

Funding Small Scale Green Energy Projects through the Green Investment Bank

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This report has been prepared by:

The Co-operative Bank

The Co-operative Bank is part of Co-operative Financial Services, one of the UK's largest and most diversified financial mutual organisations.

In 2007, the Bank ring-fenced £400 million to finance small-scale renewable energy schemes of up to £25 million in value.

Its specialist renewable finance team has now become a leader in financing the small-scale renewable sector with expertise in financial modelling and understanding the complex processes involved in installation of projects, such as planning and grid connection.

As part of the Co-operative Group's radical new Ethical Operating Plan launched in early 2011, the Bank extended its support to the sector by committing to finance £1bn to projects by 2013.

The type of projects supported by The Co-operative Bank's Renewable Energy and Asset Finance team include the Natural History Museum CHP scheme, T'ree Community Wind scheme and CRF Hydro Power Limited. For details please go to: <http://www.co-operativebank.co.uk/servlet/Satellite/1224830455736,CFSweb/Page/Corporate-SocialBanking?WT.svl=nav3>

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Grant Thornton has established working relationships with several small scale renewable developers and funders, including the Co-operative Bank. Grant Thornton also has experience of working on renewable projects with a wide and diverse array of stakeholders and technologies in the sector giving a tremendously rich knowledge base from which to draw.

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1 Executive Summary

Whilst it is accepted by government that domestic small to medium scale green energy projects have a key role to play in tackling the social and economic challenges facing the UK at the present, how this is achieved in practice is much more open to debate.

A key problem remains in financing such projects which more often than not are perceived as too risky for investors and too costly for all but the few individuals or organisations that can raise early stage equity. This report makes the case for the Green Investment Bank (GIB) to help fill this gap. Without the GIB, no other financial support mechanism for embedded and small scale schemes is likely, and this could mean that the UK misses out on significant private investment, employment creation and the development of a sustainable skills base.

There is a sense in the UK that the transition to a low carbon economy is still seen as much more of a cost than an opportunity. A consistent case needs to be made that renewable energy is an investment opportunity which can pay for itself over time.

For businesses and citizens, much of this opportunity lies with small projects. The public can see the direct benefits of investment at this scale. But they also see that decentralised energy faces complex barriers including access to finance.

If the initial barriers to the delivery of small scale projects can be overcome, the potential to support green energy by providing engagement at a local and community level is considerable. Embedded and small-scale technologies are largely proven and there are opportunities for a “cookie cutter” approach that could enable a mass rollout to take place once the model is right.

Currently, efforts to create real momentum in this sector are fragmented, which is why this report argues that the Green Investment Bank can play a key role, by providing finance and through so doing act as a co-ordinating force for commercial activity in the sector. The GIB can harness existing projects, can standardise delivery and importantly see a full return on its investment – crucially earning the taxpayer a fair profit.

The small-scale and embedded renewable energy sector sub-divides into a number of established technologies and each has its own delivery characteristics. A fundamental challenge for commercial funders in all of these technologies is that the risks are generally being addressed on a project by project basis, and the scale of the projects means that cost-effective risk mitigation measures are difficult to find.

The GIB is ideally placed to attract and share good practice to help scale up project activity in the sector.

Recognising the GIB’s primary focus on large-scale projects, an arms’ length Sustainable Energy Fund is proposed, which would provide the centralising and delivery capability for the sector

In the scenario considered in this report, the primary product envisaged is mezzanine finance to bridge any capital shortfall encountered by project sponsors seeking to provide the equity cushion required by senior debt providers. By adopting the interim risk position of a mezzanine finance provider, GIB can leverage its position to create a larger portfolio (six or more times the size of the GIB investment). This could come with an “equity kicker” to provide a share of the upside where significant risks are being assumed by the SEF.

The core principles of the SEF would be:

- SEF should finance projects that are commercially robust and are capable of

- generating adequate cash-flows to repay senior and mezzanine finance
- SEF should provide finance at beneficial but not off-market interest rates
 - Finance should be provided on flexible terms but not as grants or 'soft' loans
 - SEF finance is a bridge to meet any initial equity shortfall and enable third party senior debt finance to be introduced to provide leverage.

The case for the GIB to invest in small scale low carbon projects should be seen in 'triple bottom line' terms, achieving the following outcomes:

- addressing fuel poverty
- retention of revenues and jobs in local communities (rather than, for example, being spent on imported fuels), and
- delivering community engagement.

Investment in small scale and embedded energy projects is economically viable and a beneficial target for public investment in order to compensate for market failure. Investment in these projects will earn a return which compensates for the associated risks. The attractions of large projects are higher for many private investors as scale can deliver proportionately lower transaction and project management costs (transaction costs increase with project size but more slowly than investment) For most investors and lenders these economies of scale are more important than the normally shorter lead times of small projects and hence there is a shortage of investment in economically viable small projects.

However from a public perspective, small projects also make a contribution to social goals and carbon reduction, have greater local content and focus than larger projects and tend to encourage local engagement as they are more visible.

Employment created by small scale and embedded renewables projects will have a significant beneficial impact on local businesses as much of the supply chain

required to implement these projects (contractors, installers, electrical engineers etc.) is likely to be part of the core workforce of most communities.

The benefits delivered through market intervention are strong especially when factoring in the impact of refinancing projects, which will return capital to GIB to be reinvested.

The economic analysis assumes that a total of £200 million is invested, of which £190 million is invested in specific technologies (wind, solar hydro, AD and biomass) and £10 million held in reserve for other technologies as they mature sufficiently for GIB to finance them.

The outputs that could be created from a portfolio of £190 million are:

- 6,512 jobs created
- £56 million of taxes to HMRC per annum
- Generation of 2,940GWh pa of renewable power, 37% of the DECC target for generation from small (less than 5MW) renewables.

The initial £190 million GIB equity investment would result in total investment of £1,180 million including £908 million of private debt, with equity including GIB mezzanine ranging from 15% - 35% of capital, depending on the technology.

The CO2 displacement from this investment portfolio would be substantial and relatively rapid, given the short development timeframe for these projects. This would enable the Government to secure 'quick wins' and the portfolio itself could be refinanced relatively quickly. The Green Investment Bank requires 'shovel ready' projects to ensure it starts off with a focus on delivery and can be seen to 'work'. It is only the small-scale and embedded sector that offers the type of low risk projects that deliver carbon savings and a range of socio-economic benefits in the immediate term.

2 Setting the Context

2.1 The Green Investment Bank

Investing in the low carbon economy is a key element of the Government's plans for meeting our carbon reduction targets and providing a boost to the UK economy¹. The Green Investment Bank (GIB) is expected to play a pivotal role in meeting the overall investment need. The Chancellor's formal budget announcement also sets a clear timeline: operational from 2012 and able to borrow, subject to the position on the national debt, by 2015 / 2016.

This timetable is ambitious but it responds to the urgent need to cut carbon emissions and to boost the economy. It is possible that State Aid clearance may delay the start of operations. However, we do not think this should be the case for two reasons:

- the proposed finance for small green projects is on market terms as, we understand, will be other GIB finance and hence there is no State Aid, and
- there is a relevant and helpful precedent in that KfW, a well-established bank owned by the German government, committed in 2010 €11 billion (£9.6 billion) of funding to SMEs for energy efficiency, climate protection and renewables.

The initial capitalisation of £3 billion for the GIB may seem small relative to the investment requirements of the industry, but if the GIB can deploy its resources intelligently, it can achieve a positive 'ripple effect' that goes well beyond the

bare capital resources of the Bank by leveraging in private finance.

The need for the GIB is set against a background of a rapidly increasing investment requirement for renewable energy technologies, entailing a doubling of investment required in the coming decade, compared with the previous 10 years and an overall requirement in excess of £200 billion to 2020.

There has been considerable speculation about the expected scope of the Green Investment Bank's remit, and an announcement is expected to provide further detail shortly. Based on the limited publicity to date, there is an expectation that much of the GIB's firepower will be aimed at large scale projects: for example, key generation projects aimed at delivering substantial proportions of the Government's low carbon energy targets; infrastructure and grid projects to facilitate distribution; and potentially non-energy low carbon projects such as transport, waste water and green IT.

The Government recognises, however, that this agenda has many dimensions. The UK's energy strategy posits nothing short of a total transformation of the way the UK generates and uses energy, from the bottom up. This includes diversifying the UK's energy supply, increasing resilience and security of supply. Whilst there should be a heavy focus on replacement generation capacity, demand management will need to play a critical role.

Success is not simply about delivering a large number of projects, however. Success will be measured by the level of sustained change that the Government's low carbon agenda will embed in the behaviour of citizens and businesses, and by the level of support – or otherwise – that the Government receives for its transformational strategy.

The social and economic challenges facing the UK at the present time are also considerable and the Government needs

¹ http://cdn.hm-treasury.gov.uk/sr2010_complereport.pdf

to frame the transition to a low carbon economy within these parameters. Low carbon energy needs to be seen as opportunity as well as a cost. Thus it is important that the GIB is widely seen to produce economic benefits, jobs and taxes, quickly.

For many businesses and citizens, much of the opportunity and low carbon investment visibility is at the smaller end of the scale in terms of project size. Large scale high capital cost projects such as offshore wind are several stages removed from the direct experience of most people and may be seen as costly necessities in order to rebalance the energy mix. On the other hand, for a wide range of projects, such as anaerobic digestion, small-scale hydro, small-scale wind and Combined Heat and Power (CHP), the Government has created a range of incentives to encourage take-up, and these projects have a significant role to play in securing direct economic benefits and therefore engagement and buy-in.

The original intent with regard to the GIB is somewhat different from the kind of institution that now appears to be taking shape. It is worth noting what the Conservative Party's General Election manifesto said regarding the GIB:

“This wave of low carbon innovation we want to unleash requires investment, so we will create Britain’s first Green Investment Bank – which will draw together money currently divided across existing government initiatives, leveraging private sector capital to finance new green technology start-ups. We will create green Individual Savings Accounts to help provide the financial backing we need to create a low carbon economy.”

This commitment appears to recognise the vital role of small scale projects and individual investments in making the implementation of the low carbon agenda a success.

Consistent with the emerging governance models which stress more direct and localised accountability, there would

appear to be a prima facie role for the GIB to support small low carbon projects as at least a small part of its portfolio.

2.2 Big Society

The Big Society is a much used term, with strong political support from the current Coalition Government. It has spawned a great deal of political debate, but articulates some key principles of community and personal engagement that are highly relevant to successful policy-making if the principle is accepted that governments on their own can't make change happen.

The Big Society² website sets it out as follows:

"The Big Society is a powerful vision to change this, creating a nation of empowered citizens and communities...

we see the core of the big society as three principles:

- **Empowering individuals and communities**
- **Encouraging social responsibility**
- **Creating an enabling and accountable state."**

When it comes to the transition to a low carbon economy, the UK has to adapt quickly to cultural change. A long period of cheap on-demand energy from large scale centralised facilities, invisible to most of us, combined with a high level of material well-being (for many of us) and a protective attitude to the spaces we own and occupy, underpins the sense that we have a lot to lose from the kinds of change required to achieve this transition. Policy-makers and politicians cannot ignore the human aspect of policy implementation in this area.

A report shortly to be published by Grant Thornton on Sustainable Cities highlights, for example, the various behavioural or attitudinal "buttons" that

² <http://thebigsociety.co.uk/what-is-big-society/>

need to be pressed to secure buy-in for low carbon initiatives:

Incentive – convince people they will benefit from the initiative

Challenge – people should make sacrifices for the environment, the general good or a legacy for future generations

Reassurance – the situation is under control; for example, the lights won't go out in five years' time and lifestyles won't change

Timing – articulating the timeframe over which results can be expected.

Small scale low carbon projects can play a role in positively adding to the balance in a way in which large-scale projects generally can't, and enable some of these buttons to be pressed more effectively.

2.3 The Big Society Bank

Another significant financial institution that is taking shape is the Big Society Bank (BSB). The question whether small-scale low carbon investment could fit within the remit of the BSB has been somewhat answered by the endorsement of the outline proposals by the Cabinet Office on 9 May 2011³.

Initial analysis of these proposals suggest that BSB funds will likely be directed towards social finance and financial inclusion projects, which are only tangentially related to the low carbon sector and there is certainly no explicit reference to small scale energy in the proposals themselves.

This is perhaps understandable as low carbon investment needs finance that is knowledgeable about the sector from a technological and therefore a commercialisation perspective. Therefore the argument for a vehicle (e.g. the GIB)

³ www.cabinetoffice.gov.uk/news/big-society-bank-gets-green-light

that has a much tighter remit than the BSB holds weight – rather than a body that is focused on wider social benefits first, and small-scale energy second.

However, BSB projects can include those that appear to share the same characteristics as those we are proposing are supported by the GIB. Two of the twenty pilot projects in the Big Society Finance Fund Portfolio are related to Sustainability and Renewable Energy. Later in this section we refer to a number of community related initiatives and it is clear that not for profit and community organisations have the potential to play a key role in the small-scale low carbon sector.

In the small-scale low carbon energy sector, we would argue that the conditions are set for making acceptable commercial returns, whatever the identity and structure of the project sponsors (be they socially orientated or otherwise). The role of the GIB would be to bridge a capital and risk gap that currently exists on a commercial basis, and this would act as a catalyst for greater market penetration by private investors and funders.

Clearly there are strong links between the Big Society agenda and the delivery of the small-scale low carbon agenda, but unless the GIB assumes some responsibility for investment at this end of the market, a significant gap will open up between Government policy vehicles and this could have negative long term implications for the delivery of the UK's transition to a low carbon economy.

2.4 Challenges Facing Small-scale Projects

Although small-scale low carbon projects look attractive as part of the 'energy mix' and as a means of securing greater engagement and buy-in, take-up (particularly of projects by and for local communities and businesses), remains relatively low especially given the market in comparable economies such as Austria and Germany.

Why should this be the case? Small scale projects face a number of major challenges:

Economics - small-scale projects do not have access to the economies of scale of large projects to keep costs down. Some costs (eg due diligence for third party funders) are inelastic, which means that they are proportionately higher for small projects. This is exacerbated by the fact that small-scale projects have not yet achieved any level of standardisation.

Governance – there is often a challenge to reconcile the need for clear commercial direction with the collaborative impetus which has often given birth to the project.

Finance - small scale projects find it hard to attract third party finance as the markets are attracted by scale.

Knowhow - in an emerging sector, much of this has to be bought in, and small projects are constrained by the lack of financial resources from doing so. Knowledge is fragmented and needs to be channelled and centralised to allow the market to scale up. This is particularly the case where decentralised schemes seek to navigate the planning system – an area of risk requiring up-front funding.

This end of the low carbon sector has a large number of diverse and often highly competent sources of information which share and build on best practice, but a single repository, which could develop into a centre of excellence, is lacking – this could be a role for the GIB.

2.5 Community Projects⁴

Community projects, as a sub-set of the small-scale market are subject to the same constraints as above, as well as issues such as in-house technical expertise and need for ‘hand-holding’, project co-ordination, and up-front funding to the planning stage, which all greatly affects access to capital and perceptions of risk among private investors / funders.

Nevertheless, the last few years have seen a growth in community based low carbon projects and programmes, triggered by a number of factors, principally:

- Government support for small scale projects through FITs and RHI
- Increased awareness of climate change and environmental issues
- Greater confidence in community level governance and accountability

Alongside the key objective of tackling climate change, community ownership projects deliver in the process social and economic benefits to their members and the wider community.

Projects under some form of community ownership and control can:

- Generate higher levels of local acceptance, trust, knowledge and support. Community models are effective at avoiding and solving potentially costly problems such as opposition to planning permission.
- Address fuel poverty: CHP district heating schemes (e.g. Aberdeen Heat and Power) show how local energy generation has the potential to tackle the impact of rising fuel prices on low

⁴ Viable, renewable energy projects set up and controlled by local stakeholders who are connected to the energy needs of a particular area and who will be affected by its ongoing operations (eg households, foresters and farmers, businesses, public sector, and investors). They can take various forms such as co-operatives, social enterprises and local authorities.

income households providing affordable warmth

- Mobilise investment from the community and deliver direct economic benefits for members (eg Energy4All equity dividend, cheaper heating)
- Diversification of local economies, especially rural areas
- Increased responsiveness, transparency and direct accountability for members
- Knowledge and confidence gained translates into behavioural change at an individual household level

This growing market remains untapped in large parts of the UK and without GIB intervention will struggle to maintain its momentum.

At the same time, a number of enabling organisations, often regionally based, either have been established or are in the process of establishing themselves, with the objective of facilitating community projects. The examples given below show that this is a vibrant segment of the renewable energy sector, founded on an understanding of the need for core commercial drivers in delivering low carbon energy generation.

Carbon Leapfrog describes itself as ‘a new and unique business-led charity that galvanises and channels free professional advice from leading service providers across a range of disciplines into UK and international carbon reduction projects’. Its supporters include a range of NGOs and NDPBs, industry players, legal firms, technical advisers, accountants, banks and other businesses. A selected list of Carbon Leapfrog projects is included in Appendix A.

The Co-operative Enterprise Hub⁵ is The Co-operative’s flagship programme

⁵The Co-operative Enterprise Hub is a working name for Co-operative Action Limited. The Enterprise Hub replaced the activity of two former co-operative encouragement bodies, The Co-operative's Development Fund and C-Change.

for the promotion of the co-operative business model in the UK. The Enterprise Hub operates on a regional basis, and its activities are delivered by regional consortia of co-operative development professionals. The Enterprise Hub offers free advice and training services and, following this consultation, the opportunity to make a grant application, which must be combined with a loan application. As such, The Enterprise Hub seeks to move away from ‘grant dependency’ in the co-operative sector and towards sustainable businesses.

In 2010, The Enterprise Hub was established in all regions in England and Wales, with consortia in Scotland and Northern Ireland established in early 2011. Over the next three years, a further £7.5 million is to be invested in the work of The Enterprise Hub with a particular focus on renewable energy projects.

Communities for Renewables is an initiative set up by Regen SW in order to bring together communities interested in developing commercially viable renewables projects. The aim is to draw funding into communities so that they can ‘**drive their own projects forward and secure a fair share of the schemes’ profits**’.⁶ In March 2011, Regen SW produced a paper offering proposals regarding the focus of the Green Investment Bank on a broad front, but underlining the need for support in terms of medium and community-sized projects.

Community Energy Scotland is an independent Scottish charity providing free advice, grant funding and finance for renewable energy projects developed by community groups to benefit their community. This extends to non-profit distributing organisations such as social enterprises and housing associations. CES is able to fund community projects through the Scottish Government's

⁶ www.regensw.co.uk/projects/communities-for-renewables

Community and Renewable Energy Scheme (CARES) and also receives funding from Highlands and Islands Enterprise to support its work with communities in the Highlands and Islands.

CES is also assisting applicants to the CARES, which began offering loans for the pre-planning costs of renewables projects in Scotland in April 2011, with a budget of £5.35 million for community owned projects and £2.4 million for projects owned by land managers, farmers and SMEs. All projects are required to demonstrate a minimum level of community benefit to the local area.

Energy4All⁷ is a not-for-profit organisation formed in 2002 out of the successful Baywind Co-operative to expand the number of renewable energy co-operatives in the UK. Baywind itself was formed along the community ownership lines that were already common in Sweden.

There are now seven co-operatives with over 7,000 members, which have been assisted by and collectively own Energy4All. The latest project to be approved, Torrance, in North Lanarkshire, will have an installed capacity of 10MW and will be the largest community-owned project in the UK.

Energy4All has successfully partnered with Falck, a well-established independent developer, as part of its growth strategy.

Empower Community Fund

The purpose of the Empower Community Fund (ECF), which is yet to launch, is to accelerate the transition to a low carbon economy by providing access to capital for community renewable energy and energy efficiency projects. It is designed to create a virtuous cycle of resource allocation for social and environmental benefit that encourages

large-scale community participation, ownership and responsibility.

Omni, the organisation behind ECF, argues that while grass-roots, action-oriented responses to climate change continue to grow exponentially, the current limited access to finance is hampering the wholesale development and implementation of distributed energy solutions at anything like the scale or speed required.

ECF is designed to be a rapidly scalable funding mechanism that balances the interests of all stakeholders by providing a high quality investment opportunity with attractive returns, reinvesting profits in further community projects and facilitating ultimate community ownership of assets.

2.6 Commercial Small-scale Projects

Not all small-scale projects are community projects; nor do they need to be. There is a considerable amount of interest from businesses, landowners and small-scale developers, and these all form a significant part of the potential market.

However, the challenges at the small end of the scale are not limited to community and not for profit projects.

The introduction of the Feed-In Tariff to support small scale projects has created a significant appetite, but the challenge of raising finance remains.

Creating purely commercial programmes with sufficient scale has also proved to be a challenge and the fact that success stories are relatively limited illustrates this point.

Thumbnails of some of the higher profile small-scale developers are set out below. These illustrate that there is a commercial sector at the small end of the market, but also that it faces significant challenges.

- **Ecotricity**, an independent company that has been in existence for 15 years

⁷ www.energy4all.co.uk/home.asp

and is seen as leading the way in small-scale wind development. Ecotricity has 12 turbines consented and in construction, with a further 69 in planning (equivalent to 125 MW)⁸.

- **Maitland Mackie**, the ice-cream entrepreneur, who conceived plans to build 30,000 3MW wind turbines across the UK, by raising £10 million of finance from individual investors. The project was aimed at giving stakeholders in rural communities the chance to take substantial ownership of the wind-generating potential of their own land. The projects were to be owned by farmers, landowners and other investors. These plans had to be abandoned in early 2009 in the face of worsening economic conditions.
- **Green Highland Renewables (GHR)** was founded in 2007 and specialises in developing small scale run of river hydro projects from 50kW to 2MW. GHR provides advice and solutions to landowners and communities through the whole process of design, procurement and operation of hydro projects. The company operates a close partnership with its shareholder Scottish and Southern Energy plc. GHR currently has one operational project and five being built in 2011 / 2012, with a further 12 in development⁹.

The commercial opportunities of small-scale renewables projects for rural diversification are well recognised. The Scottish Agricultural College has undertaken detailed work across what it considers to be the primary renewables opportunities, namely: short rotation coppice; wind; hydro; wood fuel heating;

⁸ Progress Report 2009:
www.ecotricity.co.uk/about/our-progress/progress-report-2009.pdf

⁹
www.greenhighland.co.uk/documents/ghroverview.pdf

and heat pumps¹⁰. In the meantime, the NFU has produced a series of guidance documents for farmers in relation to specific renewables opportunities and is running events across the country, whilst National Farmers Union Scotland has recently established a Renewable Energy Working Group, reflecting the significance of this area of commercial activity to farmers.

If the initial barriers to the delivery of small scale projects can be overcome, the potential of this sector is considerable. The technologies are largely proven and there are opportunities for a 'cookie cutter' approach that enables a mass rollout to take place.

Planning considerations are also by an order of magnitude less complex than high end, large-scale projects but remain a barrier and a cost. If financing and structuring challenges can be resolved, this end of the market offers the prospect of a rapid rollout within a timescale which complements rather than competes with the GIB's larger scale commitments.

2.7 Conclusions

This section demonstrates the value in policy terms of addressing the small-scale low carbon agenda. It shows both the challenges faced by the sector and the range of players who are building up skills and capabilities both from a commercial and from a community perspective.

At the present time efforts to create real momentum in this sector are fragmented, which is why the report argues that the Green Investment Bank can play a key role, by providing finance and through so doing act as a co-ordinating force for commercial know-how in the sector.

The Green Investment Bank can have a rapid impact by delivering local projects through-out the country which will

¹⁰ www.sac.ac.uk/consulting/services/f-h/farmdiversification/database/renewableenergy/

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reduce carbon, create jobs and generate profits. Without GIB intervention, there is a real risk that the UK fails to harness the demand of small-scale and embedded projects

3 Key Technologies

3.1 Overview

The small-scale and embedded renewable energy sector sub-divides into a number of established technologies, each of which is well developed but has its own delivery characteristics. The purpose of this section is to briefly set these out as a precursor to the economic analysis in Section 5.

A fundamental challenge for commercial funders in all of these technologies is that the risks are generally being addressed on a project by project basis and the scale of the projects means that cost-effective risk mitigation measures are difficult to find at this level.

3.2 Small-scale wind

Although wind is an established technology, the industry as a whole has focused on scaling up. Nevertheless, with the introduction of FITs and as the number of large-scale onshore sites reduces in the UK, small wind projects are likely to come increasingly to the fore.

There is a wide range of turbines at the very small end of the market (sub 250kW), from a range of manufacturers, who are mostly relatively small. Developers and funders are therefore faced with issues around validating technical performance and the financial value of warranties provided. In the larger end of this market, (say 750kW to 1.5MW), a number of global manufacturers, such as GE and Gamesa have machines, although the range is relatively limited and availability at this scale remains a concern. A list of some of the machines currently known to be available in the market is attached at Appendix C.

3.3 Solar PV

It is unclear at the present time how the industry will react to the proposed changes in the FIT for solar projects over 50kW, and what the wider impact will be in the context of an already unsettled European market, with actual or proposed changes to support regimes in a number of countries.

There is no doubt that solar PV production is supported by a highly competitive global industry which remains attractive to investors, as illustrated, for example, by Total's recent announcement of its twin acquisition of SunPower for US\$2.3 billion, and EDF's 50% stake in French PV producer, Tenesol.

This global industry appears to be forcing the cost of production down as projects are being scaled up and investment can be ploughed into lower cost technical solutions.

For example, the world's largest solar PV plant (80MW), in Ontario, Canada demonstrates the migration of solar PV-generated electricity toward utility scale by using cadmium telluride (CdTe) thin film, which is a semiconductor layer designed to absorb and convert sunlight into electricity at a price competitive with traditional energy sources, such as fossil fuels and nuclear power. The project is expected to power more than 10,000 homes with the 120,000 MW-hours of electricity and to save more than 39,000 tons of carbon dioxide emissions a year¹¹.

Solar PV therefore has a number of attractions as part of a focused portfolio of investment, including: delivery of electricity to the point of use; ease of installation, simple and proven technology, rapid rollout, low maintenance costs and the prospect of a steep technological cost curve providing

¹¹ <http://solutions.bv.com/solar-plant%E2%80%99s-production-costs-are-now-competitive/>

greater economic benefits in the future as costs come down. Solar PV is ideally suited to an 'aggregation' model in renewable energy, particularly for the social housing sector, where projects can be batched up and refinanced later on.

Whether or not the Government is looking to develop industrial capacity in this sector in the UK, solar PV's relative convenience clearly positions it to achieving a high level of acceptance amongst the UK public and businesses.

Solar can be a good technology for urban areas as it can be implemented on roof space that has no alternative use, the visual impact is limited and installation is relatively quick and easy.

3.4 Hydro

Hydropower is the longest established form of renewable energy, accounting for almost 20% of the world's electricity and over 90% of the world's renewable power. Approximately 35% of the UK's renewable energy is provided by hydropower.

The British Hydropower Association claims that hydro beats all other electricity generating technologies with an energy pay-back ratio of 300 (energy produced/energy to produce), which is ten times more than oil-fired power stations.

Small hydro schemes have a limited visual impact on their surrounding environment, although there may be competing claims on water resources from other users.

Hydro projects are relatively capital intensive, technologically straightforward, but tend to be site specific in terms of design, construction solution and power output.

3.5 Anaerobic Digestion

Government has made clear its desire to see the anaerobic digestion (AD) sector

succeed in the UK. In July 2010, Climate Change Minister Greg Barker launched a discussion on the future of AD with a very public declaration of support:

“Turning waste into something usable is a no brainer! So I want to investigate how we can be far more ambitious in our use of anaerobic digestion. In the face of the challenge to build an economy that cuts carbon emissions, which ensures energy security, and which creates green jobs to help bring back economic prosperity - anaerobic digestion ticks all of these boxes. Plus it has the added benefit of reducing waste going to landfill.”¹²

This support for AD at the UK level is echoed by the devolved administrations. The Welsh Assembly Government sponsors the Wales Centre of Excellence for Anaerobic Digestion¹³. The Northern Ireland Energy Minister Arlene Foster has recently secured European Commission State Aid approval for proposals to increase support for electricity generated from anaerobic digestion to up to double the support currently offered under the Northern Ireland Renewables Obligation (NIRO).

Subject to approval by the Northern Ireland Assembly, the change in legislation will increase the ROC levels for electricity generated from anaerobic digestion from the current two ROCs per megawatt hour for all sizes to four ROCs per megawatt hour for generating stations up to 500kW capacity and three ROCs per megawatt hour for stations between 501kW and 5MW.¹⁴

However, this high level of government support for AD will not guarantee growth in the industry without fresh approaches to financing the projects themselves.

¹²www.decc.gov.uk/en/content/cms/news/pn10_77/pn10_77.aspx

¹³www.walesadcentre.org.uk/

¹⁴www.waterbriefing.org/index.php/home/regulation-and-legislation/item/3865-northern-ireland-minister-welcomes-eu-ruling-on-anaerobic-digestion

It has been estimated¹⁵ that the current pipeline for AD projects in the UK is of the order of £700 million in capital value, that the total number of potential projects is around 1,000, with a capital cost in the order of £2 billion – £5 billion. To date, however, the level of investment in AD projects has fallen short of expectations.

This sector has met with relatively limited commercial success so far; projects have been difficult to finance and deliver, for a host of reasons, with feedstock availability, digestate and technical issues being cited, as well as the availability of finance, on which these two issues have a major impact.

With an increasing focus on intermittency within the renewables sector, and the more general issue of energy storage, the fact that AD projects can be a source of grid-compatible biogas offers a significant development opportunity for the future.

ADBA's view is that from a technical perspective, the UK hasn't missed the boat – using AD to harness the energy potential of waste outputs is something that the UK is seen as leading development on at the present time.

The digestate produced from AD can be a high quality biofertiliser. A trial in Scotland¹⁶ showed when inorganic fertiliser prices were high, farmers could save as much as £100 per tonne in fertiliser costs by using an organic alternative. It is argued that biofertilisers present a number of advantages over inorganic fertilisers, including:

- Aiding to replenish and maintain long-term soil fertility by providing optimal conditions for soil biological activity;

¹⁵ Source: Anaerobic Digestion and Biogas Association "ADBA"

¹⁶www.wrapcymru.org.uk/applications/site_search/search.rm?term=anaerobic+digestates&searchreferer_id=29786&submit.x=37&submit.y=14

- Suppressing pathogenic soil organisms
- Degrading toxic organic chemicals
- Stimulating microbial activity around the root system of plants
- Increasing the available nitrogen for plants
- Interacting with other soil organisms and biodegradable components in the soil to supply essential nutrients
- Increasing crop yields by both enhanced growth and by protection because enhanced plant growth is accompanied by reduced stress and improved disease resistance¹⁷

In general terms, the economic drivers for AD projects seem to be shifting – whereas the gate fee has in previous years been seen to be a significant source of revenue and the digestate effectively a cost because of the restrictions around disposing of it, these positions appear to be switching.

3.6 Small-scale Biomass

With tariffs hitherto supporting electricity generation, much of the biomass market in the UK has been focused on large-scale biomass plants to deliver economies of scale and high levels of electrical output. However, with the introduction of the RHI, conditions have been created to encourage the development of small scale biomass projects, at which point these segment overlaps into the CHP segment, which is discussed below.

In biomass as in a number of other renewable technologies, Germany sets an example for the successful rollout of low carbon energy generation. Take Bavaria, for example. The key success factors for achieving a concentrated introduction and rollout of biomass in Bavaria were:

- regional government support through financial grants for biomass installations

¹⁷www.ecochem.com/t_organic_fert2.html

- beneficial legislation including premium tariffs for biomass or standard specifications for wood fuel
- strong R&D, indigenous industry capability, know-how and education.

Currently approximately 2.3 million tonnes of biomass are used for energy purposes in Bavaria which is equivalent to 3.3 % of the region's primary energy requirements.

By contrast, the small scale biomass sector in the UK is relatively fragmented, with no commercial or technical standardisation, feedstock supply and planning and environmental challenges.

Another European success story is the state of Upper Austria¹⁸, with a population of 1.4m people, which has a leading position in biomass heating: more than 25% of all modern biomass boilers installed in the European Union manufactured in the state, and it has one of the highest densities of small-scale automatic heating systems in the world. Stringent emission standards and cutting-edge technologies have contributed to rapid market development.

The 'Okoeenergie-Cluster', the network of renewable energy and energy efficiency companies in the state, comprises currently 150 companies and institutions, employing more than 6,200 people and generating annual revenues of more than 1.7 billion Euro (~ 3.5% of state GDP).

Currently renewables account for:

- 33.4% of total primary energy demand;
- 45.6% of total heating demand; and
- 78.4% of electricity

Avoided imports of fossil fuels are estimated at €1 billion.

¹⁸www.esv.or.at/fileadmin/redakteure/ESV/Info_und_Service/Publikationen/Biomass_heating_2010.pdf

The success factors in Upper Austria illustrate the effective integration of entrepreneurialism, state policy, finance and regulation.

3.7 Combined Heat & Power (CHP)

CHP is an energy efficiency technology. It provides a means to substantially reduce fuel, or 'primary energy', consumption without compromising the quality and reliability of the energy supply to consumers. Consequently it provides a cost-effective means of generating low-carbon or renewable energy. CHP has the advantage that it is controllable and hence power and heat can be supplied to match demand. Typically it can form part of a broader energy efficiency strategy.

The EU Cogeneration Directive defines CHP as delivering minimum levels of primary energy savings, with savings of 10% required for most CHP capacity. The CHPA argues that energy savings secured are however typically far greater than this minimum threshold.

The efficiency benefits of CHP go on to provide a range of wider advantages. Delivering the same energy more efficiently, using less fuel in the process reduces energy costs, enhances security of energy supply and helps mitigate dependence on imported fuels.

CHP also presents the opportunity to secure cost-effective reductions in CO₂ emissions. The scale and cost of these savings will vary with respect to the scale, fuel and type of CHP plant, and in relation to the benchmark that is being used for comparison. But the proven potential is substantial.

Today's CHP systems are based predominantly upon existing, proven power generation technologies: steam turbines, gas turbines and reciprocating engines used the world over to generate energy. This use and adaptation of existing technology not only contributes to the relatively low cost of CHP, but also

ensures that it is a proven and reliable technology, capable of delivering an immediate impact in transforming the UK's embedded energy system.

The sector does not appear to be short of manufacturing capacity, however, there remain some doubts about the effectiveness of some technologies; biomass CHP seems likely to remain a relatively small component of the small-scale low carbon sector.

Climate Change Minister Greg Barker in January 2011 showed his support for the CHP sector by opening a £2 million extension to the global headquarters ENER-G in Salford, Greater Manchester. The company is aiming to create 100 new jobs in 2011.

4 A Role for the GIB

Investment in small scale and embedded energy projects is economically viable and a logical target for public investment in order to compensate for market failure. Investment in these projects will earn a return which compensates for the associated risks but the projects are not attracting sufficient capital as there is excess demand for investment in green projects and a significant number of private investors prefer large-scale projects. The attractions of large projects include relatively low transaction costs (transaction costs increase with project size but more slowly than investment) and relatively low project management cost per pound invested. For most investors and lenders these economies of scale are more important than the normally shorter lead times of small projects and hence there is a shortage of investment in economically viable small projects.

However from a public perspective, these small projects also make a contribution to social goals and carbon reduction. In particular, small projects have greater local content than larger projects which normally require highly specialised resources that are not available locally. In addition, small projects tend to encourage local engagement as they are often sited closer to populated areas and hence are more visible. An acceptable rate of return for a Green Investment Bank Mezzanine Fund could be less than the normal rates which would be demanded by private equity (around 15% - 20%).

4.1 Sustainable Energy Fund

If it is accepted that support for small scale low carbon energy projects would bring significant benefits both in economic terms and in support of the Government's low carbon agenda, consideration needs to be given as to how this support could be delivered in a way that is effective and incremental, whilst being complementary to GIB's other functions. GIB will have limited personnel as well as financial resources. The small scale sector also presents a different dynamic from the larger generation and infrastructure projects. For these reasons, a degree of separation is likely to be needed between GIB's large scale activities and its intervention in the smaller end of the market.

For the purposes of this paper, we have termed this proposed intervention the Sustainable Energy Fund (SEF). This section presents a scenario of how the SEF, under an 'arms' length' arrangement, could provide financial support to the small scale low carbon sector, tied to the development of an effective commercial framework which ensures that projects can be refinanced and aggregated later, if this is appropriate.

4.2 Core Principles

- SEF should finance projects that are commercially robust and are capable of generating adequate cash-flows to repay senior and mezzanine finance
- SEF should provide finance at beneficial but not off-market interest rates
- Finance should be provided on flexible terms but not seen as grants or "soft" loans
- SEF finance is seen as a bridge to meet the capital shortfall and enable third party senior debt to be introduced to provide leverage

4.3 ‘Smart Finance’ – Standardisation and Portfolio Risk Assessment

For many years, a ‘cookie cutter’ approach has been the holy grail of commercial players at the small end of the low carbon market. This entails rigorous standardisation between projects in order to minimise the cost of developing each project and mitigate against diseconomies of scale. Commercial operators have met with some success in this area, but are constrained by their own position in the market, by the underlying technical variations in many low carbon technologies and by the due diligence requirements placed around the availability of third party finance.

In addition, a significant proportion of the sector will remain difficult for commercial aggregation models to access, because of the characteristics of projects or project sponsors (such as community or NfP organisations).

In the meantime, the level of technical competence in the marketplace has increased significantly, as evidenced by the growth in membership of specialist trade associations, such as the Anaerobic Digestion and Biogas Association (ADBA), the British Hydropower Association (BHA) and the Combined Heat & Power Association (CHPA). These organisations, together with the more broadly based association such as the Renewable Energy Association (REA), Renewable UK and Scottish Renewables, provide access to significant know-how in the delivery of projects across the spectrum; what is missing is a co-ordinating body to act as a lightning rod to bring the requisite technical knowledge together, perhaps in some ways similar to the role WRAP currently plays in the waste sector, which would in turn allow the creation of a standardised check-list approach for project viability and due diligence.

Funded by GIB, SEF could play this role and effectively set the standards for commercially robust small-scale low carbon projects.

4.4 Financial Products

There is a wide variety of means for providing financial support to the small end of the low carbon market. Broadly, these can either take the form of direct funding or indirect support. In this report, we consider that the key product which would provide incremental support to the sector on top of what can already be secured by commercial markets is a mezzanine product which addresses the shortage of risk capital at the small end of the market primarily for the pre-operational stage of projects.

By offering a targeted financial product closely tied to a co-ordinated assessment of the key risks and issues for each technology, SEF on behalf of GIB could act as a catalyst for market expansion at this end of the sector.

In general terms, renewable energy projects see a significant uplift in value once planning consent is obtained, although the uplift is perhaps less definitive for feedstock based projects (eg biomass, AD) than for non-feedstock based projects (e.g. Wind, solar, hydro). This is due to the de-risking of the project as a direct result of securing planning consent. If the fund takes a portfolio approach to financing projects at different risk stages (a mix of pre-consent, pre-construction, construction and operation), this can be used to embed value in the portfolio.

The additional early stage risk taken by the fund could, for example, be represented by an ‘equity kicker’, allowing the fund to recover some of the value uplift later.

5 Economic Analysis

5.1 'Triple Bottom Line'

The case for the GIB to invest in small scale low carbon projects should be seen in 'triple bottom line' terms.

The phrase 'the triple bottom line' was first coined in 1994 by John Elkington, the founder of a British consultancy called SustainAbility. His argument was that companies should be preparing three different 'bottom lines' – in essence, three Ps: profit, people and planet¹⁹. Alternatively, this can be seen in terms of financial, social and environmental performance of a company over a period of time. Clearly the same principles should apply to government policy and its expected impact.

This section concentrates primarily on the economic impact of investing in small scale low carbon projects. The social and environmental benefits are harder to quantify as there is a lack of established tools and standards by which to assess them, but they are visible in a qualitative sense and we touch on some of the social benefits of investing in small scale projects in Section 2. These include:

- addressing fuel poverty through local generation or energy efficiency projects developed in areas of deprivation
- retention of revenues in local communities (rather than, for example, being spent on imported fuels), and
- delivering community engagement.

The kinds of jobs likely to be created by small scale and embedded renewables projects are likely to have a significant beneficial impact on local businesses as much of the supply chain required to

implement these projects (contractors, installers, electrical engineers etc.) is likely to be part of the core workforce of most communities. Whilst key technical components (solar panels, wind turbines, etc.) may be sourced from elsewhere, project developers are likely to want to use local labour forces and sub-contractors.

The local jobs discussed above are more difficult to achieve in larger scale projects.

5.2 Economic Overview

It may be argued that the impact of small scale low carbon projects is not expected to be material and that for this reason the GIB could not or should not divert resources in this direction. This report suggests this argument is mistaken, and that small scale low carbon projects are an important part of the mix, for the following reasons:

- The overall economic impact of a sustained programme of investment at this end of the market can be significant
- The timescale for achieving an economic impact from small scale projects may be shorter than for larger projects as the technological challenges are less material, timescales for development and construction are shorter and with aggregation there are significant refinancing opportunities, creating a ready exit route for GIB funds
- On a per MW basis, small scale renewables projects are more labour intensive than larger ones, and can allow local supply chains to play a more significant role, so the impact on employment may be more visible. With the decline of the building sector, small scale renewables are helping to keep building and civil engineering contractors in work
- The perceived economic impact may be greater than for large scale projects because the projects will be more closely and visibly embedded in local communities

¹⁹www.economist.com/node/14301663

In order to support the economic case for small-scale low carbon projects, Grant Thornton has undertaken some high level financial modelling and analysis for an indicative portfolio with an investment value of £200 million.

It should be emphasised that this modelling has been carried out on an indicative basis only – as a ‘straw man’ for discussion and debate.

Of this £200 million figure, £190 million has been allocated to specific technologies and £10 million held in reserve for other technologies as they mature sufficiently for GIB funding. Clearly these are notional figures, and while every effort has been made to seek industry benchmarks, consistent, detailed information is hard to obtain and the generic nature of the projects means that the figures will not have a project specific level of accuracy. The purpose of this exercise is to provide a sense of scale of the opportunity and look at what might be a reasonable technology mix.

Specific technologies

For the specific technologies, we have assumed that projects can be financed through a mix of project sponsor equity, mezzanine finance provided by the GIB and senior debt provided by a third party lender. Project owners would be expected to invest equity investment and benefit from commercial returns from the projects.

The purpose of the mezzanine finance is to bridge any shortfall in capital likely to be encountered by project sponsors when they seek to provide the equity cushion required by the senior debt providers. The advantage of mezzanine finance is that it is tax efficient within the project vehicle and can be repaid rapidly as cash-flows permit. By adopting the interim risk position as a mezzanine finance provider, GIB can leverage its position to create a larger portfolio (6 times the size of the GIB investment). There are variances in

gearing and other assumptions according to technology which are detailed later in this section. In summary, the outputs that could be created by 2020 from a portfolio of this size are:

- 6,512 jobs created. It should be noted that this is the results of modelling of a specific set of portfolio assumptions. At the present time no exercise has been undertaken to look at job creation over the entire small-scale carbon sector, but Community Renewable Energy (CoRE) estimate that each 1,000kW AD plant creates about seven jobs and sustains 19 directly²⁰, so extrapolated over, say, the NFU’s estimate of 1,000 AD plants, this produces a figure significantly in excess of the figure that resulted from this modelling exercise.
- £56 million of taxes to HMRC per annum
- Generation of 2,940 GWH pa of renewable power, 37% of the DECC target for generation from small (less than 5MW) renewables
- Significant displacement CO2 per annum and over the lifetime of the portfolio.

We have assumed that this portfolio consists of the following in terms of GIB investment:

- £61 million wind
- £30 million solar
- £30 million hydro
- £49 million AD
- £19 million biomass

The initial £189 million GIB equity investment would result in total investment of £1,180 million including £908 million of private debt, with equity including GIB mezzanine ranging from 15% - 35% depending on the technology. A table summarising revenues and

²⁰www.nef.org.uk/communities/documents/Local_United_Anaerobic_Digestion_Diffusion_Pack_Jan2011c.pdf

financing per technology is provided in Appendix B.

We recommend that 5% of the SEF be allocated to other technologies. In our view this £10 million should be reserved for technologies which are not yet sufficiently mature for funding under the SEF but will become so in the near term. Such technologies could include heat pumps (air and ground source), marine renewables (wave and tidal) and geothermal.

The remainder of this section outlines the approach used to prepare the high level estimates for this portfolio, including the key assumptions made.

5.3 Small-scale Wind

In order to estimate the benefits of investing in a portfolio of wind projects, we have undertaken high level financial modelling based on a 1.5MW²¹ single turbine project which qualifies for the FIT, as a notional small wind project. Clearly in practice there will be a wide diversity of turbine types, so this modelling is for indicative purposes only.

The model assumes a capacity factor of 30% and that all energy generated is exported to the grid therefore qualifying for the £0.03p export tariff in addition to the generation tariff. Capital costs are assumed to be £3,263 million. All of these assumptions will vary on a project by project basis – for example, a lower capacity factor will prevail in many parts of the country, but on the other hand the financial benefit will be greater if the power is exported for more than the minimum export tariff or a proportion used on-site to offset higher costs of energy purchased.

The project is assumed to be funded with 80% senior debt and 20% equity, which consists of 15% ‘mezzanine’ finance

²¹ 1.5 MW wind turbines are produced and sold by GE Energy. See Appendix C.

provided by the GIB and 5% equity provided by the project sponsors. The 15% mezzanine finance bridges the highest risk period and can be rapidly repaid from cash-flow post operations, leaving a highly leveraged project supported by predictable cash-flows.

The project is modelled as generating 3.9 GWh of electricity each year and revenue of £0.509 million in the first year. This illustrative project is summarised in Table 1.

Table 1: Illustrative wind project

Capacity	1.5MW
Funding:	
Debt	£2,610,000
Mezzanine Debt	£489,375
Equity	£163,125
Total	<u>£3,262,500</u>
Gross Revenue pa	£508,520
% equity + mezz./ total funding	20%
Sponsor equity IRR	21.3%
Power generated pa (kWh)	3,942,000

Based on an assumption that GIB funds 125 projects costing £408 million, an investment of some £61 million of GIB mezzanine funding would be required.

On the basis that around 1MW of wind power displaces around 1,400 t CO₂ per annum and around 35,000 t CO₂ in the project lifetime, the total displacement for a 187.5MW portfolio would be 262,000 p.a. and 6,562,000 in total.

5.4 Solar PV

To estimate the benefits of investing in a portfolio of solar PV projects, we have undertaken high level financial modelling based on a portfolio of 1,000 4kW installations qualifying for a FIT tariff, such as might be developed by a housing association.

The parameters for this assumption are that with the revised FIT proposed by the

Government, the solar market in the UK is likely to be restricted to domestic housing where the roof capacity is generally estimated to be between 4kW and 8kW, and we have taken a relatively small-scale rollout such as might be undertaken by a housing association or a developer targeting a particular urban area. At these levels of installation per rollout, the economies of scale for a typical domestic roof installation start to make sense.

With the expected revision of the FIT the Government has sent a clear signal that it does not expect to see large numbers of project over 50kW. A small project has been used so that it qualifies for a tariff of 43.3p/kWh for an occupied building and 37.8p for a new building, our projects assume a 50:50 split (as GIB will not be established till 2012, the projects it finances will qualify for the revised tariffs). The project is assumed to have a capital cost of £10 million and generates 3.5GWh of power per annum based on a 10% capacity factor. It is assumed that the project will be funded 85% by debt, 10% by GIB mezzanine and 5% through project sponsor equity. The project further assumes a 50:50 split between onsite use and export. The illustrative project is summarised in Table 2.

Table 2: Illustrative solar project

Capacity	2,000 x 2KW
Funding	
Debt	£8,500,000
Mezzanine	£1,000,000
Equity	£500,000
Total	<u>£10,000,000</u>
Gross Revenue pa	£1,309,460
% equity + mezz./ total funding	15%
Sponsor equity IRR	15.4%
Power generated pa (kWh)	3,504,000

If we assume 30 programmes, this would represent a total GIB investment of £30 million.

Solar PV might be expected to represent a small proportion of the total fund compared with some other technologies as it is the nearest to 'plug and play' technology and therefore carries comparatively little risk. Resources might be focused in a limited number of 'beacon' projects brought forward by public sector sponsors, which deliver significant ancillary benefits and are perhaps seen as an integral part of wider sustainability strategies.

5.5 Hydro

To estimate the benefits of investing in a portfolio of small-scale hydro projects, we have undertaken high level financial modelling using a 0.5MW project which qualifies for the FIT as a proxy for a typical small hydro project.

The project assumes a capacity factor of 40%. The capital cost of £1.375 million (or an equivalent cost of £2.75 million per MW) is assumed to be funded with 75% senior debt, 15% GIB mezzanine and 10% equity provided by project sponsor. The project is assumed to generate 1.8GWh of electricity each year and annual revenue of £0.254 million. This illustrative project is summarised in Table 3.

Table 3: Illustrative hydro project

Capacity	0.5MW
Funding	
Debt	£1,031,250
Mezzanine	£ 206,250
Equity	£ 137,500
Total	<u>£1,375,000</u>
Gross Revenue pa	£254,040
% equity + mezz./ total funding	25%
Sponsor equity IRR	12.5%
Power generation pa (KWh)	1,752,000

145 projects like this would represent a GIB investment of £30 million. The constraint is likely to be the availability of

appropriate sites – hence the relatively small proportion of the fund assumed.

5.6 Feedstock Projects

In the following two project types (Anaerobic Digestion and Biomass heat), feedstock supply is a key additional issue to be addressed. GIB is assumed to provide 25% of the capital in the form of mezzanine, with 10% equity provided by project sponsors, giving a 35% cushion for senior debt.

Anaerobic Digestion

In order to calculate the estimated benefits of investing in a portfolio of anaerobic digestion projects, we have undertaken high level financial modelling using a 0.5MW project which qualifies for the FIT as a proxy for a typical AD project, although this may be at the small end of the scale for AD projects. The capital cost of £1.882 million, is based on current market estimates. The project is assumed to generate 4.1GWh of electricity each year and annual revenue of £0.621 million from energy production. This illustrative project is summarised in Table 4 below with operating costs modelled as 50% of revenues.

Table 4: Illustrative anaerobic project

Capacity	0.5MW
Funding	
Debt	£1,223,000
Mezzanine	£470,600
Equity	£188,240
Total	<u>£1,882,400</u>
Gross Revenue pa	£ 621,210
% equity + mezz./ total funding	35%
Sponsor equity IRR	34%
Power generated pa (KWh)	4,114,000

If we assume GIB finances 105 of these projects, this would create a requirement for mezzanine debt of £49 million.

It is difficult to find consistent data regarding CO2 savings for anaerobic digestion projects, but looking at the website for one of the industry leaders, Biogen Greenfinch²² indicates that a tonne of food-waste diverted from landfill to AD saves between half a tonne and a tonne of CO2. One of Biogen Greenfinch's plants, Westwood, processes 45,000 tonnes a year and produces 1.7MWe of electricity. A 1MWe equivalent plant would, at the more conservative end of this estimate, save 13,235 tonnes of CO2 per annum, or 330,875 tonnes over its 25 year life. This would equate to 695,000 t CO2 displaced per annum or 17,371,000 over the life of the portfolio.

Biomass Heat

We have used a 0.5MW biomass heat project, with heat generation qualifying for the Renewable Heat Incentives at 6.5p / kWh. The capital cost of the project is £1.5 million and is assumed to be funded with 65% private debt, 25% GIB mezzanine and 10% equity provided by project sponsor. The project is assumed to generate 3.7GWh of heat each year. Key financial aspects of this illustrative project are summarised in Table 5.

Table 5: Illustrative biomass heat project

Capacity	0.5MW
Funding	
Debt	£975,000
Mezzanine	£375,000
Equity	£150,000
Total	<u>£1,500,000</u>
Gross Revenue pa	£242,000
% equity + mezz./ total funding	35%
Sponsor equity IRR	7%
Heat generated pa (KWh)	3,723,000

²² www.biogen.co.uk/over-about-biogen-plants.asp

With the FIT tariff providing a rate of 12.1p / kWh of energy produced for AD projects and the Renewable Heat Incentive giving a tariff of 6.5p / kWh for the biomass projects, this leads to the Equity IRRs on the AD and Biomass Heat projects being significantly different at 34% and 7% respectively.

If we assume GIB finances 50 projects, this would create a requirement for mezzanine debt of £19 million.

Biomass heat clearly significantly reduces CO2 emissions. The Carbon Trust²³ estimates that there is a saving of at least 90% compared with equivalent fossil fuels.

5.7 Refinancing

One of the key benefits to the GIB of investing in small scale projects is the ability to develop a portfolio of projects rapidly to secure 'quick wins' from both a financial and a political perspective. In order to generate early returns and increase the amount of private investment in the sector, it would seem likely that GIB will dispose of its project mezzanine debt and re-invest the proceeds once the projects have established an operational track record.

As the GIB will be established in 2012 and small renewable projects can be developed relatively quickly there would be time before 2020 for the GIB to invest in a first round of projects (Round 1 projects), sell their equity and reinvest in a further round of projects (Round 2 projects). In modelling returns to GIB, a conservative assumption has been made that GIB will sell its mezzanine for initial cost, and will not make a profit, and that the Round 2 portfolio will replicate the Round 1 portfolio. It should be

²³www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/Biomass%20end%20user%20guide.pdf

emphasised that this analysis is provided on an indicative basis only.

The annual economic impact of the two rounds is tabulated in Appendix D.

5.8 Economic Impact

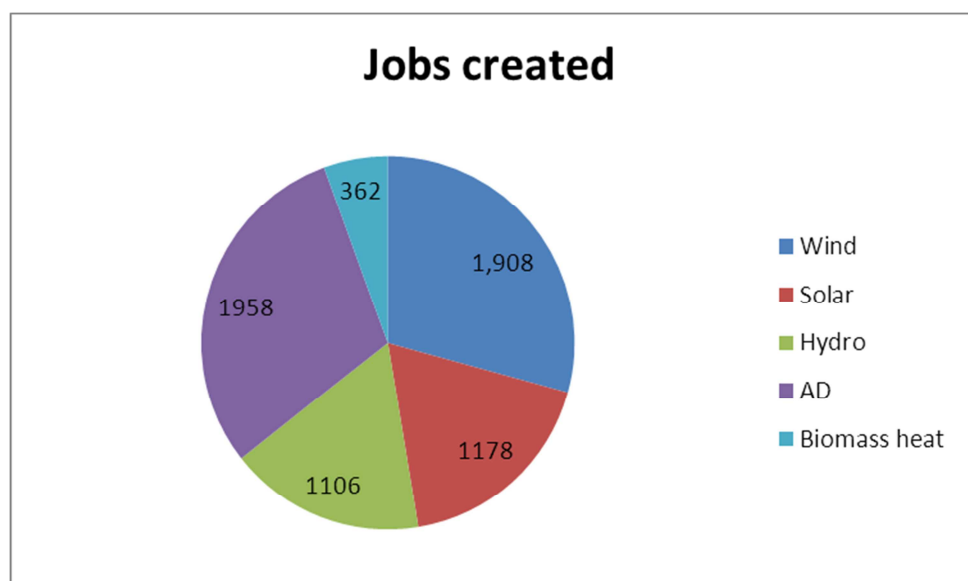
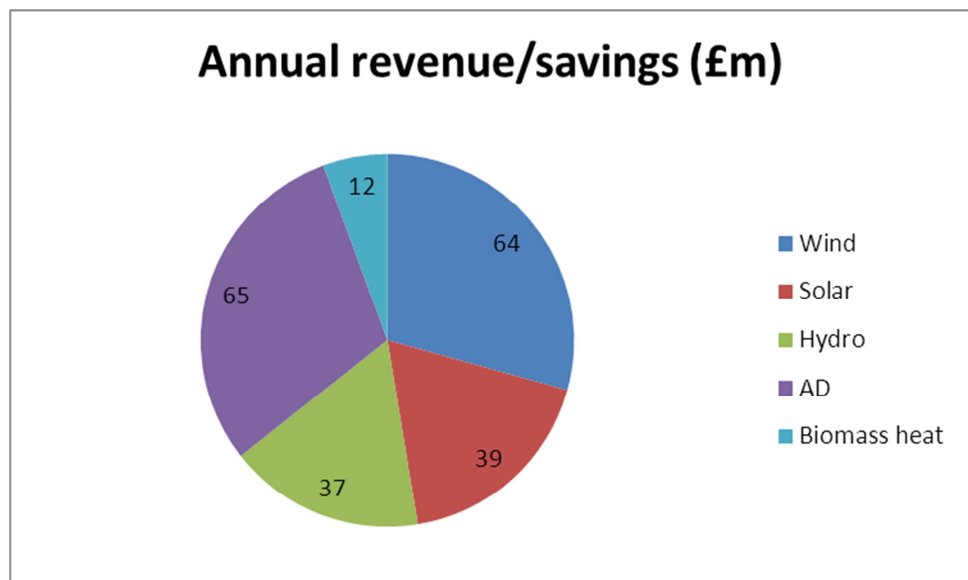
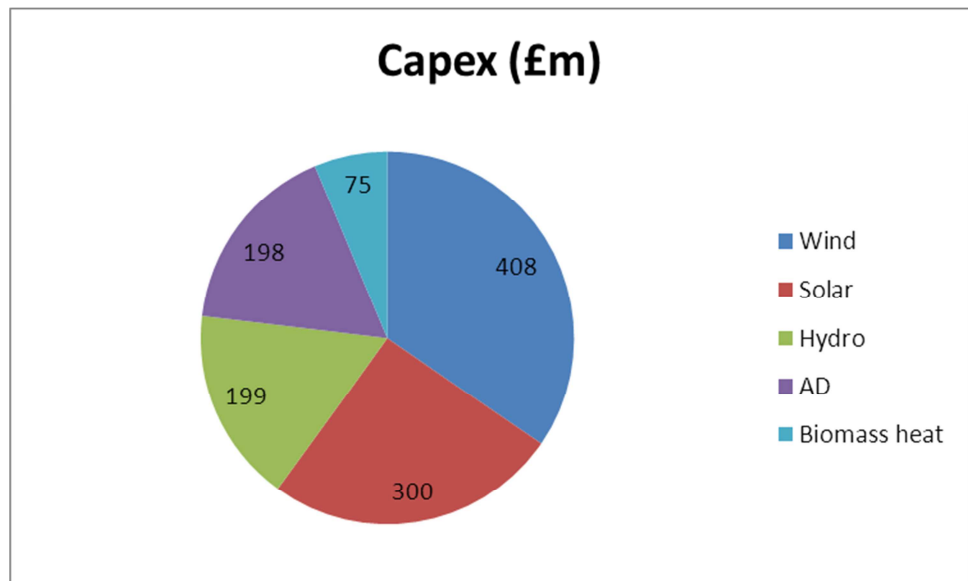
We have considered the economic impacts generated by the portfolio of projects in Appendix B assuming that as a result of refinancing both the Round 1 portfolio and the Round 2 portfolio will be operating in 2020. The economic contribution of these two portfolios is assessed in terms of the contribution to economic Gross Value Added (GVA), jobs, taxes and the Government's target for generation by small renewable projects. These impacts are summarised in Appendix D.

Key elements of our approach to economic analysis and the assumptions underlying it are:

- Industry turnover to GVA impacts calculated using data from the Annual Business Inquiry. (GVA is estimated as 27% of turnover)
- Supply chain impacts are assessed using data on the UK economy (based on ABI data, supply chain activity calculated as 26% of turnover)
- The economic multiplier is 120% which allows for subsequent rounds of expenditure in the economy following on from the initial stimulus of the construction, feed stock supply and operation of the projects
- Job creation impacts are calculated by examining productivity per employee and relating this to the overall economic contribution of the sector (based on Office of National Statistics data, this has been calculated using a sector GVA per employee of £42,000)
- Tax is calculated on the basis of £8,670 pa per employee in the sector
- The contribution towards achieving Government's 2020 target of 8,000,000 MWh for generation by small renewables projects

5.9 Conclusions

The outputs from this analysis is summarised graphically below:



6 Conclusions

This report sets out the case for targeted investment by government in the small-scale renewable and embedded energy sectors. The only realistic body that would be able to deliver the investment efficiently and with a commercial focus would be the Green Investment Bank.

The initial funding for small projects of £200 million is sufficient to generate £1 billion in total investment and represents only a small proportion of the GIB's initial capital allocation. This initial £200 million will likely to generate a return to the public purse even before the first large-scale deal is struck. As such the £200 million represents a low risk public investment which would garner public support due to its local application.

The localised benefits of such investment are both economic and social, and cannot be guaranteed by larger projects. The benefits of small projects are also more immediate, with projects already in the pipeline that are able to be 'de-risked' by targeted GIB investment. The GIB is also able to provide expertise and a focal point to bring together existing skills and knowledge and therefore makes it crucial to the delivery of significant investment and carbon savings.

Overall this report seeks to make the case for a GIB that is proactive and enabling, but targeted in delivering the best value for public funds. The authors of this report believe that there is a strong case for GIB to support small scale decentralised energy in advance of larger projects coming to fruition as without GIB, the risks to our future low carbon communities are too great.

Appendix A: Carbon Leapfrog Projects

Carbon Leapfrog – Selected Current Projects

Abbotts Mills, Canterbury

Its mission is to develop a Centre for Sustainable Urban Living in Canterbury, which will provide a platform for show-casing modern, de-centralised generation methods including hydro-electric power as well as other cutting edge environmental science and technology from across the UK. The plan is to develop a hub of environmental and sustainable excellence, incorporating a renewable energy centre, a museum about the importance of the River Stour, a community café and an organic community garden in historic Canterbury in Kent.

Awel Aman Tawe, Wales

Awel Aman Tawe (AAT) is aiming to develop a 4.6MW community wind farm on Mynydd y Gwrhyd, 20 miles north of Swansea consisting of 2 turbines, 100m to tip. AAT was one of the winners of the DECC Low Carbon Communities Challenge. AAT was formed as a direct result of a local Agenda 21 public meeting in September 1998. Incorporated as a company limited by guarantee in 2000, AAT undertook a year of consultation regarding the installation and operation of a community windfarm to generate income to be used to finance local regeneration initiatives.

The key aims for the community wind farm are to

- Generate clean power and heat from renewable sources
 - Reduce local energy costs and create warmer homes
 - Develop local skills and create employment
-

Ashton Hayes Going Carbon Neutral Project, Cheshire

A local initiative with the ambition to create the first carbon neutral UK village has been running since November 2005 and has so far reduced carbon dioxide emissions in the village by 23%. The project is all about behavioural change, awareness, sharing best practice as well as introducing technology that will supply the village with renewable energy and an income stream.

Bathamton Weir, Somerset

Bath Community Energy Company (BCE) was set up to develop, promote and run renewable energy and energy efficient projects in Bath and the surrounding area. The first part of a series of projects is installing a Hydro turbine on the Bathampton Weir (River Avon). This Industrial Provincial Society (IPS) was founded by six professionals with wide knowledge of environmental law, advisory and consultancy. BCE has a bigger ambition and is also looking to set up PV Solar panels on local schools and buildings as well as working with local authorities to investigate the case for wind energy in the area.

Bollington Carbon Revolution, Bollington

Bollington, located 15 miles south of Manchester, is a semi-rural town with an outstanding community spirit. The Bollington Carbon Revolution (BCE) is a group of local active volunteers who believe that the town can be a part of the new carbon revolution, driven by the voluntary sector at the local level. The first key objective of BCE is to eco refurbish an old toilet block into a low carbon demonstration project which will be used to educate local residents and businesses in how to retrofit buildings to reduce carbon emissions.

Bristol Green Doors, Bristol

The Bristol Green Doors (BGD) initiative is all about sharing knowledge and awareness about how to make people's homes more energy efficient by presenting real life examples. The organisation has been set up to satisfy the thirst for knowledge of how to retrofit Bristol's houses, providing inspiration and motivation to take up the challenge of green refurbishment. BGD has the potential to reduce carbon emissions in Bristol by 2,100 tonnes next year (2011). CL is currently scoping out BDG requirement for support.

Community Energy Warwickshire, Warwickshire

Community Energy Warwickshire is seeking to promote renewable energy generation and developing, installing and operating renewable energy sources; promote sustainable uses of energy and reductions in carbon emissions; and promoting public awareness of environmental and related issues and supporting educational initiatives.

As its first investment in renewable energy, Community Energy Warwickshire proposes to install solar PV panels at hospitals in south Warwickshire, which it will finance from a public share offer and from which it will derive income, primarily from the Feed-in Tariff. It is also developing a community programme of volunteer-led activities to raise awareness of energy efficiency and sustainability issues and promote behavioural change.

Eco People, London

The project mission is to facilitate and promote investment in energy generation and efficiency across the UK. Creating a pool of capital is central to this vision, in order to:

- Reduce the cost of investment in energy conservation and generation,
 - Provide financial assistance;
 - Maximise the benefits of existing grants and revenue schemes;
 - Generate the necessary scale to meet the challenges ahead;
 - Prove the investor return model;
 - Attract broadest range of investment/investors
-

Goring & Streatley Sustainability Group (GSSG) Hydro, Oxfordshire and Berkshire

This is a community led, volunteer driven, not-for-profit sustainable investment for the benefit of current and future generations of Goring & Streatley. The scheme aims to extract energy from the flow of the river Thames and convert it into 265 kilowatts (kW) of clean electricity (at peak) by installing three 3.6m Archimedes Screws on the weir. This is equivalent to the average electricity consumption of 500 homes, providing over 1 million kWh per year.

GreenTrust, South West England

Green Trust (GT) is a Community Interest Company (CIC) with the ambition to bring large scale renewable wind energy projects to local communities in the South West of England. The overriding principle is to ensure impacted communities are consulted, have the opportunity to take ownership of the decision making process and benefit from the profits generated from the turbines. The idea allows GTW to enter a space where many commercial developers have failed due to the lack of local community engagement and buy-in.

Ham Hydro, Greater London

When the Ham Hydro project is completed it will be one of the largest of its kind in Europe. Installing four Archimedes screws on Teddington Weir in the River Thames is expected to generate renewable energy of about 1.9GWh pa which means a reduction in carbon emissions by 1000 tonnes every year. That translates into providing renewable energy to about 900 households pa. The project has already received significant publicity and a high level of interest from the local community as well as strong support from local MPs Vince Cable and Zac Goldsmith.

Haringey, London

The project is set up as an IPS established by the Muswell Hill Sustainability Group in 2010 with over 100 local shareholders with a Directors and Management Committee having a wide range of experience and knowledge of energy and community issues. The key objective is to install PV and energy efficiency measures in up to 10 schools in the London Borough of Haringey and through these projects extend the existing work on retrofitting homes and changing behaviour currently taking place.

K-SET, Cumbria

The project's objective is to develop hydro power on a weir on the River Lune, which runs along the boundary of Killington Village. So far a feasibility study has been undertaken which shows that a 50 kW Archimedes screw type turbine could be installed which would produce 233 MWh of power annually. Key objectives are to:

- Generate an income in order to fund the building of more power generation projects;
 - Help householders with loans to install energy saving measures
 - Train and employ local tradesmen to install carbon reduction equipment; and
 - Demonstrate that small villages can rise to the challenge of carbon reduction
-

Low Carbon Oxford North, Oxford

LCON's Energy Group is developing a community renewable energy scheme (working title 'North Oxford Community Renewables') to:

- lower North Oxford's carbon footprint
- generate income to support LCON's other activities

LCON are planning to install solar panels on large roofs in North Oxford, working in partnership with building owners and occupiers. LCON intend to raise money to finance this programme through a community share offer (through a community benefit IPS).

Appendix B: Illustrative SEF portfolio

This appendix provides a summary of the portfolio of initial projects we have modelled. The appendix does not cover the 5% of the SEF which we have recommended be allocated to other technologies. In our view this £10m should be reserved for technologies which are not yet sufficiently mature for funding under the SEF but will become so in the near term. Such technologies could include heat pumps (air and ground source), marine renewables (wave and tidal) and geo-thermal.

Illustrative SEF portfolio (£k)

	Wind	Solar	Hydro	AD	Biomass Heat	Portfolio
Mezzanine, % of Portfolio	31%	15%	15%	25%	9%	95%
Senior Debt	£326,250	£255,000	£149,531	£128,474	£48,750	£908,005
GIB Mezzanine	£61,172	£30,000	£29,906	£49,413	£18,750	£189,241
Project Sponsor Equity	£20,391	£15,000	£19,938	£19,765	£7,500	£82,594
Total funding	£407,813	£300,000	£199,375	£197,652	£75,000	£1,179,840
Revenue pa	£63,565	£39,284	£36,836	£65,227	£12,100	£217,012
% equity funding ²⁴	20%	15%	25%	35%	35%	23%
Generation pa (MWh)	492,750	105,120	254,040	431,970	186,150	1,470,030

²⁴ Mezzanine + sponsor equity divided by total capital

Appendix C: Small scale wind turbines

Small-scale wind turbines understood to be currently available:

Manufacturer & make	Capacity
Enercon E Series (E-33; E-48; E-53; E-44)	330kW – 900kW
Evance R9000	5kW
Fuhrlander	1.5MW
Gaia 133	11kW
Gamesa	850kW
GE	1.5MW
Northern Power 100	100kW
Proven Energy Series (7, 11, 35-2)	2.5kW – 12.1kW
Suzlon S-82	1.5MW
WES 18	80kW – 250kW
WES 30	80kW – 250kW

Appendix D: Economic Analysis

This appendix provides a summary of our analysis of the economic impact of GIB funding the recommended portfolio of projects. The appendix does not cover the 5% of the SEF which we have recommended be allocated to other, as yet undefined, projects.

Table A: Annual economic impact in 2020 Round 1 (£'000)

	Round 1 portfolio					Round 1 total
	Wind	Solar	Hydro	AD	Biomass Heat	
Revenue	£63,565	£39,284	£36,836	£65,227	£12,100	£217,012
GVA contribution	£17,015	£10,515	£9,860	£17,460	£3,239	£58,089
Supply chain	£16,369	£10,117	£9,486	£16,797	£3,116	£55,885
Induced spending	£6,677	£4,126	£3,869	£6,851	£1,271	£22,794
Total GDP addition	£40,061	£24,758	£23,215	£41,108	£7,626	£136,768
Jobs created	954	589	553	979	181	3,256
GVA	£40,061	£24,758	£23,215	£41,108	£7,626	£136,768
Tax	£8,267	£5,109	£4,790	£8,483	£1,574	£28,223
Generation/Gov target	6%	1%	3%	5%	2%	18%

Table B: Annual economic impact in 2020 Round 2 (£'000)

	Round 2 portfolio					Round 1 total	Grand total
	Wind	Solar	Hydro	AD	Biomass Heat		
Revenue	£63,565	£39,284	£36,836	£65,227	£12,100	£217,012	£434,024
GVA contribution	£17,015	£10,515	£9,860	£17,460	£3,239	£58,089	£116,178
Supply chain	£16,369	£10,117	£9,486	£16,797	£3,116	£55,885	£111,770
Induced spending	£6,677	£4,126	£3,869	£6,851	£1,271	£22,794	£45,588
Total GDP addition	£40,061	£24,758	£23,215	£41,108	£7,626	£136,768	£273,536
Jobs created	954	589	553	979	181	3,256	6,512
GVA	£40,061	£24,758	£23,215	£41,108	£7,626	£136,768	£273,536
Tax	£8,267	£5,109	£4,790	£8,483	£1,574	£28,223	£56,446
Generation/Gov. target	6%	1%	3%	5%	2%	18%	37%

Appendix E: Glossary

AD	Anaerobic Digestion
ADBA	Anaerobic Digestion and Biogas Association
BHA	British Hydropower Association
BSB	Big Society Bank
CARES	Community and Renewable Energy Scheme
CES	Community Energy Scotland
CHP	Combined Heat and Power
CHPA	Combined Heat and Power Association
CoRE	Community Renewable Energy
DECC	Department of Energy and Climate Change
ECF	Empower Community Fund
EU	European Union
FITs	Feed-in Tariffs
GHR	Green Highland Renewables
GIB	Green Investment Bank
GVA	Gross Value Added
HMRC	HM Revenue & Customs
IRR	Internal Rate of Return
NDPB	Non-Departmental Public Body
NfP	Not for profit
NFU	National Farmers Union
NGO	Non-Governmental Organisation
NIRO	Northern Ireland Renewables Obligation
PV	Photovoltaic
REA	Renewable Energy Association
RHI	Renewable Heat Incentive
ROC	Renewables Obligation Certificate
RPI	Retail Price Index
RSL	Registered Social Landlord
SEF	Sustainable Energy Fund
WRAP	Waste and Resources Action Programme



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