Solar Renewable Potential in North London - Work Stream 2: Market testing – analysis of finance and delivery options

CT Account Manager: Donna Klein

Email: donna.klein@carbontrust.co.uk

Tel: 01865 885110

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Author: Bethan Phillips

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Author: Bethan Phillips

Signature .... (hard copy only)
Date: .... (hard copy only)

QA: Duncan Price

Signature .... (hard copy only)
Date: .... (hard copy only)

Author contact details
Email: bethan.phillips@camcoglobal.com
Telephone:

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1 Executive summary

Scope of work

Camco has been appointed by the Carbon Trust, on behalf of the London Borough of Haringey, to undertake a study of the potential for developing the potential for solar renewable energy technologies in north London.

The key objective of this project is to unlock investment in roof-mounted solar photovoltaic (PV) and solar thermal technologies, and maximise the resulting benefit for the local area by developing inter-borough delivery partnerships for PV on non-domestic and domestic buildings, including social housing stock.

The analysis undertaken in the first work stream of the project showed that there is enormous potential in the study area, and that this potential is spread across a range of building types and locations, although the greatest concentration is in the south of the assessment area.

An evaluation tool has been developed which will be used by local authorities so that, in the future, the solar potential of additional sites can be assessed. It can also be used for the modification of characteristics for sites already modelled within this project, should more accurate building specific data become available.

This phase of work has built on the results of the analysis under Work Stream 1 to determine the financial return for the key sites, as well as finance and delivery options analysis.

Financial analysis

The financial analysis carried out has indicated that all projects should be limited to a maximum of 50kWp in order to maximise overall returns under the FIT, rather than looking to generate the maximum amount of electricity. The sites analysed within the evaluation tool have the largest roof spaces, and therefore they offer the best economic potential.

The mean IRR for these 1,042 sites is 9.5%, representing a total capital expenditure of £122m, a total NPV of £45m, and a total PV capacity of 41MWp. Scenario testing has shown that the IRR of may vary from 6.5% to 12.7% under the best and worst case scenarios. Based on a minimum IRR of 6% for publicly funded projects and 10% for privately funded projects, this is well within the minimum required for public sector funding. Therefore, the risk associated with the worst case scenario is likely to be much more of a consideration if private funding is required; however, there is still potential for returns greater than 10%.

In all boroughs, the greatest economic potential lies in the social housing sector; schools/nurseries provide the second largest potential.

High level analysis has been carried out to estimate the potential for all Local Authority owned buildings. For projects with an IRR of greater than 6%, an estimated 9,891 sites have been identified, with 74MWp of PV potential. For projects with an IRR of greater than 10%, an estimated 4,673 projects have been identified with 25MWp of PV potential.

Delivery models

The most suitable delivery models for the local authorities are likely to be either the contracting model or the roof rental model, given the potential complexities of other models. Financial comparison of these delivery models suggests that for most projects, the contracting model is likely to make most economic sense, provided capital is available and risks can be effectively managed. Consideration of the roof rental model for better performing sites is dependent on the level of risk that is acceptable to the LA’s.

Market analysis

Initial market analysis has shown that there is likely be strong interest in this project both from PV suppliers / installers and those willing to invest capital (such as the PV roof rental providers). The size of the project is likely to be large enough to be of interest to those seeking sizable contracts yet also sufficiently focussed as to be manageable. The compact geographic location will be an advantage as it will reduce site survey times and enable installation teams to move from one site to the next without too much difficulty.

Importantly, Local Authorities are generally seen as strong contract counterparties so long as internal decision making is not too protracted. Perceptions of additional delays as a result of the potential requirement to enter an OJEU-compliant competitive tendering process could potentially be mitigated by use of an established procurement framework such as London RE: NEW run by the London Development Agency which will shorten the timeframe.

Potential pressure on the PV supply chain, particularly smaller players, suggests that the next 2-3 months will be critical for determining the installation capacity for this project.

An important consideration is the time taken to resolve internal client project planning, complete procurement and then for the installer to carry out detailed site-based surveys. Procurement can take at least 3 months, whilst site survey and tenant liaison can add another month before the first installation (it then continues on a rolling basis).

The key to the success of this project will be the speed with which the project can be progressed before the large scale review is concluded and now that the April 2011 inflation has been applied to the tariffs. It is likely to be important for the LAs to sign up installation partners by early summer to have a good chance of securing capacity and installing a significant number of systems by the end of March 2012.

Conclusions

If even 10% of the potential was realised, this would be a programme of up to 8MWp which is significant but achievable in the current market. Access to capital and appetite for risk will be key in determining the most appropriate delivery model. Swift decisions need to be made so as to unlock this potential in the coming year.

2 Introduction

2.1 Background

Camco has been appointed by the Carbon Trust, on behalf of the London Borough of Haringey, to undertake a study of the potential for developing the potential for solar renewable energy technologies in north London.

This report comprises the second work stream of this project which unlocks investment potential in solar energy across six north London boroughs who together make up the cross borough working group:

- London Borough of Haringey, LSP (Local Strategic Partnership) and Haringey 40:20
- London Borough of Camden, LSP and Climate Change Partnership
- London Borough of Islington, LSP and Climate Change Partnership
- London Borough of Waltham Forest, and LSP
- London Borough of Enfield and LSP
- London Borough of Hackney and LSP

In Work Stream 1, the technical potential was estimated using databases of local authority owned buildings provided by each borough. This analysis determined bespoke, optimised PV system sizes for each roof space using the feed-in-tariff banding to maximise revenues and investment potential. The outputs were then used to develop a tool, to which additional properties can be added, allowing each borough to compare different buildings and attribute scores based on perceived importance of different merits.

2.2 Methodology

Work Stream 2 looks to hone the initial financial analysis by discounting the cash flows and then comparing them to an alternative ownership model. This alternative model – rent-a-roof – though less lucrative, provides a lower-risk alternative. Other ownership models such as “PV for free” and joint ventures are also explored. Headline figures relating to the investment potential have been provided, broken down by borough, in this report and the analysis behind these conclusions are available in the Excel tool which has been upgraded to look at detailed revenue streams by individual building.

Alongside this financial analysis, initial market-testing has also been carried out. Key market players, such as EAGA and British Gas, have provided valuable insight on aspects such as market interest and supply chain constraints.

In addition to this report an investment prospectus will be supplied which will draw on key findings from the market testing and financial analysis stages of work stream 2. The investment prospectus will summarise the business case of the projects identified provided a simple means of delivering information to potential project partners.

3 Delivery model

3.1 Delivery model options

A summary of the potential delivery models is shown in the diagram below. These range from the ‘PV for free’, where the local authority (LA) is not required to invest any capital, and therefore risk is low but equally financial reward is low, through to the ‘Do-It-Yourself’ option, where the LA is invests all of the capital, with a higher potential risk but much greater financial returns are possible.

This section explores each of the delivery models in detail.

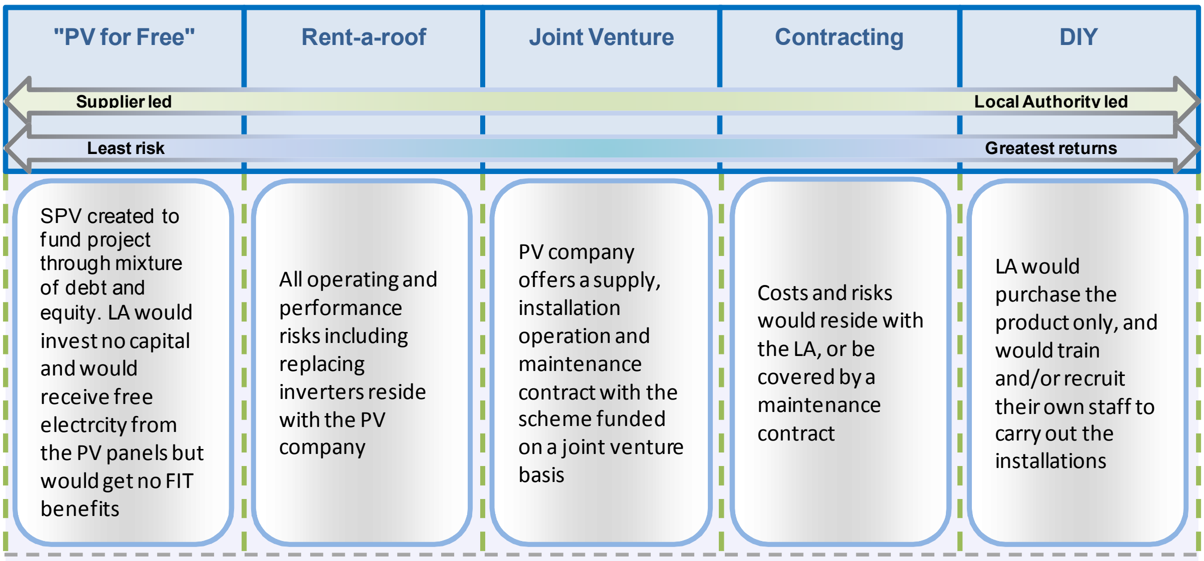
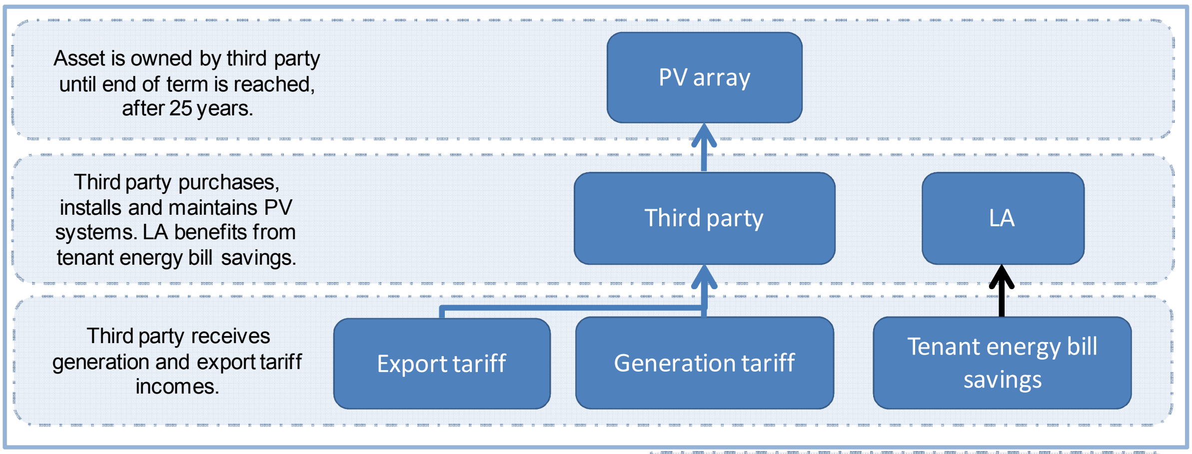


Figure 3-1 Delivery model options

3.1.1 'PV for free'

This model involves a third party arranging finance, purchasing, installing and maintaining the PV equipment. The third party owns the PV system and receives the FIT and export payments. There is therefore no capital investment or borrowing required, but savings are generated as a result of free electricity for tenants.

This option represents the lowest risk for the LA with no capital investment required, but also the lowest financial returns.



Advantages
- No direct capital investment required by LA
- No maintenance obligation
- Cost savings from free electricity generated
- After 25 year period, installation handed over to LA, when the system could continue to generate electricity

Disadvantages
- LA receives no FIT revenue
- LA maintains limited say in the location of the installation
- After 25 year period, LA takes on maintenance obligation

Figure 3-2 'PV for free' delivery model

3.1.2 Rent-a-roof

The 'rent-a-roof' model is very similar to the 'PV for free' model, but the LA receives income for the use of the roof, in addition to the savings arising from free electricity for tenants.

The local authority leases or licenses the roof space of the building to the third party for 25 years, in return for a fee, which may or may not be linked to the level of the FIT income received by the third party. At the end of the 25 year period, the lease or license expires and the ownership of the equipment passes to the LA. The nature of this arrangement means that the LA is responsible for insurance and maintenance.

This option has the potential to generate a limited amount of revenue, with no direct capital investment required, but with a certain amount of risk associated with it.

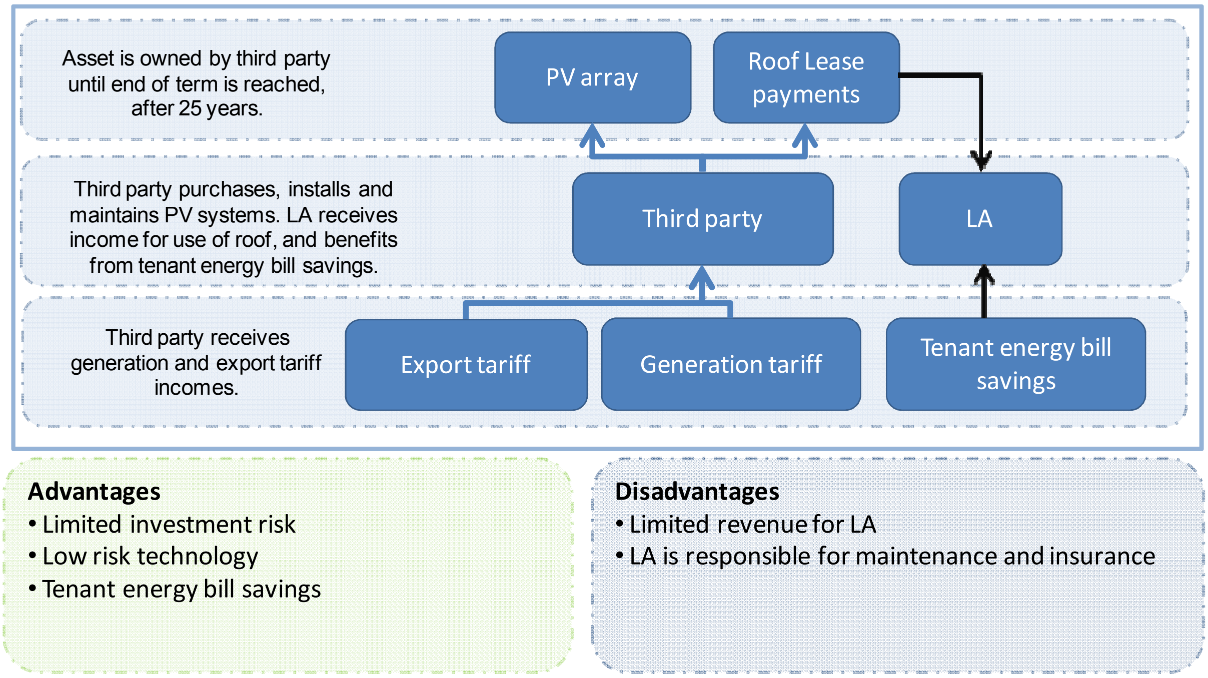


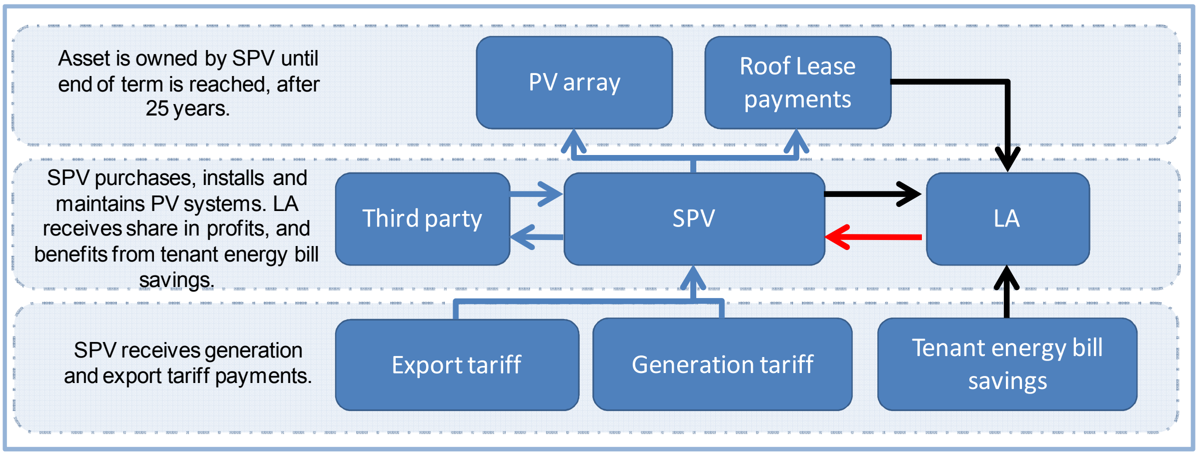
Figure 3-3 Rent-a-roof delivery model

3.1.3 Joint venture

Under a joint venture model, the LA and a third party set up a Special Purpose Vehicle (SPV) which purchases, installs and maintains the PV system. The LA and third party provide the SPV with capital funding, while the SPV owns the PV system and receives the generation and export tariff payments. The LA and third party will receive a share of these profits in proportion to the capital invested.

The LA may also receive payments in return for leasing the roof space to the SPV, and it will also benefit from savings arising from free electricity for tenants. As with the 'rent-a-roof' arrangement, at the end of the 25 year period, the lease expires and the ownership of the equipment passes to the LA and the third party.

This model therefore requires some capital investment or borrowing but this is off balance sheet, and has the potential to provide more income than the 'rent-a-roof' or 'PV for free' models.



Advantages
- Long term returns and guaranteed income
- LA benefits from electricity generated
- Many energy suppliers and financial institutions interested in benefit and risk sharing
- Off balance sheet
- Limited risk
- Guaranteed revenue stream

Disadvantages
- Contractual complexity
- Protracted set up
- LA only receives portion of FIT benefits
- Investment required

Figure 3-4 Joint Venture delivery model

3.1.4 Contracting

This model is similar to the 'DIY' model described below. It requires the LA to install and maintain the PV system, but the installation of the system is contracted out to a specialist PV company, for which there is likely to be a cost premium compared with the JV model. The asset is owned by the LA, and the LA benefits from the FIT revenue. In addition, the tenant benefits from savings arising from free electricity.

This model requires full capital investment, with the associated risk resting with the LA, but this option provides the greatest revenue potential.

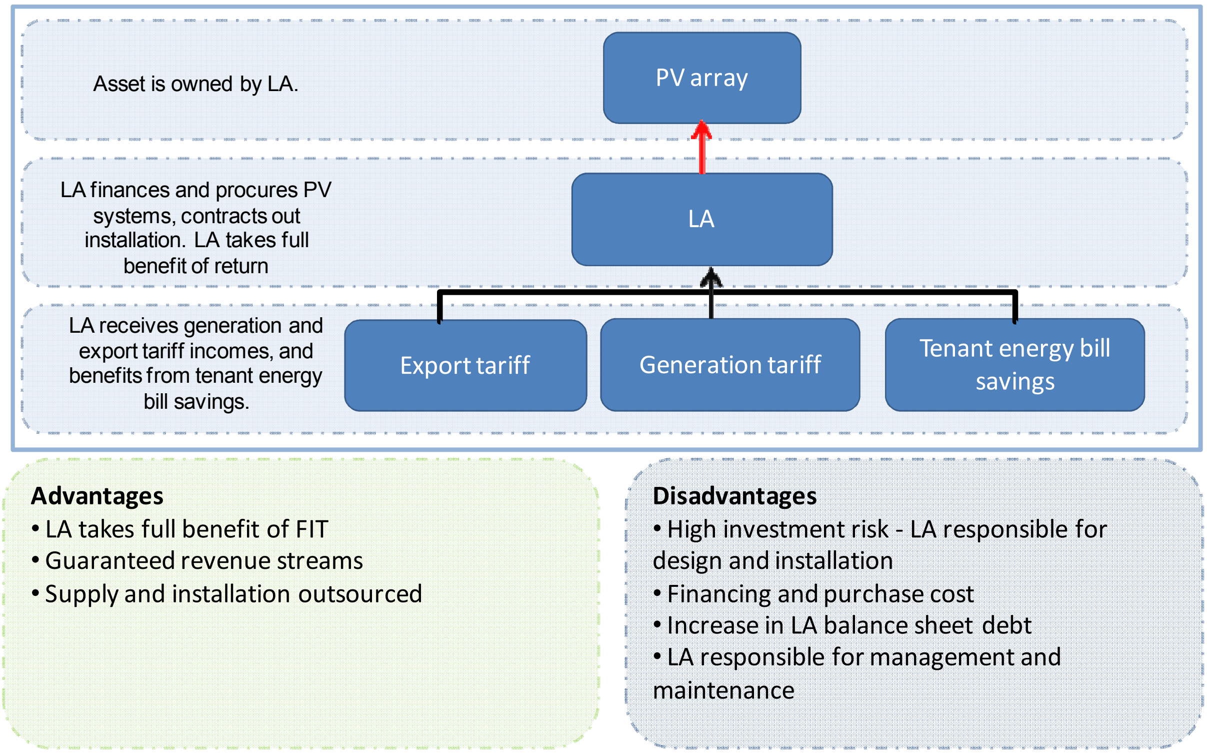


Figure 3-5 Contracting delivery model

3.1.5 DIY

As with the contracting option, the 'Do-it-yourself' model requires the LA to install and maintain the PV system, but installation is carried out by either its own staff, or staff trained by the LA, which may be more cost effective than contracting this service out. However, installation staff will need to be MCS accredited and may have limited installation capacity in the run up to the first FIT degression in April 2012. The asset is owned by the LA, and the LA benefits from the FIT revenue. In addition, the tenant benefits from savings arising from free electricity.

This model requires full capital investment, with the associated risk resting with the LA, but this option provides the greatest revenue potential.

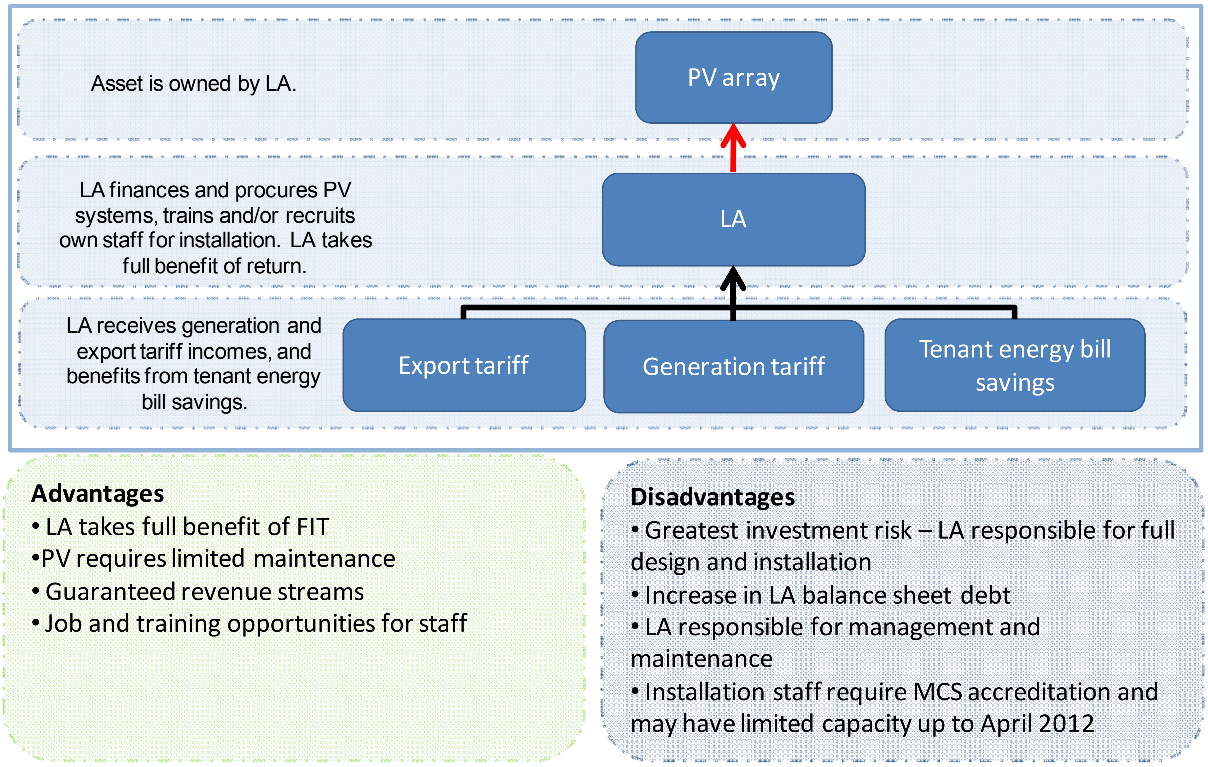


Figure 3-6 DIY delivery model

3.2 Delivery models appraisal

The DIY option is a very significant commitment for the LAs – both in terms of capital expenditure, risk and time; the time required to deliver these projects is key given the uncertainty in the FIT scheme beyond March 2012. 'PV for free' and 'rent-a-roof' models are low risk but may be considered a missed opportunity since the returns are so limited.

Table 3-1 below shows the likely speed of installation versus risk and value for each of the delivery models. It can be seen that if low risk is desirable, PV for free and roof rental represent attractive delivery models. However, if high value is desirable, and the associated higher risk is acceptable, the contracting option is likely to be most attractive. The JV option sits in the centre of potential risk and value, but speed of installation is likely to be relatively slow.

Table 3-1

Speed of installation versus risk and value by delivery model				
Speed	**Fast**	PV for free Roof rental		
	Medium			Contracting
	Slow		JV	DIY
		Low	**Medium**	**High**
		Risk and value		

4 Financial modelling

4.1 Introduction

Following discussions with the client team, the ability to assess the economic potential of sites has been incorporated into the evaluation tool, using discounted cashflow analysis. The methodology used for assessing the overall potential of each site, using a scoring system to take into account additional factors such as planning and vandalism risk, has been modified to take into account project IRR, rather than simply FIT revenue.

In order to allow discounted cashflow analysis to be provided within the tool for every site, we have made the following assumptions:

- To avoid making the model unnecessarily complex, we have assumed that all PV projects are undertaken in the same year, 2011; FIT rates are therefore not subject to degression as this is before March 2012
- All projects are subject to the same global assumptions e.g. panel type and output

4.2 Assumptions

4.2.1 Deployment risk and Feed in Tariff level

The generation tariff level has been assumed throughout to be as per the proposed figures given in the government's consultation document, shown in Table 4-1 below. These figures are intended to take effect from the 1st August 2011.

Table 4-1 Generation tariffs

FIT - Generation tariff for PV		
Scale	**Proposed rate under consultation p/kWh**	**Original rate p/kWh**
≤4 kW retrofit	41.3	41.3
>4-10kW	36.1	36.1
>10 - 50kW	31.4	31.4
>50-100kW	19	31.4
>100-150kW	19	29.3
>150-250kW	15	29.3
>250kW - 5MW	8.5	29.3

However, there are barriers that may cause delays on the project. These include primarily the risk of ensuring that the systems are installed, commissioned and registered for the Feed in Tariff by the end of March 2012. Given the range of installation sizes and project types, this is considered medium risk, but may be mitigated by grouping sites into more manageable packages. This is explored in further detail later in this report.

There may be additional deployment risk associated with unexpected problems with particular properties such as poor access, tenant resistance (if the tenant is not the LA) or legal complexity with shared ownership properties. Further issues with grid reinforcement and lead-in time for PV system components, especially inverters, may also cause delays and increase deployment risk.

4.2.2 Export tariff and energy bill cost savings

The export tariff is set at 3p/kWh throughout and assumed to be secured on an estimated 40% of generation. This is considered to be a conservative estimate since, with the ideal site selection, this could be reduced to zero. For example, the largest buildings are likely to have a high electricity demand in relation to the generated electricity, and for those which are industrial, there will be a 7 day a week demand, and therefore it is likely that minimal electricity would be exported. In reality, an export meter will need to be fitted to monitor this accurately. Conversely, an estimated 60% of the generated electricity has been assumed to be consumed on site, off-setting electricity bills at an estimated cost of 10p/kWh[1].

4.2.3 Capital costs

The capital cost is a very important number for the overall business case. A range of values have been tested based on our recent experience on projects across a range of PV capacities:

- For the low scenario, we have assumed a cost of £4000/kWp which represents the mid-upper end of capital costs.
- For the medium scenario (base case), we have assumed a cost of £3600/kWp which represents the mid-range of expected capital costs.
- For the high scenario, we have assumed a cost of £3300/kWp which represents the lower end of expected capital costs.

4.2.4 Operation and maintenance costs

Operation and maintenance costs are another critical area with a major impact on the overall project business case. In many ways, PV systems are largely maintenance free, being essentially clean, silent and with no moving parts. However, to get the best out of the system they should be monitored and faults should be fixed quickly. Examples include temporary or permanent inverter failure or shading of the system caused by dirt accumulation on the panels. Most inclined panels are largely self-cleaning. However, some PV companies allow for costs of cleaning (perhaps every 5 years). Other costs that may be incurred include meter reading (although this can potentially be done remotely) plus insurance of the system.

Reliable data on operating costs is hard to come by despite PV systems being installed for well over a decade in the UK. This is because the scale of deployment is now much greater and the feed in tariff places urgency on swift repair and maintenance. Indicative prices have been obtained from PV companies through recent discussions on this topic but this is a fast moving area.

As a base case assumption, we have used the following assumptions:

- <4W: fixed cost of £110
- 4-10kW: £24/kWp
- 10-100kW: £22/kWp
- 100-5000kW: £20/kWp

Inverter replacement costs are considered separately, as described below.

4.2.5 Inverter replacement costs

In the model, we have allowed for two replacements of the inverters during the 25 year lifecycle of the project. It is possible that only one is required but since this is such a critical item for

[1] *Source: Quarterly Energy Prices, Department of Energy and Climate Change*

capturing the revenue stream, we feel this is a prudent approach to take.

As a base case assumption, we have used an estimate of 5% of the capital cost in years 10 and 20 for inverter replacement, which is taken from our recent experience of a range of PV projects.

4.2.6 FIT degression rates

The level of the generation tariff applied to PV systems installed in the future will decrease with time, based on annual degression rates. The degression rate is used only to determine the tariff applicable to the system based on its registration date - once a tariff has been allocated, that rate would apply for the full 25 years. The tariffs start to degress from March 2012. However, as described above, degression has not been assumed in this analysis as projects are assumed to be complete by March 2012.

4.2.7 PV output degradation rate

As PV systems age, their performance output may reduce slightly over time, as a characteristic of cyrstalline cells when exposed to solar irradiation, and also potentially due to accumulation of dirt. On this basis, a small degradation rate of 1% has been applied to the energy generation figures.

4.2.8 Inflation

Income inflation is another critical value in the financial model. We have made the following assumptions:

- For the low scenario we have taken a conservative value of 1% in order to give a safe buffer against low inflation
- For the medium scenario (base case) we have used a more typically quoted 2%
- For the high scenario, we have used 3% which is an optimistic figure

The index-linked nature of the FIT is a prime reason why pension funds and other long term investors are interested in owning PV systems. However, knowing which value to set over a 25 year period is difficult.

4.2.9 Discount rate

For NPV analysis, we have assumed a discount rate of 6%, which is commensurate with the cost of capital from the public works loan board, plus a small margin for risk. For private investment, we have used a discount rate of 10% which is typical.

4.3 Results

This section provides a summary of the financial analysis undertaken. Further, more detailed, output can be found in the appendices of this report.

4.3.1 Summary of all projects

Table 4-2 Summary of all PV projects identified

Summary of all potential PV projects identified, optimised on FIT band						
FIT Tariff bracket	Number of installations	Sum of Total Size (kWp)	IRR (mean value)	Total Indicative CAPEX	NPV (mean value)	Total annual generation (kWh)
10kW to 50kW	857	31498	9.3%	£ 94,495,450	£ 40,233	24,595,927
50kW to 150kW	151	17596	5.7%	£ 49,576,750	-£ 7,934	13,791,192
150kW to 250kW	29	7014	4.2%	£ 19,288,500	-£ 113,955	5,425,892
250kW to 5MW	5	3218	1.3%	£ 8,849,500	-£ 739,789	2,536,159
Total	1,042	59,326	8.6%	£ 172,210,200	£ 25,219	46,349,171

Table 4-2 shows a summary of all projects broken down into the four main fit bands. It is clear that the greatest potential, both in terms of total annual generation and in terms of economic attractiveness, lies in the 10-50kW FIT bracket. Projects which would have fared well in terms of annual FIT revenue, as described under Workstream 1, are shown to be less suitable by lower IRRs and negative net present values; many of the projects in the highest FIT bracket (250kW to 5MW) yield a negative IRR.

Following this analysis, the decision to limit all projects to a maximum of 50kWp was taken. This ensures that roof spaces with the best solar potential are able to achieve the maximum possible IRR, rather than looking to generate the maximum amount of electricity. This will reduce the overall theoretical carbon savings which can be achieved in this exercise, but by proposing more lucrative projects from the outset, a higher level of investment could be attracted, potentially allowing a greater number of projects to come to fruition. All further analysis in this report uses this finding that it will not be financially attractive to invest in projects above 50kWp.

It is important to note that these projects will become less lucrative with every year following March 2012, due to the degression of the FIT rates discussed in section 4.2.6.

4.3.2 Summary of all projects using the 50kWp cap

The table below shows the relative scales of investment across different building types owned by all the LAs in the six London boroughs. A breakdown by borough is provided in Appendix 1. All assumptions made relating to building type have been taken directly from the databases provided by each borough.

Table 4-3 Summary of all projects broken down by building type

Overall summary of projects capped at 50kWp					
Building Type	**Sum of Indicative CAPEX**	**Sum of NPV**	**IRR**	**Total Size (kWp)**	**Number of projects**
Playground	£ 141,000	£ 63,425	10.06%	47	2
Depot	£ 873,000	£ 389,830	10.06%	291	6
University Building	£ 600,000	£ 252,463	9.85%	200	4
Industrial Units	£ 4,191,000	£ 1,703,091	9.79%	1,397	32
Housing	£ 1,614,000	£ 632,762	9.70%	538	12
Shops	£ 1,221,000	£ 472,705	9.60%	407	10
Office Building	£ 5,439,000	£ 2,056,826	9.49%	1,813	43
Social Housing	£ 57,279,950	£ 21,605,501	9.44%	19,093	546
Doctors Surgery	£ 432,000	£ 156,724	9.42%	144	4
Schools/Nursery	£ 30,354,000	£ 11,196,763	9.37%	10,118	220
Unknown	£ 2,391,000	£ 861,116	9.35%	797	20
Car Park	£ 498,000	£ 180,209	9.28%	166	4
Emergency Service Building	£ 123,000	£ 43,120	9.25%	41	1
Street Trader	£ 300,000	£ 103,639	9.21%	100	2
WC/Changing Rooms	£ 273,000	£ 88,326	9.01%	91	2
Care home/Day centre	£ 4,956,000	£ 1,608,399	9.01%	1,652	40
Leisure Centre	£ 2,733,000	£ 870,505	8.94%	911	19
Cemetery	£ 150,000	£ 46,926	8.92%	50	1
Community Building	£ 1,959,000	£ 572,994	8.86%	653	18
Cafe/Restaurant	£ 219,000	£ 63,215	8.83%	73	2
Library	£ 1,626,000	£ 459,993	8.73%	542	15
Town Hall	£ 1,593,000	£ 503,612	8.67%	531	12
Commercial (unclassified)	£ 3,003,500	£ 908,395	8.59%	1,001	26
Religious buildings	£ 105,000	£ 26,914	8.42%	35	1
Total	**£ 122,074,450**	**£ 44,867,456**	**9.37%**	**40,691**	**1,042**

4.3.3 Breakdown of results by borough

The following graphs indicate the total level of investment in each borough for projects with an internal rate of return greater than 6% and greater than 10%. In all boroughs, the greatest potential lies in the social housing sector. Schools/nurseries provide the second largest potential. The total net present value of the total project investment for a PV array lifetime of 25 years is also indicated.

4.3.3.1 Camden

Investment in Camden for projects with internal rates of return above 6% is focused in four categories: social housing (62%), commercial (14%), schools and nurseries (7%) and office buildings (6%). This leaves just 11% falling into the other categories identified in Figure 4-1. A similar spread is seen in projects with an IRR of over 10% with the category 'depots' also showing a reasonable potential (6%).

Camden has the fourth highest total investment potential for projects with an IRR above 6% (equating to 6.5MWp) but the lowest overall potential for projects over 10% (equating to 0.9MWp).

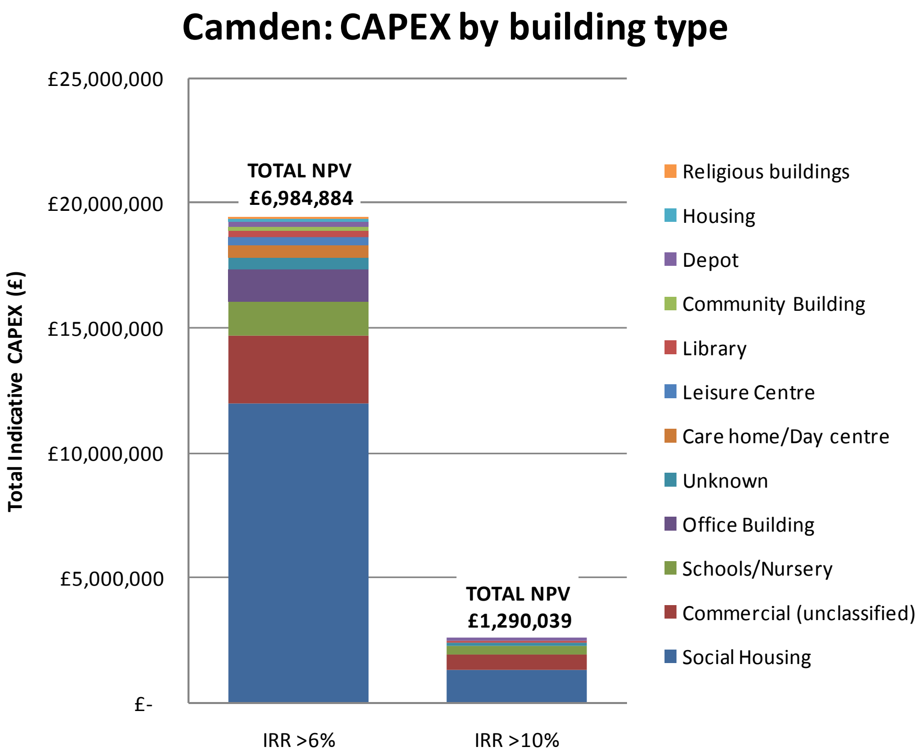


Figure 4-1: Total CAPEX of all projects with an IRR >6% in Camden, broken down by building type

4.3.4 Enfield

Most of the potential in Enfield lies in the social housing sector (43%) and schools/nurseries (35%) for projects with an IRR greater than 6% (equating to a total of 5.2MWp); a similar distribution is seen for projects with IRRs above 10% (equating to 2MWp).

Enfield has the lowest potential in all six boroughs for projects with an IRR greater than 6% but the highest potential for projects with an IRR over 10%. This means that Enfield has the highest proportion of third party investable projects of all boroughs.

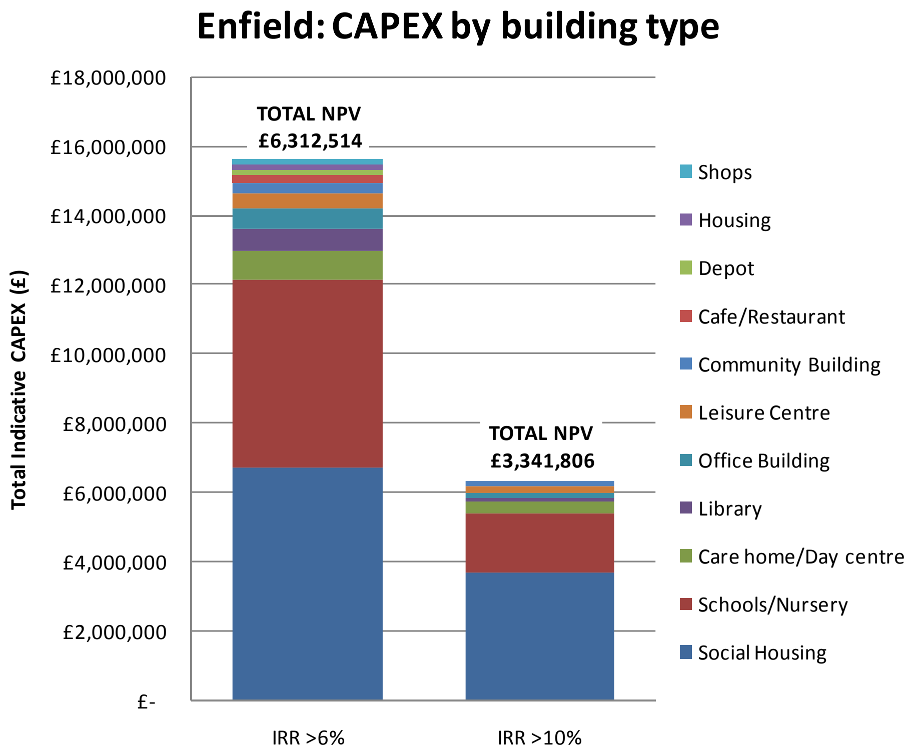


Figure 4-2: Total CAPEX of all projects with an IRR >6% in Enfield, broken down by building type

4.3.5 Haringey

Potential in Haringey is focussed mainly into the social housing sector and schools/nurseries for both projects with IRRs above 6% (equating to 6.8MWp) and 10% (equating to 1.3MWp). These two sectors account for 70% of the overall potential.

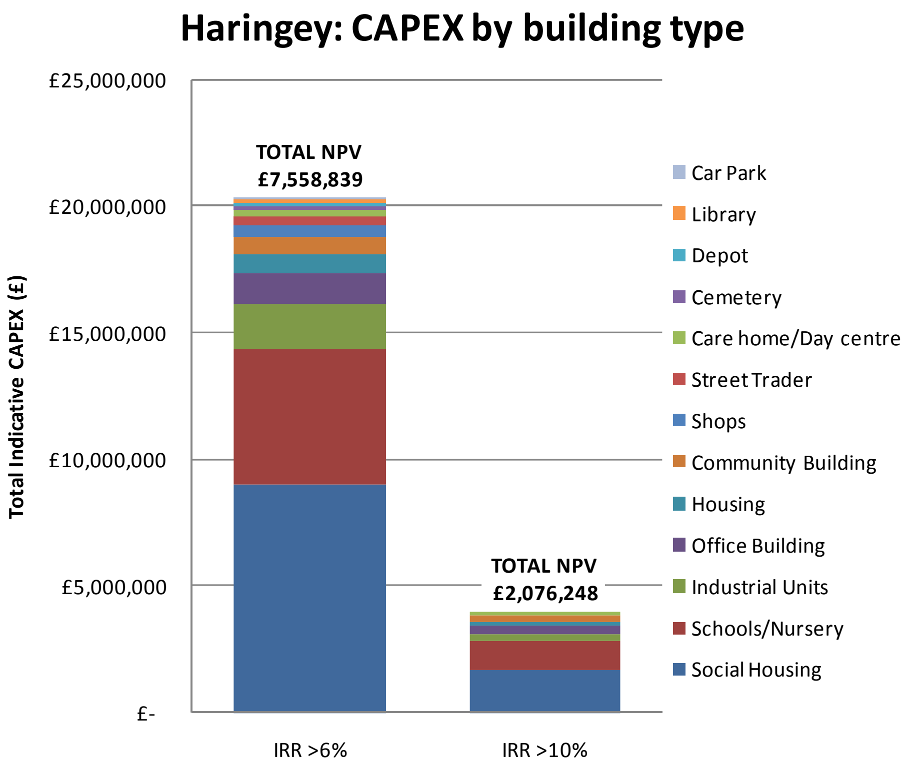


Figure 4-3: Total CAPEX of all projects with an IRR >6% in Haringey, broken down by building type

4.3.6 Hackney

78% of the overall potential for Hackney lies in the two largest categories: social housing (47%) and schools/nurseries (31%) for projects with IRRs greater than 6% (equating to 7.5MWp). For projects above 10% (equating to 1.5MWp), these same two categories account for 81% of the total potential. Hackney contains the second highest volume of capital investment (and NPV) for projects over 6% IRR.

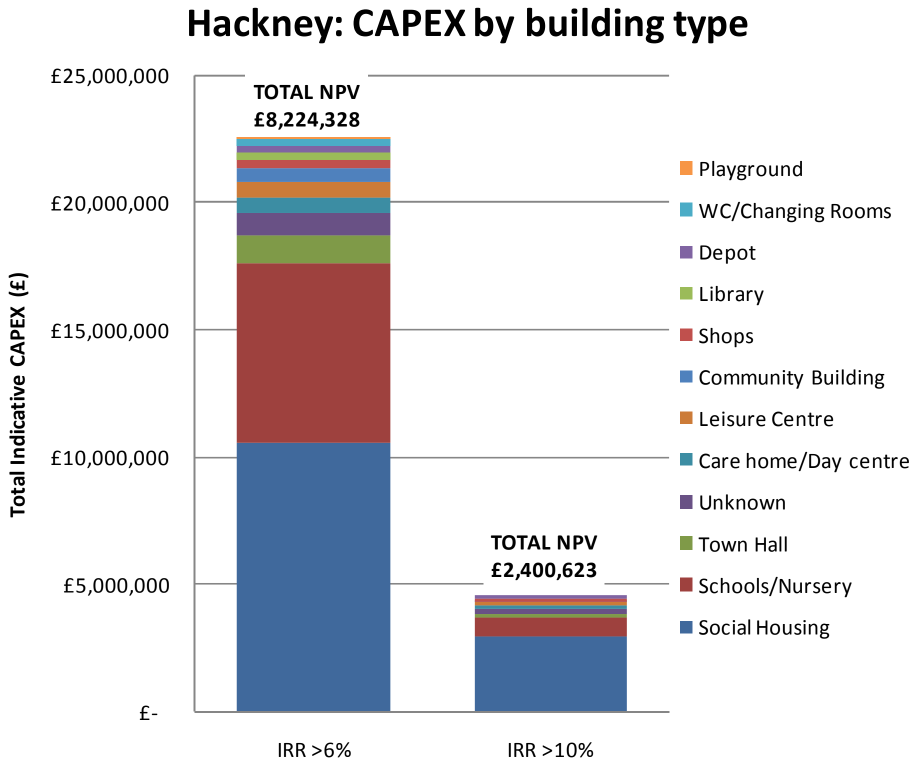


Figure 4-4: Total CAPEX of all projects with an IRR >6% in Hackney, broken down by building type

4.3.7 Islington

Islington has the highest volume of capital investment potential (and NPV) across all six London boroughs for projects with an IRR above 6% (equating to 8.3MWp). The social housing sector is by far the largest area for investment (57% of projects above 6% IRR; 59% of projects above 10% IRR, equating to 1.5MWp). Schools and nurseries are the second largest comprising 19% of the total project investment for both IRR brackets.

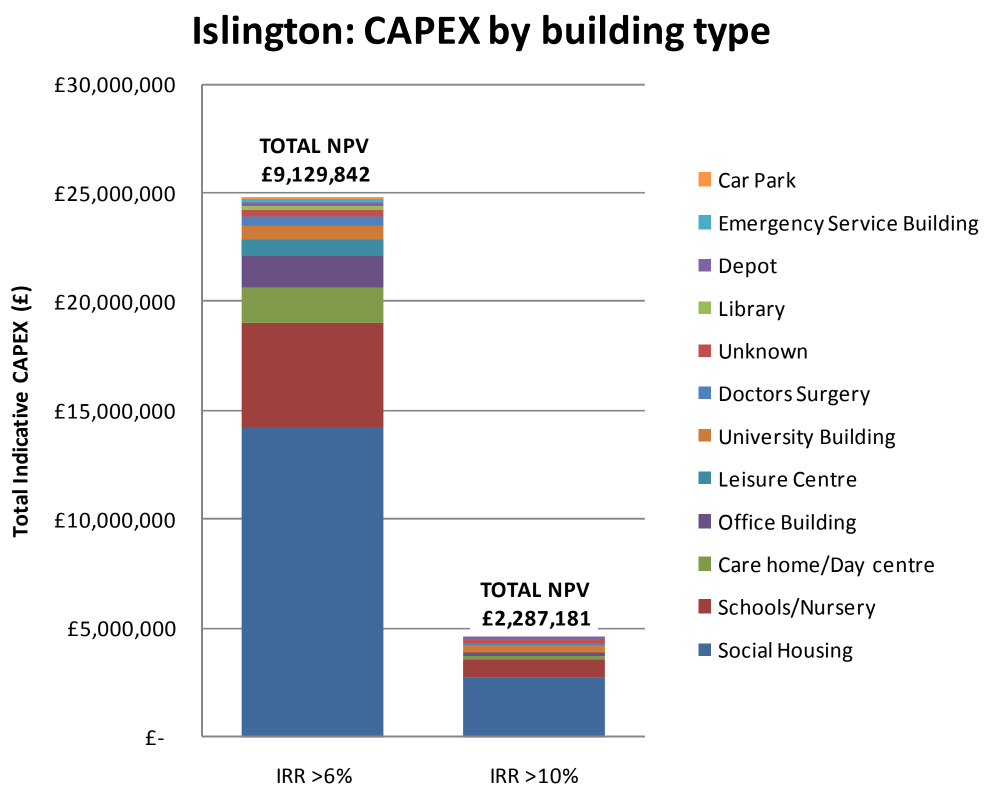


Figure 4-5: Total CAPEX of all projects with an IRR >6% in Islington, broken down by building type

4.3.8 Waltham Forest

In Waltham Forest, schools and nurseries comprise the largest sector (36% of projects with an IRR above 6%, equating to 5.8MWp, and 41% of projects with an IRR over 10%, equating to 1.7MWp), this is followed by social housing and industrial units.

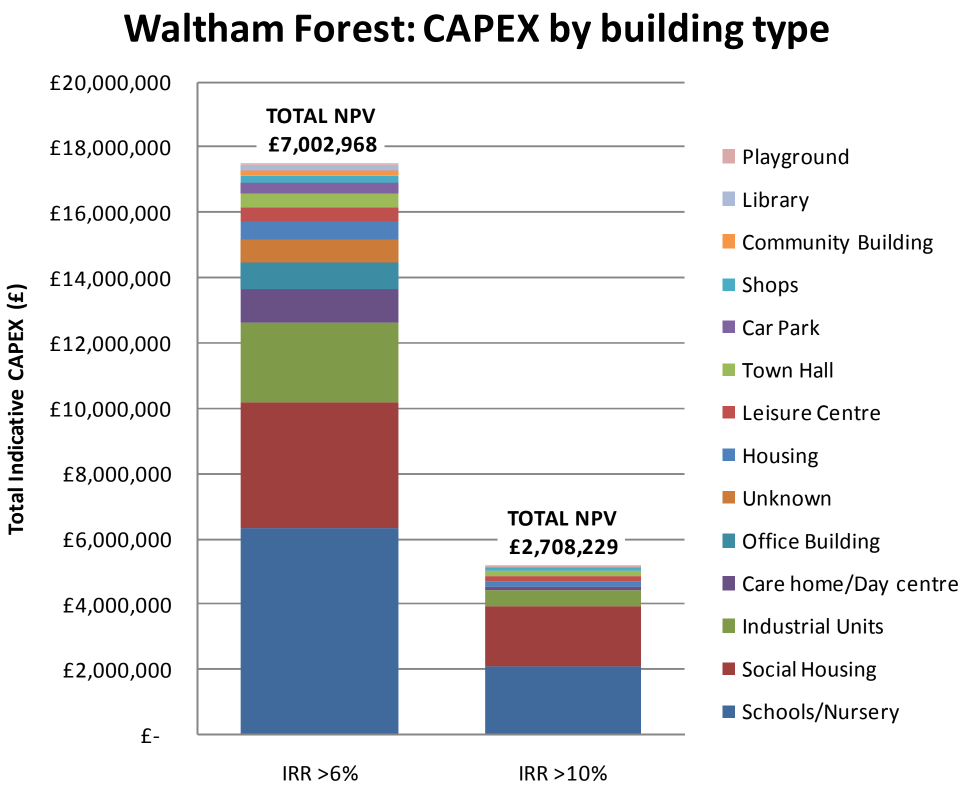


Figure 4-6: Total CAPEX of all projects with an IRR >6% in Waltham Forest, broken down by building type

4.4 Sensitivity analysis

Figure 4-7 demonstrates the impact of variations in key parameters on IRR for all the projects across all boroughs, based on the ‘best’, ‘base-case’ and ‘worst’ scenarios. This identifies which uncertainties could pose the biggest risk in relation to project profitability. The ranges used in the different scenarios are shown in Table 4-4.

The installation cost range has the biggest influence on project IRR, demonstrating that this is the most important parameter that is within the LA’s control – where possible contracts should be built in bulk to ensure economies of scale are taken advantage of. The performance ratio (i.e. the overall efficiency of the system, taking into account issues such as maintenance down time) also will have a large impact on the overall system finances showing the importance of selecting the best locations, good installers and reliable systems. Operation and maintenance costs have minimal impact on IRR.

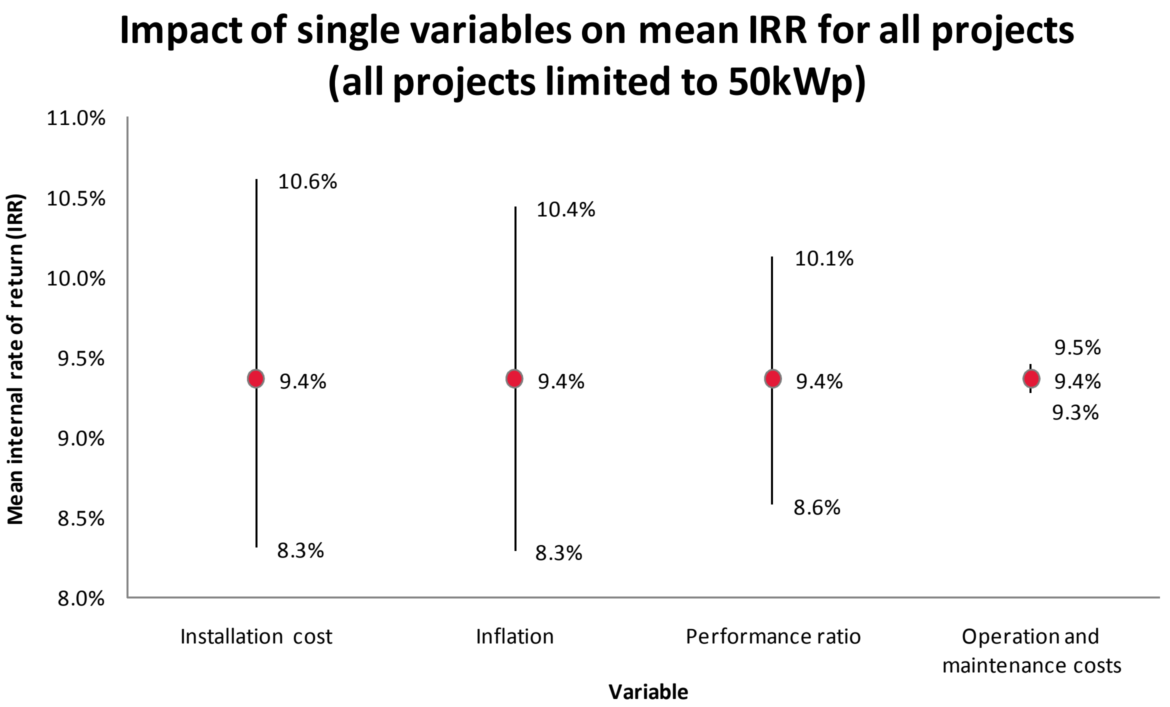


Figure 4-7: Sensitivity analysis of best, base case and worst scenarios when individually applied to all 50kWp-capped projects across the six North London boroughs

Table 4-4: Range of variables used in the best-, base- and worst- case scenarios

Variable	Best Case	Base case	Worst Case
RPI/Inflation	3%	2%	1%
Annual displaced fuel inflation rate	3%	2%	1%
Performance ratio	0.85	0.8	0.75
Installation costs			
0-4kW	£ 3,000	£ 3,250	£ 3,500
4-10kW	£ 2,800	£ 3,050	£ 3,300
10-100kW	£ 2,700	£ 3,000	£ 3,300
100-5000kW	£ 2,500	£ 2,750	£ 3,000
Operation and maintenance costs			
4-10kW	£ 22	£ 24	£ 26
10-100kW	£ 20	£ 22	£ 24
100-5000kW	£ 18	£ 20	£ 22

4.4.1 Scenario testing

Using the ranges identified in Table 4-4, the best, base and worst case have been analysed, and the results are shown in Figure 4-8 below. The findings of this analysis have been illustrated by taking the total NPV for a 25 year PV array lifetime using a discount rate of 6%. The analysis was only conducted on projects achieving a minimum internal rate of return of 6% in the base-case scenario.

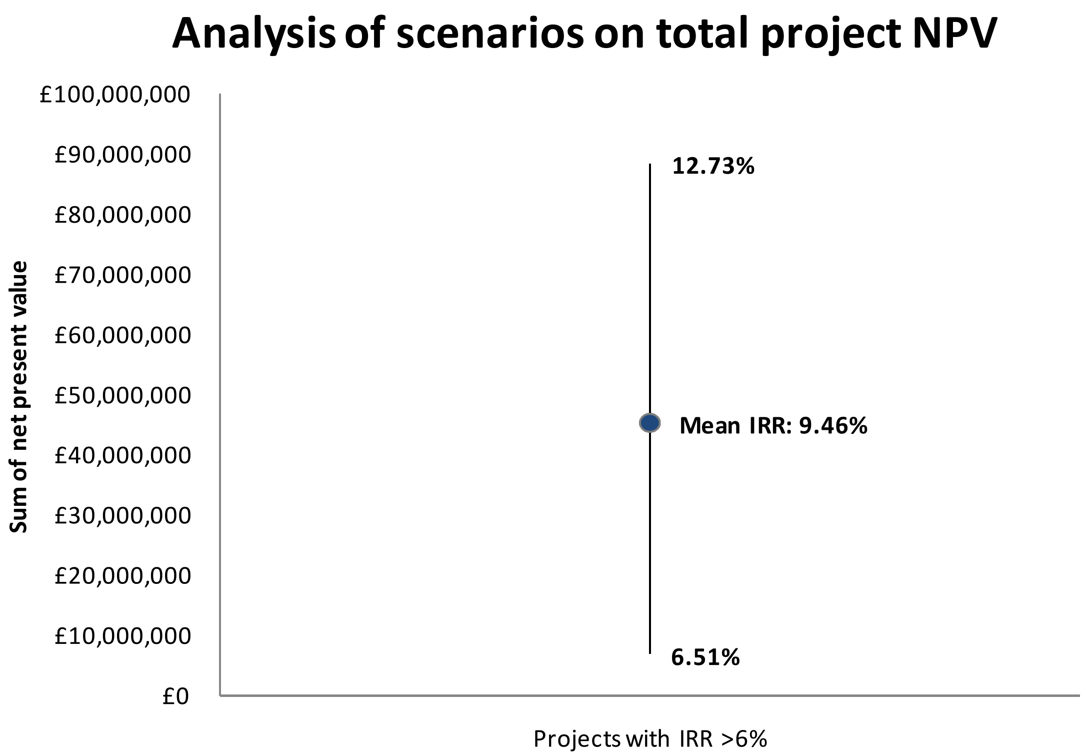


Figure 4-8: Analysis of best, base and worst scenarios

This analysis of the three different scenarios is undertaken to indicate the level of risk/opportunity for all projects. The graph shows that the mean IRR of 9.5% varies from 6.5% to 12.7% under the best and worst case scenarios. Since the mean IRR is relatively high, with the worst case scenario still above 6%, it is well within the minimum required for public sector funding. Therefore, the risk associated with the worst case scenario is likely to be much more of a consideration with private funding; however, there is still potential for returns greater than 10%.

5 Overall portfolio potential

The analysis has so far been restricted to the priority list of around 1,000 properties selected during Work Stream 1 of this project. These buildings were selected on the basis that they represented the best potential for PV installations by virtue of the fact that they have the largest roof area, of above 500m^2.

However, these buildings represent only 3% of the total number of properties owned by the LAs, and therefore the additional potential available from the remaining buildings must also be considered. We have therefore made a high level assessment of the likely potential for these buildings, in addition to the detailed analysis already carried out.

The table below shows the total number of buildings in each of these categories. The total number of buildings for which data was received from all of the LAs is 35,636.

Table 5-3

Breakdown of buildings assessed	
Building type	**Number of buildings**
Modelled buildings – residential	558
Non-modelled buildings - residential	33,139
Sub-total - residential	33,697
Modelled buildings – non-residential	484
Non-modelled buildings – non-residential	1,455
Sub-total – non-residential	1939
Total – all buildings	**35,636**

5.3 Theoretical opportunity potential for non-modelled buildings

This assessment is based on the following assumptions, outline below.

Residential properties

To achieve an IRR of >6%:

- Assumed to have pitched roofs
- 50% of properties with pitched roofs will have a roof facing within the range south east to south west
- Of these properties, 50% will be suitable for installation of PV, i.e. have:
  - Little or no shading
  - Few or no obstructions (roof lights, chimneys etc)
  - Be structurally sound
  - Be sufficiently accessible
- Therefore, 25% of properties will be suitable for PV installation and achieve an IRR of >6%
- Assumed PV capacity of 2kWp

To achieve an IRR of >10%:

- Assumed to have pitched roofs
- 25% of properties with pitched roofs will have a roof facing within the range south east to south west
- Of these properties, 50% will be suitable for installation of PV, i.e. have:

- Little or no shading
- Few or no obstructions (roof lights, chimneys etc)
- Be structurally sound
- Be sufficiently accessible

- Therefore, 12% of properties will be suitable for PV installation and achieve an IRR of >10%
- Assumed PV capacity of 2kWp

Non-residential properties

To achieve an IRR of >6%:

- Assumed to have flat roofs
- 100% of properties with flat roofs can have PV panels mounted facing between south east and south west.
- Of these properties, 40% will be suitable for installation of PV, i.e. have:
  - Little or no shading
  - Few or no obstructions (roof lights, chimneys etc)
  - Be structurally sound
  - Be sufficiently accessible
- Therefore, 40% of properties will be suitable for PV installation and achieve an IRR of >6%
- Assumed PV capacity of 30kWp

To achieve an IRR of >10%:

- Assumed to have flat roofs
- 100% of properties with flat roofs can have PV panels mounted facing between south east and south west.
- Of these properties, 20% will be suitable for installation of PV, i.e. have:
  - Little or no shading
  - Few or no obstructions (roof lights, chimneys etc)
  - Be structurally sound
  - Be sufficiently accessible
- Therefore, 20% of properties will be suitable for PV installation and achieve an IRR of >10%
- Assumed PV capacity of 30kWp

5.4 Overall opportunity potential

The overall theoretical opportunity potential is shown in the table below, for those projects which achieve an IRR of greater than 6%, and for those with an IRR of greater than 10%. An IRR of 6% could represent a publicly funded scenario, whilst an IRR of greater than 10% could represent a privately funded scenario.

The table includes those buildings which have been analysed in the evaluation tool and also the additional buildings described above.

Table 5-4 Overall theoretical opportunity potential by IRR

Overall theoretical opportunity potential by IRR				
	IRR >6%		IRR >10%	
	Number of buildings	PV capacity (MWp)	Number of buildings	PV capacity (MWp)
Modelled buildings	1,024	40	240	9
Non-modelled buildings – non-residential	582	17	291	8
Non-modelled buildings - residential	8,285	17	4,142	8
Total	**9,891**	**74**	**4,673**	**25**

The table shows that the total theoretical potential is 74MWp for projects with an IRR of greater than 6%, and 25MWp for projects with an IRR of greater than 10%.

The deployment potential outlined above is based on theoretical potential. Actual deployment potential will be reduced based on factors such as planning and vandalism risk. For the modelled sites, this will be reflected in the scoring system used to assess sites in the evaluation tool. For the non-modelled sites, the potential will be similarly reduced.

5.5 Ownership model testing

There are two main ownership models which are likely to be most suitable for assets under LA ownership – the contracting model and the rent-a-roof scheme. In the contracting model, the local authority provides all of the investment for the project thus taking all the risk, but also all benefits from the feed-in-tariff. The rent-a-roof scheme is a lower risk option where the local authority will collect fixed, regular payments from an external investor who finances and maintains the operation of the PV system.

To calculate the NPV of rent-a-roof projects, the lease value of each roof has been assessed using the figures in Table 5.5.

Table 5.5

Rent-a-roof valuation factors used to determine lease payments for rent-a-roof schemes (based on market-research for other projects provided by E-on)valuation factors	
Annual payments for residential properties*	£35/kWp
Annual payments for non - residential properties	£25/kWp

These revenues have then been discounted at 6% over a 25 year period to allow a comparison to be made between these figures and those from the feed-in-tariff revenue analysis described earlier in this report. The cap of 50kWp has been applied to all projects as investors would also take into consideration the reduction in IRR for schemes larger than this.

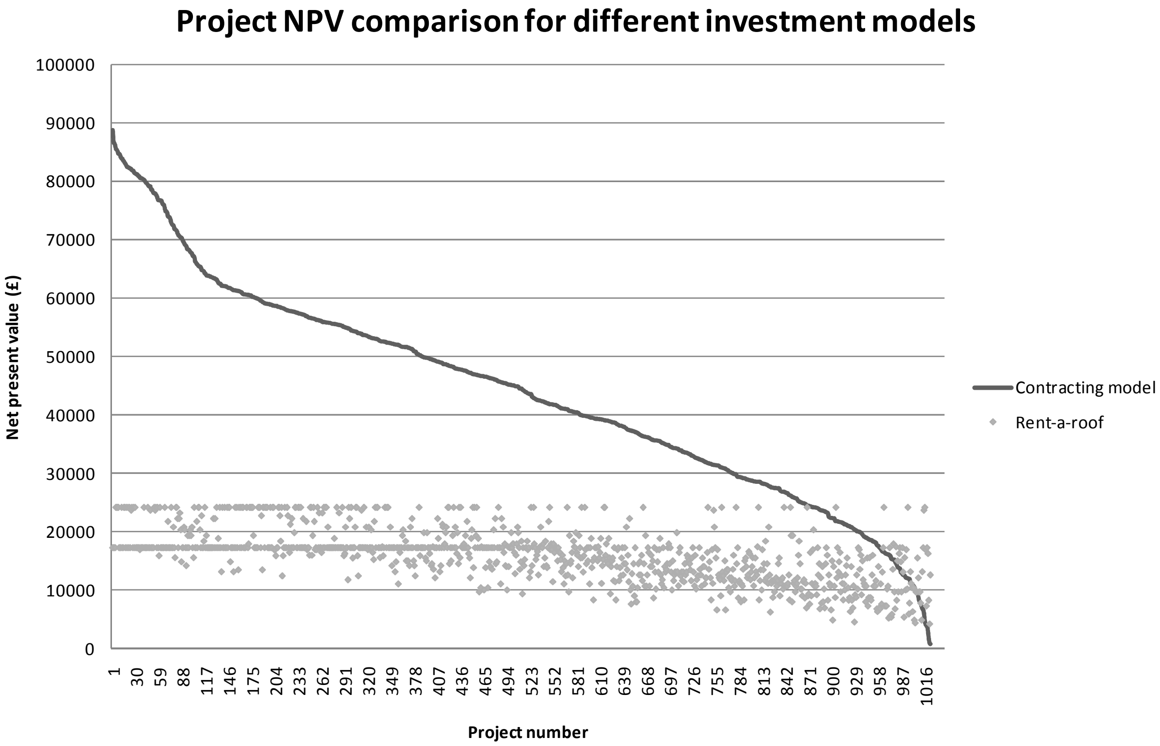


Figure 5-1 Comparison of NPV under different ownership models

Figure 5-1 has been constructed by ranking the NPV under the contracting model for all projects with an IRR greater than 6%; the equivalent NPV obtained under the rent-a-roof scheme has then also been plotted. This analysis illustrates the significantly higher level of income that could be achieved by taking on the investment and risk for best performing projects. Conversely, this also demonstrates that for projects below a certain NPV under the contracting model (approximately £30,000), the associated risks may make the rent-a-roof scheme a more attractive choice.

The large number of 'rent-a-roof' values which occur at £24,120 and £17,229 are the values of 50kWp systems on residential and non-residential buildings respectively. These repeated values are due to the high cluster of systems at the 50kWp cap.

6 Market analysis

6.1 Current market view

This section of the report summarises the current market conditions for the supply and installation of PV to councils, housing associations and other owners of property assets seeking to implement large scale programmes. This is based on Camco discussions with market players in recent weeks across a range of projects. It is also informed by the shifting policy landscape regarding the Feed in Tariff.

6.1.1 Market interest

It is expected that there will be strong interest in this project both from PV suppliers / installers and those willing to invest capital (such as the PV roof rental providers). The size of the project is likely to be large enough to be of interest to those seeking sizable contracts yet also sufficiently focussed as to be manageable. The compact geographic location will be an advantage as it will reduce site survey times and enable installation teams to move from one site to the next without too much difficulty.

The generally good solar irradiance in London will probably help to attract investor attention although the potential for difficult site access and overshading could be perceived as disadvantages.

Importantly, Local Authorities are generally seen as strong contract counterparties so long as internal decision making is not too protracted. There could be perceptions of additional delays as a result of the potential requirement to enter an OJEU-compliant competitive tendering process. This could potentially be mitigated by use of an established procurement framework such as London RE: NEW run by the London Development Agency which will shorten the timeframe.

6.1.2 Supply chain constraints

It is expected that there will be a surge in activity in the PV sector during 2011 as a result of interest from local authorities and housing associations translating into signed contracts. This could potentially put pressure on the supply chain, particularly smaller players, some of whom already have busy order books. The next 2-3 months will be critical for determining the installation capacity for this project as a number of large scale procurement exercises are under way.

One important consideration is the time taken to resolve internal client project planning, complete procurement and then for the installer to carry out detailed site-based surveys. Procurement can take at least 3 months, whilst site survey and tenant liaison can add another month before the first installation (it then continues on a rolling basis).

As an indication of current market capacity, EAGA claim they can carry out 3000 domestic installs/month and has significant capacity remaining. Their priority focus is securing projects to be funded through their new Special Purpose Vehicle.

British Gas has a newly established supply chain through acquisition of Solar Technologies (rebranded British Gas Solar – part of British Gas New Energy). They recently signed an installation agreement with L&Q housing association for an approximately £20m programme across social housing in London. BG claims to have the ability to ramp up installation capacity through partnership with contractors.

There are many other large and small providers in the market. However, the examples above have been cited to indicate the potential for establishing a large scale programme.

6.1.3 Policy risks

Since the announcement of the fast track review for Feed in Tariff, the main policy focus is on supporting domestic installations as well as small scale non-residential applications of less than 50kWp in size. This has led to the PV supply market switching its attention from large commercial and ground-mounted applications towards the portfolios of smaller systems. There remains some policy risk regarding how the comprehensive FIT review, due by the end of 2011, will affect this aggregated approach. The market is currently divided as to how tariffs will be affected. Most expect the rates to remain unchanged for projects completed before end March 2012, whilst some consider it important to install as much as possible before the end of 2011. The market generally considers there to be a high likelihood of a large reduction in rates from April 2012 – perhaps 20% a cut for residential systems. However, it is considered that this will be partially balanced by an increase in FIT payments in line with inflation and a possible reduction in capital costs.

The general consensus, not surprisingly, is that it is best to proceed with development programmes as quickly as possible now before the large scale review is concluded and now that the April 2011 inflation has been applied to the tariffs. Capital costs have not currently risen; however, it is possible that the supply chain will get squeezed later this year, leading to some upward pressure on pricing or at least a reduced ability to drive down prices through economies of scale on large programmes. Generally, the leading installers are bidding for a number of substantial contracts at present, suggesting that it is important for the LAs to sign up installation partners by early summer to have a good chance of securing capacity and installing a significant number of systems by the end of March 2012.

7 Conclusions

The financial analysis carried out has indicated that all projects should be limited to a maximum of 50kWp in order to maximise overall returns under the FIT, rather than looking to generate the maximum amount of electricity. The sites analysed within the evaluation tool have the largest roof spaces, and therefore they offer the best economic potential.

The mean IRR for all of these 1,042 sites is 9.5%, representing a total capital expenditure of £122m, a total NPV of £45m, and a total PV capacity of 41MWp. Scenario testing has shown that the IRR of may vary from 6.5% to 12.7% under the best and worst case scenarios. Since the mean IRR is relatively high, with the worst case scenario still above 6%, it is well within the minimum required for public sector funding. Therefore, the risk associated with the worst case scenario is likely to be much more of a consideration if private funding is required; however, there is still potential for returns greater than 10%.

In all boroughs, the greatest economic potential lies in the social housing sector; schools/nurseries provide the second largest potential.

High level analysis has been carried out to estimate the potential for buildings excluded from the detailed analysis, and therefore to include all LA owned buildings .For projects with an IRR of greater than 6%, an estimated 9,891 sites have been identified, with 74MWp of PV potential. For projects with an IRR of greater than 10%, an estimated 4,673 projects have been identified with 25MWp of PV potential.

In practice, this potential is likely to be constrained by other prioritisation consdierations and supply chain capacity. The availability of capital and each LA’s appetite for risk will be key determining factors. If even 10% of the potential was realised, this would be a programme of up to 8MWp which is significant but achievable in the current market.

Given the attractiveness of this portfolio of sites, as identified under the market testing carried out, the speed at which the LAs can progress this project, and sign up installation partners will be key to the success of the project.

Appendix 1

Breakdown by borough (with 50kWp limit on installed capacity)

Table 7-1: Camden PV potential (broken down by building type)

Summary: Camden				
Building Type	**Sum of Indicative CAPEX**	**IRR**	**Sum of Total Size (kWp)**	**Number of projects**
Care home/Day centre	£ 450,000	8.98%	150	3
Commercial (unclassified)	£ 3,003,500	8.59%	1001	26
Community Building	£ 183,000	8.89%	61	2
Depot	£ 150,000	11.07%	50	1
Housing	£ 150,000	8.97%	50	1
Leisure Centre	£ 366,000	9.02%	122	3
Library	£ 225,000	9.80%	75	2
Office Building	£ 1,248,000	9.28%	416	9
Religious buildings	£ 105,000	8.42%	35	1
Schools/Nursery	£ 1,344,000	8.92%	448	10
Social Housing	£ 12,522,500	9.08%	4174	116
Unknown	£ 528,000	9.52%	176	6

Table 7-2: Enfield PV potential (broken down by building type)

Summary: Enfield				
Building Type	**Sum of Indicative CAPEX**	**IRR**	**Sum of Total Size (kWp)**	**Number of projects**
Cafe/Restaurant	£ 219,000	8.83%	73	2
Care home/Day centre	£ 969,000	9.00%	323	8
Community Building	£ 300,000	9.28%	100	3
Depot	£ 150,000	8.54%	50	1
Housing	£ 150,000	9.27%	50	1
Leisure Centre	£ 438,000	9.94%	146	3
Library	£ 603,000	8.54%	201	6
Office Building	£ 600,000	9.94%	200	6
Schools/Nursery	£ 5,394,000	9.72%	1798	38
Shops	£ 150,000	9.83%	50	1
Social Housing	£ 6,870,000	9.66%	2290	68

Table 7-3: Hackney PV potential (broken down by building type)

Summary: Hackney				
Building Type	**Sum of Indicative CAPEX**	**IRR**	**Sum of Total Size (kWp)**	**Number of projects**
Care home/Day centre	£ 606,000	8.63%	202	5
Community Building	£ 645,000	7.98%	215	6
Depot	£ 273,000	10.27%	91	2
Leisure Centre	£ 600,000	8.76%	200	4
Library	£ 303,000	8.84%	101	3
Playground	£ 60,000	9.76%	20	1
Schools/Nursery	£ 7,020,000	9.19%	2340	51
Shops	£ 315,000	9.40%	105	3
Social Housing	£ 10,587,450	9.62%	3529	108
Town Hall	£ 1,176,000	8.42%	392	9
Unknown	£ 906,000	9.26%	302	7
WC/Changing Rooms	£ 273,000	9.01%	91	2

Table 7-4: Haringey PV potential (broken down by building type)

Summary: Haringey				
Building Type	**Sum of Indicative CAPEX**	**IRR**	**Sum of Total Size (kWp)**	**Number of projects**
Car Park	£ 96,000	8.85%	32	1
Care home/Day centre	£ 288,000	10.00%	96	2
Cemetery	£ 150,000	8.92%	50	1
Community Building	£ 681,000	9.41%	227	6
Depot	£ 150,000	9.43%	50	1
Housing	£ 738,000	9.62%	246	5
Industrial Units	£ 1,779,000	9.53%	593	14
Library	£ 117,000	8.30%	39	1
Office Building	£ 1,224,000	9.77%	408	10
Schools/Nursery	£ 5,334,000	9.43%	1778	39
Shops	£ 498,000	9.53%	166	4
Social Housing	£ 9,045,000	9.31%	3015	76
Street Trader	£ 300,000	9.21%	100	2

Table 7-5: Islington PV potential (broken down by building type)

Summary: Islington					
Building Type	**Sum of Indicative CAPEX**		**IRR**	**Sum of Total Size (kWp)**	**Number of projects**
Car Park	£	102,000	8.98%	34	1
Care home/Day centre	£	1,626,000	8.82%	542	14
Depot	£	150,000	10.77%	50	1
Doctors Surgery	£	432,000	9.42%	144	4
Emergency Service Building	£	123,000	9.25%	41	1
Leisure Centre	£	729,000	8.62%	243	5
Library	£	228,000	7.97%	76	2
Office Building	£	1,509,000	9.41%	503	12
Schools/Nursery	£	4,914,000	9.05%	1638	37
Social Housing	£	14,394,000	9.43%	4798	142
University Building	£	600,000	9.85%	200	4
Unknown	£	300,000	10.40%	100	2

Table 7-6: Waltham Forest PV potential (broken down by building type)

Summary: Waltham Forest					
Building Type	**Sum of Indicative CAPEX**		**IRR**	**Sum of Total Size (kWp)**	**Number of projects**
Car Park	£	300,000	9.63%	100	2
Care home/Day centre	£	1,017,000	9.35%	339	8
Community Building	£	150,000	9.58%	50	1
Housing	£	576,000	10.01%	192	5
Industrial Units	£	2,412,000	9.99%	804	18
Leisure Centre	£	600,000	8.71%	200	4
Library	£	150,000	9.32%	50	1
Office Building	£	858,000	9.07%	286	6
Playground	£	81,000	10.37%	27	1
Schools/Nursery	£	6,348,000	9.62%	2116	45
Shops	£	258,000	9.92%	86	2
Social Housing	£	3,861,000	9.90%	1287	36
Town Hall	£	417,000	9.42%	139	3
Unknown	£	657,000	8.83%	219	5

camco

Camco Advisory Services Ltd
172 Tottenham Court Road, London, W1T 7NS
t +44 (0)20 7121 6100 f +44 (0)20 7121 6101