small scale (up to 50MW capacity). Biomass combustion can be undertaken in three different ways:

(a) Co-firing: combustion of a small amount of biomass materials (initial co-firing trails used about 5-10% biomass) with coal in an existing coal-fired power station. This practice is used by certain coal-fired generators in the UK such as Drax, RWE and E.On;

---

[1] http://www.theccc.org.uk/reports/bioenergy-review

[2] By way of illustration, a large, severe fire broke out in the wood handling section of the Tilbury power station in February 2012, causing significant damage.

(b) Conversion of existing coal-fired plants to biomass: several major coal power station owners are considering converting their coal fired power stations to biomass. Tilbury (RWE NPower) was the first biomass conversion of its kind in the UK, which became operational in November 2011. This plant has suffered some difficulties, including the outbreak of a fire in the fuel handling process, demonstrating the difficulties of large scale biomass operations;

(c) Greenfield dedicated biomass plants: most capacity will be provided by larger plants (capacity greater than 50MW) which are likely to be heavily dependent on imported biomass. A number of vertically integrated utilities are developing new dedicated biomass stations[3] – E.On owns and operates the UK's largest dedicated biomass plant. The UK Government is aware of a number of projects currently in development; Scottish and Southern Energy ("**SSE**") owns one medium scale renewable combined heat and power plant and RWE and E.On are each building new biomass CHP plants. This can include more advanced thermal conversion technologies such as Gasification, Pyrolysis and pyrolysis upgrading: convert biomass into a gaseous, or occasionally liquid, form, which can be used to generate power.

Scope of GIB biomass intervention

1.5 The scope of GIB's investment in biomass power will include projects which use biomass materials as the primary fuel power generation (sometimes with heat), as either Greenfield dedicated plants or conversion, or the co-firing of biomass materials with conventional fossil fuels.

1.6 The scope also includes investment in the following ancillary infrastructure which is primarily dedicated to supporting a biomass power plant:

(i) Fuel preparation infrastructure,

(ii) Fuel handling and transportation infrastructure,

(iii) Fuel storage

This ancillary infrastructure could either present an investment opportunity on a stand-alone basis, to support the wider biomass infrastructure, or could be part of a wider investment in a biomass power plant, together with supporting dedicated infrastructure.

1.7 As the use of biomass increases, the UK will require investment in additional biomass power plants including the above listed ancillary facilities. Investment in biomass power plants can involve associated investment in the ancillary upstream fuel

[3] Eco2 are currently building a 40 MW CHP plant.

Deleted: , including the

Formatted: Bullets and Numbering

Deleted: activities:

Formatted: Outline numbered + Level: 3 + Numbering Style: i, ii, iii, ... + Start at: 1 + Alignment: Left + Aligned at: 1.25 cm + Tab after: 0 cm + Indent at: 2.5 cm

Deleted: Harvesting/baling/milling: specialist machinery is needed during the production of some forms of biomass such as miscanthus and short rotation coppice;

Deleted: Chipping, pelletising, briquetting, torrefaction and drying facilities: convert solid biomass such as wood and non-food energy crops into a form which is suitable for electricity generating stations;¶

Deleted: ,

Deleted: and storage of fuels in specialist equipment to maintain the fuel qualities of the biomass and avoid fires;

Formatted: Bullets and Numbering

Formatted: Indent: Left: 1.25 cm

Deleted: Crushers, filtration systems: used in the production and treatment of vegetable or used cooking oil;

Deleted: <#>Co-firing stations: direct combustion or steam cycle electricity generation;¶
<#>Conversion of coal power station to biomass;¶
<#>Dedicated biomass stations (at all scales);¶
<#>Renewable CHP (at all scales): capture "usable" heat and tend to increase the overall efficiency of the engine; and¶
<#>Gasification, Pyrolysis and pyrolysis upgrading: convert biomass into a gaseous, or occasionally liquid, form, which can be used to generate power.

Formatted: Bullets and Numbering

infrastructure as part of a vertically integrated project. Even where investment is not vertically integrated, the uncertainties of demand for biomass power lead to reduced investment in the supply chain, leading all the market failures affecting biomass power investment to cascade into the fuel supply chain (see §1.8(vi) below). Accordingly, the wider biomass fuel supply chain is included within the scope of this application.

Deleted: 3.86(vi)

Market failures affecting biomass

1.8 There are a number of market failures that affect the supply of capital for large scale biomass infrastructure projects:

Formatted: Bullets and Numbering

(i) Limited balance sheet capacity by traditional investors: traditionally, development and construction of large scale power facilities in Europe has largely been financed either by utilities, using internal and external sources, or by independent power project developers providing equity and securing long term financing from banks and insurance companies. As stated in a white paper produced by UK utility SSE, "major utilities are already high leveraged and therefore unable to take on large quantities of additional debt without damaging their credit ratings".[4] This is corroborated by the credit assessments.

> *"Strong business risk profile offset by a significant capex program (...) [one-third of which] has been earmarked for renewables projects (...) We believe that the capex program will result in negative discretionary cash flows through the period, and consequently, higher debt levels."*[5]

> *"[SSE's] large investment programme of £8bn over the 2010-2015 period, with significant focus on renewables (...) carries execution and financial risks. (...) Moody's sees no potential for upward pressure on ratings given the group's limited financial flexibility."*[6]

This issue is exacerbated by information asymmetries leading to principal-agent distrust; despite the potential for significant returns from biomass, shareholders or debt providers are concerned about potential investors' motives to raise capital. This creates the need to introduce new investors, such as the GIB.

(ii) Structural changes in bank and insurance markets leading to a lack of long term financing: the infrastructure sector has largely been financed by long term debt, typically in the form of project finance from commercial banks. As

---

[4] SSE (2001), "An Energy White Paper. A package of reforms to encourage investment in electricity generation", May, p8.

[5] S&P on E.ON, 28 July 2010.

[6] Moody's on SSE, 19 December 2011

described at §Error! Reference source not found., with banks no longer providing the scale of financial intermediation required between such asset owners and investment projects, the dramatically increased investment needs of the Green economy (as detailed in §Error! Reference source not found.) an increase from £9 billion of annual investment in 2010 to £30 to £50 billion by 2020) mean that in the Green sector more than others new intermediaries are required. However, market failures are preventing the formation of such new intermediaries at the scale and pace required.

Deleted: 3.26(iv)

Deleted: 2.34

It should be noted that as this market failure affects the Green sector across the board, it is applicable to each of the GIB's sectors, all of which are competing with a range of investment opportunities to secure vastly increased amounts of finance.

(iii) Risk aversion due to limited commercial development: there are currently only a small number of fully operating dedicated biomass power generation plants globally and few of these are large scale; only very few dedicated biomass power plants operate over 50MW globally, and none so far in the UK. Construction is considered to be the riskiest stage in a project (in terms of additional costs or delays to the project) so lenders are unwilling to invest or are looking to offset potentially over-priced investment risk through increased requirements on EPCs (engineering, procurement and construction costs), increased risk premiums and the requirement for long term feedstock contracts.

These conditions can render it challenging to obtain sufficient finance, in particular for smaller projects which are subject to higher relative capital costs, have higher relative risk premiums and higher relative EPC costs, leading some financiers to overestimate the risks. Further, banks are unwilling to lend sufficient money on viable terms to scale-up operations because there are few examples of large scale (100MW and above) biomass power projects including large scale dedicated biomass, biomass conversion, CHP and co-firing (those looking to increase the proportion of co-firing higher than 15%). These conditions are currently inhibiting the development of pyrolysis and gasification technologies. However, given the number of large scale electricity plants currently in planning or awaiting the outcome of the RO banding review (approximately 2.5GW), banks expect a significant take up once there are one or two plants generating successfully. The injection of GIB capital on commercially viable terms would therefore be likely to act as a catalyst to further private investment.

(iv) Risk aversion, due to technology uncertainty: although there is some private investment in the sector, investors' lack of understanding of the technologies used in the sector is leading to a mispricing of risk which is constraining the injection of sufficient capital into the sector. Concerns about technology viability are particularly problematic for investment in technologies which have been newly applied to biomass, such as early stage combustion technologies including gasification and pyrolysis. This is in part due to a lack of reference plants for investors to base key decisions upon. These projects can gain a lower rate of return and are higher risk than conventional biomass to power technologies, and are therefore more difficult to fund. Funding offered to the sector is therefore insufficient to allow the sector to grow to meet renewable energy targets. The GIB offers potential for funding the development of plants which would allow for the development of a track record in the sector. This should have the effect of overcoming potential investor's misperceptions of the risk which will fuel further private sector investment.

(v) Risk aversion due to concerns around fuel pricing: feedstock accounts for 50% to 75% of the full generation costs[7] and concerns over price fluctuations may therefore deter investment in the sector. These may result from foreign exchange risk (for imported biomass) and because biomass prices remain exposed to seasonality, location and availability of supplies. As a result, it is difficult for biomass developers and generators to hedge their positions. Combined with little correlation between fuel costs and power prices, this can subject developers to significant feedstock price risk. This market failure affects all technologies which require a high volume of biomass that needs to be sourced. It is expected that it will take time before the financing market is sufficiently confident about the nature and risks involved in biomass supply contracts to support significant investment in biomass power projects.

(vi) Risk aversion due to concerns around security of fuel supply: as there is no central, stabilised market equalising supply and demand across regions, the uncertainties and risks related to biomass supply are larger than lenders in energy markets expect from existing fossil fuel supplies. As a result of constrained supply, prospective investors have demanded multiple contracts of five to seven year duration with bioenergy suppliers across different geographical regions. This has been challenging to achieve and has affected investment in small and large scale dedicated biomass, CHP, pyrolysis and gasification. Oxera notes that, smaller, non utility developers may, in particular, find it harder to obtain long term-feedstock contracts:[8]

> *The availability of a viable, long-term, bankable wood fibre supply contract for non-utility takers is by no means certain.*

There is therefore a role for the GIB to provide commercial funding to enable the development of early supply.

Oxera notes that if a supply chain contains small players, or is sufficiently immature that there is a limited number of such counterparties, project development may only be possible with vertical integration into feedstock supply. This would restrict project development to large vertically integrated utilities players with sufficient financial strength to invest. For example, EDF has acquired its first biomass pellet manufacturing plant in Germany. In these

---

[7] Morgan Stanley Research Group: European Utilities; Biomass: Right technology, wrong economics?; August 24, 2010 (page 6).

[8] Reuters (2012), 'Analysis: UK bets on biomass in move away from coal', May 25.

circumstances, there would be a role for the GIB to invest into projects where such large players are capital constrained, namely due to their constrained balance sheets.

(vii) Risk aversion concerning ancillary infrastructure due to uncertainty of demand: Banks, which are experiencing a constrained ability to lend, have demonstrated a reluctance to invest until electricity generation stations are in place. However, all links in the biomass ancillary infrastructure (production, storage, transport and processing) need to be in place in advance of the electricity generating station and the biomass ancillary infrastructure will not be invested in until there is a high level of certainty that demand will justify such investment. Specifically, generators are being hindered by the lack of suitable infrastructure and are unable to plan effectively for long term contracts with high volumes of biomass. This has led to a lack of willingness to invest in infrastructure until the supply of biomass is significant. The failure affects all listed infrastructure and ancillary technologies and reflects a wider market failure of coordination.

(viii) The lack of a track record in long-term consistent government policies in the biomass sector: As Green investments generally rely on government policies, which must be in place long-term to ensure a return to the project, uncertainty in future policy support has led to a perceived risk to investors. Eventually, market failures affecting information asymmetry of the technology and market for biomass and the associated policy uncertainty should reduce as the technology is further deployed, markets scale-up and policy stabilises. The UK Government believes that GIB investment in biomass technologies will accelerate investment in the sector by demonstrating that Government policy is strongly in support of biomass and commercial investments in biomass are now viable on a long term basis.

1.9 As demonstrated by the market failures above, there is an acute need for additional sources of capital on market terms to meet renewable energy targets. GIB investment could contribute to these objectives in the following ways:

Formatted: Bullets and Numbering

(i) from a purely financial perspective, GIB commercial investment in the sector could replace funding previously provided by traditional investors but which is no longer available due to long term structural changes in the market; and

(ii) a number of the additional failures broadly arise from a lack of information or imperfect information and are expected to be overcome with time; once one or two examples have demonstrated commercial success, similar technologies should be deemed lower risk. GIB investment in early-stage projects would demonstrate the commercial success of preliminary projects. This would have the effect of overcoming potential investors' misperceptions of risk and would therefore accelerate long term capital intermediation from new classes of private sector investors in the sector.

1.10 Substituting grid electricity and fossil fuels with biomass stands to make a significant contribution to decarbonising energy and heat generation. Biomass power is considered essential to meeting renewable energy targets. The UK Bioenergy Strategy of April 2012 indicates scenarios for the biomass power sector with the potential to deliver, by 2020, 20-40 TWh, equivalent to 5-11% of the UK's total power generation. Analysis set out in the Renewables Energy Roadmap indicates that in central range scenarios, the biomass heat and power sector has the potential to deliver 68-100 TWh, equivalent to 30-43% of the UK's renewable energy targets. Oxera has calculated that the finance gap could lie in the range of £3.4 to £5.4 billion by 2020 (and as illustrated at Figure Error! No text of specified style in document..2 below):[9]

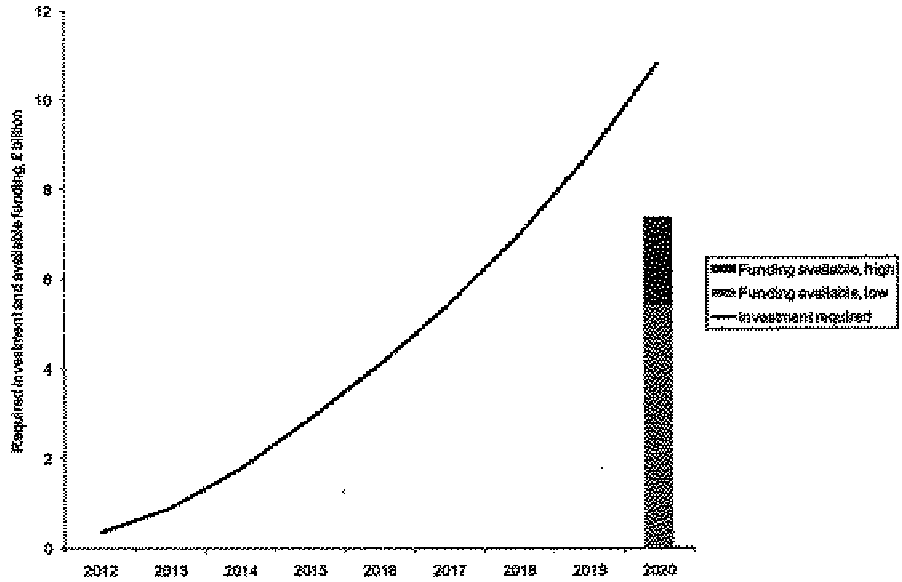
Formatted: Bullets and Numbering

Deleted: Figure 3.4

Figure Error! No text of specified style in document..2
Funding gap in the biomass sector (2011/12 prices)

Deleted: 3

Deleted: 4



[9] Analysis by Vivid Economics suggest that only £55 to £75 billion of finance may be available (from utility balance sheets, bank debt, infrastructure funds and insurance funds). See Vivid Economics (2001), "The Green Investment Bank: Policy and Finance Context", October, p.40. If available finance were allocated across sectors in proportion to sector requirements, this would imply that the funding gap in the Biomass sector could lie in the range of £3.4 to £5.4 billion by 2020. This is an indicative first approximation and implies that there is a similar relationship between risk and return across sectors – that is, although risks and returns may differ across sectors, risk is not priced significantly differently across them. It is likely to represent a conservative estimate, and further constraints may limit access to finance in some sectors – e.g. the desire for large utilities to limit exposure to a particular sector to a fixed proportion of their balance sheet, or that lenders are wary of highly levered financial structures such that not all potential debt finance can be utilised.

Source: *Vivid Economics (2011), 'The Green Investment Bank: Policy and Finance Context', October, p.57 and Oxera carried out for BIS analysis.*

1.11 The current pipeline of potential projects exceeds the UK's Renewable Energy Roadmap target to build an additional 750 MW to 2,750 MW of biomass capacity by 2020, primarily though the conversion of existing coal plants and the building of Greenfields plants. However, the majority of projects are subject to investor approval and only a small proportion have reached financial close. Oxera estimates that the overall pipeline of plants currently being considered by developers is around 3,300 MW; however only 400 MW have either reached financial close or is expected to reach financial close shortly.[10]

Formatted: Bullets and Numbering

1.12 To date at least five dedicated biomass power project developers with 600MW projects under development have approached the UK Government seeking funding assistance. These projects are estimated to require over £1 billion for construction. Similarly, sponsors of 4GW of operating coal power capacity have approached the UK Government for funding assistance for the conversion to biomass plants or increased levels of co-firing of biomass. These projects are likely to require a further £1.2 billion of funding. Given that £2.2 billion of financing is at risk without GIB intervention, against an approximately £3.8 billion investment requirement, providing evidence that potentially as much as 60% of the investment requirement identified could face funding difficulties without additional intervention by the GIB to mobilise further private finance into Biomass power.

---

[10] Platts (2012), "Power on Europe", May 28th.

[redacted]

From: [redacted]
Sent: 19 July 2012 17:48
To: [redacted]
Cc: [redacted]
Subject: TRIM: RE: GIB state aid - Biomass power

Attachments: Bioresource supply - for GIB.xlsx
TRIM Dataset: M1
TRIM Record Number: D13/313755
TRIM Record URI: 13967211

[redacted]

Please see attached spreadsheet which includes 2011 DUKES stats on imported woody biomass and three bioresource supply scenarios developed for the Bioenergy Strategy. The supply figures represent what could potentially be available, not what we think will be demanded, although they still provide a sense of magnitude of the increase in supply required from current levels to what may be expected in 2020.

Happy to discuss,

[redacted]

[redacted]
Economic Adviser | Strategic Analysis | Department of Energy and Climate Change

☎ [redacted]

Bioresource supply - for GIB.x...

From: [redacted]
Sent: 19 July 2012 16:33
To: [redacted]
Cc: [redacted]
Subject: FW: GIB state aid - Biomass power

[redacted],

I have provided some answers to the questions below.

The text could look something link this...

As the electricity grid is decarbonised, the source of electricity will become more diverse and increasingly decentralised. The UK will require investment in additional biomass power plants and a higher volume of imported and domestic biomass will be supplied [add supporting figures relating to the scale of the increase]. The Renewables Roadmap highlights the challenge of increasing the volume of sustainable biomass to meet this demand, and evidence gathered in support of the UK Bioenergy Strategy identifies that there is a shortfall in the investment needed to deliver this. This shortfall is largely due to the uncertainty in the demand for biomass, causing market failures affecting biomass power to cascade into the fuel supply chain. Key areas of investment needed includes changes in infrastructure to cater for high volumes of biomass being transported through ports, and access to increased locations in the UK. All locations will require safe storage. Overcoming the costs high upfront costs to establish perennial energy crops in the UK is needed, and in some cases specialist equipment to plant and harvest the biomass. Fuel needs to be converted into a form that is suitable to deliver into the electricity generator which can require additional processing infrastructure, including pelleting, briquetting or torrefaction. [Jayne are you able to add a bit which says who is seeking to invest in this infrastructure?]

Happy to discuss,

[redacted]

From: [redacted]
Sent: 17 July 2012 11:57
To: [redacted]
Cc: [redacted]
Subject: GIB state aid - Biomass power

[redacted] good to speak earlier concerning input on the biomass power section of the GIB state aid application.

As discussed, we want to bolster further the case for the sector to cover not only biomass power plants (co-firing, conversion and dedicated new-build), but to also cover key elements of "ancillary infrastructure" - i.e. investment in fuel preparation, transportation and storage.

The attached case is the latest submitted to the EC this Monday 16th. We've amended it somewhat to put the focus more precisely on key elements of ancillary infrastructure.

Key questions on which you could help us are the following:

- Is the scope of ancillary infrastructure correctly described? Is anything obvious missing?

I don't know if it counts as 'infrastructure' but support to overcome the high upfront costs needed to establish a perennial energy crop in the UK seems appropriate, along with any specialist equipment to plant/ harvest/bail or transport the biomass.

Could also add grid connections, but am not aware that this is a particularly significant barrier.

- What evidence is there to support market failures constraining finance in the ancillary infrastructure - I could imagine we could include:
    - Supporting commentary in other DECC publications that investment in supply chain could be significant (i.e. beyond capacity of current players)

I don't think we have quantified the levels of investment that needs to go into the supply chain, but we have a study which aims to look at that due for next year.
<< File: Copy of 5135-barriers-to-bioenergy-matrix.xls >>
The attached "barriers matrix" that we published as supporting evidence alongside the bioenegry strategy (http://www.decc.gov.uk/en/content/cms/meeting_energy/bioenergy/strategy/strategy.aspx) touches on the supply side needs. Rows 21, 22, 23, 24, 28, 38, 40, 43, 46, 47, 48, 49, 50, 51, 52, 55 of fuel specific barrier point to lack of investment in planting, making, storing or transporting biomass fuel. Row 1 of the technology specific barriers refers to lack of investment in district heating, which cuts across to the heat case as well, row 5 refers to grid connections, row 22 is investment infrastructure in ports and other transport e.g. rail.

The Renewable Energy Roadmap (http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/renewable-energy/2167-uk-renewable-energy-roadmap.pdf) refers to challenges/ uncertain costs in the biomass supply chain. I couldn't see a really explicit reference to the need to improve the supply chain infrastructure (as it is more focussed on sustainability aspects), but paras such as 2.13, 3.141, 3.150 (Actions) could explain the need to ramp up the supply and acknowledges that there are challenges to achieving this.

- A sense of who would typically invest in such infrastructure - is this a burden that would usually fall on the utilities?

Bioenergy is mainly being developed by independents rather than utilities and some of them are taking up infrastructure investments themselves. Jayne may be in a position to provide some additional information on this.

- Any further wording to support the case qualitatively that there will need to be major investment in ancillary infrastructure (i.e. making the case that most biomass will be imported, that the increase in imported biomass will go from X-Ym tonnes, representing annual growth of Z%, that it is less dense and has greater volume per unit CV than coal, and therefore requires greater transportation/ storage logistics. Re investment in fuel preparation, presumably we need to focus on the expansion of the UK domestic market - what evidence can we bring in here?

We are seeking to provide you with these figures, but I'm afraid we have not been able to finish these today. Alexis will forward these separately - hopefully at some point tomorrow.

- Any information on costs - do we have any estimates of the cost of investment in supply chain e.g. £ per unit investment and quantum of investment?

I'm afraid we don't have these sorts of figures.

If you could assist us with this information by end Thursday this week (19th July), that would be very helpful. We are not looking for large volumes of data or wording - just a few key additional paragraphs to insert to bolster the case.

Many thanks

[redacted]

<< File: 20120716_Biomass power section.doc >>

[redacted] | UK Green Investments | Department for Business, Innovation & Skills | Orchard 1, UG1, 1 Victoria Street, London SW1H 0ET |Direct Line [redacted] | Mobile [redacted] | www.bis.gov.uk

Summary

Estimated bioresources potentially available to the UK in 2020

Imported bioresources		2020		
		Restricted	Medium	High
TWh	Imported Agricultural residues	23	55	86
	Imported woody bio	94	73	343
Modt	Imported Agricultural residues	4	10	16
	Imported woody bio	16	14	65
	Total Modt	**20**	**20**	**80**

TWh to Mt of feedstock 0.169 Based on Forestry Commission estimates for conversions (19 GJ/odt)
Bioresource supply on net calorific value basis

Actual imported woody biomass to UK in 2011

DUKES 2011 data	
Total current woody imports TWh	5
Total current woody imports Modt	1

DUKES figures show approximately **1Modt** of woody biomass (including energy crops was imported into the UK in **2011**. (Ofgem estimate 1.3 Modt in 2011)

Bioresource supply scenarios assumed in the Bioenergy Strategy analysis suggest between **20 and 80 Modt** could be potentially available to the UK in **2020.**

Imported supply is expected to increase significantly from current rates to what is estimated to be available in 2020 (estimates are based on increases in planting rates and market development - see Bioenergy Strategy Analytical Annex for more details - http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/bio-energy/5136-bioenergy-strategy-analytical-annex.pdf)

To note: The bioresource supply scenarios developed for the Bioenergy Strategy modelling were intended to test how robust the patterns of bioenergy use were to changing bioresource availability. The intention was not to forecast future bioresources available to the UK. Bioresource supply availability in the future is highly uncertain, and therefore the estimates here should be used with caution.

y crops)

est

at is
g rates
details -
/5136-

gy
re to

is
n.

All figures based on DUKES 2012 data

Trade summary for pellets, wood and wood waste

Thousand tonnes of oil equivalent

Gross calorific value

	Pellets		Fuel wood		Chips/sawdust/waste		Pell
	Imports	Exports	Imports	Exports	Imports	Exports	Imports
2009	18.7	5.0	3.6	15.7	71.7	24.9	18.3
2010	221.5	24.2	1.0	38.4	47.7	45.5	216.0
2011	420.2	17.1	2.7	35.2	30.7	131.1	409.7

tonne oil equivalent to TWh	0.00001163

TWh

Gross calorific value

	Pellets		Fuel wood		Chips/sawdust/waste		Pell
	Imports	Exports	Imports	Exports	Imports	Exports	Imports
2009	0.218	0.058	0.042	0.182	0.834	0.289	0.212
2010	2.576	0.281	0.012	0.447	0.554	0.529	2.512
2011	4.887	0.199	0.031	0.409	0.357	1.524	4.764

lets	Net calorific value Fuel wood		Chips/sawdust/waste	
Exports	Imports	Exports	Imports	Exports
4.9	3.2	13.9	64.0	22.7
23.6	0.9	34.0	42.4	42.8
16.7	2.4	31.1	27.5	121.6

lets	Net calorific value Fuel wood		Chips/sawdust/waste	
Exports	Imports	Exports	Imports	Exports
0.057	0.037	0.161	0.744	0.264
0.274	0.011	0.396	0.494	0.497
0.194	0.028	0.362	0.319	1.414

2011 woody imports 5.112

Restricted Scenario TWh

feedstock	2011	2015	2020	2025	2030	2035	2040	2045	2050
Agricultural residues - imports	23.7	23.1	22.6	21.9	20.3	16.3	12.3	8.3	4.3
Microalgae oil imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UK macroalgae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arboricultural arisings	1.9	2.5	3.3	4.0	4.8	4.8	4.8	4.8	4.8
1G Bioethanol - import	69.2	40.1	0.8	4.8	8.4	6.7	5.1	3.4	1.8
Tall Oil - imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current oil crops	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Current oil crops (import)	29.1	27.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Agricultral Residue	14.5	17.1	19.8	20.6	21.4	21.4	21.4	21.4	21.4
Emerging oil crops (import)	0.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food Waste	1.1	2.5	4.0	5.0	6.0	6.0	6.0	6.0	6.0
Forestry residues	0.1	0.2	0.4	0.5	0.7	0.7	0.7	0.7	0.7
landfill gas	32.2	24.3	17.2	11.7	8.3	8.3	8.3	8.3	8.3
Livestock manures	1.3	1.6	1.9	2.1	2.3	2.3	2.3	2.3	2.3
Renewable fraction of wastes	2.8	4.9	6.7	7.6	8.0	8.0	8.0	8.0	8.0
Sawmill co-products	3.6	3.8	4.1	4.3	4.5	4.5	4.5	4.5	4.5
Sewage sludge	2.2	2.3	2.5	2.7	2.9	2.9	2.9	2.9	2.9
Short Rotation Forestry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Starch crops	0.9	1.4	1.9	2.3	2.6	2.6	2.6	2.6	2.6
Stemwood	0.8	1.4	1.9	2.4	2.9	2.9	2.9	2.9	2.9
Sugar crops	0.9	1.4	1.9	2.3	2.6	2.6	2.6	2.6	2.6
Tallow	0.4	0.8	1.2	1.3	1.5	1.5	1.5	1.5	1.5
UK Energy Crops	0.0	1.1	3.3	6.6	18.0	18.0	18.0	18.0	18.0
Used Cooking Oil	1.0	1.1	1.3	1.4	1.5	1.5	1.5	1.5	1.5
Waste Wood	11.4	16.9	22.2	22.0	21.7	21.7	21.7	21.7	21.7
Woody biomass - imports	4.8	26.2	94.0	227.2	446.0	357.8	269.7	181.5	93.3
Total	**202.3**	**201.2**	**210.9**	**350.7**	**584.4**	**490.6**	**396.7**	**302.9**	**209.1**

Medium scenario TWh

feedstock	2011	2015	2020	2025	2030	2035	2040	2045	2050
Agricultural residues - imports	23.7	39.4	55.1	62.9	65.3	53.4	41.6	29.7	17.8
Microalgae oil imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UK macroalgae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arboricultural arisings	8.0	8.3	8.9	9.3	9.9	9.9	9.9	9.9	9.9
1G Bioethanol - Import	100.9	102.3	57.0	90.7	127.5	104.3	81.1	58.0	34.8
Tall Oil - imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current oil crops	0.2	0.2	0.0	0.1	0.2	0.2	0.2	0.2	0.2
Current oil crops (import)	30.4	51.0	0.0	0.0	28.7	23.5	18.2	13.0	7.8
Dry Agricultral Residue	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9
Emerging oil crops (import)	1.0	2.4	0.0	0.0	12.1	9.9	7.7	5.5	3.3
Food Waste	5.1	5.9	6.8	7.3	7.7	7.7	7.7	7.7	7.7
Forestry residues	1.7	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.9
landfill gas	33.0	25.0	17.7	12.1	8.6	8.6	8.6	8.6	8.6
Livestock manures	2.6	2.9	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Renewable fraction of wastes	3.4	5.6	7.4	8.4	8.8	8.8	8.8	8.8	8.8
Sawmill co-products	4.8	4.9	4.9	5.0	5.1	5.1	5.1	5.1	5.1
Sewage sludge	2.8	3.0	3.1	3.3	3.4	3.4	3.4	3.4	3.4
Short Rotation Forestry	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2
Starch crops	2.8	3.1	3.3	3.5	3.6	3.6	3.6	3.6	3.6
Stemwood	6.3	6.4	6.5	6.6	6.6	6.6	6.6	6.6	6.6
Sugar crops	2.8	3.1	3.3	3.5	3.6	3.6	3.6	3.6	3.6
Tallow	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
UK Energy Crops	0.5	1.1	4.9	11.7	41.7	41.7	41.7	41.7	41.7
Used Cooking Oil	1.2	1.3	1.5	1.7	2.0	2.0	2.0	2.0	2.0
Waste Wood	20.5	21.5	22.2	22.0	21.7	21.7	21.7	21.7	21.7
Woody biomass - imports	3.9	3.9	73.0	203.3	434.1	355.2	276.2	197.3	118.4
Total	**281.1**	**318.4**	**306.0**	**481.8**	**821.4**	**700.0**	**578.6**	**457.2**	**335.8**

Ambitious scenario TWh

feedstock	2011	2015	2020	2025	2030	2035	2040	2045	2050
Agricultural residues - imports	23.7	54.7	85.6	105.9	103.1	93.6	79.6	65.6	36.0
Microalgae oil imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UK macroalgae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arboricultural arisings	12.1	12.1	12.7	13.2	14.0	14.0	14.0	14.0	14.0
1G Bioethanol - import	100.7	102.8	58.5	93.6	91.1	82.6	70.3	57.9	31.8
Tall Oil - imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Current oil crops	0.3	0.3	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Current oil crops (import)	30.4	51.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry Agricultral Residue	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
Emerging oil crops (import)	1.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food Waste	7.9	8.2	8.5	8.7	8.8	8.8	8.8	8.8	8.8
Forestry residues	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
landfill gas	34.2	26.0	18.5	12.7	9.0	9.0	9.0	9.0	9.0
Livestock manures	4.5	4.7	4.9	5.1	5.3	5.3	5.3	5.3	5.3
Renewable fraction of wastes	4.6	7.3	9.2	10.3	10.4	10.4	10.4	10.4	10.4
Sawmill co-products	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Sewage sludge	3.3	3.4	3.5	3.6	3.6	3.6	3.6	3.6	3.6
Short Rotation Forestry	0.0	0.0	0.0	0.0	0.8	0.8	0.8	0.8	0.8
Starch crops	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Stemwood	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Sugar crops	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Tallow	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
UK Energy Crops	0.5	1.4	5.8	23.7	64.1	64.1	64.1	64.1	64.1
Used Cooking Oil	1.5	1.6	1.8	1.9	2.0	2.0	2.0	2.0	2.0
Waste Wood	22.8	22.6	22.2	22.0	21.7	21.7	21.7	21.7	21.7
Woody biomass - imports	3.3	96.6	343.5	823.7	802.0	727.4	618.6	509.8	279.8
Total	**307.2**	**454.3**	**630.9**	**1,180.7**	**1,192.6**	**1,099.9**	**964.8**	**829.6**	**543.9**

(11)

[redacted]

From: [redacted]
Sent: 18 February 2013 15:09
To: [redacted]
Cc: Callard Richard (ShEx)
Subject: Biomass power - campaign letter to UKGIB

[redacted]

Are you still handling HMG policy on biomass power? As you may know, the UK Green Investment Bank recently committed £100 million to financing the Drax biomass conversion project. This has prompted a campaign letter challenging the merits of the Bank investing in biomass (see below).

The letter is addressed to the Bank's chairman, Lord Smith - copied to SofS BIS. I am not sure it is for the bank to engage in policy discussions about the merits of the different renewable energy technologies within its sectoral scope. The Government has identified the Bank's scope (including biomass - though it is not a priority sector). So the Government seems best placed to handle questions about why this sector should be considered green.

Presumably, this is a familiar issue and DECC has dealt with similar letters in the past. Grateful for your thoughts on how to address this one.

Many thanks

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted])
Sent: 14 February 2013 16:09
To: [redacted]; [redacted]; [redacted]
Subject: Advice for CDU re campaign emails: Green Bank: Stop funding big biomass!

[redacted]
I wonder if I could get your views on this campaign – see first email in chain.

They're addressed to Lord Smith, Chairman of GIB & BIS has been copied in.

Would we respond if it is copied to us?

There have been 4 so far. Here is the campaign website and email template:
http://www.biofuelwatch.org.uk/2013/green-bank-alert/

Thanks

[redacted]

[redacted] | Correspondence Officer | Central Drafting Unit, Ministerial and Parliamentary Support Team | Department for Business, Innovation & Skills | [redacted] | www.bis.gov.uk | Blog: blogs.bis.gov.uk | Twitter: @bisgovuk

-----Original Message-----
From: [redacted] On Behalf Of Cable MPST
Sent: 14 February 2013 15:34
To: BIS Central Drafting Unit
Subject: FW: Green Bank: Stop funding big biomass!

TO please

[redacted]

x[redacted]

-----Original Message-----
From: [redacted]
Sent: 14 February 2013 15:18
To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO_2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]

---

(12)

[redacted]

From: [redacted]
Sent: 19 February 2013 11:17
To: [redacted]
Cc: Callard Richard (ShEx)
Subject: RE: Biomass power - campaign letter to UKGIB

[redacted]

We can provide you with lines but ultimately it is for UKGIB to decide and if and how to respond.

[redacted]

From: [redacted]
Sent: 19 February 2013 10:31
To: [redacted])
Cc: Callard Richard (ShEx)
Subject: RE: Biomass power - campaign letter to UKGIB

The campaign letter was copied to BIS SofS. I think it is fine for HMG to take control of providing a response given the substantive issue relates to the merits of large scale biomass power projects. UKGIB is an NDPB - so an arm of government - but it does not have responsibility for policy.

Thanks

[redacted]

From: [redacted])
Sent: 19 February 2013 10:17
To: [redacted]
Cc: Callard Richard (ShEx)
Subject: RE: Biomass power - campaign letter to UKGIB

[redacted],

Am asking for advice. As the campaign isn't directed to gov, I don't think we can answer directly. It may be that we can provide UKGIB with an information note, if asked. That's what I'm checking.

[redacted]

From: [redacted])
Sent: 19 February 2013 09:52
To: [redacted]
Cc: Callard Richard (ShEx); [redacted])
Subject: RE: Biomass power - campaign letter to UKGIB

Thanks [redacted] grateful for your thoughts on how to handle this anti large biomass campaign letter directed at the UKGIB and copied to BIS.

[redacted]

From: [redacted]

Sent: 19 February 2013 09:26
To: [redacted]
Cc: Callard Richard (ShEx); [redacted]
Subject: RE: Biomass power - campaign letter to UKGIB

[redacted]

[redacted] copied into the email, is the lead on biomass.

[redacted]

From: [redacted]
Sent: 18 February 2013 15:09
To: [redacted]
Cc: Callard Richard (ShEx)
Subject: Biomass power - campaign letter to UKGIB

[redacted]

Are you still handling HMG policy on biomass power? As you may know, the UK Green Investment Bank recently committed £100 million to financing the Drax biomass conversion project. This has prompted a campaign letter challenging the merits of the Bank investing in biomass (see below).

The letter is addressed to the Bank's chairman, Lord Smith - copied to SofS BIS. I am not sure it is for the bank to engage in policy discussions about the merits of the different renewable energy technologies within its sectoral scope. The Government has identified the Bank's scope (including biomass - though it is not a priority sector). So the Government seems best placed to handle questions about why this sector should be considered green.

Presumably, this is a familiar issue and DECC has dealt with similar letters in the past. Grateful for your thoughts on how to address this one.

Many thanks

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 14 February 2013 16:09
To: [redacted]; [redacted]
Subject: Advice for CDU re campaign emails: Green Bank: Stop funding big biomass!

Hello
I wonder if I could get your views on this campaign – see first email in chain.

They're addressed to Lord Smith, Chairman of GIB & BIS has been copied in.

Would we respond if it is copied to us?

There have been 4 so far. Here is the campaign website and email template:
http://www.biofuelwatch.org.uk/2013/green-bank-alert/

Thanks

[redacted]

[redacted] Correspondence Officer | Central Drafting Unit, Ministerial and Parliamentary Support Team | Department for Business, Innovation & Skills | [redacted] | [redacted] | www.bis.gov.uk | Blog: blogs.bis.gov.uk | Twitter: @bisgovuk

-----Original Message-----

From: [redacted]) On Behalf Of Cable MPST
Sent: 14 February 2013 15:34
To: BIS Central Drafting Unit
Subject: FW: Green Bank: Stop funding big biomass!

TO please

[redacted]

-----Original Message-----
From: [redacted]
Sent: 14 February 2013 15:18
To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO_2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]

13

[redacted]

From: [redacted]
Sent: 26 February 2013 15:50
To: [redacted]
Cc: [redacted] Callard Richard (ShEx); [redacted];
[redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution
Attachments: UKGIB Drax - sustainability issues.doc

[redacted] copy all

BIS and DECC have been discussing how best to respond to a major email campaign that raises concerns about the UKGIB decision to provide £100 million to the financing for converting Drax power station to run partly on biomass fuel.

I understand the UKGIB is planning to meet with representatives of Biofuel Watch next week to hear their concerns about the project and to explain their decision to invest.

Separately, HMG will need to provide a written response to emails we have received on this issue. I am happy to prepare the draft response but clearly it will be important to obtain DECC input and ensure you are content with the text.

Thank you for the briefing material below. This is helpful. However, I would appreciate some further DECC advice to help me draft a response. I attach a list of questions I think reflect the main concerns expressed in the email campaign. I should be grateful if DECC would consider these and provide responses to help me understand the arguments.

The campaign letters make points specifically about the impact of large scale biomass power projects. The distinction appears to relate to the requirement for dedicated fuel production sources and substantive changes in land use. The campaign does not appear to be expressing concern about small scale biomass power projects so we do not need to make points that relate to the merits of these.

Many thanks in advance for your help. Ideally we would be in a position to submit a draft reply to Ministers for approval by close on Thursday.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 22 February 2013 14:12
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass! - draft contribution

[redacted]

I understand you require a contribution for the above campaign.

Please find some lines below to use.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]

-----Original Message-----
From: [redacted]
Sent: 21 February 2013 15:11
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass!

[redacted]

BIS have received the below campaign and have approached us for a contribution on the biomass aspect.

We have the lines below. Are these ok to send over or do you want to add anything?

Thanks

We see an important role for bio-energy at all scales, from householder energy, through community scale projects, to large electricity generating stations. Bio-energy can help with energy security by using a wide range of UK-sourced biomass and providing a controllable energy supply, balancing variable technologies such as wind. By 2020, bio-energy could provide 11% of total UK energy (heat, transport and electricity) without significant impacts on food production or the environment.

DECC's Renewables Obligation (RO) sustainability criteria include a GHG lifecycle emissions saving target of 60% for biomass power against the average EU fossil grid intensity (which is at least a 68% saving compared to coal). Together with general restrictions on the use of biomass materials sourced from land which is important on carbon or biodiversity grounds. The emission levels quoted by some reports (49% higher than coal) do not accurately reflect the actual way harvested wood is used, where high quality wood is processed into timber for construction and manufacturing, and only the forestry and sawmill residues used for energy. This mixed use is common practice for UK forests and many examples of imported wood.

The RO sustainability criteria apply to the use of imported as well as domestic biomass and biogas used for electricity generation. This means that any direct land use change, whether in the UK or elsewhere, will be considered as part of the greenhouse gas (GHG) lifecycle assessment. Generators are required to provide annual sustainability reports to Ofgem on their performance against the criteria. To support industry, we have provided an easy to use GHG lifecycle assessment tool that generators and their supply-chains can use to further improve their performance.

Our current consultation on sustainability proposes we go even further to ensure sustainability and significant GHG savings. We intend to bring a requirement for biomass power generators to provide an independent audit report and to formally link meeting the improved criteria with eligibility for support. Our proposals also include a GHG trajectory where the GHG target becomes tougher in 2020, then tightens further in 2025, so driving industry to reduce lifecycle emissions over time. We also intend to introduce sustainable forest management criteria that build on established forest certification schemes such as Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). These international schemes cover a broad range of social and environmental issues, such as protecting biodiversity and maintaining forest productivity, that are part of managing a forest sustainably. The aim is to ensure whether woodfuel is sourced from the UK, other EU member states, North America or elsewhere, that there are suitable controls in place to prevent deforestation or environmental degradation.

The Large Combustion Plant Directive (LCPD), an air quality Directive, places limits on emissions of sulphur dioxide and nitrogen oxides from any plant above 50MW capacity, including biomass. Plants which decide to opt-out are required to close by the end of 2015 at the latest. The remaining combustion plants will need to comply with the Industrial Emissions Directive (IED), which replaces the LCPD and sets more stringent emissions limits from 1 January 2016.

[redacted]
Department of Energy & Climate Change (DECC) Correspondence Manager 5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]

-----Original Message-----
From: [redacted]
Sent: 15 February 2013 08:55
To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]

This email was received from the INTERNET.

Communications via the GSI may be automatically logged, monitored and/or recorded for legal purposes.

WHY IS IT APPROPRIATE FOR THE UKGIB TO INVEST IN LARGE SCALE BIOMASS POWER?

- The project sponsors claim the conversion project will result in a reduction in carbon emissions of 300 million tonnes per year. Is that credible?

- Will the biomass fuel for Drax (imported from North America) be produced from a dedicated bio-energy crop?

- Is there a negative environmental impact of creating such a large scale bio-energy fuel supply chain?

  - Are established forests being cleared to be replaced with biofuel products?

  - What impact does this have on carbon capture properties of the land use?

  - What impact does this have on wildlife and biodiversity?

- How does the project fit with RO sustainability criteria aimed at preventing negative impacts on biodiversity and carbon capture properties of land?

- How does Ofgem ensure electricity generators source biomass fuel from sustainable sources – effectiveness of GHG lifecycle assessment tool?

- How effective are forest certification schemes (FSC / PEFC) at preventing deforestation and negative environmental impacts?

- Does the Industrial Emissions Directive mean Drax would be required to close by end 2015 if it did not introduce biomass?

- Consultation on sustainability proposes increased requirements - including biomass power generators to provide an independent audit report. Is Drax being required to produce such a report?

(14)

[redacted]

From: [redacted]
Sent: 27 February 2013 09:43
To: [redacted]
Cc: [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution
Attachments: FW: Biomass line to take

[redacted]

Further to my email of yesterday, I just found the attached email from December with a reply to a T/O on the merits of biomass prepared by [redacted] in ORED. Thought this material could be useful in preparing our response to the email campaign. Copying in [redacted] to be aware.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 26 February 2013 15:50
To: [redacted]
Cc: [redacted] Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted] copy all

BIS and DECC have been discussing how best to respond to a major email campaign that raises concerns about the UKGIB decision to provide £100 million to the financing for converting Drax power station to run partly on biomass fuel.

I understand the UKGIB is planning to meet with representatives of Biofuel Watch next week to hear their concerns about the project and to explain their decision to invest.

Separately, HMG will need to provide a written response to emails we have received on this issue. I am happy to prepare the draft response but clearly it will be important to obtain DECC input and ensure you are content with the text.

Thank you for the briefing material below. This is helpful. However, I would appreciate some further DECC advice to help me draft a response. I attach a list of questions I think reflect the main concerns expressed in the email campaign. I should be grateful if DECC would consider these and provide responses to help me understand the arguments.

The campaign letters make points specifically about the impact of large scale biomass power projects. The distinction appears to relate to the requirement for dedicated fuel production sources and substantive changes in land use. The campaign does not appear to be expressing concern about small scale biomass power projects so we do not need to make points that relate to the merits of these.

Many thanks in advance for your help. Ideally we would be in a position to submit a draft reply to Ministers for approval by close on Thursday.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 22 February 2013 14:12
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass! - draft contribution

[redacted]

I understand you require a contribution for the above campaign.

Please find some lines below to use.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]

-----Original Message-----
From: [redacted]
Sent: 21 February 2013 15:11
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass!

[redacted]

BIS have received the below campaign and have approached us for a contribution on the biomass aspect.

We have the lines below. Are these ok to send over or do you want to add anything?

Thanks

We see an important role for bio-energy at all scales, from householder energy, through community scale projects, to large electricity generating stations. Bio-energy can help with energy security by using a wide range of UK-sourced biomass and providing a controllable energy supply, balancing variable technologies such as wind. By 2020, bio-energy could provide 11% of total UK energy (heat, transport and electricity) without significant impacts on food production or the environment.

DECC's Renewables Obligation (RO) sustainability criteria include a GHG lifecycle emissions saving target of 60% for biomass power against the average EU fossil grid intensity (which is at least a 68% saving compared to coal). Together with general restrictions on the use of biomass materials sourced from land which is important on carbon or biodiversity grounds. The emission levels quoted by some reports (49% higher than coal) do not accurately reflect the actual way harvested wood is used, where high quality wood is processed into timber for construction and manufacturing, and only the forestry and sawmill residues used for energy. This mixed use is common practice for UK forests and many examples of imported wood.

The RO sustainability criteria apply to the use of imported as well as domestic biomass and biogas used for electricity generation. This means that any direct land use change, whether in the UK or elsewhere, will be considered as part of the greenhouse gas (GHG) lifecycle assessment. Generators are required to provide annual sustainability reports to Ofgem on their performance against the criteria. To support industry, we have provided an easy to use GHG lifecycle assessment tool that generators and their supply-chains can use to further improve their performance.

Our current consultation on sustainability proposes we go even further to ensure sustainability and significant GHG savings. We intend to bring a requirement for biomass power generators to provide an independent audit report and to formally link meeting the improved criteria with eligibility for support. Our proposals also include a GHG trajectory where the GHG target becomes tougher in 2020, then tightens further in 2025, so driving industry to reduce lifecycle emissions over time. We also intend to introduce sustainable forest management criteria that build on established forest certification schemes such as Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). These international schemes cover a broad range of social and environmental issues, such as protecting biodiversity and maintaining forest productivity, that are part of managing a forest sustainably. The aim is to ensure whether woodfuel is sourced from the UK, other EU member states, North America or elsewhere, that there are suitable controls in place to prevent deforestation or environmental degradation.

The Large Combustion Plant Directive (LCPD), an air quality Directive, places limits on emissions of sulphur dioxide and nitrogen oxides from any plant above 50MW capacity, including biomass. Plants which decide to opt-out are required to close by the end of 2015 at the latest. The remaining combustion plants will need to comply with the Industrial Emissions Directive (IED), which replaces the LCPD and sets more stringent emissions limits from 1 January 2016.

[redacted]
Department of Energy & Climate Change (DECC) Correspondence Manager 5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]

-----Original Message-----
From: [redacted]]
Sent: 15 February 2013 08:55

To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]

[redacted]

From: [redacted]
Sent: 27 February 2013 09:38
To: [redacted]
Subject: FW: Biomass line to take

Attachments: Draft Reply to Ministers Case TO2012-19843.doc

From: [redacted]
Sent: 21 December 2012 11:37
To: [redacted]
Cc: [redacted]
Subject: RE: Biomass line to take

Hello, [redacted]

Here is a draft reply I did for a recent case claiming that biomass doesn't reduce CO_2.

Draft Reply to Ministers Case ...

You should find some useful stuff here. (The last paragraph on the first page onward is about waste.)

Cheers.

[redacted]

From: [redacted]
Sent: 21 December 2012 10:43
To: [redacted]
Subject: FW: Biomass line to take

[redacted]

Can you help with lines?.

[redacted]

[redacted]
Renewable Energy Supply Chain
Industry & Investment Team
Office of Renewable Energy Deployment
Department of Energy and Climate Change
Area 4B
3 Whitehall Place, London SW1A 2AW
Tel: [redacted]
http://www.decc.gov.uk

From: [redacted]
Sent: 21 December 2012 10:29
To: [redacted]
Subject: FW: Biomass line to take

[redacted]

In [redacted] absence could you assist.

[redacted]

From: [redacted]
Sent: 21 December 2012 10:28
To: [redacted]
Subject: Biomass line to take

[redacted]

Could you let me have the lines to take DECC uses on why HMG believes biomass power is green - particularly in relation to the Drax project involving conversion from coal firing. We are expecting some criticism of GIB investment in the Drax deal.

Many thanks

[redacted]
GIB Team ShEx
[redacted]

Treat Official Case TO2012/19843.

Draft Reply:

Thank you for your further letter of 16 November about your concerns regarding the use of biomass fuel for electricity generation.

We recognise that the carbon savings from biomass can vary widely because, as you point out, the savings are offset by the fossil energy that is used for cultivation (such as fertilisers), harvesting, processing and transportation. Major land use change, particularly deforestation and drainage of peat bogs, can completely negate the carbon saving, as well as cause damage to biodiversity and other ecosystem resources. It is, therefore, critical that biomass resources are grown sustainably.

When the biomass is grown, harvested, processed and transported sustainably it can be a very low carbon energy source. A 2009 Environment Agency report showed typical GHG savings (compared to fossil gas) for forestry residue woodchips of between 81% - 97%, and for waste woodchips of between 79% - 99%.

In April 2012, we published the Bioenergy Strategy, which sets out a framework for the use of sustainably produced biomass feedstocks to the UK up to 2050. The Strategy's overarching principle is that bio-energy must be produced sustainably and that there is a role for UK Government to steer sustainable development in the UK and as, far as possible, internationally. We have reformed the planning system in England to encourage local authorities to plan for renewables development in the right places.

The sustainability criteria under the Renewables Obligation (RO) include a minimum greenhouse gas (GHG) emissions saving compared to fossil fuel, and general restrictions on the use of materials from land important on carbon or biodiversity grounds – e.g. from wetlands, peatlands and primary forest.

In June 2011, the Government published a Review of Waste policies in England. This recognises the important part that energy from waste can play in helping to meet renewable energy targets, diversifying supply, and providing economic opportunities.

The Review suggests that renewable electricity generated from waste through combustion technologies could almost treble from the current 1.2TWh to between 3.1TWh and 3.6TWh by 2020.

However, our aim is to get the most energy out of genuinely residual waste, not to get the most waste into energy recovery. The UK currently recycles around 35% of municipal waste, with 12% recovered for energy and 53% going to landfill.

Energy recovery can be a sustainable option for waste that would otherwise go to landfill, so avoiding landfill methane emissions. The choice of energy from waste technology depends on the type of waste, local circumstances and finance. All waste facilities are subject to environmental monitoring and regulation by the Environment Agency.

(15)

[redacted]

From: [redacted]
Sent: 27 February 2013 09:51
To: [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

Hi [redacted]

I have asked [redacted], the policy lead for this area if she is ok to provide some more lines.

I will let you know when she gets back to me. She was copied in to your mail so she can see the deadline you have set.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

From: [redacted]
Sent: 26 February 2013 15:50
To: [redacted]
Cc: [redacted] Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted] copy all

BIS and DECC have been discussing how best to respond to a major email campaign that raises concerns about the UKGIB decision to provide £100 million to the financing for converting Drax power station to run partly on biomass fuel.

I understand the UKGIB is planning to meet with representatives of Biofuel Watch next week to hear their concerns about the project and to explain their decision to invest.

Separately, HMG will need to provide a written response to emails we have received on this issue. I am happy to prepare the draft response but clearly it will be important to obtain DECC input and ensure you are content with the text.

Thank you for the briefing material below. This is helpful. However, I would appreciate some further DECC advice to help me draft a response. I attach a list of questions I think reflect the main concerns expressed in the email campaign. I should be grateful if DECC would consider these and provide responses to help me understand the arguments.

The campaign letters make points specifically about the impact of large scale biomass power projects. The distinction appears to relate to the requirement for dedicated fuel production sources and substantive changes in land use. The campaign does not appear to be expressing concern about small scale biomass power projects so we do not need to make points that relate to the merits of these.

Many thanks in advance for your help. Ideally we would be in a position to submit a draft reply to Ministers for approval by close on Thursday.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 22 February 2013 14:12
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass! - draft contribution

Hi [redacted]

I understand you require a contribution for the above campaign.

Please find some lines below to use.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]
Sent: 21 February 2013 15:11
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass!

Hi [redacted]

BIS have received the below campaign and have approached us for a contribution on the biomass aspect.

We have the lines below. Are these ok to send over or do you want to add anything?

Thanks

We see an important role for bio-energy at all scales, from householder energy, through community scale projects, to large electricity generating stations. Bio-energy can help with energy security by using a wide range of UK-sourced biomass and providing a controllable energy supply, balancing variable technologies such as wind. By 2020, bio-energy could provide 11% of total UK energy (heat, transport and electricity) without significant impacts on food production or the environment.

DECC's Renewables Obligation (RO) sustainability criteria include a GHG lifecycle emissions saving target of 60% for biomass power against the average EU fossil grid intensity (which is at least a 68% saving compared to coal). Together with general restrictions on the use of biomass materials sourced from land which is important on carbon or biodiversity grounds. The emission levels quoted by some reports (49% higher than coal) do not accurately reflect the actual way harvested wood is used, where high quality wood is processed into timber for construction and manufacturing, and only the forestry and sawmill residues used for energy. This mixed use is common practice for UK forests and many examples of imported wood.

The RO sustainability criteria apply to the use of imported as well as domestic biomass and biogas used for electricity generation. This means that any direct land use change, whether in the UK or elsewhere, will be considered as part of the greenhouse gas (GHG) lifecycle assessment. Generators are required to provide annual sustainability reports to Ofgem on their performance against the criteria. To support industry, we have provided an easy to use GHG lifecycle assessment tool that generators and their supply-chains can use to further improve their performance.

Our current consultation on sustainability proposes we go even further to ensure sustainability and significant GHG savings. We intend to bring a requirement for biomass power generators to provide an independent audit report and to formally link meeting the improved criteria with eligibility for support. Our proposals also include a GHG trajectory where the GHG target becomes tougher in 2020, then tightens further in 2025, so driving industry to reduce lifecycle emissions over time. We also intend to introduce sustainable forest management criteria that build on established forest certification schemes such as Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). These international schemes cover a broad range of social and environmental issues, such as protecting biodiversity and maintaining forest productivity, that are part of managing a forest sustainably. The aim is to ensure whether woodfuel is sourced from the UK, other EU member states, North America or elsewhere, that there are suitable controls in place to prevent deforestation or environmental degradation.

The Large Combustion Plant Directive (LCPD), an air quality Directive, places limits on emissions of sulphur dioxide and nitrogen oxides from any plant above 50MW capacity, including biomass. Plants which decide to opt-out are required to close by the end of 2015 at the latest. The remaining combustion plants will need to comply with the Industrial Emissions Directive (IED), which replaces the LCPD and sets more stringent emissions limits from 1 January 2016.

[redacted]
Department of Energy & Climate Change (DECC) Correspondence Manager 5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]

Sent: 15 February 2013 08:55
To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO_2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]

[redacted]

From: [redacted])
Sent: 27 February 2013 10:11
To: [redacted]
Cc: [redacted]; Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted]

I don't recognise the opening para on Mick's letter. If I'd seen it I wouldn't have let it past as the drafting gives the wrong impression. Will look at your earlier e-mail.

[redacted]

From: [redacted]
Sent: 27 February 2013 09:43
To: [redacted]
Cc: [redacted] Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted]

Further to my email of yesterday, I just found the attached email from December with a reply to a T/O on the merits of biomass prepared by Mick Cornell in ORED. Thought this material could be useful in preparing our response to the email campaign. Copying in Mick to be aware.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 26 February 2013 15:50
To: [redacted]
Cc: [redacted]; Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted] copy all

BIS and DECC have been discussing how best to respond to a major email campaign that raises concerns about the UKGIB decision to provide £100 million to the financing for converting Drax power station to run partly on biomass fuel.

I understand the UKGIB is planning to meet with representatives of Biofuel Watch next week to hear their concerns about the project and to explain their decision to invest.

Separately, HMG will need to provide a written response to emails we have received on this issue. I am happy to prepare the draft response but clearly it will be important to obtain DECC input and ensure you are content with the text.

Thank you for the briefing material below. This is helpful. However, I would appreciate some further DECC advice to help me draft a response. I attach a list of questions I think reflect the main concerns expressed in the email campaign. I should be grateful if DECC would consider these and provide responses to help me understand the arguments.

The campaign letters make points specifically about the impact of large scale biomass power projects. The distinction appears to relate to the requirement for dedicated fuel production sources and substantive changes in land use. The campaign does not appear to be expressing concern about small scale biomass power projects so we do not need to make points that relate to the merits of these.

Many thanks in advance for your help. Ideally we would be in a position to submit a draft reply to Ministers for approval by close on Thursday.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 22 February 2013 14:12
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass! - draft contribution

Hi [redacted]

I understand you require a contribution for the above campaign.

Please find some lines below to use.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]
Sent: 21 February 2013 15:11
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass!

Hi [redacted]

BIS have received the below campaign and have approached us for a contribution on the biomass aspect.

We have the lines below. Are these ok to send over or do you want to add anything?

Thanks

We see an important role for bio-energy at all scales, from householder energy, through community scale projects, to large electricity generating stations. Bio-energy can help with energy security by using a wide range of UK-sourced biomass and providing a controllable energy supply, balancing variable technologies such as wind. By 2020, bio-energy could provide 11% of total UK energy (heat, transport and electricity) without significant impacts on food production or the environment.

DECC's Renewables Obligation (RO) sustainability criteria include a GHG lifecycle emissions saving target of 60% for biomass power against the average EU fossil grid intensity (which is at least a 68% saving compared to coal). Together with general restrictions on the use of biomass materials sourced from land which is important on carbon or biodiversity grounds. The emission levels quoted by some reports (49% higher than coal) do not accurately reflect the actual way harvested wood is used, where high quality wood is processed into timber for construction and manufacturing, and only the forestry and sawmill residues used for energy. This mixed use is common practice for UK forests and many examples of imported wood.

The RO sustainability criteria apply to the use of imported as well as domestic biomass and biogas used for electricity generation. This means that any direct land use change, whether in the UK or elsewhere, will be considered as part of the greenhouse gas (GHG) lifecycle assessment. Generators are required to provide annual sustainability reports to Ofgem on their performance against the criteria. To support industry, we have provided an easy to use GHG lifecycle assessment tool that generators and their supply-chains can use to further improve their performance.

Our current consultation on sustainability proposes we go even further to ensure sustainability and significant GHG savings. We intend to bring a requirement for biomass power generators to provide an independent audit report and to formally link meeting the improved criteria with eligibility for support. Our proposals also include a GHG trajectory where the GHG target becomes tougher in 2020, then tightens further in 2025, so driving industry to reduce lifecycle emissions over time. We also intend to introduce sustainable forest management criteria that build on established forest certification schemes such as Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). These international schemes cover a broad range of social and environmental issues, such as protecting biodiversity and maintaining forest productivity, that are part of managing a forest sustainably. The aim is to ensure whether woodfuel is sourced from the UK, other EU member states, North America or elsewhere, that there are suitable controls in place to prevent deforestation or environmental degradation.

The Large Combustion Plant Directive (LCPD), an air quality Directive, places limits on emissions of sulphur dioxide and nitrogen oxides from any plant above 50MW capacity, including biomass. Plants which decide to opt-out are required to close by the end of 2015 at the latest. The remaining combustion plants will need to comply with the Industrial Emissions Directive (IED), which replaces the LCPD and sets more stringent emissions limits from 1 January 2016.

[redacted]
Department of Energy & Climate Change (DECC) Correspondence Manager 5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]
Sent: 15 February 2013 08:55
To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]

---

(17)

[redacted]

From: [redacted]
Sent: 28 February 2013 16:57
To: [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted]

Any progress with this?

[redacted]

From: [redacted])
Sent: 27 February 2013 09:51
To: [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

Hi [redacted]

I have asked [redacted] the policy lead for this area if she is ok to provide some more lines.

I will let you know when she gets back to me. She was copied in to your mail so she can see the deadline you have set.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

From: [redacted]
Sent: 26 February 2013 15:50
To: [redacted])
Cc: [redacted]; Callard Richard (ShEx); [redacted])
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted] copy all

BIS and DECC have been discussing how best to respond to a major email campaign that raises concerns about the UKGIB decision to provide £100 million to the financing for converting Drax power station to run partly on biomass fuel.

I understand the UKGIB is planning to meet with representatives of Biofuel Watch next week to hear their concerns about the project and to explain their decision to invest.

Separately, HMG will need to provide a written response to emails we have received on this issue. I am happy to prepare the draft response but clearly it will be important to obtain DECC input and ensure you are content with the text.

Thank you for the briefing material below. This is helpful. However, I would appreciate some further DECC advice to help me draft a response. I attach a list of questions I think reflect the main concerns expressed in the email campaign. I should be grateful if DECC would consider these and provide responses to help me understand the arguments.

The campaign letters make points specifically about the impact of large scale biomass power projects. The distinction appears to relate to the requirement for dedicated fuel production sources and substantive changes in land use. The campaign does not appear to be expressing concern about small scale biomass power projects so we do not need to make points that relate to the merits of these.

Many thanks in advance for your help. Ideally we would be in a position to submit a draft reply to Ministers for approval by close on Thursday.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 22 February 2013 14:12
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass! - draft contribution

H[redacted]

I understand you require a contribution for the above campaign.

Please find some lines below to use.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]
Sent: 21 February 2013 15:11
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass!

Hi [redacted]

BIS have received the below campaign and have approached us for a contribution on the biomass aspect.

We have the lines below. Are these ok to send over or do you want to add anything?

Thanks

We see an important role for bio-energy at all scales, from householder energy, through community scale projects, to large electricity generating stations. Bio-energy can help with energy security by using a wide range of UK-sourced biomass and providing a controllable energy supply, balancing variable technologies such as wind. By 2020, bio-energy could provide 11% of total UK energy (heat, transport and electricity) without significant impacts on food production or the environment.

DECC's Renewables Obligation (RO) sustainability criteria include a GHG lifecycle emissions saving target of 60% for biomass power against the average EU fossil grid intensity (which is at least a 68% saving compared to coal). Together with general restrictions on the use of biomass materials sourced from land which is important on carbon or biodiversity grounds. The emission levels quoted by some reports (49% higher than coal) do not accurately reflect the actual way harvested wood is used, where high quality wood is processed into timber for construction and manufacturing, and only the forestry and sawmill residues used for energy. This mixed use is common practice for UK forests and many examples of imported wood.

The RO sustainability criteria apply to the use of imported as well as domestic biomass and biogas used for electricity generation. This means that any direct land use change, whether in the UK or elsewhere, will be considered as part of the greenhouse gas (GHG) lifecycle assessment. Generators are required to provide annual sustainability reports to Ofgem on their performance against the criteria. To support industry, we have provided an easy to use GHG lifecycle assessment tool that generators and their supply-chains can use to further improve their performance.

Our current consultation on sustainability proposes we go even further to ensure sustainability and significant GHG savings. We intend to bring a requirement for biomass power generators to provide an independent audit report and to formally link meeting the improved criteria with eligibility for support. Our proposals also include a GHG trajectory where the GHG target becomes tougher in 2020, then tightens further in 2025, so driving industry to reduce lifecycle emissions over time. We also intend to introduce sustainable forest management criteria that build on established forest certification schemes such as Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). These international schemes cover a broad range of social and environmental issues, such as protecting biodiversity and maintaining forest productivity, that are part of managing a forest sustainably. The aim is to ensure whether woodfuel is sourced from the UK, other EU member states, North America or elsewhere, that there are suitable controls in place to prevent deforestation or environmental degradation.

The Large Combustion Plant Directive (LCPD), an air quality Directive, places limits on emissions of sulphur dioxide and nitrogen oxides from any plant above 50MW capacity, including biomass. Plants which decide to opt-out are required to close by the end of 2015 at the latest. The remaining combustion plants will need to comply with the Industrial Emissions Directive (IED), which replaces the LCPD and sets more stringent emissions limits from 1 January 2016.

[redacted]
Department of Energy & Climate Change (DECC) Correspondence Manager 5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]
Sent: 15 February 2013 08:55
To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]

18

[redacted]

From: [redacted]
Sent: 07 March 2013 15:27
To: [redacted]
Cc: [redacted]; Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted] copy all

Not sure where we have got to with this. I think we still need to produce some text for HMG's response to this anti large scale biomass campaign. Grateful for your advice on the key points raised by the campaign.

Please note that the GIB's meeting with Biofuel Watch is now scheduled for 20 March.

[redacted]

From: [redacted]
Sent: 27 February 2013 10:11
To: [redacted]; [redacted]
Cc: [redacted]; Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted]

I don't recognise the opening para on [redacted] letter. If I'd seen it I wouldn't have let it past as the drafting gives the wrong impression. Will look at your earlier e-mail.

[redacted]

From: [redacted]
Sent: 27 February 2013 09:43
To: [redacted]
Cc: [redacted]; Callard Richard (ShEx); [redacted])
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted]

Further to my email of yesterday, I just found the attached email from December with a reply to a T/O on the merits of biomass prepared by [redacted] in ORED. Thought this material could be useful in preparing our response to the email campaign. Copying in [redacted] to be aware.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 26 February 2013 15:50
To: [redacted]
Cc: [redacted] Callard Richard (ShEx); [redacted]
Subject: RE: Green Bank: Stop funding big biomass! - draft contribution

[redacted] copy all

BIS and DECC have been discussing how best to respond to a major email campaign that raises concerns about the UKGIB decision to provide £100 million to the financing for converting Drax power station to run partly on biomass fuel.

I understand the UKGIB is planning to meet with representatives of Biofuel Watch next week to hear their concerns about the project and to explain their decision to invest.

Separately, HMG will need to provide a written response to emails we have received on this issue. I am happy to prepare the draft response but clearly it will be important to obtain DECC input and ensure you are content with the text.

Thank you for the briefing material below. This is helpful. However, I would appreciate some further DECC advice to help me draft a response. I attach a list of questions I think reflect the main concerns expressed in the email campaign. I should be grateful if DECC would consider these and provide responses to help me understand the arguments.

The campaign letters make points specifically about the impact of large scale biomass power projects. The distinction appears to relate to the requirement for dedicated fuel production sources and substantive changes in land use. The campaign does not appear to be expressing concern about small scale biomass power projects so we do not need to make points that relate to the merits of these.

Many thanks in advance for your help. Ideally we would be in a position to submit a draft reply to Ministers for approval by close on Thursday.

[redacted]
UKGIB Team ShEx
[redacted]

From: [redacted]
Sent: 22 February 2013 14:12
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass! - draft contribution

Hi [redacted]

I understand you require a contribution for the above campaign.

Please find some lines below to use.

Thanks

[redacted]
Department of Energy & Climate Change (DECC)
Correspondence Manager
5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]
Sent: 21 February 2013 15:11
To: [redacted]
Subject: FW: Green Bank: Stop funding big biomass!

Hi [redacted]

BIS have received the below campaign and have approached us for a contribution on the biomass aspect.

We have the lines below. Are these ok to send over or do you want to add anything?

Thanks

We see an important role for bio-energy at all scales, from householder energy, through community scale projects, to large electricity generating stations. Bio-energy can help with energy security by using a wide range of UK sourced biomass and providing a controllable energy supply, balancing variable technologies such as wind. By 2020, bio-energy could provide 11% of total UK energy (heat, transport and electricity) without significant impacts on food production or the environment.

DECC's Renewables Obligation (RO) sustainability criteria include a GHG lifecycle emissions saving target of 60% for biomass power against the average EU fossil grid intensity (which is at least a 68% saving compared to coal). Together with general restrictions on the use of biomass materials sourced from land which is important on carbon or biodiversity grounds. The emission levels quoted by some reports (49% higher than coal) do not accurately reflect the actual way harvested wood is used, where high quality wood is processed into timber for construction and manufacturing, and only the forestry and sawmill residues used for energy. This mixed use is common practice for UK forests and many examples of imported wood.

The RO sustainability criteria apply to the use of imported as well as domestic biomass and biogas used for electricity generation. This means that any direct land use change, whether in the UK or elsewhere, will be considered as part of the greenhouse gas (GHG) lifecycle assessment. Generators are required to provide annual sustainability reports to Ofgem on their performance against the criteria. To support industry, we have provided an easy to use GHG lifecycle assessment tool that generators and their supply-chains can use to further improve their performance.

Our current consultation on sustainability proposes we go even further to ensure sustainability and significant GHG savings. We intend to bring a requirement for biomass power generators to provide an independent audit report and to formally link meeting the improved criteria with eligibility for support. Our proposals also include a GHG trajectory where the GHG target becomes tougher in 2020, then tightens further in 2025, so driving industry to reduce lifecycle emissions over time. We also intend to introduce sustainable forest management criteria that build on established forest certification schemes such as Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). These international schemes cover a broad range of social and environmental issues, such as protecting biodiversity and maintaining forest productivity, that are part of managing a forest sustainably. The aim is to ensure whether woodfuel is sourced from the UK, other EU member states, North America or elsewhere, that there are suitable controls in place to prevent deforestation or environmental degradation.

The Large Combustion Plant Directive (LCPD), an air quality Directive, places limits on emissions of sulphur dioxide and nitrogen oxides from any plant above 50MW capacity, including biomass. Plants which decide to opt-out are required to close by the end of 2015 at the latest. The remaining combustion plants will need to comply with the Industrial Emissions Directive (IED), which replaces the LCPD and sets more stringent emissions limits from 1 January 2016.

[redacted]
Department of Energy & Climate Change (DECC) Correspondence Manager 5th Floor
3 Whitehall Place
London, SW1A 2AW
[redacted]
Email: [redacted]

-----Original Message-----
From: [redacted]
Sent: 15 February 2013 08:55
To: enquiries@greeninvestmentbank.com; Cable MPST; Enquiry Enquiry (Other Government Departments); robert.smith@weir.co.uk
Subject: Green Bank: Stop funding big biomass!

Dear Lord Smith,

Please don't let the Green Investment Bank finance or fund any more big biomass projects. Loans such as the £100 million one you gave Drax Plc in December 2012 to finance its conversion to biomass only make matters worse for the environment, the climate and communities.

Big biomass isn't green or renewable energy – in fact it's hugely destructive and responsible for unsustainable logging and landgrabbing in the Global South. Biomass power stations also emit up to 50% more CO2 per unit of energy than coal power stations and a growing number of studies show that their overall climate impact is likely to be even worse than that of coal for at least one or two generations.

Drax are converting to biomass to get around EU air quality regulations and to take advantage of big government subsidies for big biomass, not because they want to reduce their carbon emissions. Please don't make matters worse by financing the current rush for biomass conversions and dedicated biomass power stations.

By funding coal-to-biomass conversions you are keeping old, polluting power stations going for even longer – this is not green investment. We'd like you to make a commitment not to fund any more big biomass or biofuel projects through Green Bank investment.

Yours sincerely,

[redacted]