

Title: UK Green Investment Bank IA No: BIS0342 Lead department or agency: BIS Other departments or agencies: DECC, DEFRA, HMT	Impact Assessment (IA)		
	Date: 15/05/2012		
	Stage: Final		
	Source of intervention: Domestic		
	Type of measure: Other		
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Summary: Intervention and Options	RPC Opinion: RPC Opinion Status
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Cost of Preferred (or more likely) Option			
Total Net Present Value	Business Net Present Value	Net cost to business per year (EANCB on 2009 prices)	In scope of One-In, Measure qualifies as One-Out?
£100m	£m	£m	No
			NA

What is the problem under consideration? Why is government intervention necessary?

The overarching market failure is environmental externalities, where the impact of an activity on the environment is not fully priced into the market. There are also a number of market failures and barriers that manifest in financial markets and constrain the supply of finance, including: financial market capacity constraints, risk aversion due to imperfect information and information asymmetries, positive spillovers in knowledge, high financing transaction costs and coordination problems. There are also government failures which induce policy uncertainty. Without a UK Green Investment Bank (UK GIB), there is an increased risk that the UK will not achieve its green targets/ambitions and face higher costs of doing so.

What are the policy objectives and the intended effects?

The UK GIB's rationale is supporting the UK's transition to a green economy by targeting policy and market failures/barriers manifesting in financial markets and constraining the supply of finance in green infrastructure and late stage innovation. The UK GIB is a non-regulatory measure supporting BIS's departmental vision of defining a 'new economic model that delivers sustainable growth across the country and international competitiveness in a low-carbon economy no longer reliant on a narrow range of sectors'. It supports DECC's departmental objective ('DO') to 'drive ambitious action on climate change at home and abroad' and Defra's DO to 'support a strong and sustainable green economy, resilient to climate change'.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

The relevant options that have been considered are:

- Option 1: Do Nothing
- Option 2: Fund (an example of which involves the consolidation of existing interventions)
- Option 3: Increasing the application of existing alternative energy and climate change policies.
- Option 4: UK Green Investment Bank (UK GIB) - this is the recommended option. It is a spending measure, not a regulatory one.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 04/2015

Does implementation go beyond minimum EU requirements?		No			
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	Micro Yes	< 20 Yes	Small Yes	Medium Yes	Large Yes
What is the CO ₂ equivalent change in greenhouse gas emissions? (Million tonnes CO ₂ equivalent)			Traded: 51	Non-traded: 12	

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) that the benefits justify the costs.

Signed by the responsible SELECT SIGNATORY: _____ Date: _____

Summary: Analysis & Evidence

Policy Option 1

Description: Do Nothing

FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	High: Optional	Best Estimate:

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised costs by 'main affected groups'

Other key non-monetised costs by 'main affected groups'

Increased risk of missing the UK's green targets/ambitions. Some overall costlier technologies being taken forward in advance of the cheaper ones with smaller upfront capital costs & less risk. A slower move down the technology cost curve as economies of scale are not achieved as quickly, as there is less learning by doing & information dissemination. A potential increase in cost of adaptation to climate change with slower deployment and investment in green infrastructure/late stage innovation.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised benefits by 'main affected groups'

Other key non-monetised benefits by 'main affected groups'

Avoided (low) potential risks from novel technologies prematurely being deployed and crowding out more market ready technologies that would otherwise have been able to enter the market. Avoided potential costs associated with stranded assets or lock in of near to market 'green' technologies that do not leave room for future potentially cheaper innovation.

Key assumptions/sensitivities/risks

Maximum of 5 lines

Discount rate (%)

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs:	Benefits:	Net:	No	NA

Summary: Analysis & Evidence

Policy Option 2

Description: Fund

FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	High: Optional	Best Estimate:

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised costs by 'main affected groups'

Other key non-monetised costs by 'main affected groups'

Investment shortfall in facilitating a transition to a green economy is not addressed as the policy and market failures/barriers that manifest in financial markets are not targeted. If a fund consolidated existing interventions: the cost of streamlining different funding streams (which have different aims and routes to market); legal issues relating to amalgamation (e.g. cost of winding up contracts); and potential trade offs between funding existing interventions and new ones.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised benefits by 'main affected groups'

Other key non-monetised benefits by 'main affected groups'

Benefit to 'green' business from a potential increase in one-off funding to green investment and late stage innovation if funds may otherwise have gone elsewhere. There could also be subsequent higher green impacts (e.g. avoided carbon emissions).

Key assumptions/sensitivities/risks

Maximum of 5 lines

Discount rate (%)

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs:	Benefits:	Net:	No	NA

Summary: Analysis & Evidence

Policy Option 3

Description: Increasing the application of existing alternative energy and climate change policies

FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
			Low: Optional	High: Optional	Best Estimate:

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised costs by 'main affected groups'

Other key non-monetised costs by 'main affected groups'

0.2 ROC (Renewable Obligation Certificates)/Mwh increase would lead to a large increase in RO/FIT payments and deadweight loss of £17m associated with a higher cost of electricity.
 £30/tonne Increase in Landfill Tax: deadweight loss of £1bn. Increase through the CCL (Climate Change Levy) of non-domestic energy prices by £1.38/mwh: deadweight loss of £37m. Some of these measures are transfers which will have distributional impacts on energy intensive industries, the fuel poor and SMEs.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low		Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised benefits by 'main affected groups'

Other key non-monetised benefits by 'main affected groups'

Increasing ROCs would lead to an increase in renewable energy and increase CO2 savings.
 Increasing Landfill Tax would divert waste away from landfill and increase CO2 savings.
 Increasing CCL would reduce energy use and increase CO2 savings.

Key assumptions/sensitivities/risks	Discount rate (%)	3.5
Impact of £1bn from UK GIB in offshore wind, waste and NDEE (non domestic energy efficiency) compared to a level of increase in an existing policy (ROCs, landfill tax and CCL, respectively) that would deliver the same green impact.		

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs:	Benefits:	Net:	No	NA

Summary: Analysis & Evidence

Policy Option 4

Description: UK Green Investment Bank

FULL ECONOMIC ASSESSMENT

Price Base Year 2011	PV Base Year 2012	Time Period Years 19	Net Benefit (Present Value (PV)) (£m)		
			Low: -1300	High: 1500	Best Estimate: 100

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised costs by 'main affected groups'

Monetised cost varies by technology, as per their respective IAs. IAs include monetised capex and opex costs. This is included in the NPV estimate.

There are no first order costs on business - this is not a regulatory measure.

Other key non-monetised costs by 'main affected groups'

Start up and administration costs of the UK GIB (para 142 of evidence pages).

Potential loss from higher level of default than anticipated (para 142 of evidence pages). Note: estimated returns to the UK GIB are risk adjusted.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate			

Description and scale of key monetised benefits by 'main affected groups'

NPV estimate includes savings from CO2 avoided and financial returns.

Other key non-monetised benefits by 'main affected groups'

Improved UK competitiveness in green technologies and innovation/knowledge spillovers; additional investment and green impact from the demonstration effect; reduced technology costs due to learning from wider deployment and technological progress; greater diversification of the fuel mix; ancillary environmental benefits (e.g. from waste); distributional impacts e.g. employment in assisted areas.

Key assumptions/sensitivities/risks

Discount rate (%) 3.5

The NPV has been constructed using IA costs and benefits produced by OGDs and Vivid for individual technologies. UK GIB funds distributed across 8 green sectors using Monte Carlo analysis - this analysis provided estimates of the mid point NPV (and range) using a scenario of 90% of UK GIB funds committed (see para 123). No assessment of future borrowing in phase 3 has been made. (Annex 1: assumptions). The time period used for assessment varies by technology (e.g. offshore wind - 30 years).

BUSINESS ASSESSMENT (Option 4)

Direct impact on business (Equivalent Annual) £m:			In scope of OIOO?	Measure qualifies as
Costs:	Benefits:	Net:	No	NA

Evidence Base

Summary and context

1. This Impact Assessment (IA) has been prepared ahead of legislation for the UK Green Investment Bank ('UK GIB'). The UK GIB itself is a financial measure and not a regulatory one. This IA therefore does not need clearance from the Regulatory Policy Committee.

Problem under consideration

2. The overarching market failure is environmental externalities, where the impact of an activity on the environment is not fully priced into the market. This has prompted government action, including the introduction of a number of targets and policy instruments to help deliver them.
3. Alongside this, there are certain market failures and barriers that manifest themselves in the financial markets and constrain the supply of finance, as well as policy failures leading to uncertainty. These issues are constraining the level and speed of investment in UK green infrastructure and late stage innovation, which is required to meet legally binding targets and green policy ambitions.
4. Current government policies help to make green investment more attractive through increasing returns to renewable energy generation and imposing costs on fossil fuel use. However, they do not directly target the aspects of market failures that manifest themselves in financial markets and constrain the supply of finance.

Options

5. The options considered in this IA to tackle the problem under consideration are:
 - Option 1: Do Nothing
 - Option 2: Fund (an example could involve the consolidation of existing interventions).
 - Option 3: Increasing the application of existing Government policies (for the purpose of this analysis, specifically in respect of the offshore wind, waste treatment and non-domestic energy efficiency sectors).
 - Option 4: UK Green Investment Bank
6. Following quantitative and qualitative analysis set out in the following evidence pages, the recommended option is Option 4 – the UK Green Investment Bank. It is the only option considered in this IA that targets aspects of particular market failures and barriers that manifest themselves in the financial market. The UK GIB helps to address the flow of capital to green projects which are commercially viable, but where private sector investors have withheld investment as a result of these market failures / barriers. In this way, it is the only option that mobilises private sector investment directly and through a demonstration effect. For example, demonstrating the financial viability of investments can increase market

confidence in a novel technology. In seeking to target these market failures and barriers, the UK GIB complements the existing suite of government policies which aim to make green investment more attractive through increasing returns to renewable energy generation and imposing costs on fossil fuel use.

Value for money

7. The IA analysis indicates that the UK GIB should offer value for money.
8. The analysis in this IA highlights that the UK GIB is better at providing targeted tailored financial interventions than other policy tools to accelerate additional capital into green infrastructure. When compared to increasing the application of alternative existing policies, the UK GIB is more efficient in delivering green investment as it offers a more project specific intervention.
9. IAs assess a range of economic, social and environmental effects. The net present value (NPV) is the usual criterion used in IAs to assess value for money. The term NPV is used to describe the difference between the present value of a stream of costs and a stream of benefits over time.
10. It is impossible to be definitive on the exact NPV estimates for the UK GIB. The UK GIB will be set up as an arm's length financial institution. It is not possible to predict investments, as they will depend on market demand for the UK GIB's products and how best the UK GIB chooses to meet its objectives in the context of the pipeline of potential projects. The NPV estimates in this IA are illustrative only. They are not likely to represent nor will they determine the UK GIB's investment activity once it is set up. NPV estimates have been generated for four illustrative portfolios, comprising various scenarios of investments in different sectors. In addition, Monte Carlo analysis has been undertaken to give an estimated NPV range to reflect the level of uncertainty ex-ante on the portfolio make up.
11. The illustrative NPV estimates in the IA are in respect of the £3 billion that Government committed in Budget 2011 to fund the UK GIB over the period to 2015. The analysis in this IA does not address the potential costs and benefits of the UK GIB thereafter. The UK GIB, as an independent financial institution, aims to target certain market failures manifesting themselves in financial markets on an ongoing basis beyond 2015.
12. Certain renewable energy sectors, such as offshore wind, have a negative NPV due to their high cost, for which they receive significant subsidies provided by Government. However, such sectors are crucial for helping the UK to meet its carbon reduction and energy targets and have other non-monetised benefits, such as reduced technology costs due to learning from wider deployment and technological progress. It seems probable that such non-monetised benefits outweigh the cost of the subsidies provided by Government. Other sectors, such as non-domestic energy efficiency, have a positive NPV. If the UK GIB invests more in sectors that provide a positive NPV for the UK, it would lead to a higher estimated NPV for the UK GIB's activity.

13. The indicative NPV range for the UK GIB, set out in the front sheets of the IA, therefore spans the negative to the positive: -£1,300 million to £1,500 million, based on various assumptions. The mid-point estimate is £100 million. While any investments that the UK GIB might make in certain renewable energy sectors could help contribute to a negative NPV for the UK GIB's activity at a certain point in time, this does not mean that the investments themselves are not commercially sound. Indeed, one of the operating principles for the UK GIB is 'sound finances'. A key objective of the UK GIB is to make commercial investments, which in turn will allow the UK GIB to reinvest the returns in future green investments and help to make its green impact enduring.

Additional impacts

14. The illustrative NPV estimates do not include a range of benefits that the UK GIB is expected to deliver. The additional benefits of the UK GIB could include:

- a. Increased investment and green impacts from the demonstration effect of the UK GIB. This demonstration effect could result in additional investment from the private sector, for example: from additional sources of capital (such as from institutional investors) as a result of increased confidence in the technology, from demonstrating the financial viability of investments.
- b. Economic benefits, such as potential longer term economic growth benefits
- c. Innovation spill-overs
- d. (Skilled) employment in assisted areas
- e. Option value
- f. Reduced technology costs due to learning from wider deployment and technological progress
- g. Ancillary environmental benefits (such as from waste)
- h. Greater diversification of the fuel mix, facilitating energy security.

Areas covered in this IA

15. In line with the standard structure of IAs, the following sections are covered here:

- a. Problem under consideration and rationale for intervention
- b. Policy context and objective
- c. Description of options considered (including Do Nothing)
- d. Impacts
- e. Assumptions and Sensitivities (Annex 1)
- f. Detailed results from Sensitivity Analysis (Annex 2)
- g. Post-Implementation Review (Annex 3)
- h. Sources (Annex 4)

Problem under consideration and rationale for intervention

16. This IA has been prepared ahead of legislation for the UK GIB. The UK GIB itself is a financial measure and not a regulatory one. This IA therefore does not need clearance from the Regulatory Policy Committee.
17. The UK is committed to achieving the successful transition to a green economy and delivering long-term sustainable growth. This transition will require the more sustainable use of natural assets, less environmental damage, improved resource efficiency and greater energy security and resilience, while also maximising growth over the longer term and supporting high skilled employment. This challenge necessitates unprecedented investment in new green infrastructure and innovation, with infrastructure investments (broadly defined) of £220 – 330 billion over the next decade (or £22-33 billion a year on average) required¹.
18. The transition is constrained by a series of market failures and other barriers. Existing government policy is focused on overcoming some of these market failures using a range of policy instruments. However, even after these policies are implemented, aspects of certain market failures and barriers that manifest in financial markets can affect the financing of the green economy and limit investment. Without further intervention, these would lead to under-investment against the Government’s ambitious green objectives and legally binding climate change commitments.
19. The economic rationale for UK GIB intervention in selected green sectors is that, by targeting these market failures and barriers that manifest in the financial markets, it can help to reduce the under-provision of capital and/or increase the speed of its deployment, thus improving green outcomes.

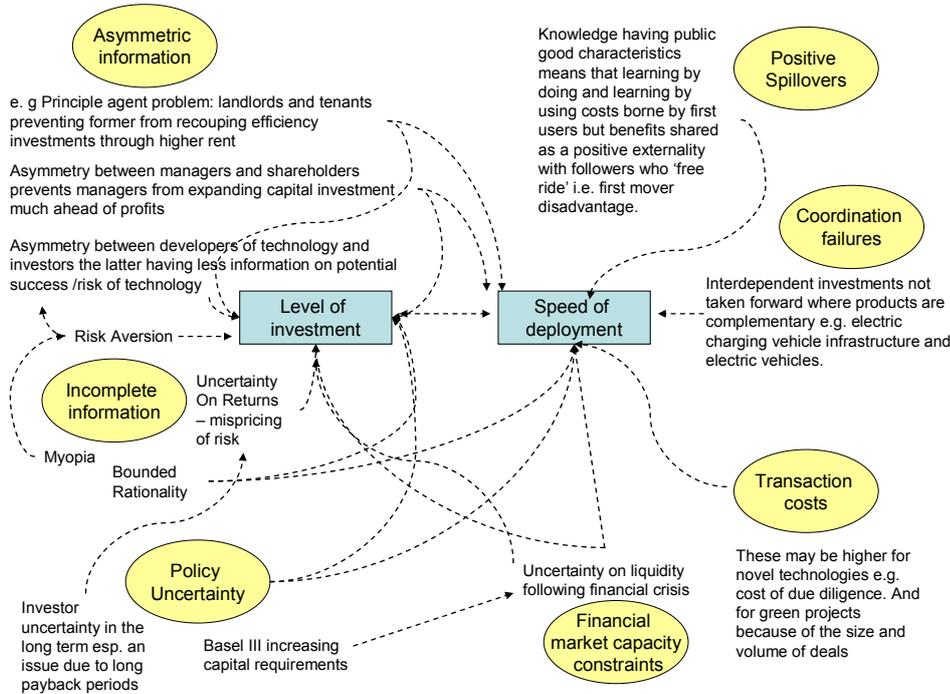
Market and policy failures / barriers

20. There are a wide range of market failures and barriers in various parts of the green economy which limit private sector investment in green sectors. The overarching market failure which is a key driver of the UK’s climate change targets is environmental externalities. The Stern Review (2006) highlighted climate change as the result of a global externality associated with greenhouse gas emissions, where the full cost of emissions in terms of climate change is not factored into decision making. In addition, the climate being a public global good means that the price and amount of goods and services do not reflect the environmental consequences of consumption and investment.
21. In addition to the overarching negative environmental and climate change externalities, there are a number of relevant market failures and barriers which the UK GIB is designed to target. These, as well as being “green” sector-specific, manifest themselves in the financial markets and thus affect the availability of finance. Market and policy failures and barriers interact to hamper the speed of technology deployment and limit the level of investment going into green technologies – the UK GIB seeks to address these (see the diagram at Figure 1 below).

¹ Vivid Economics in association with McKinsey & Co., October 2011

22. The UK GIB has the potential to address risks which are not directly addressed by existing or planned forthcoming policies, such as construction and technology risk. It also has the potential to cover a wide range of green sectors, such as waste and heat (which certain proposed policies such as Electricity Market Reform do not). Crucially, the UK GIB is the only option in this IA that helps target market failures that manifest themselves in the financial sector to constrain the supply of finance available to green infrastructure and late stage innovation. In this way, the UK GIB is a useful complement to existing Government policies.

Figure 1: Interaction of market failures and barriers (source BIS)



Source: BIS

23. **Policy uncertainty:** Green investments are dependent on government policies, which must be in place long-term in order to create an attractive investment climate, especially because of the long payback period on investments. The lack of track record in long-term green policies is considered a key external risk to private sector investors. *The UK GIB, which will be an independent financial institution with legislation to enshrine its enduring green purpose, is designed to help reduce this uncertainty. It helps to strengthen the signal from Government of committed action into the longer term, and mitigate the regulatory risks perceived by private sector investors of investing, both through the UK GIB co-investing in specific green projects and also through a demonstration effect of investing in particular sectors (for example, from demonstrating the financial viability of investments).*

24. The market failures and barriers which manifest themselves in the financial sector and constrain the availability of finance for many green sectors which the UK GIB seeks to address, include:

25. **Financial market capacity constraints:** Evidence gathered from market reports and interviews with financial market players shows that there is a financial market capacity problem. This manifests itself at a macro level where the need to invest in around £220-330 billion of green infrastructure over the next decade to meet environmental targets and the

government's green ambitions is above the rate of investments seen in recent decades. Whereas historic green investment has been in the region of £6 billion to £8 billion per annum, even in the near future green investment will need to be at least twice this amount, while by 2020 it is expected to need to be between four times and six times higher than historically. *The UK GIB directly addresses this issue by providing access to finance. It will help to galvanise the market, acting as a pioneer lender to green infrastructure and late stage innovation and thereby mobilise capital from other providers through its participation. The UK GIB will also increase private sector finance through its demonstration effect.*

26. At a firm / sectoral level, players which might have been expected to increase such investment face natural limits. Companies are limited in the pace at which new equity can be raised, and the financial macroeconomic environment is placing constraints on the amount of debt that banks can provide. In the last decade, UK companies active in green sectors have raised around £15 billion a year for a variety of investments (though not all green). This number includes bond issues, syndicated loans and rights issues by power generation companies, waste management companies, water utilities, railways operators and diversified utilities. *By working to a principle of 'crowding in' rather than 'crowding out', investing where a project is unable to attract all of its required finance from the private sector, the UK GIB will enhance the ability of some firms to raise the necessary finance and help to mobilise private sector investment. This will increase investment in green infrastructure.*

27. **High (perceived or real) financing transaction costs:** Many green projects involve novel technologies and business models which do not have a track record. This can increase the costs of due diligence. In addition, green projects can sometimes be high in number, but small in size and distributed across a large number of sites. For example, energy efficiency projects across a large corporate estate or within the domestic sector. These factors can raise the costs of assessing and monitoring, and organising external finance. They are a feature of information costs and asymmetry (discussed below). *The UK GIB can help to overcome high transaction costs by devising or supporting innovative finance mechanisms which aggregate sources of finance and/or projects.*

28. **Risk aversion due to imperfect information and information asymmetries:** Green investment has a number of risks attached. Often, investment in key sectors of the Green Economy lack deal precedent and a track record of performance. Uncertainty can exist around construction costs, technology reliability and performance, policy certainty or counterparty risks. In addition, there are also misperceptions around the risks of investing in the Green Economy. While different investor groups can be comfortable with different elements of risk profiles, the number of investors willing to take the set of required risks may be limited by the lack of information and experience. As a result, interventions which help to lower the perceived risks for certain types of investment may be required to expand the range of willing investors. *Through increasing the level of investment in such commercially viable projects, the UK GIB will play a part in developing a track record, thereby increasing the ability of investors to evaluate such projects and thus help to reduce risk aversion. This includes reducing perceived risk not directly targeted by existing or planned forthcoming policies, such as construction and technology risk. By increasing the level and speed of deployment, the UK GIB will facilitate stronger market signals to agents and consequently reduce the information gap on the commercial viability or financial rewards of investment – and through this demonstration effect the UK GIB will mobilise additional private sector investment.*

29. **Positive spillovers in knowledge:** Adopters of new technologies / business models will generate positive externalities, as ‘fast followers’ can reap the benefits of successful strategies and proven mechanisms while avoiding the upfront investment and learning costs. This is compounded by uncertainty of the benefits and long pay back periods. Such ‘free riding’ means that private sector firms and capital markets may be unwilling to take the risk, which can inhibit innovation as the technology / business models will not be developed. It reflects an underlying market failure whereby innovators may not be able fully to capture the value of their innovation and be sufficiently rewarded for taking risks on earlier investments. *With the UK GIB taking on some of the financial risk/cost of investment, firms may be in a better position to take on risks which may generate positive spillovers in knowledge. The UK GIB will provide investment for commercial projects that otherwise would not have attracted sufficient private sector investment. Therefore it is more likely that the money will fund more novel technologies within a sector, rather than existing policies which intervene at a sector level.*
30. **Coordination problems:** Coordination problems mean that interdependent investments are not necessarily taken forward in an optimal manner, if at all. In the case of offshore wind for example, the timing of power transmission construction, installation shipping, turbine and tower delivery and foundations completion all need to be coordinated. *The UK GIB will target this market failure indirectly. By indicating to which sectors the UK GIB will potentially provide finance, coordination may be improved as interdependent parts of the supply chain will have clearer signals on speed and scale of deployment of technologies.*
31. This diversity of market failures and barriers affects different ‘green sectors’ to different degrees. These are summarised in Table 2. The table does not constitute a comprehensive list of ‘green sectors’.

Table 2: Summary of market failures and barriers at the sector level

	Sector					Financial			
	Externalities	Information asymmetry	Market power	Complements	Public goods	Access to bank capital	Novelty & risk mis-perception	Transaction costs	Balance sheet limits
Offshore wind	✓	✓	✓	✓	✓		✓		✓
Commercial and Industrial waste	✓	✓	✓	✓	✓	✓	✓		✓
Non-domestic energy efficiency	✓	✓					✓	✓	
Electric vehicle infrastructure			✓	✓			✓		
Green Deal	✓	✓					✓		✓
Rolling stock			✓	✓					
Carbon capture and storage	✓		✓	✓	✓		✓		✓
Flood defence			✓		✓				
Nuclear power	✓		✓						✓
Smart meter			✓				✓		✓
Smart grid			✓						
Marine	✓	✓			✓		✓		✓
Renewable heat	✓	✓		✓			✓		
Solar PV	✓		✓						

Source: Vivid Economics in association with McKinsey & Company

Policy context and objective

32. The particular market failures and other barriers outlined above can be found in many sectors relevant to the green economy. While many of these failures and barriers might be reduced in time, the overlap with the imperatives to meet challenging targets, to deliver on green policy ambitions and facilitate a transition to a green economy in the near/medium term means that additional public resources and signalling through active support is required now.

33. The existing suite of policy interventions does not fully address market failures and barriers that constrain the supply of finance. They focus more on improving the revenue stream which also encourages investment. To tackle risk aversion that constrains the supply of finance, it is less effective to increase revenue rather than address such constraints directly. There is therefore a strong rationale for an intervention in the form of a UK GIB to complement the existing government policies that help to improve the revenue stream: a

publicly funded financial vehicle with deep expertise in financial markets, which delivers investments in UK green infrastructure and late stage innovation and mobilises private sector capital – with the objective of helping to ensure that the UK makes a successful transition to a green economy and meets its environmental goals and legally binding climate change commitments.

34. Such an intervention would make the existing policy approach more comprehensive, with different interventions complementing each other where appropriate. The UK GIB offers tailored and targeted financial interventions, whilst existing policies include the pricing of carbon, revenue support policies (such as the Renewables Obligation, and the future introduction of Electricity Market Reform), innovation support, competition regulation, efficiency standards, and public provision of services.

Coalition Commitment

35. In May 2010, the Coalition Agreement committed the government to creating a Green Investment Bank.
36. The BIS Structural Reform Plan directly supports this, through Action 1.1: Establishing a green investment bank to support private investment in green infrastructure and late stage technologies. This supports BIS's departmental vision of defining a 'new economic model that delivers sustainable growth across the country and international competitiveness in a low-carbon economy no longer reliant on a narrow range of sectors'. It also supports DECC's departmental objective to 'drive ambitious climate change at home and abroad' and Defra's departmental objective to 'support a strong and sustainable green economy, resilient to climate change'.
37. The Government committed in the 2011 Budget to fund the UK GIB with £3 billion over the period to 2015. The UK GIB will become a key component of the transition to a green economy, complementing other green policies to help accelerate additional investment and help meet the Government's energy and climate change targets and green ambitions.

Green targets and ambitions

38. UK green commitments include:
- a. 2008 Climate Change Act: This commits the UK to reduce its greenhouse gas emissions by at least 80% by 2050, relative to 1990. This long-term target is complemented by a series of near-term, five year carbon budgets that are also statutory obligations. The carbon budgets mandate that UK greenhouse gas emissions have to be reduced by 34% in 2020 and 50% in 2027, both relative to 1990. These are legally binding commitments that are subject to an annual review on progress by the independent Committee on Climate Change. Non-compliance may be challenged in court.
 - b. Renewable energy: Through the EU's Renewable Energy Directive, the UK is committed to produce 15% of its energy from renewable energy sources by 2020, with interim milestones of 4% for 2011-12, 5.4% by 2013-14, 7.5% by 2015-16,

and 10.2% by 2017-18. The Government outlined its strategy for meeting the 2020 target in the UK Renewable Energy Strategy (RES) of July 2009 and Renewable Energy Roadmap of 2011.

- c. Waste: The UK has binding targets: to reduce biodegradable municipal waste to landfill to 50% of 1995 levels by 2013 and 35% of 1995 levels by 2020; to recover at least 70% of construction and demolition waste; and to recycle at least 50% of household waste by 2050.
- d. Transport: The UK has adopted EU-wide targets to reduce the carbon intensity of new cars and vans to 95 grams per kilometre (g/km) and 147 g/km respectively. It is also committed to return aviation emissions to 2005 levels by 2050. There are no direct targets on rail, although the Government is committed to modernising and upgrading the UK's railway infrastructure.
- e. Water: The Government's aspiration is to reduce water consumption in England (policy on water is devolved to the regional administrations) to an average of 130 litres per person per day by 2030 from the current level of around 150 litres per person.
- f. Natural environment: The UK Biodiversity Action Plan (UKBAP) sets various targets on land restoration and expanding habitats to be achieved by 2015.

39. The UK GIB shall help support these targets and ambitions that are at the core of the transition to a green economy, where economic growth is maximised while managing natural assets sustainably.

Sectors

40. It is recognised that the Green Economy is nascent and fast changing, and that it may comprise different sectors at different points in the future. It could include:

- a. Biomass
- b. Carbon Capture and Storage
- c. Electric Vehicle Charging Infrastructure
- d. Flood defences
- e. Green Deal
- f. Marine Energy
- g. Non-domestic energy efficiency
- h. Nuclear Energy
- i. Offshore Wind
- j. Onshore Wind
- k. Renewable Heat (including heat pumps)
- l. Smart Meters
- m. Solar photovoltaics
- n. Train rolling stock
- o. Waste – Energy from Waste and Commercial and Industrial Waste Recovery

Description of options considered (including Do Nothing)

Option (1) – Do Nothing

41. There are a range of existing government interventions to support the Government's aim of achieving the transition to a green economy and meeting its legally binding climate change commitments. The table below sets out some key policy instruments currently in force:

Policy instrument
Renewable Obligation – to be superseded by the Contract For Difference Feed-in-Tariffs
Carbon Price Support
EU Emissions Trading Scheme
Feed-in-Tariffs
Renewable Transport Fuel Obligation
Carbon Reduction Commitment
Climate Change Levy
Climate Change Agreements
Building Regulations
Carbon Emissions Reduction Target, Community Energy Savings Programme, Warm Front
Smart Metering
Renewable Heat Incentive
Carbon Capture and Storage demonstration, Carbon Capture Readiness
Landfill Tax
Enhanced Capital Allowances
Innovation Support Vehicles (eg the National Renewable Energy Centre)
Vehicle Excise Duty
Grants to purchase electric vehicles

42. The existing suite of Government policies is not static. For example, the Government recently published a White Paper on Electricity Market Reform which includes a package of reforms to target market failures, including around prices in the energy-only market not sending the correct market signals to ensure optimal security of supply, and barriers to entry in the market which could lead to insufficient capacity. The UK GIB complements proposed policies such as this.

43. Through increasing returns to renewable energy generation and imposing costs on fossil fuel use, these existing government policies make green investments more attractive and improve their risk adjusted rate of return. However, they do not directly target aspects of particular market failures and barriers that manifest themselves in financial markets and constrain the supply of finance to green projects, or reduce the risk perceived by the private sector of investing in green projects. Doing Nothing would therefore mean that the constraints affecting the financial market would still remain, and commercially viable green investments may not go ahead.

44. A benefit of 'Do Nothing' is that the money which would be spent via the UK GIB on green infrastructure and late stage innovation would go on alternative policies which the Government could have financed using public funds.
45. Also, there could be the avoided risk of new policy instruments paying for novel technologies to be prematurely deployed and crowding out more market ready technologies that would otherwise have been able to enter the market. However, as many policies are broadly technologically neutral, this is judged to be low risk. It could also avoid higher costs associated with stranded assets or lock in of near to market 'green' technologies that do not leave room for future potentially cheaper innovation.
46. The costs of doing nothing are:
- a. an increased risk of missing the UK's challenging carbon reduction and renewable energy targets and the Government's wider green ambitions. This is because existing policies do not directly target particular market failures that manifest themselves in the financial markets.
 - b. some overall costlier technologies being taken forward in advance of the cheaper ones. For example, where a technology has a smaller upfront capital cost, has fewer product-specific assets (namely assets which can be used for more than one purpose) or are perceived as less risky, access to the financial markets may be easier.
 - c. a less rapid move down the technology cost curve as economies of scale are not achieved as quickly, given there is less learning by doing and information dissemination. Also the lower demand for these technologies could lead to less innovation in the area.
 - d. A potential increase in the cost of adaptation to climate change with slower deployment of technology and lower levels of investment in green infrastructure and late stage innovation (with the former a consequence of the latter).
47. 'Do nothing' is therefore not considered a viable option. It does not target the problem of market failures and barriers that manifest in the financial markets and thereby facilitate the transition to a green economy.

Option (2) – Fund

48. An alternative option of a Fund has been considered but is not recommended.
49. The key reason why a Fund is not recommended is that it would not directly address the policy and market failures and barriers that manifest in financial markets and contribute to the investment shortfall which restricts the transition to a green economy.
50. As a Fund is more focused on making grants rather than investments, it would have no (or very limited) ability to leverage or 'crowd in' private capital and recycle investments. It would be limited in its ability to mobilise additional private sector investment through the signals it provides to the market, as it would not be able to indicate the financial viability of

investments. Its reliance on public funding would be greater in order to have a more ongoing impact or 'enduring' impact, given that it would not make commercial returns that could be reinvested into future green investments.

51. A Fund could take many forms. An example could involve the consolidation of existing interventions under a single umbrella structure, either as an existing entity or under a new body. This could for example see the potential rationalisation of certain organisations and their funds to improve Government support for low carbon innovation and the commercialisation of new technologies. The umbrella structure could administer the distribution of funds from a number of centralised Government funded organisations that have a green remit (and in theory provide many of the interventions currently delivered by BIS, DECC and the organisations they work with).
52. Such a fund could also involve further costs associated with channelling the different funding streams (which have different aims and routes to market); legal issues relating to amalgamation (such as the cost of winding up contracts); and potential trade offs between funding existing interventions and new ones (for example, redirecting spending away from innovation towards more commercially attractive infrastructure investments). These costs are likely to exceed the potential benefits of long term efficiency savings which are difficult to calculate given that the organisations Government works with would have various agendas to deliver other than green-related interventions.
53. In December 2011, DECC published a joint cross-Government Low Carbon Innovation Delivery Review on how Government can improve the way it collectively designs and delivers its low carbon innovation programmes. This did not recommend a consolidation of existing interventions as described.
54. For these reasons, a Fund is not recommended to target the problem of market failures and barriers that manifest in the financial markets and thereby facilitate the transition to a green economy.

Option (3) – Increasing the application of existing policies

55. The option of 'Increasing the application of existing government policies' has been considered but is not recommended².
56. As noted throughout this IA, there is uncertainty around the level of UK GIB investments in different green sectors, given that it will be set up as an independent financial institution. Modelling and analytical work has been undertaken by Vivid Economics in association with McKinsey & Company in order to enable a comparison of an increase in the application of existing policies to the Do Nothing at Option 1 and the UK GIB at Option 4. This enables the changes to existing policies to be calibrated so that they have the same impact on capacity development as the GIB would have if it undertook particular levels of investment. It is not possible to establish a single existing policy mechanism that covers the breadth of sectors in the Green Economy. Complications also arise from the continuing development of the policy landscape.

² For more detail on this option, see Vivid Economics in association with McKinsey & Co., *The economics of the Green Investment Bank: costs and benefits, rationale and value for money*, report prepared for the Department for Business, Innovation & Skills, October 2011

57. Given the wide range of policy instruments designed to help meet the Government's environmental targets and ambitions, three key sectors have been chosen for the purposes of the analysis to illustrate the indicative impacts of increasing the application of existing policies. These sectors are initial priority sectors for the UK GIB.
58. The three sectors considered in further detail are:
- a. Offshore wind;
 - b. Non-local authority Commercial and Industrial waste ('waste treatment', primarily energy from waste plants (EFWs) and Commercial and Industrial Waste treatment facilities - referred to here as material recovery facilities (MRFs)); and
 - c. Non-domestic energy efficiency (NDEE).
59. The following existing policies have been chosen for the purposes of illustrative analysis as viable ways to help deliver the objectives of increasing investment in key green infrastructure assets:
- a. Offshore Wind: an increase in the number of Renewables Obligation Certificates (ROCs) that offshore wind farms currently receive per MWh of electricity generated, hence increasing the returns of investment in this sector;
 - b. Waste treatment: a further increase in the Landfill Tax to encourage greater diversion of waste away from landfill through increasing the cost of not diverting; and
 - c. NDEE: an increase in the Climate Change Levy which increases the cost of energy use.
60. As it is not clear what the mix of the UK GIB's portfolio will be (which will depend on market demand for the UK GIB's products and how best the UK GIB as an independent financial institution chooses to meet its objectives in the context of the pipeline of potential projects), the illustrative analysis below considers the impact of an indicative £1 billion investment from the UK GIB in each of the three sectors. It then compares that to a level of increase in an existing alternative policy that would deliver the same impact.
61. Scenarios are considered under each area to reflect some of the uncertainties facing each sector:
- a. Offshore wind: Low, base and high scenarios reflecting the variations in the forecast electricity demand in 2020, the level of renewable energy contribution, and the percentage of offshore wind contribution within that;
 - b. Waste treatment: Low, base and high scenarios reflecting variable growth rates of waste arisings, landfill diversion rates and how non-landfill waste is treated; and
 - c. NDEE: Lower and upper bounds reflecting the range of lifetimes over which energy efficiency measures deliver both energy savings and CO₂ savings.
62. The analysis does not undermine the existing policy suite. The economic rationale for the UK GIB in selected green sectors is that, by targeting aspects of market failures and barriers that manifest in financial markets, it can help reduce the under-provision of capital and/or

increase the speed of its deployment, thus improving green outcomes. Whilst existing policies may provide a blanket improvement on returns or increase in cost of fossil fuel use, the UK GIB through its tailored and targeted financial interventions can reach commercial projects which would otherwise not go ahead. It is therefore an efficient and complementary policy intervention for accelerating investment in green infrastructure and late stage innovation relative to existing policies.

63. No assessment has been made in respect of existing policies in other green sectors. In many cases this is because there is a significant lack of data, given the nascent status of the technologies. However for the electricity generating sectors (including onshore wind, photovoltaics and biomass) similar conclusions could be drawn around the impacts of increasing ROC banding levels. For the Green Deal, an alternative could be the continuation of the Carbon Emissions Reduction Target (CERT). No assessment of this has been made but CERT was thought less able to help those in hard-to-treat homes and was not considered to help those most badly affected by fuel poverty.

Key Conclusions

64. According to the illustrative analysis, it is assumed that £1 billion of UK GIB funding equates to an extra 0.2 ROCs for offshore wind, a £30 per tonne increase in the Landfill Tax, or increased Climate Change Levy to increase non-domestic energy prices by £1.38 per mwh.

65. The analysis of all three sectors suggests that the UK GIB is a more efficient policy instrument regarding targeting market failures that manifest themselves in the financial market compared to the respective alternative existing policies, and has the potential to act as a useful complement to the existing policy suite. Further, in some incidences, the UK GIB's more targeted approach (through being able to assess investment opportunities on a project by project basis, rather than on a sector- or technology-wide assessment) could lead to positive distributional impacts with respect to, for example, the four million fuel poor, SMEs and energy intensive industries.

66. While investments in some of the sectors have the potential to deliver a positive NPV (MRF in the waste sector and NDEE opportunities), others do not (offshore wind and EFW in the waste sector). However, this is driven primarily by the higher relative cost of low-carbon alternatives (for example, renewable energy generation technologies) in comparison with more traditional alternatives (such as fossil fuel energy generation technologies). These findings are in line with Impact Assessments undertaken covering these technologies.

67. Increasing spend on existing government policies does not target aspects of certain market failures that constrain the availability of finance. It also has significant distributional implications, as they lead to increases in energy prices. These impact on energy intensive industries, SMEs, and the fuel poor in particular. There are also deadweight losses leading to inefficiencies in the market. They do however lead to lower greenhouse gas emissions and other green benefits. The UK GIB option would provide a more targeted approach to delivering support to ensure better efficiency, lower transfers and better distributional impacts.

Analysis for three sectors

68. The assessment undertaken by Vivid Economics on the value-for-money on each sector, laying out the case for the UK GIB relative to increasing the application of existing alternative policies, is set out below:

a. Offshore Wind

69. Offshore wind is expected to be a significant contributor to the UK's ability to meet both its renewable energy targets and carbon reduction targets through helping to decarbonise energy generation.

70. In 2020, 33-87 TWh per annum of electricity output (between 13-32 GW of installed capacity) from offshore wind may be required to help meet targets, with the breadth of the range primarily being driven by the level of power output assumed to come from other renewable energy sources over the period.

UK Green Investment Bank

71. For illustrative purposes only, it is assumed that £1 billion of UK GIB funds is invested in offshore wind. Additional offshore wind capacity brought on-stream by this UK GIB investment of £1 billion has an NPV of -£620 to -£240 million, with a central case of -£480 million³, over twenty five years. This incorporates the capital cost of the assets, the value of the electricity supplied, and the CO₂ savings over the lifetime of the asset. The UK GIB intervention would therefore contribute around 0.9 TWh p.a. of additional renewable electricity by 2020 and reduce emissions in 2020 by 0.3 mtCO₂ per annum.

Alternative existing policy – increase in the Renewables Obligation band for offshore wind

72. Given the construction of the analysis, an increase in the RO banding for offshore wind would be, by definition, as effective as the UK GIB in increasing capital into the sector. The analysis suggests that an increase in the revenue support equivalent to 0.2 ROCs/MWh⁴ would lead to the same present value of plant operation – around -£480 million in the central case – and delivering 0.9 TWh of additional renewable electricity by 2020 and an emissions reduction of 0.3 mtCO₂ per annum. As a result of simply increasing the RO level, there is also a small deadweight loss of around -£17 million associated with a higher cost of electricity, meaning that the UK GIB is a more efficient policy instrument.

³ The central case NPV is not in the middle of the range as the analysis has been undertaken on the basis of establishing 'better than expected' or 'worse than expected' states of the work, rather than a linear assessment, reflecting the 65th and 35th percentiles of the results achieved in the modelling. The 50th percentile may be thought of as the expected value. These percentiles, which are generated through using @Risk modelling, do not connote a probability because probability distributions for all parameters are not known.

⁴ The increase of 0.2 ROC/MWh is achieved in the following way. The investment resulting from £1 billion of GIB funds is estimated to be £1 billion in the case of GIB co-investment equity and £2.4 billion in the case of GIB operational mezzanine debt. The Alternative Policy must motivate an equivalent level of investment to have an equivalent effect. It is assumed that the Alternative Policy achieves investment of £2.4 billion, the same as the higher of the two GIB cases. It is not possible to specify precisely the level of ROCs required to achieve this increase as there are a number of uncertainties regarding the factors driving the dynamics of an offshore wind farm. An increase in ROCs by 0.2 ROC/MWh (a 10% increase in the level of banding at the time of writing) boosts revenue by around 6%. An increase of £2.4 billion is approximately a 5% increase on the £48 billion assumed to be invested in the 'do nothing' case. The magnitude of the increase in ROCs therefore seems to be reasonable, but there is no justification for it beyond this.

76. As highlighted above, this illustrative analysis has focused on two technology options – MRFs and EFW. Depending on the scenario used, total demand for capacity for these two technologies in 2020 ranges from 0-9 million tonnes per annum, underlining the concerns around uncertainty about the returns to future investment in this sector.

UK Green Investment Bank

77. For illustrative purposes, the UK GIB is assumed to invest £1 billion in this sector, split equally between MRFs and EFW. In this case, an additional 4.1 mtpa (million tonnes per annum) of capacity is calculated to be built (3.3 mtpa MRF and 0.8 mtpa EFW):

- a. MRF capacity is cheaper than landfill disposal once the value of avoided emissions from virgin material production is taken account of. The NPV is £430 - 1,130million depending on the carbon values used (traded or non-traded).
- b. EFW capacity is more expensive than landfill. The power sales from the plant and the emissions savings do not fully compensate for the additional costs, and as such, the NPV is calculated to be -£510 million.

78. The illustrative analysis suggests that the overall NPV of the programme of investment in this sector could range from -£80 million to £700 million when the cost implications of potentially changing the structure of the financing are taken into account. Furthermore, the UK GIB investment would reduce transfers under the Landfill Tax paid by around £2.7 billion.

Existing alternative Policy option – increase Landfill tax

79. It is estimated that in order to deliver the same level of additional capacity as the UK GIB option (4.1 mtpa), the Landfill Tax would have to increase by around £30/t. As a result, the NPV of the infrastructure created is assumed to be the same as the UK GIB assessment⁵, but the distinction between the options is that an increase in the Landfill Tax leads to significant distributional and efficiency impacts. A £30/t increase would lead to a deadweight loss (as is usual with a tax increase) estimated to be worth just over £1 billion. Under this option, the NPV is -£1,100m to -£400million, and the transfers paid under the Landfill tax fall by around £385 million.

Summary

80. The illustrative analysis undertaken suggests that the UK GIB option should generate a better outcome than increasing the Landfill Tax. As with the analysis undertaken for offshore wind, the UK GIB potentially delivers a more efficient policy instrument through providing a more targeted way to intervene at a project level than a blanket increase in Landfill Tax. The change in transfers reflects the incidence of tax, with an increase in Landfill Tax providing a blanket increase in the transfer between those needing to process waste and those processing waste at non-landfill sites (given that the level of the Landfill Tax per tonne of

⁵ Though different projects might come forward as the two policies impact on different market failures.

83. An illustrative £1 billion investment in energy efficiency measures is calculated to deliver an NPV of £300-1,674 million. The size of the range is a function of the lifetime over which the energy efficiency measures deliver both energy savings and CO₂ savings, with longer lifetimes (up to twenty-five years) delivering a higher NPV. At the top end of this range, this could deliver a fall in energy consumption of 3.5 TWh p.a., with an associated reduction in CO₂ emissions of 1.1 mtCO₂ pa.
84. There is a knock-on impact on the energy supply market from increased uptake of energy efficiency measures, with analysis suggesting that an investment of this scale could deliver a deadweight gain of up to £1 million from lower energy prices. It is also estimated that there could be a reduction of transfers between producers and consumers with a present value of up to £367 million.

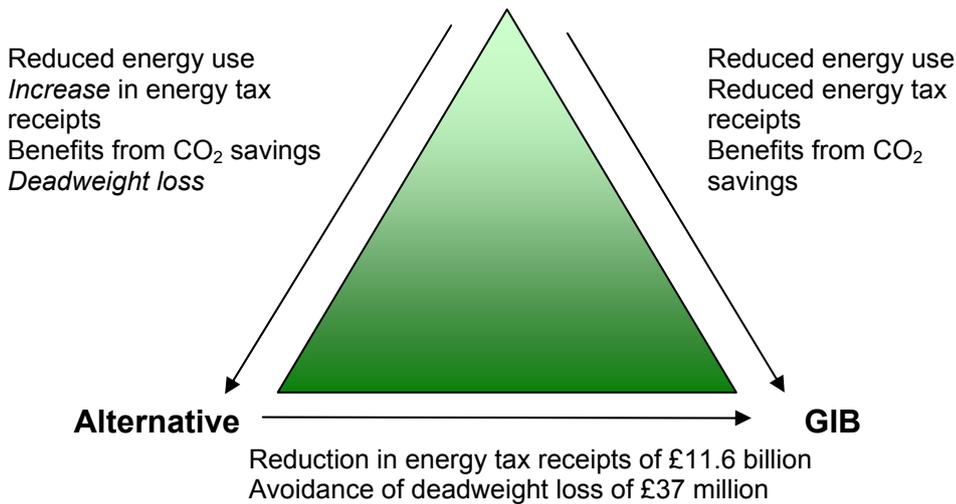
Alternative policy – increase in the Climate Change Levy

85. If the Climate Change Levy were to rise to deliver the same level of impact as outlined above for the UK GIB, the impact on energy consumption and CO₂ savings would be the same, but the price of non-domestic energy would potentially increase by £1.38/MWh. This increase would lead to a deadweight loss of around £37 million in Present Value (PV) terms and also lead to transfer payments (through higher taxes), with a PV of close to £12 billion.

Summary

86. As with the previous two sectors, the diagram below provides an illustration of the analysis. NDEE investments have the potential to offer substantial positive NPV due to the significant energy savings that could be realised, and hence avoidance of carbon emissions.
87. As with the other two sectors, the UK GIB is the preferred option in comparison to increasing the application of the existing alternative policy under this illustrative assessment, due to the large transfers associated with increasing the Climate Change Levy. The UK GIB is potentially therefore the more efficient policy response. The targeted intervention of the UK GIB could also potentially lead to lower increases in the electricity price than the alternative intervention, which could have distributional implications with respect to the four million fuel poor, energy intensive industries and SMEs.

Figure 5: Summary of effects of UK GIB and alternative existing interventions: Non-Domestic Energy Efficiency



Source: Vivid Economics

88. In conclusion, increasing the application of alternative existing policies is not considered a viable option in order to target the problem of certain market failures and barriers that manifest in the financial markets and thereby facilitate the transition to a green economy.

Option 4 – UK Green Investment Bank (UK GIB) – RECOMMENDED OPTION

89. This option is a new publicly funded financial vehicle for delivering joint public and private investment in UK green infrastructure and late stage innovation, stepping flexibly into sectors when required and out of a sector when no longer necessary. It is a direct instrument to get to the heart of the current investment shortfall in facilitating a transition to the Green Economy.

90. The strength of the UK GIB lies in tackling market failures and barriers that manifest themselves in the financial sector, which are not targeted by complementary industrial, environmental and fiscal policies. Therefore, without a UK GIB intervention the issues and constraints in the financial market would still remain. A UK GIB complements existing government policies that tend to focus on increasing returns to green technologies or increasing the costs of using fossil fuels, by targeting aspects of certain market failures and barriers that manifest in the financial markets and constrain the supply of finance.

91. The UK GIB will operate as an arm's length financial institution with specialist expertise in green investments. Given the range of market failures manifesting in financial markets and the breadth and evolving nature of the Green sector, the best way to deliver the financial interventions needed to accelerate the transition to a Green economy is through a new, enduring institution. Understanding the ultimate causes of financial market failures requires deep knowledge and expertise, helped through participation in the market.

92. The UK GIB will provide targeted and tailored financial interventions, and will be dedicated to mobilising additional private sector finance into green infrastructure projects. In this way, it will 'crowd in' rather than 'crowd out' private sector finance in the market. It is assumed that the UK GIB will recycle its funds into other investments. The UK GIB can also help to

increase investment in green sectors through its 'demonstration' effect. This demonstration effect could result in additional investment from the private sector, for example: from additional sources of capital (such as from institutional investors) as a result of increased confidence in the novel technology from demonstrating the financial viability of investments.

93. Key to the operation of the UK GIB is that its focus will change over time. As one technology builds up a track record and the financial market becomes increasingly comfortable and content to invest in/lend to it, or it proves not to be workable, the rationale for the UK GIB operating in that market decreases. It can then be expected to exit and get involved in other sectors.

94. To fulfil its role of catalysing private sector investment, the UK GIB must operate commercially and make sound investment decisions, leading the market as a respected, innovative financial institution, deploying first of a kind finance and thereby attracting subsequent private investment. It is important that the UK GIB makes commercial investments so it can preserve its capital base and continue to accelerate additional finance into green sectors on an ongoing basis, and be an enduring institution.

95. Credibility and market confidence will be increased if the interventions are made at arm's length from Government by professionals with financial expertise. Evidence of absence of political interference will also be important to ensure that the UK GIB is perceived as a rational investor. This is particularly important for leveraging capital from institutional investors, namely pension and insurance funds, seeking long-term investments.

96. The UK GIB will be set up as a 'Companies Act' company, and legislation will enshrine its independent status as an enduring green institution with a key public role. The Government will be the sole initial shareholder of the UK Green Investment Bank plc.

97. The UK Green Investment Bank plc will have a statement of objects in its articles of association. This must be consistent with the statutory 'green purposes'. The UK GIB will have a number of strategic priorities, agreed with the Government as shareholder, for each Spending Review period. Subject to approval by the European Commission, there will be the following priority sectors over the Spending Review period to 31 March 2015, with at least 80% of the funds being committed by the UK GIB:

- a. offshore wind power generation;
- b. commercial and industrial waste processing and recycling;
- c. energy from waste generation, including gasification, pyrolysis and anaerobic digestion for the production of heat and/ or power;
- d. non-domestic energy efficiency, including onsite renewable energy generation and heat; and
- e. support for the Green Deal.

98. Furthermore, potential investments will be assessed against the following principles:

- a. Sound Finances: seek to:

(i) deploy its capital and expertise as a responsible investor; and

(ii) manage risk to deliver positive financial portfolio returns,

in each case in a manner which will preserve and build UK GIB's capital base as an institution which is intended to have an enduring Green Impact;

b. Additionality: seek to operate alongside other market participants so as to introduce and mobilise additional investment that contributes to the Green Impact, where UK GIB considers it appropriate to do so;

c. Strategic alignment with HM Government: Seek to align its activities with HM Government's green policy objectives and initiatives, by avoiding duplication; and

d. Overcoming Market Failures:

(i) seek to overcome market failures and improve market effectiveness, whilst minimising adverse impacts on competition and trading conditions; and

(ii) operate consistently with the terms of any EU State Aid approvals applicable to UK GIB from time to time (the "State Aid Requirements").

99. When considering the above framework, the UK GIB will be encouraged to consider broader benefits⁶ to establish optimal VfM, especially in the instance where application of this framework leaves it indifferent between prospects. These benefits, aligned to the UK GIB mission, include: green impacts from the demonstration effect of the UK GIB; reduced technology costs due to learnings from wider deployment and technological progress; and other ancillary environmental impacts.

100. The UK GIB will comprise the following phases:

a. Phase I – Incubation: April 2012 to achievement of state aid approval. The Government will make direct financial investments on market terms prior to the establishment of the UK GIB to accelerate investment in the green economy. UK Green Investments, comprised of project finance professionals, has been set up within the Department for Business, Innovation & Skills to execute these direct financial investments.

b. Phase II – Establishment: Following state aid approval, the UK GIB will be fully operational as a stand-alone institution.

⁶ Except in so far as these benefits are already reflected in the subsidies from Government

- c. Phase III – Full borrowing UK GIB: From April 2015, the GIB will be given powers to borrow (subject to public sector net debt (PSND) falling as a percentage of GDP). This will enable the up-scaling of UK GIB activity.

101. The analysis is being carried out on the basis of the £3 billion funding over the period to 2015, as announced in the 2011 Budget.
102. Funding will be provided as equity or grant in aid over this period. Both equity and debt would score against PSND and public sector net borrowing (PSNB) in the same way, as HM Government is the sole initial shareholder of the UK GIB.
103. In Budget 2010, the Chancellor set out a supplementary debt target, namely to ensure that PSND as a percentage of GDP is falling by 2015-16. As part of meeting these targets, the 2010 Spending Review plans entail a reduction in total managed expenditure of over £80 billion in 2014-15. If the Government provided the UK GIB with borrowing powers to fund any additional investment activity over and above £3 billion during the period to 2015, it could jeopardise the Government's ability to stay inside its fiscal plans.
104. Up to April 2015, the UK GIB will work to develop a solid balance sheet and credibility. A reputation as a credible financial intermediary is likely to be important for rating agencies to make informed assessments with regards to the UK GIB's creditworthiness. The UK GIB will not have borrowing powers in this period.
105. Beyond April 2015, the range of borrowing mechanisms for the UK GIB could include: directly from the market without a Government guarantee; via the national loans fund; via standard Debt Management Office borrowing; or via the Debt Management Office's issuing special 'green gilts' with proceeds ear-marked for use by the UK GIB.

Modelling and analysis

106. Detailed modelling and analytical work has been undertaken by Vivid Economics and McKinsey & Company as part of the development work underpinning the case for establishing a UK GIB. This work includes comparing the impacts of the UK GIB with the Do Nothing Scenario (Option 1) and increasing the application of alternative existing policies for offshore wind, waste treatment and NDEE (see Option 3).
107. This modelling and analytical work covers a range of impacts that the UK GIB could have. As the UK GIB will operate as an arm's length financial institution, it is impossible to predict the sector mix that the UK GIB invests in, the nature of the investments, and the exact extent of the impacts. Furthermore, some of the assumptions on which the work is based (set out below) may change in the future. This modelling is therefore illustrative only. It is not likely to represent the UK GIB's future investment activities, and is not intended to determine those activities.
108. Four illustrative portfolios have been presented to show the variability of potential impacts of Phases 1 and 2 of the UK GIB. The various illustrative portfolios cover potential

investment mixes in the first three years of the UK GIB and do not include the future recycling of returns from those first investments (as is envisaged the UK GIB will be able to do).

109. Eight sectors have been selected to form the portfolio composition of the four illustrative portfolios. These are offshore wind, energy from waste, commercial and industrial waste facilities, non-domestic energy efficiency, domestic energy efficiency, Green Deal, onshore wind, solar PV and biomass. These illustrative sectors were selected based on a qualitative assessment carried out by Vivid Economics, based on:

- a. the degree to which the UK GIB complements or duplicates existing policies;
- b. the additionality of UK GIB spend in a sector; and
- c. whether the sector is ready for investment in commercial scale deployment (within the three years of the initial budget).

110. The illustrative portfolios represent the position at the end of Year 3 (2014-15). The sector mix within the portfolio and the amount of spend varies across the years while the portfolio builds up.

111. The summaries of illustrative portfolios are:

Portfolio 1 – 90% committed 2012-15: diverse

- high demand, investing 90% of the UK GIB's £3 billion in the first three years
- diversified across the eight sectors (such that no one sector has more than 30% of the UK GIB's fund)

Portfolio 2 – 60% committed 2012-2015: diverse

- low demand, investing just 60% of the £3 billion in the first three years
- diversified across the eight sectors (such that no one sector has more than 22% of the UK GIB's fund)

Portfolio 3 – 90% committed 2012-2015: offshore wind

- high demand, investing 90% of the £3 billion in the first three years
- less diversified/more risky portfolio as it is heavily weighted towards offshore wind (54% of the UK GIB's fund)

Portfolio 4 - 100% committed 2012-15: diverse

- low initial demand rising over the three years so that all the UK GIB's budget is committed (with a profile of £500 million, £1,000 million and £1,500 million each year)
- slightly more diverse than Portfolio 3 but still weighted towards offshore wind (47% of the UK GIB's fund)

112. The illustrative portfolios (except Portfolio 4) assume at least 80% of investments are in the initial priority sectors of the UK GIB, apart from the Green Deal. The Green Deal was not a priority sector for the purposes of this analysis.
113. Monte Carlo analysis has also been undertaken for scenarios where 90% of UK GIB funds are committed. This technique enabled the proportions of each sector within a portfolio to be varied randomly, which in turn created a range of possible outcomes and an (illustrative) expected value.
114. Phase 3 has not been explicitly modelled. However, the methodology applied to Phase 2 would apply in the same way. The scale and direction of costs and benefits would be heavily dependent on which sectors the UK GIB supports.

Summary of Costs and Benefits for UK GIB

115. In the Table below, the NPV illustrative figures are net of costs (excluding the operating costs for the UK GIB).

Table 6

Net Present Value (NPV)	Phase 1	Phase 2⁷
NPV £/m (Range based on illustrative portfolios, from para 119) ⁸	-370 to 450	-1,335 to 1,630
NPV £/m (Range based on Monte Carlo analysis - 90% funds committed) – from para 123	-1300 to 1500 (99% confidence interval) (mid point estimate: 100)	
The estimated UK GIB financial returns and green impact within the NPV:		
Financial returns to UK GIB. Range based on illustrative portfolios, from para 137 ⁹ (%)	6.1% to 8.2%	6.1% to 7.6%
Green impacts¹⁰ (millions of tonnes of CO ₂ equivalent). Range based on illustrative portfolios, from para 129.	22m to 31m (of which 17m to 25m tonnes are traded)	80m to 112m (of which 63m to 91m tonnes are traded)
Green impacts (tCO ₂ /£m). Range based on Monte Carlo analysis – 90% funds committed - para 129	1.54 to 2.24 (99% confidence interval) (mid point estimate: 1.91)	
Public Sector costs of the UK GIB within the NPV¹¹:		
Opportunity cost to government (real terms)	£465 to 700 million at 2.5% ¹² cost of capital	£1,680 million to £2,770 million at 2.5% cost of capital
Non-monetised Impacts		

⁷ Includes impacts of Phase 1

⁸ Vivid Economics, "The Economics of the Green Investment Bank: costs and benefits, rationale and value for money", 2011, (*published*) and McKinsey Model Portfolio Construction for BIS, October 2011. The range of results in this table reflects the 4 illustrative portfolios of the GIB. Note that the impacts from the recycling of GIB funds are not included here. Account is taken of expected levels of additionality.

⁹ Financial returns to GIB are from initial investments in the first three years.

¹⁰ Over the appraisal periods, which vary between sectors but are in the main 20-30 years

¹¹ The operating costs are not included in the NPV

¹² Equates to 10 year gilt rate (as at August 2011)

Other impacts	<ul style="list-style-type: none"> ▪ Operating costs ▪ Increased investment and green impacts from the demonstration effect of the UK GIB. ▪ Innovation spillovers ▪ (Skilled) Employment in Assisted Areas ▪ Option value ▪ Unlikely to be any discernable impact on economic growth in the short term, but expected to facilitate growth in the longer term ▪ Reduced technology costs due to learning from wider deployment and technological progress, ▪ Greater diversification of the fuel mix; ▪ Ancillary environmental benefits (e.g. from waste)
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Net Present Value Estimates

116. The NPV estimates have been constructed using analysis from other Government Departments (OGDs) and Vivid based on impact assessments on individual technologies which have been weighted according to the assumed portfolio make up. Given that the costs and benefits will be heavily dependent on what sectors are chosen for investment, these NPVs serve as illustrative examples only. The NPV estimates on the costs side include: the capital expenditure and operational expenditure of technologies. On the benefits side, it includes financial returns to the private sector and to the UK GIB, and CO₂ emissions avoided.
117. The NPV figures do not fully represent the true expected social value of the UK GIB. There are a number of impacts which are not captured in the NPVs. On the cost side, this includes the start up and administrative cost as well as potential loss from higher levels of default than anticipated. On the benefits side, the UK GIB will provide a signalling function to other lenders/investors about the viability of a sector and through its participation, potentially induce investment through knowledge and innovation spillovers. Some investments the UK GIB will make will have greater spillovers and signalling effects than others in terms of mobilising further private sector investment – but these impacts would be difficult to predict ex-ante. Therefore the mobilisation of additional private capital via the UK GIB's ability to demonstrate 'the power of example', as it moves into new sectors or develops new products and consequential improved competitiveness/ reduced costs in green technologies, is not captured. It seems probable that the non-monetised benefits outweigh the non-monetised costs.
118. Given the sectors being considered for investment, this assessment focuses on the measurement of 'green impact' in terms of carbon reduction. Going forward, trading off - for example, improvements in water quality or reduced congestion with reductions in CO₂ - will need to be considered in economic terms. These ancillary environmental impacts are not included in the NPV. Other potentially less significant benefits from the UK GIB might include greater diversification of the fuel mix and distributional impacts (paragraph 139) for example employment in assisted areas.

NPV: Illustrative Portfolio Analysis

119. The driving factor behind the differences in NPV for each portfolio is the proportion of the funds which go to offshore wind and non-domestic energy efficiency. In this case, Portfolio 3 has a higher proportion of offshore wind (which provides a negative NPV to the UK, though is crucial in helping the UK meet its carbon reduction and renewable energy targets) and a lower proportion of non-domestic energy efficiency (which provides a positive NPV) than Portfolios 1 or 2. The slightly higher NPV of Portfolio 2 over Portfolio 1 also reflects this sector weighting. Differences in NPV between Phases 1 and 2 reflect the changing size and composition of portfolio investments.

Table 7 – Net benefit to society by Portfolio - Phase 1

Portfolio	Net benefit to society (NPV)
1	£355million
2	£450million
3	-£370million
4	£315million

Table 8 – Net benefit to society by Portfolio - Phase 2

Portfolio	Net benefit to society (NPV)
1	£1,285million
2	£1,630million
3	-£1,335million
4	-£1,100million

120. All illustrative portfolios show reduced CO₂ emissions and Portfolios 1 and 2 show a net benefit to society.

Sensitivity Analysis on the Portfolio NPV

121. Key factors that will affect the impact of the UK GIB and for which more detail is provided in Annex 2 include:

- a. Assumed level of additionality: If the UK GIB were to invest in projects that would have gone ahead anyway or merely *accelerate* projects rather than bring *new* projects to fruition, the net benefits to society and the CO₂ impacts would be significantly reduced.
- b. End of year flexibility: It is assumed for the purposes of this analysis only and simplicity, that there is no year end flexibility and that all underspend is returned to HMT. If the money is carried over there would be a more positive impact.
- c. Default rate: If the default rate is 10% higher than expected across all sectors, the NPV and CO₂ impacts fall.
- d. Mobilisation rate: Interviews and market testing (McKinsey & Company) have indicated that, as a central estimate and related to the illustrative examples set out within this IA, a mobilisation rate of four could be expected (namely for every £1 of

UK GIB money a further £3 of private sector money would be mobilised). Sensitivity analysis assumes that the mobilisation rate is only three. Both NPV and CO₂ impacts fall compared to the base case. See Annex 2 for further detail.

- e. Delay in State Aid so that Phase 2 does not begin until 2015: As less is spent on aided products, financial returns would be slightly higher than if there was no delay. If State Aid clearance is not forthcoming at all one might expect (in the short term) the returns to be the same as those noted in the base case for Phase 1.
- f. Phase 2 does not carry forward Phase 1 investments. The benefits of Portfolios 1 and 2 still outweigh the costs. It is however intended that the UK GIB will carry forward Phase 1 investments.

122. Portfolios 1 and 2 show considerable resilience against the sensitivity analysis. However, default rates (over and above those already assumed by the modelling) of over 10% will lead to negative net benefits to society. Furthermore, if projects are likely to merely be accelerated by the UK GIB's involvement, the NPV and CO₂ benefits can potentially fall significantly.

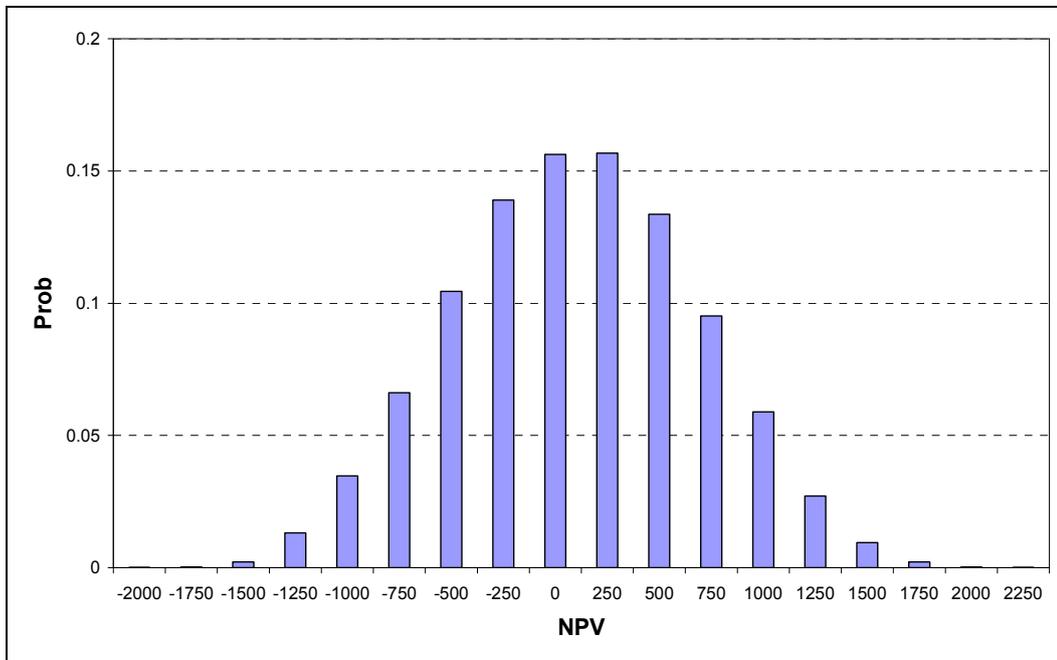
NPV estimates based on Monte Carlo Analysis

123. The results from the Monte Carlo Analysis are included in the front sheets of this IA. The mid-point estimate regarding return of the NPV range is £100 million.

Distribution of impacts – “Monte Carlo” approach

124. Given the uncertainty around the full range of sectors the UK GIB will initially support and hence the make up of its investment portfolio, a sensitivity analysis was conducted on the effect the sector split can have on the possible distribution of the impacts. The NPV and CO₂ values for a portfolio can vary depending upon how money is distributed across the various sectors within the portfolio. In order to assess the range and likelihood of possible NPV and CO₂ values, a ‘Monte-Carlo’ approach to distributing the money was adopted. This used the same underpinning data which informed the illustrative portfolio analysis above. Thus, for the scenario modelled whereby 90% of the UK GIB's budget is committed over three years, multiple runs/simulations were made in which the funds were randomly allocated between the sectors. The mean NPV of the resulting distribution (namely its most likely value) and the likely spread of the possible NPV results can then be estimated.

Figure 9: Distribution of the impact of UK GIB, scenario; 90% funds committed 2012-15 (diverse portfolio) - NPV



Source; BIS

125. The mean of this distribution is approximately £100 million. In broad terms, there is approximately a 56% chance of having a positive NPV over the first three years. At a 99% confidence interval the range for the NPV is between -£1300m (low) and £1500m (high).

Benefits

Environmental Benefits (green impacts based on four illustrative portfolios)

126. Of the fifteen sectors¹³ initially identified, carbon emissions reductions are the relevant environmental impact for all but two (flood defences and rolling stock). Thus the focus of this assessment is on carbon reduction (not least because these two sectors are not initial priority sectors for the UK GIB). Going forward, trading off - for example, improvements in water quality or reduced congestion with reductions in CO₂ - will need to be considered. Estimates of the CO₂ reductions are drawn from Vivid Economics modelling and various Impact Assessments.

127. Some of the fifteen sectors which operate in the electricity market fall under the EU Emissions Trading Scheme. Thus, whilst reducing the UK's territorial carbon emissions, the reduction in carbon emissions from these sectors does not count towards meeting the UK's Carbon Budgets and hence the legal requirements under the Climate Change Act¹⁴. However these carbon emissions reductions are included, alongside the sectors delivering

¹³ Biomass, marine, nuclear, offshore wind, onshore wind, solar, waste - energy from waste and commercial and industrial waste recovery, train rolling stock, smart meters, electric vehicle charging infrastructure, flood defences, Green Deal, non domestic energy efficiency, renewable heat and carbon capture and storage.

¹⁴ The UK GIB support of these sectors will help meet the UK's Renewable Energy target and, in the longer term, might put the UK in a stronger position if there is a global binding carbon reduction agreement or if the EUETS cap gets tighter.

non-traded carbon savings¹⁵, as they give an indication of the relative “greenness” of projects in different sectors.

128. The net benefit to society measured here includes the value of the carbon reduction through the use of the official DECC shadow price of carbon¹⁶.

129. As all the sectors are green, the main difference between the illustrative portfolios outlined within this IA is that Portfolio 2 has a greater under-spend (40%, compared to 10% and no underspend). The difference in the green impact between Portfolios 1, 3 and 4 is again the proportions of the funds going to offshore wind (with a relatively low CO₂ per £ of capital expenditure) and non-domestic energy efficiency (with a green impact per £ which is over four times as much). Here the CO₂ savings are over the appraisal period of up to thirty years (depending on the nature of the projects).

Table 10 – Green Impact by Portfolio - Phase 1*

Portfolio	Green impacts (CO₂)
1	31 million tonnes (25 million tonnes traded and 6million tonnes non-traded)
2	22 million tonnes (17 million tonnes traded and 5 million tonnes non-traded)
3	25 million tonnes (22 million tonnes traded and 3million tonnes non-traded)
4	26 million tonnes (21 million tonnes traded and 5 million tonnes non-traded)

Table 11 – Green Impact by Portfolio - Phase 2

Portfolio	Green impacts (CO₂)
1	112 million tonnes (91 million tonnes traded and 22 million tonnes non-traded)
2	80 million tonnes (63 million tonnes traded and 17 million tonnes non-traded)
3	91 million tonnes (81 million tonnes traded and 10 million tonnes non-traded)
4	97million tonnes (82 million tonnes traded and 15 million tonnes non-traded)

*numbers may not add up due to rounding

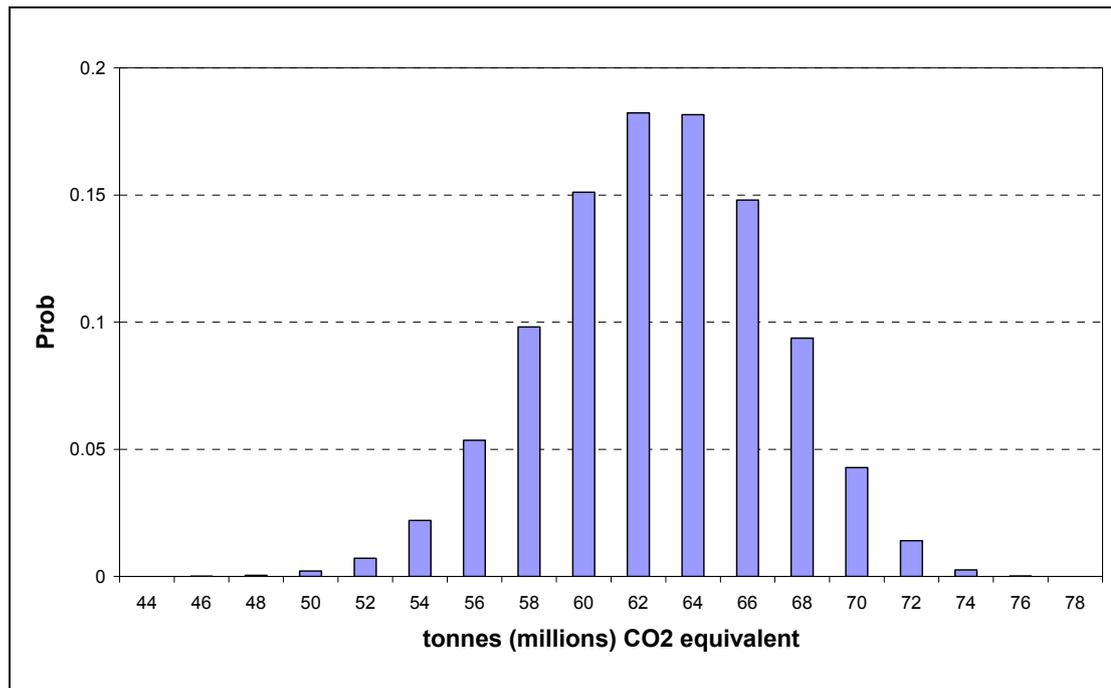
The Phase 3 emissions’ reductions would be proportional to the level and type of UK GIB investment.

Monte Carlo analysis for distribution of green impacts for 90% of UK GIB funds committed up to 2015.

¹⁵ Commercial and Industrial waste treatment facilities will reduce non-traded emissions. As renewable heat moves users of gas from generating heat to using electricity instead, this will increase traded carbon emissions but reduce non-traded emissions. Green Deal, smart meters and non-domestic energy efficiency might save non-traded carbon emissions where gas use, rather than electricity use, is reduced.

¹⁶ Note that carbon values are not consistent across all sectors. The most recent carbon values are used for the illustrative NPVs calculated by Vivid (offshore wind, NDEE, and waste) whilst for some other sectors the Impact Assessments used to estimate the NPVs are based on older carbon values.

Figure 12: Distribution of the green impact of UK GIB, scenario; 90% funds committed 2012-15: CO₂



Source; BIS

The mean of this distribution is approximately 62 million tonnes of CO₂ equivalent.

The green impact from *additional* mobilised private sector investment (second order) from the 'demonstration' effect of the UK GIB is not estimated.

Benefit to 'green' businesses where the UK GIB intervenes (not included in NPV)

130. There are a number of green sectors that could be potential targets for the UK GIB's activities. The direct benefit to those businesses in which the UK GIB invests will be the £3 billion in available funding, and recycled funds. There is also the private sector returns from the sale of electricity or other products resulting from the UK GIB's activity.

131. 'Sustained rapid pace of investment' required in the green space may exceed the capacity of the natural principal sponsors to supply capital. By participating in the capital structure of projects and working to achieve earlier refinancing after construction, the UK GIB may facilitate businesses to accelerate their activity in this space. Refinancing (a potential activity for the UK GIB) releases equity for the principal sponsors, allowing them to recycle it and thereby achieve a faster and more sustainable growth path where reinvestment is in further green projects.

132. For projects where there are coordination market failures, the UK GIB may facilitate business opportunities by providing investment to mobilise private sector sources of capital and therefore could indirectly provide strategic coordination between the players and so reduce uncertainty.

133. The move to a green economy offers substantial opportunities for UK businesses. Furthermore, the UK GIB's investments in green infrastructure and late stage innovation will act as a signal to other investors that projects are commercially viable. This demonstration effect may mobilise capital from other providers and further accelerate investment in the sector.

Economic benefit (not included in NPV)

134. The UK GIB is expected to facilitate economic growth in the longer term if its investments (i) offer higher social returns than the alternative use of the public and private funds, (ii) generate greater technology spillovers (including exports/licensing of technologies), or (iii) create greater disruptive competition. The first of these is identifiable by a high NPV, a property which some of the sector investments examined here possess. Three positive examples are: energy efficiency which improves the supply side productivity of the economy; smart meters which enhance the productivity of the power infrastructure; and, materials recovery facilities which enhance materials resource efficiency as well as providing greater competition on sources of core materials. Offshore wind, however, is a counter-example; it generates market outputs of lower value than its input costs, and so records a negative impact on GDP, but nevertheless crucially contributes significantly towards environmental targets. The potential for technology spillovers is difficult to identify but is greatest for the most rapidly innovating sectors, including offshore wind. This in turn offers the potential for reduced technology costs due to learning from wider deployment and technological progress. Finally, disruptive technologies which increase innovation in competing technologies might include electric vehicles given their effect on internal combustion engines. Generally, long run spillovers may be expected, particularly from innovation. The origin and scale of benefits to long term growth also depend on the opportunity foregone in terms of any alternative use of the public funding allocated to the UK GIB, or the risk of a negative effect on growth from increased spending.

135. The UK GIB's targeted interventions should help to improve the mobilisation of new investors of both debt and equity, enhance the pricing of risk in financial markets through increased transparency, and provide investment for commercial projects that would otherwise not have attracted sufficient private sector finance due to the novelty of technology/business model (particularly by becoming involved in the early stages of deployment); and thereby improve the functioning of financial markets and access to finance for such businesses. This process might occur naturally and slowly without the UK GIB. However, the UK GIB aims to speed it up and in doing so, contribute to the adoption of innovations and potentially help drive economic growth in the long term.

136. It is possible that some of the projects which the UK GIB supports will provide the UK with an option value. For example, by investing in a range of technologies there is more likelihood of being at the cutting edge of a promising future technology with less risk of locking the UK into a narrow range of technologies in a fast moving part of the global economy.

UK GIB financial return

137. The gross return (risk-adjusted) to the UK GIB reflects the revenue it could make on its investments. Estimated return varies across the four illustrative portfolios. Phase 1 provides

higher returns than Phase 2 as the proportion of aided products is limited by State Aid rules in this phase. Portfolio 2 offers noticeably lower returns across the two phases due to the lower proportion of non-aided products. This is because the portfolio of projects invested in would not be the same - they would potentially tend to be less risky, with shorter lead times and less novel. These are ex ante predictions of returns adjusted for risk. These returns do not reflect the benefits of a diverse portfolio per se.

138. In all cases the returns exceed the government’s cost of capital (of 2.5%) plus the cost of operating the UK GIB (0.5%-1%).¹⁷

Table 13: Financial Returns to the UK GIB by Portfolio- Phase 1

Portfolio	GIB return (pa)
1	7.4%
2	6.1%
3	8.2%
4	7.4%

Table 14: Financial Returns to the UK GIB by Portfolio- Phase 2

Portfolio	UK GIB return (pa)
1	7.0%
2	6.1%
3	7.6%
4	7.0%

Distributional impacts (not included in NPV estimates)

139. The distributional impacts of the UK GIB are likely to be limited for two reasons. Firstly, support is tailored to only bringing forward commercial projects that are unable to attract sufficient finance, rather than providing support to all new (or existing) projects. This limits the amount of government intervention and therefore the degree of distortion in the market. Secondly, as the investments that the UK GIB will make are targeted, it has less impact on energy prices and therefore less impact on businesses (such as SMEs or the energy intensive industries) and on households (such as the 4 million fuel poor¹⁸).

140. There might be investment in Assisted Areas (not least in the Incubation Phase – Phase 1, when the regional aid elements of the General Block Exemption Regulation would be used) leading to potential increases in economic activity in those areas. As the projects that the UK GIB will invest in are not predetermined, it is not possible to estimate the potential impact of, for example, training and innovation spend on jobs and the economy in assisted areas.

¹⁷ Phase 3 has not been explicitly modelled but results are likely to follow the same direction as estimates for phase 2, however they will be heavily dependent on what is assumed about the proportion of funds it spends across sectors.

¹⁸ As estimated by DECC, 2009

Costs

141. There are no direct costs to business.

142. Opportunity cost: The opportunity cost of supporting the UK GIB is equal to the return forgone on alternative projects which HMG could have financed using public funds. Given the significant uncertainties surrounding the expected rate of returns which HMG could achieve on alternative investment projects, the analysis assumes that it is equal to the risk-free rate of 2.5%, plus the operating cost of the UK GIB of a further 0.5-1% pa.

Costs (not included in the NPV) include:

- a. Cost of inputs. Funding to cover: start-up costs, costs of policy work including pre-Phase 1 policy team of approximately ten Full Time Equivalent staff (FTEs), UK GIB staff costs and provision of office space in an appropriate location. A preliminary assessment of staffing levels estimates that over the period to 2015, the UK GIB will consist of fifty to seventy FTEs, including the transaction team and support activities, though the headcount may rise over time.
- b. The potential crowding out of private sector investment. However, this is considered a small risk as the UK GIB will work to a 'crowding in' principle, and support commercial projects that would not have proceeded otherwise.
- c. Potential losses occurring through greater default risk on UK GIB's investment portfolio and potential costs associated with accumulating debt in Phase 3.

143. The monetised benefits outweigh the monetised costs in the 'best estimate' scenario (as presented in the Monte Carlo NPV analysis). Results are of course highly sensitive to portfolio mix.

Conclusion

144. In conclusion, the UK GIB is the recommended course of action as it is the only option that targets the aspects of certain market failures and barriers that manifest in the financial markets, thereby facilitating the UK's transition to a green economy.

Direct costs and benefits to business calculations (following OIOO methodology)

145. The UK GIB option at Option (4) is not in scope of One In, One Out as it is a spending decision and not a regulation. This IA has been prepared as there will be legislation to enshrine the UK GIB's enduring green nature.

Wider impacts

Competition Assessment

146. The European Commission requires evidence that the benefits of the UK GIB (facilitating the transition to a green economy) balance the costs of distortions created to competition. It has a methodology for assessing allowable state aid, and will consider whether establishing the UK GIB and providing it with funding is both an effective and proportionate manner by which to develop the green economy. The competition assessment covers all the markets affected by the proposed state aid, so distortions of competition will be evaluated at the investor level, in the banking markets and at the level of the ultimate beneficiaries of aid in the green sector. Allowing the UK GIB to borrow will require further EU state aid clearance.
147. Fair, non-discriminatory, transparent and objective processes will be used to select the beneficiaries of any aid which will minimise any possible distortions to competition either within the UK or the EU.
148. As any State Aid provided by the UK GIB will be open to all interested parties with the necessary technical capacity, proposals will be suitably benchmarked and only the minimum aid necessary will be provided to any successful project. It is also important to recognise that in many cases, there will be a very limited amount of suitable private sector capacity and so rather than distorting competition, the UK GIB intervention will actually help to foster it.
149. Where green projects are 'novel' there will be imperfect information and information costs, which like fixed costs can lead to imperfect competition and deter other investors. The UK GIB's activities may help to stimulate competition among capital providers by making information more accessible. It will be vital to balance these benefits with the commercial confidentiality which it needs to maintain itself as a credible financial intermediary. In addition, the UK GIB will work towards a principle of 'crowding in' rather than 'crowding out', investing where a project is unable to attract all of its required finance from the private sector. The UK GIB will enhance the ability of some firms to raise the necessary finance and help to mobilise private sector investment.
150. Also related to novelty, the act of lending to a project is a signal to other lenders, a form of externality, that the project is viable. Thus the UK GIB may act as a pioneer lender and through its participation, mobilise additional capital from other providers. Therefore, there is likely to be increased activity in this space as a result of the 'demonstration' effect of the UK GIB.

Small Firms Impact Test

151. The UK GIB will not be restricted with respect to the size of business it invests in. It is therefore not expected to have a disproportionate impact on SMEs.
152. The low carbon and renewable sectors that the UK GIB could invest in vary in terms of the concentration of small and medium sized businesses. The likelihood of investment in SMEs will therefore vary depending on sector.

Equalities Impact Assessment

153. The UK GIB is not expected to have an impact on equality and diversity, namely on race, religion or belief, disability, sex, age, gender reassignment, pregnancy and maternity, or sexual orientation.

Greenhouse Gas Assessment

154. There will be a reduction in GHG from increasing investments in green technologies and infrastructure. See tables 10 and 11.

Environmental Impact Test

Waste management system

155. If the UK GIB invests in waste management systems there will be an impact on the sector. The existing policy suite for waste does not target issues around the availability of upfront finance for waste infrastructure with the scale and degree of flexibility that is proposed for the UK GIB. The UK GIB is likely to be more effective at stimulating the large scale increase in investment that is required.

156. The UK GIB's investment in projects will specifically target market failures and barriers by:

- supporting installations which drive material up the waste hierarchy;
- creating greater understanding of short term and merchant feedstock markets thereby increasing market confidence in feedstock availability
- developing the waste treatment sector such that the market can begin to have confidence in the operational performance of plants;
- bringing down the cost of more environmentally beneficial technology options for supporting late stage development;
- bringing down the cost of due diligence;
- demonstrating the performance of newer, more advanced technologies at a more commercial scale, the 'first mover disadvantage', such that the investment sector can rely on robust operational data and track record, giving the private sector confidence to invest in future capacity and enabling the markets to mature; and
- supporting existing programmes or funds where expertise is available but funding limits their effectiveness

157. By providing targeted finance where market failures are currently limiting investment in critical waste infrastructure, the UK GIB aims to stimulate private sector lending as the symptoms of the market failures are overcome. The UK GIB will help to galvanise the market, rather than distort it, and through its participation mobilising capital from other providers.

Air Pollution

158. There will be a reduction in air pollution through lower GHG emissions (see GHG emission impact test section) from increased investment in low carbon and renewable technologies.

Material change to the appearance of landscape/townscape

159. Material change to the appearance of landscape/townscape is possible depending on specific UK GIB investments, however, any investments that could have such an impact (such as onshore wind) would require requisite planning and consent applications. For instance, although onshore wind is cheaper than offshore wind, it suffers considerable planning consent difficulties (including on account of its unpopularity with residents near to proposed sites) and is therefore not expected to achieve more than 35TWh/y at most by 2020. It is impossible to determine the scale of impact on landscape, as UK GIB investments will be driven by market demand and criteria related to green impact, sound finances and additionality. However, the impact will be managed through the planning process.

160. For all of the above, it is not possible to discern the locality of any environmental impact as the technologies could be deployed anywhere in the UK. As the investments will be in late stage innovation and green infrastructure, there will be a time lag before any impact can be seen. However, the impact is expected to be long lasting due to the nature of investments. The temporal impact will vary at project level.

Rural Proofing

161. The UK GIB is not expected to have any significant impact on rural areas.

Annex 1: Assumptions and Sensitivities

Recycling of UK GIB funds

162. Informed by financial market interviews and analysis, it is assumed that the UK GIB recycles its funds into other investments. It is assumed that this is on average every five years to reflect the construction time and initial operation, and it carries on over a twenty year period.

Uncertainty around potential projects

163. Currently there is uncertainty around the precise pipeline of projects, so there are assumptions around average rates of return for the eight sectors based on available data and an ex ante assessment of risks (Vivid Economics). The estimates of CO₂ impacts and benefits to society are calculated by Vivid Economics for offshore wind, waste and non-domestic energy efficiency¹⁹. For the other sectors, due to a lack of data, Vivid Economics has taken as its starting point Impact Assessments for existing policies to give an indication of returns to the sectors. These assumptions are then used within the four illustrative portfolio scenarios to construct the NPV estimates.

164. It is also assumed that net benefits per £ and CO₂ per £ are constant irrespective of the volume of funds invested and the timing of that investment. This is arguably a strong assumption as it might be expected that in some cases costs and/or benefits decrease with the increased volume of investment.

A mobilisation rate of four is assumed to be created by the UK GIB (ie for every £1 of UK GIB money a further £3 is mobilised from the private sector), based on McKinsey & Co analysis around the likely pipeline of projects.

165. Monte Carlo analysis has been used to undertake some risk analysis around the distribution of the net benefits to society and the CO₂ impacts, as illustrative portfolios differ.

Monte Carlo analysis – key assumptions

166. The sectors with the smallest capacity for investment based on Vivid Economics' analysis – Material Recovery Facilities (MRFs), Energy from Waste, biomass, and NDEE - were assumed to receive the maximum amount of capital the sectors could absorb for every iteration of the simulation. This assumption was made for each of the three years.

167. For the remaining sectors, money was distributed in one of two ways:

- a. a random value taken from a uniform distribution with zero as the lower limit and the specific maximum value of the sector as the upper limit;
- b. a random value taken from a uniform distribution with zero as the lower limit and a constant value as the upper value, which was the same across all the remaining sectors.

¹⁹ Vivid Economics, The Economics of the Green Investment Bank: costs and benefits, rationale and value for money, 2011

168. The difference between these two approaches means that in method (a) there is an inherent weighting for those sectors with larger maximum values. In method (b), there is no weighting for a particular sector. In effect, money is distributed randomly across the remaining sectors. For each of the three years, there was a 50% chance of using either method.

Displacement

169. The private sector cost of capital is included in the costs of the offshore wind, waste and non-domestic energy efficiency projects to reflect the opportunity cost of capital additionally going into green projects. For the other sectors cost estimates are taken from Impact Assessments for policies affecting these sectors.

Additionality

170. The financial returns to the UK GIB, the net benefits to society and the CO₂ impacts are adjusted to reflect the additionality taken from Vivid Economics' analysis. Within the base case it is assumed that projects which are additional would not go ahead without UK GIB support. In the sensitivities analysis, consideration is also given to the scenario where the UK GIB might merely accelerate projects.

Discount rate

171. In line with the Green Book, a discount rate of 3.5% is used. For all sectors a twenty - thirty year appraisal period is used depending on the nature of the asset (though for flood defences, benefits over a hundred years are included). For offshore and onshore wind, a thirty year appraisal period is used as it better reflects the life of the assets and the importance of these sectors in achieving the longer term carbon reduction targets in 2050.

Treatment of inflation

172. Nominal figures are deflated by 2.7% per annum, HM Treasury's GDP deflator. UK GIB financial returns are given in nominal terms.

Calculations for the portfolio analysis

173. The UK GIB returns for each portfolio uses the McKinsey risk-adjusted rate of return for products (equity, subordinated debt and senior debt) in each sector, and their sector splits (based on the pipeline of projects).

174. The net benefit to society takes the forecast real total capital spend (UK GIB plus private sector) and multiplies it by the NPV/£ of the sector, adjusted for additionality. This factor for offshore wind, waste (energy from waste, and commercial and industrial waste facilities) and non-domestic energy efficiency is determined by sector and market analysis and by modelling by Vivid Economics. For the other four sectors, the factor is informed by analysis undertaken for various Impact Assessments.

175. The green impacts follow a similar methodology.

Other impacts

176. If the UK GIB were to invest in flood defences for example, an assessment would need to be made of the non-CO₂ impacts.
177. There is significant uncertainty around the detailed nature of the UK GIB's specific investments, given it will be an independent financial institution and investments will be dependent on market demand. However, there might be investment in Assisted Areas (not least in the Incubation Phase - Phase 1, when the regional aid elements of the General Block Exemption Regulation would be used) leading to increases in jobs in those areas. Also, as UK GIB investments are likely to be in newer technologies, innovation spillovers (net of displacement and leakage) and training spend might be a part of the projects.
178. It is possible that some of the additional projects which the UK GIB supports will provide the UK with a real option value – for example, by investing in a range of technologies there is less likelihood of shifting out of a promising future technology or locking the UK into a narrow range of technologies in a fast moving part of the global economy.
179. The origin and scale of benefits to economic growth depend on the opportunity forgone in any alternative use of the public funding allocated to the UK GIB, or the risk of a negative effect on growth from increased spending in the light of the fiscal position. They also depend upon the net returns from the re-allocation of capital across sectors.

Annex 2: Results from sensitivity analysis

a. 100% additionality

180. From Vivid Economics work of the eight sectors assessed in the illustrative portfolios, waste and non-domestic energy efficiency were assumed to be 75% additional, biomass 50% additional, and onshore wind and photovoltaics were not additional. The rest were assumed to be 100% additional²⁰. The table below sets out the NPV and CO₂ illustrative returns if all projects were assumed to be 100% additional.

Table 15: Impact of increased additionality - Phase 1

Portfolio	Rate of return to UK GIB	NPV	CO₂
1	9.2%	£415million	41m tonnes
2	8.5%	£460million	30m tonnes
3	9.6%	-£420million	32m tonnes
4	9.5%	£270million	34m tonnes

Table 16: Impact of increased additionality - Phase 2

Portfolio	Rate of return to UK GIB	NPV	CO₂
1	8.9%	£1,500million	147m tonnes
2	8.5%	£1,660million	108m tonnes
3	8.9%	-£1,530million	115m tonnes
4	9.9%	-£1,590million	124m tonnes

Projects are merely accelerated

181. If the UK GIB were merely to *accelerate* projects rather than bring *new* projects to fruition, the net benefits to society and the CO₂ impacts would be significantly reduced. This might be the case if, for example: Investors become more comfortable with the green agenda and green technologies in general; price signals start to become very strong in the market; or, if other policies are introduced. If, for example, all additional projects invested in by the UK GIB are merely brought forward five years, the NPV and CO₂ impacts would fall to around 20% of the base case estimates.

b. Year end flexibility

182. Portfolios 1-3 assume no year end flexibility and that all under-spend is returned to HM Treasury. Portfolio 4 assumes that funds are carried forward into Year 3 and are fully spent. This sensitivity adds in another year to the UK GIB's operations. The CO₂ savings and NPV below now cover four years. For each portfolio, the fourth year uses the same split as in the third year. The table below shows the incremental impact of the additional year and the total

²⁰ Vivid Economics in association with McKinsey & Co., *The economics of the Green Investment Bank: costs and benefits, rationale and value for money*, report prepared for the Department for Business, Innovation & Skills, October 2011, page 186

for the four years. The increase is the greatest for Portfolio 2 as it has the largest under-spend. It also retains the highest NPV, as its investments continue as earlier years and also has the greatest green impact.

Table 17: Impact of Year-End Flexibility by Portfolio

Portfolio	Additional green impact	Total green impact of 4 years' investment	Additional NPV	Total NPV of 4 years' investment
1	12 million tonnes	124 million tonnes	£135 million	£1,420 million
2	50 million tonnes	131 million tonnes	£1,020 million	£2,650 million
3	9 million tonnes	100 million tonnes	-£140 million	-£1,475 million

c. Increased default beyond that priced into capital costs

183. If the default rate is 10% higher than expected across all sectors, the NPV and CO₂ impacts fall. This increased default rate has a significant impact on the NPV of the illustrative portfolios. 10% was chosen as it is broadly the point where the NPV range of Portfolio 1 turns from positive to negative (90% Committed 2012-2015: diverse).

Table 18: Impact of increased default by 10%, by portfolio

Portfolio	Phase 1 NPV	Phase 2 NPV	Phase 1 CO ₂ impact	Phase 2 CO ₂ impact
1	£41million	£148million	28m tonnes	101m tonnes
2	£220million	£795million	20m tonnes	70m tonnes
3	-£610million	-£2,210million	23m tonnes	82m tonnes
4	£85million	-£2,100million	23m tonnes	87m tonnes

d. Lower mobilisation rate

184. Analysis, interviews and market testing from Vivid Economics in consultation with McKinsey & Co indicate that, as a central estimate, a mobilisation rate of four could be expected (namely for every £1 of UK GIB money a further £3 of private sector money would be mobilised). This sensitivity assumes that the mobilisation rate is only three. Both NPV and CO₂ impacts fall compared to the base case.

Table 19: Impact of lower mobilisation rate of 'three' by portfolio

Portfolio	Phase 1 NPV	Phase 2 NPV	Phase 1 CO ₂ impact	Phase 2 CO ₂ impact
1	£265million	£965million	23m tonnes	84m tonnes
2	£340million	£1,220million	17m tonnes	60m tonnes
3	-£280million	-£1,000million	19m tonnes	68m tonnes
4	£235million	-£825million	19m tonnes	73m tonnes

e. Delay in State Aid so that Phase 2 does not begin until 2014/15

185. As less is spent on aided products, the table shows that illustrative returns are slightly higher than under the base case. In the absence of State Aid clearance, in the short term, the returns are assumed to be the same as those noted in the base case for Phase 1.

Table 20: Impact of delay in receiving State Aid clearance by Portfolio

Portfolio	1	2	3	4
UK GIB Returns	7.2%	6.1%	8%	7.1%

f. Phase 2 does not carry forward Phase 1 investments

186. The table below sets out the real NPV and CO₂ illustrative impacts of investments for the UK GIB in 2013/14 and 2014/15. If investments are not carried forward / investments are not recycled, the benefits of Portfolios 1 and 2 still outweigh the costs. However, it is intended that Phase 2 will take on Phase 1 investments.

Table 21: Impact of not carrying forward projects by Portfolio

Portfolio	Rate of return to UK GIB	NPV	CO₂
1	6.8%	£930m	81m tonnes
2	6.1%	£1,180m	58m tonnes
3	7.2%	-£965m	66m tonnes
4	6.8%	-£1,415m	71m tonnes

Annex 3: Post Implementation Review (PIR) Plan

187. The objective of the evaluation will be to understand how the UK GIB was implemented, the effects it had, as well as for whom and why. The structure of the evaluation plan will cover the following elements:
- a. A Logic Model, which defines the overall structure, including inputs, activities, outputs, outcomes and impact;
 - b. A Benefits Realisation plan, identifying key metrics based on the strategic priorities and operating principles;
 - c. Benefits logs, detailing data required to measure the success measures; and
 - d. Process and methodologies for evaluation

Further work on identifying appropriate indicators to evaluate and measure success and process evaluation will be integrated over the coming months.

188. Internal data systems will be gathered (for example portfolio composition) and the UK GIB will ensure it can access relevant data from the projects it finances. It is common practice for investors to require substantial amounts of data on a regular basis from the primary sponsors of the projects.

189. Baseline: The UK GIB baseline will be formed by estimating the counterfactual in terms of the extent to which the UK GIB accelerates and increases private sector investment in green sectors. This will need to take account of substitution (where investment in a particular sector is at the expense of investment in other green sectors), leakage (where benefits are leaked abroad) and deadweight loss (where activity would have happened anyway). The baseline will be constructed based on, for instance, ex-ante and ex-post data collection, especially with regards to investor perceptions on the opportunity cost of investment and the UK GIB as a driver of specific green investment.

190. A review of the UK GIB will be conducted by the National Audit Office (NAO). Early engagement with the NAO will take place to ensure there is a joint understanding of requirements. Internal reviews will also be conducted at regular intervals. Where appropriate, reviews will be published to encourage transparency

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