Solar Renewable Potential in North London: Work Stream 1 – Opportunity Mapping

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1 Executive summary

Camco have 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. This will be done by establishing the opportunity potential across the north London area, and on the basis of this potential, establishing a large-scale delivery model, where economies of scale reduce procurement costs, which may be attractive to groups of investors or partners.

The analysis undertaken in this first work stream of the project has shown 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.

The total PV capacity identified in the longlisted sites is around 62MWp, and around 7kWp for the twenty shortlisted sites. The majority of the shortlisted sites are in the range 150-250kWp, with the potential to generates significant revenue from FIT. However, consideration will need to be given to the potential risk and uncertainty associated with the government's fast track review of installations over 50kWp.

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.

As part of the next phase of work, the results of this analysis will be used to determine financial return for the key sites, as well as finance and delivery options analysis.

2 Introduction

2.1 Background

Camco have 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. This will be done by establishing the opportunity potential across the north London area, and on the basis of this potential, establishing a large-scale delivery model, where economies of scale reduce procurement costs, which may be attractive to groups of investors or partners.

In order to maximise the scale of the opportunity, as well as to take advantage of the potential to share learning across boroughs, a cross-borough working group has been established in the north London region, in which the solar renewable energy potential will be considered within this area. The following boroughs are involved:

- 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

The project is led by the London Borough of Haringey, on behalf of the cross-borough working group.

Haringey 40:20 is a membership organisation which is working towards achieving a carbon emissions reduction of 40% by 2020 (compared to 2005 levels), as part of the Friends of the Earth 'Get Serious' campaign. This target was adopted by the Council in November 2009, together with a commitment to develop an action plan to reduce carbon emissions. Haringey 40:20 provides a forum to take forward the development of the borough wide carbon management plan being developed in 2011 and also provides information and support to members.

Key drivers for the local authorities involved in this project are:

- **Income generation**

This is the primary client driver for this project, and taking advantage of opportunities offered by building stock, both domestic and commercial.

- **Carbon reductions**

A further driver is the generation of tangible carbon reductions which have the ability to be realised relatively quickly. Income can be used to offset investment in energy efficiency improvements. Each of the boroughs involved has already identified the installed capacity of renewable energy required to achieve long term carbon reduction targets.

- **Energy cost savings**

Through the introduction of solar renewable technologies, it is expected that energy bill reductions can be achieved for both local authorities and residents in domestic properties. In

particular, the recent introduction of government incentive schemes for both technologies to support their uptake in the UK - the Feed In Tariff for PV and the Renewable Heat Incentive for solar thermal - provide further financial support for these technologies. These are discussed in more detail later in this report.

Additional, secondary drivers include:

- Improved engagement by building users with renewable energy technologies and energy consumption
- General energy awareness throughout the region through visibility of technologies
- The methodology and findings of this analysis are detailed in the body of this report.

2.2 Project scope and objectives

The project is to be delivered in three "objectives". This report presents the findings of Objective 1 of the study, with two further objectives to follow. The three "objectives" are as follows:

1. Opportunity mapping
2. Market testing – analysis of finance and delivery options
3. Evaluation

Objective 1 is focussed on identifying, at a high level, and prioritising potential sites for PV and solar thermal on local authority owned buildings. PV is a primary focus for this study because of the greater returns available from the Feed in Tariff compared with those for solar thermal under the Renewable Heat Incentive scheme. In addition, an evaluation tool is required for each of the local authorities to use in the future to determine the potential for further specific sites. The evaluation tool will be populated initially with data obtained as part of the opportunity mapping process; however, building specific details can be modified in the future where there is more accurate data available for specific sites.

2.3 Methodology

The project has been split into three work streams. The table below indicates the objectives under each work stream and the associated delivery process: This report covers work undertaken within Work Stream 1.

Table 2-1 Methodology summary

Methodology			
Work Stream		**Objectives**	**Delivery process**
1	Opportunity mapping	Develop pre-feasibility assessment method and collection tool and deliver training Carry out pre-feasibility and collect data in consistent format across the sub-region	Establish and agree and criteria
			Design evaluation tool
			Data collection
			Analysis of opportunity potential
			Design and deliver a training package
2	Market testing – analysis of finance and delivery options	Carry out assessment of ownership and delivery models and relative benefits of each Carry out analysis of potential local economic benefit	Market analysis
			Finance and delivery options analysis
			Outline finance model
			Investment prospectus
3	Evaluation	Carry out evaluation of work undertaken, and produce guidance for Local Authorities	Evaluation of solar opportunity process
			Presentation to steering group

2.4 National level policy drivers for installing solar renewables

In light of the continuing global focus on climate change, a wide range of far reaching and ambitious policy drivers have been put in place by the government during recent years with the intention of delivering rapid and lasting reductions in the UK's carbon emissions.

At the national level, the Climate Change Act 2008 set out a legally binding 80% reduction in carbon by 2050 and 34% by 2020 relative to 1990 levels. In addition to these targets, the UK is committed to sourcing 15% of its energy from renewable sources by 2020, almost a seven-fold increase from 2008. Led by these key high level targets, carbon reduction and renewable energy targets have taken a leading role in policy setting at borough level.

The Energy Act 2008 sets out the powers to introduce Feed-in-Tariffs (FiT) and the Renewable Heat Incentive (RHI). Each of these schemes proposes direct financial support to generators of renewable electricity (FIT) and heat (RHI) to reflect the amount of energy generated. In both cases, the level of support offered is intended to level the playing field for different renewable energy technologies, such that a solid investment case can be generated for the installation of a renewable technology option which is well suited to its application.

2.4.1 The Feed in Tariff

The UK has to generate up to 40% of its electricity from renewable sources by 2020 to meet the EU targets, which represents a ten-fold increase in the next ten years. As part of reaching this target, it is planned that 2% of electricity will be generated from small-scale renewables by 2020. Feed in Tariffs (FITs) have been introduced to provide a financial incentive for businesses

to make use of small-scale renewable technologies, and help the government increase the amount of electricity generated from renewable to meet these challenging targets.

FITs came into effect on 1 April 2010 and apply to a range of small scale renewable energy technologies of <5MW: wind, hydro, anaerobic digestion, micro CHP and PV. Although the FITs are established in law, rather than coming from the government, the tariffs are actually paid by the energy suppliers, via a levelisation process, who pass on the cost of the FIT scheme to all their electricity customers.

FIT gives three financial benefits:

- Generation tariff: a set rate for every kWh of electricity produced, even if it is not used entirely on site, which varies according to the technology installed. Technologies should become cheaper over time, so a degression is applied to PV tariffs, and therefore this rate will change each year for new participants. However, it will remain the same once participants have joined the scheme, so that they are effectively 'locked in'. Tariffs are intended to provide a return of around 5-8% for PV, and are index-linked to inflation. Support for PV will be provided for 25 years, whilst most other technologies will receive support for 20 years.
- Export tariff: an additional bonus payment for each kWh of electricity exported into the grid. This is paid over and above the generation tariff, either at a guaranteed flat rate of 3p/kWh or at the open market value. Domestic participants will have their export deemed at 50% until smart meters are rolled out.
- Energy bill savings: a saving in electricity costs, from using the renewable energy generated on site.

Table 2-2 below shows proposed revised generation tariffs under the government's fast track review of PV for installations >50kWp which will take effect from the 1st August 2011. The government's comprehensive review will address installations <50kWp – the government has said these rates will remain unchanged until April 2012, 'unless the review reveals a need for greater urgency.'[1]

Table 2-2 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, due to a much greater than expected up-take of FIT (PV installations accounted for 94% of FIT payments by number of installations as of 26th January this year), the government

[1] *Feed-in Tariffs: Written Ministerial Statement by Gregory Barker, Minister of State, 18 March 2011, http://www.decc.gov.uk/en/content/cms/news/fits_wms_gb/fits_wms_gb.aspx*

announced in February the start of the first review of the FIT scheme, which will consider all aspects of the scheme including:

- Tariff levels
- Degression rates and methods
- Eligible technologies
- Arrangements for exports
- Administrative and regulatory arrangements
- Interaction with other policies
- Accreditation and certification issues

The review will be completed by the end of 2011, with tariffs remaining unchanged until April 2012 (unless the review reveals a need for greater urgency).

The review will also include fast-track consideration of solar photovoltaic projects over 50kW, defined as large scale, with a view to making any resulting changes to tariffs as soon as practical, and likely to be in July 2011. Support from FIT for PV at this scale therefore represents a key area of uncertainty.

2.4.2 The Renewable Heat Incentive

Heating accounts for 47% of the UK's carbon dioxide emissions and 60% of typical domestic energy bills[2]. The development of low carbon heating solutions is therefore viewed as a key delivery vehicle in achieving the UK's carbon reduction targets.

The Renewable Heat Incentive was announced in March 2011, and is due to be introduced in June 2011. It promises a fixed level of financial support for generators of renewable heat, and is believed to be the first scheme of its kind in the world.

The RHI is a tariff-based scheme with payments made to the generators of renewable heat per unit of heat output. It will be available for all scales of installation within industrial, public and commercial sectors from July 2011. The scheme will be extended to the domestic sector in 2012 with an interim arrangement ('RHI Premium Payment') put in place to provide around £15m of grants for renewable heat installations, equivalent to around 25,000 homes. According to the Government's figures, the RHI will save 44 million tonnes of carbon dioxide by 2020.

Unlike the FIT mechanism, the RHI will be paid from general taxation rather than a pass through to consumer energy bills. The RHI is designed to deliver a return of 12% on the marginal cost over a gas alternative for all technologies except solar thermal which gets a lower return of 5% due to its greater maturity. This is higher than the intended range for the FIT (5-8%) - a result of the generally greater complexity and risk associated with renewable heat projects.

The extension of the scheme to the domestic sector in 2012 is aligned with the introduction of the Green Deal funding scheme for low carbon housing refurbishment. To address concerns expressed at the consultation stage, the 'RHI Premium Payments' will be primarily targeted at off gas grid properties and only provided to those that meet minimum standards of energy efficiency, as demonstrated by Energy Performance Certificates. Recipients of the grants will also be required to provide feedback on monitored performance data.

The scheme will support a range of renewable heat producing technologies including solar thermal up to 200kW, as well as biomass and ground source heat pumps. Large solar thermal is

[2] *Source: "Consultation on the renewable heat incentive", DECC,*

http://www.decc.gov.uk/en/content/cms/consultations/rhi/rhi.aspx

currently excluded as further work on costs is proposed; however, this may be included in 2012.

The tariff for solar thermal will be 8.5p/kWh, and will be payable for 20 years. It will be based on metered heat output (no deeming). The level of support is fixed, and increases with inflation. However, degression will be introduced after 2012 for new schemes only. “Grandfathering” will apply – i.e. the installation will retain the level of support at time of registration regardless of degression of tariff rates to new entrants. The likely interim premium payment for domestic solar thermal installations will be a cash lump sum of £300 per unit.

2.4.3 The Carbon Reduction Commitment Energy Efficiency Scheme

The Carbon Reduction Commitment Energy Efficiency Scheme (CRC) affects medium scale energy users in the UK that fall below the threshold of the EU ETS, with electricity consumption of over 6,000MWh per year with half hourly metering. This therefore includes local authorities. During the CSR, the government announced considerable changes to the CRC. While the initial proposals for the CRC were that it would be revenue neutral, with carbon charges recycled to reward the best participants, the revenue is now intended to be kept by the treasury. This makes the scheme a direct carbon charging mechanism for its participants.

The impact of the CRC is that connection to a low carbon electricity or heat source has the potential to go some way to reduce an organisation’s liability to carbon related costs, increasing the effective value of this low carbon energy, and is therefore a financial driver for local authorities. However, to capture the value under the CRC, it will not be possible to claim FIT or RHI and the carbon benefits – for example, if FIT or RHI are to be claimed, the carbon benefit of the renewable technology cannot be claimed.

3 Site selection criteria

3.1 Introduction

In order to assess the potential for solar renewables and develop a shortlist of viable local authority owned assets which offer the greatest opportunity, a framework for initial site evaluation, or screening, has been developed. Given the number of assets to be assessed, this initial screening process has been carried out using a desk-top assessment of the theoretical, technical potential of the site, using a Geographic Information System (GIS) based tool – this approach is described in more detail later in this report.

For those sites which are to be taken to the detailed feasibility stage, a more extensive technical assessment is likely to be required to verify the technical potential obtained in the first stage, and also to take into account detailed site specific information, such as roof structure and location of the nearest grid connection, and this would necessitate a site visit. However, this is outside the scope of this project.

3.2 Screening criteria

The screening criteria used for this assessment relate mainly to the physical characteristic of the building and its roof, and also economic, social, environmental and site-specific criteria. These are shown in the table below. Each of the criteria has been given a weighting to indicate its relative importance. This weighting has been used to assess each potential site, the process for which is described in more detail in section 4.

Table 3-1 Screening criteria

Screening criteria		
Criteria	**Description**	**Weighting**
Roof area available for PV panels	Larger roof areas can provide economies of scale and have been prioritised for shortlisting. Smaller roof areas may not be economically viable due to the fixed installation cost. The minimum roof area considered is around 16m² or 2kWp capacity.	High
Shading	Buildings are ideally sufficiently high and of similar height for shading from surrounding buildings not to be a significant issue. However, shading from projections on the roof, such as mechanical plant and lift over-runs must also be considered.	High
Orientation	A roof facing between south west and south east is the optimum, but an east-west orientation only decreases yield by around 20%, so these orientations should not be ruled out at the early stage.	High
Inclination	Solar panels are most effective when they are positioned facing the sun at a perpendicular angle at noon. The inclination angle varies considerably between winter and summer but for a fixed panel the best yield is achieved for an inclination of around 30-35 degrees to the horizontal. Horizontally mounted panels produce 30% less energy but panels can typically be inclined by 10% on a flat roof to optimise yields, roof area and wind loading.	High
Complexity of roof layout	Skylights, building plant and other projections on a roof can make the layout complex and unsuitable for PV, and therefore fewer and larger areas of roof are preferable in order to group panels together to reduce installation and other costs, and to avoid complications of connecting discrete panels located in different parts of the roof. Skylights and other projections can divide up the roof area into discrete parts.	High
Potential to consume electricity on-site	The use of generated electricity on site will enhance the financial benefit of each installation, because the grid export tariff is limited to 3p/kWh, whilst avoid electricity costs or sale price to tenants could be at least 10p/kWh. The building type provides an indication of the ability to consume electricity on site.	Medium
Access (maintenance / vandalism risk)	Although the panels will be roof-mounted, vandalism risk may be relatively high where buildings are accessible from outside, such as single storey buildings, or are not manned by security personnel, such as apartment blocks. Ease of access to the roof for external personnel will need to be examined as well as ease of access to the roof from the inside of the building for personnel to install and maintain and clean the PV panels.	Medium
Potential for awareness raising	The visibility of the PV or solar thermal panels on the roof, and energy generation display meters may enable awareness-raising of renewable energy technologies. For some sites, it may even be possible for the general public to visit parts of the installation.	Low

4 Analysis of opportunity potential

4.1 Data sources

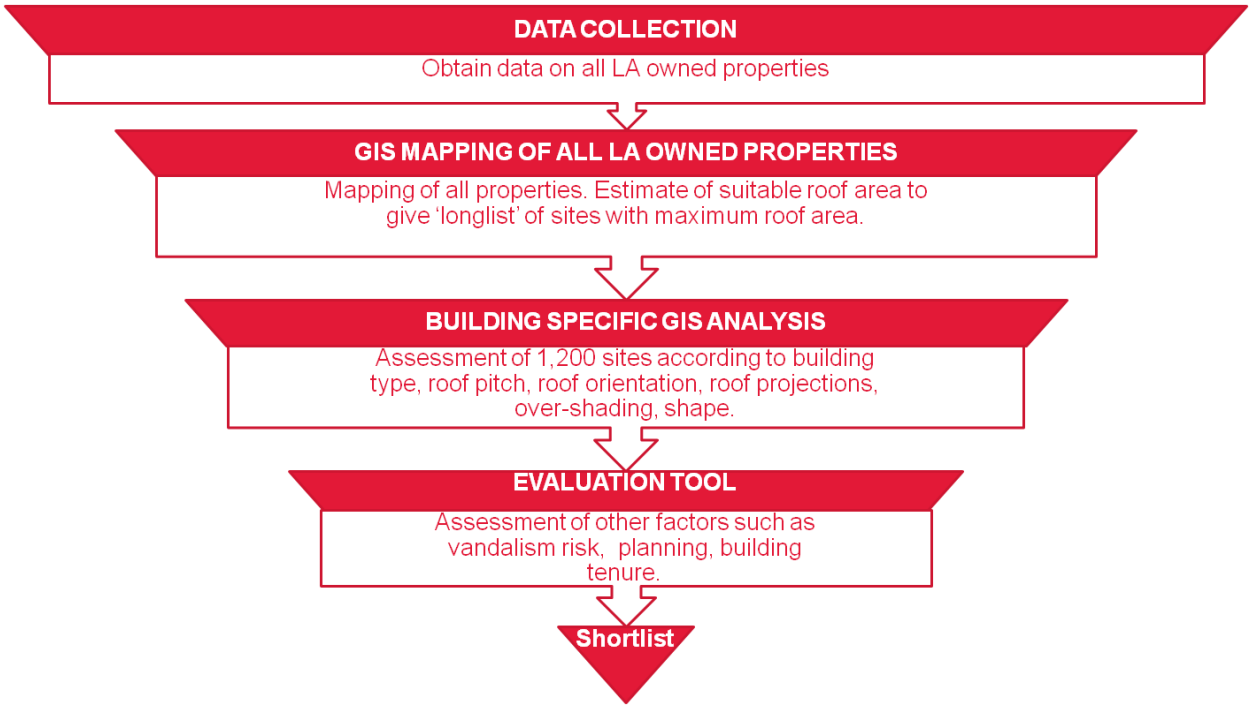
Building information has been obtained from the following sources:

- Council asset registers, listing non-residential properties
- Housing stock databases
- LLPG (Local Land and Property Gazetteer) databases, containing address details and grid coordinates of all properties within the study area
- Ordnance Survey MasterMap Topography layer. This GIS layer shows the accurate position and extent of practically all physical features on the landscape including buildings

4.2 Methodology

The diagram below summarises the process for analysing the opportunity potential in the assessment area.

Figure 4-1 Opportunity potential methodology



4.2.1 GIS mapping

Following collection of data from each borough on local authority owned buildings, GIS was used to map all buildings, and provide an estimate of roof area.

LLPG (Local Land and Property Gazetteer) data was used to plot (as points) all the properties listed in the council assets registers and housing stock databases. This point layer was then overlaid with OS MasterMap to select the buildings including council owned properties. It should be noted that, as a result of this approach, buildings only partially owned by the Council were also selected.

The footprint of the selected buildings, as per MasterMap, was calculated in GIS. Assuming that roof area correlates approximately to footprint area, the buildings were ranked based on their

footprint area and the top 1,200 were selected to create a 'longlist' of sites. All the buildings included in this selection have a roof area above 500m^2. The types of buildings selected range from blocks of flats to commercial buildings, of various sizes and complexity, to community buildings, such as schools and health centres.

4.2.2 Building specific GIS analysis

These prioritised sites were then analysed by a specialist GIS analysis company, Geo Information Group, which used Photo interpretation of aerial photography[3] and GIS functionality to carry out a detailed assessment of the solar potential for each of the sites on the longlist.

The methodology used to identify suitable areas and estimate solar potential is explained in detail in the Appendices.

The attributes assessed, and the corresponding categories were:

- Orientation – with respect to north
- Roof slope type – flat; low slope (10°–25°); sloped (>25°); complex (no single dominant roof component); no building on aerial imagery
- Area of suitable roof – for large complex buildings with multiple roof elements of different aspects and sizes, only the areas of the roof suitable for a full installation were considered in the analysis. A single roof element was considered suitable if its area exceeds 16m^2 and has an orientation between 90° and 270°. This was categorised into: suitable area for a solar panel installation almost certainly exists (minimum area 4 m x 4 m), with only a few minor features on the roof surface; possible area for a solar panel installation exists – may be too small or have too many roof features; no suitable area is judged to exist for an installation (less than 4x4m, or too many obstructions); no building on aerial imagery
- Shadow effects - likely building shadow; likely tree shadow; no apparent shadow effects; no building on aerial imagery
- Solar irradiance – this takes into account the slope and orientation of the roof, building height, and local topography, and is measured in Wh/m²; the solar radiation value calculated represents the maximum potential for a calendar year. It does not take into account weather effects or potential shadowing effects from surrounding buildings that may reduce the maximum potential value - these factors have been accounted for in the evaluation tool

These sites were used to populate the evaluation tool, in order to assess for other factors, such as risk of vandalism, planning issues and building tenure, and then develop the final shortlist of sites.

[3] *The aerial imagery used in the PI process was from the Cities Revealed London 2010 dataset, dated 23rd May 2010. The dataset has a 10cm resolution.*

5 Evaluation tool

The evaluation tool is primarily intended to 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.

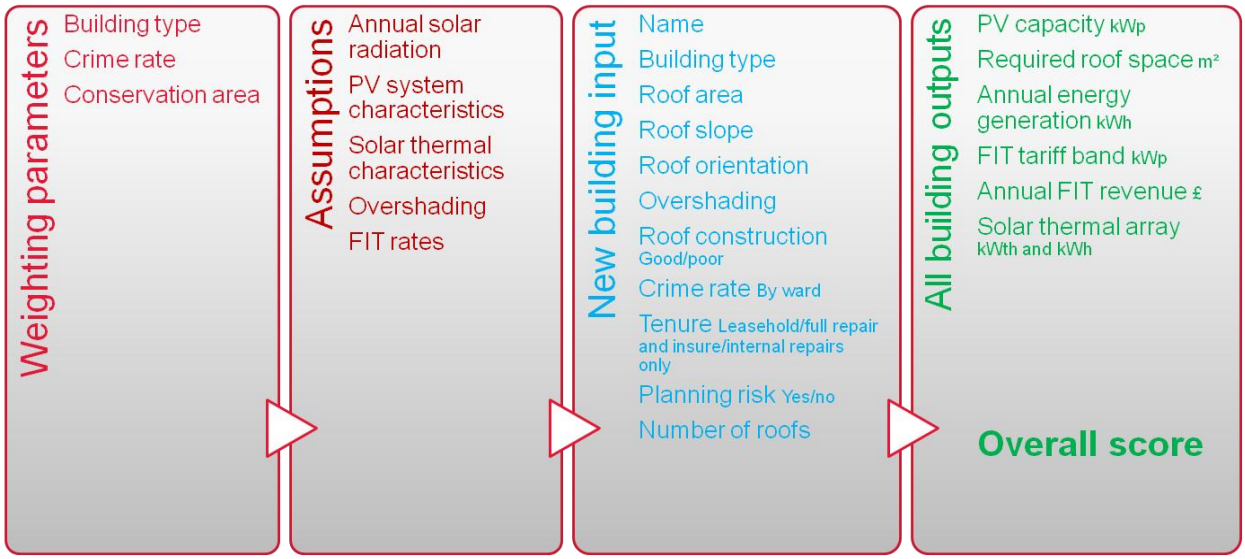
The tool is Excel based, and assesses each potential site against a number of scored criteria, described earlier in this report, with the highest scoring sites indicating the greatest potential. Each of the criteria is assigned a maximum potential score and a weighting, with an overall output score enabling the list of sites to be ranked according to PV potential.

The general structure of the tool is that input sheets match the format and resolution of available data, whilst the calculation sheets interpolate and extrapolate data to achieve the level of detail required in order to estimate PV potential.

The evaluation tool has been structured to allow sub-sets of data to be selected in order to appraise specific projects and/or a portfolio of buildings - for example selected on the basis of location or expected yield.

The structure of the tool is shown in the figure below.

Figure 5-1 Evaluation tool structure



The tool has two main tabs:

- New building input - this is intended for the entry of data for new buildings, and it works out the solar potential for each additional building
- All building outputs - this tab is used to show the results both for the buildings already modelled as part of this project, and any additional buildings added to the tool

Figure 5-2 New building input tab: building information entry

B	C	D	E	F	G	H	I	J
Address Details					Building Information			
TOID	Building Name	Address	Borough	Ward Name	Primary Use	Roof Construction	Tenure	Planning restrictions
1000000001	Example 1	Address	Borough	Camden: Bloomsbury	Cafe/Restaurant	Poor	Freehold	Yes
1000000002	Example 2	Address	Borough	Camden: Belsize	Care home/Day centre	Good	Internal repairs only lease	Yes
1000000003	Example 3	Address	Borough	Islington: Hillrise	Cafe/Restaurant	Good	Freehold	No

Figure 5-3 New building input tab: roof information entry

M	N	O	P	Y	Z	AA	AB	AK	AL	AM	AN
Roof space 1				Roof space 2				Roof space 3			
Roof Area (m²)	Slope (°)	Orientation	Overshading	Roof Area (m²)	Slope (°)	Orientation	Overshading	Roof Area (m²)	Slope (°)	Orientation	Overshading
52	0	South	No apparent shadow effects	52	30	South	No apparent shadow effects	52	0	South	No apparent shadow effects
37	0	SE/SW	Likely tree shadow	12	0	South	No apparent shadow effects	22	0	E/W	No apparent shadow effects
52	0	South	No apparent shadow effects	52	0	South	No apparent shadow effects	52	0	South	No apparent shadow effects

Figure 5-4 All building outputs tab: building attributes

B	C	D	E	F	G	H	I	J	K
SITE SPECIFIC INFORMATION									
TOID	Building Name	Address	Borough	Ward Name	Building Type	Roof Construction	Crime Rate	Tenure	Planning Constraints
					List	Good/Poor	Value	Select	Yes/No
1000001804860803	LARKSWOOD PRIMARY SCHOOL	NEW ROAD	WALTHAM FOREST		Schools/Nursery		178.35		No
1000001804866676	COLES PARK	WHITE HART LANE	HARINGEY		Schools/Nursery		194.09		No
1000001804869092	NEW EDMONTON LEISURE CENTRE	THE NEW EDMONTON L	ENFIELD		Leisure Centre		254.66		No
1000001804884095	VINCENT HOUSE - FLAT 11	0	ENFIELD		Housing		185.00		No
1000001804885893	FREDERICK BREMER SCHOOL	SIDDELEY ROAD	WALTHAM FOREST		Schools/Nursery		213.76		No
1000000001	Example 1	Address	Borough	Camden: Bloomsbury	Cafe/Restaurant	Poor	909.30	Freehold	Yes
1000000002	Example 2	Address	Borough	Camden: Belsize	Care home/Day centre	Good	129.64	Internal repairs only	Yes
1000000003	Example 3	Address	Borough	Islington: Hillrise	Cafe/Restaurant	Good	146.17	Freehold	No
0		0 0	0	0	0	0	0.00	0	0
0		0 0	0	0	0	0	0.00	0	0
0		0 0	0	0	0	0	0.00	0	0

Figure 5-5 All building outputs tab: technical outputs

L	M	N	O	P	Q	R	S
PV Array						Solar Thermal Array	
Total Size (kWp)	Required roof space (actual) m²	Number of roofs	Annual generation (kWh)	FIT Tariff bracket	Annual Revenue	Capacity (kWth)	Annual Generation (kWh)
144	1421.958241	1	105,607.64	50-150kW	£ 20,065.45	-	-
45	385.1876594	1	39,258.04	<50kW	£ 12,327.02	-	-
46	378	1	36,593.29	<50kW	£ 11,490.29	-	-
50	438.2	1	38,717.36	<50kW	£ 12,157.25	-	-
353	2848.3	1	187,480.80	150-250kW	£ 28,122.12	-	-
18		3	14,376.00	10-50kW	£ 4,514.06	-	-
4		0	4,612.80	<4kW	£ 1,905.09	94.36	78,453.60
18		3	13,838.40	10-50kW	£ 4,345.26	-	-

Figure 5-6 All building outputs tab: weighting characteristics

T	U	V	W	X	Y	Z	AA	AB
Normalised Values								Overall Score
Level of FIT Revenue (PV)	Number of Roofs (PV)	Solar Thermal Potential	Building Type score	Roof condition	Vandalism Risk score	Tenure	Planning Risk Score	
100	30	0	20	0	10	0	10	
0.25	1.00	0.50	0.67	0.00	1.00	0.00	1.00	88.8032409
0.16	1.00	0.50	0.67	0.00	1.00	0.00	1.00	78.98053359
0.15	1.00	0.50	1.00	0.00	1.00	0.00	1.00	84.58510572
0.15	1.00	0.50	0.33	0.00	1.00	0.00	1.00	72.09836797
0.36	1.00	0.50	0.67	0.00	1.00	0.00	1.00	99.02990276
0.06	0.40	0.50	0.67	0.00	0.33	0.00	0.00	34.3965547
0.02	0.00	1.00	0.67	1.00	1.00	0.00	0.00	25.75153825
0.06	0.40	0.50	0.67	1.00	1.00	0.00	1.00	50.84894843

Two further tabs are provided in which supporting data may be modified if required:

- Weighting parameters
- Assumptions

Weighting parameters are assigned as follows:

- Building type (high/medium/low) – dependent on site's ability to consume electricity on site, security and potential for awareness raising
- Crime rate – these are based on Home Office crime statistics by ward (total number of crimes divided by ward population); this is obviously a highly simplified way of considering this risk, and the risk of vandalism would need to be reviewed on a building by building basis
- Conservation area (yes/no) – for data analysed so far, sites located in conservation areas are deemed to have a planning risk; however, if further specific information is available for buildings, this should be taken into account

The assumptions tab covers technical and financial constraints, such as PV performance characteristics. It is considered unlikely that users would adjust these figures.

Cells which are not related to the analysis already carried out and can be adjusted are highlighted in purple.

The 'all building outputs' tab generates an overall score for each building. The list of buildings can then be ranked according to score to determine the sites with greatest potential.

6 Opportunity mapping shortlist

All of the 1,200 sites on the longlist have been plotted on a map using GIS to give a high level indication of the potential for PV across the six boroughs. This is shown in the figure below, with residential and non-residential defined, as well as the scale of possible PV installation. The map shows that the greatest concentration of sites is in the south of the assessment area, particularly Haringey, Camden and Islington. The lowest concentration of potential sites is in Enfield, particularly in the north-west of the borough. The majority of the sites analysed are residential properties – i.e. social housing.

Analysis of all longlisted sites is shown in the following graphs. Figure 6-1 shows the distribution of overall scores for sites – the top twenty sites score from 99 to 163, and therefore this highlights that these sites have the highest potential in terms of FIT revenue, and lowest risk in terms of vandalism and planning constraints.

Figure 6-1 Overall scoring distribution for longlisted sites

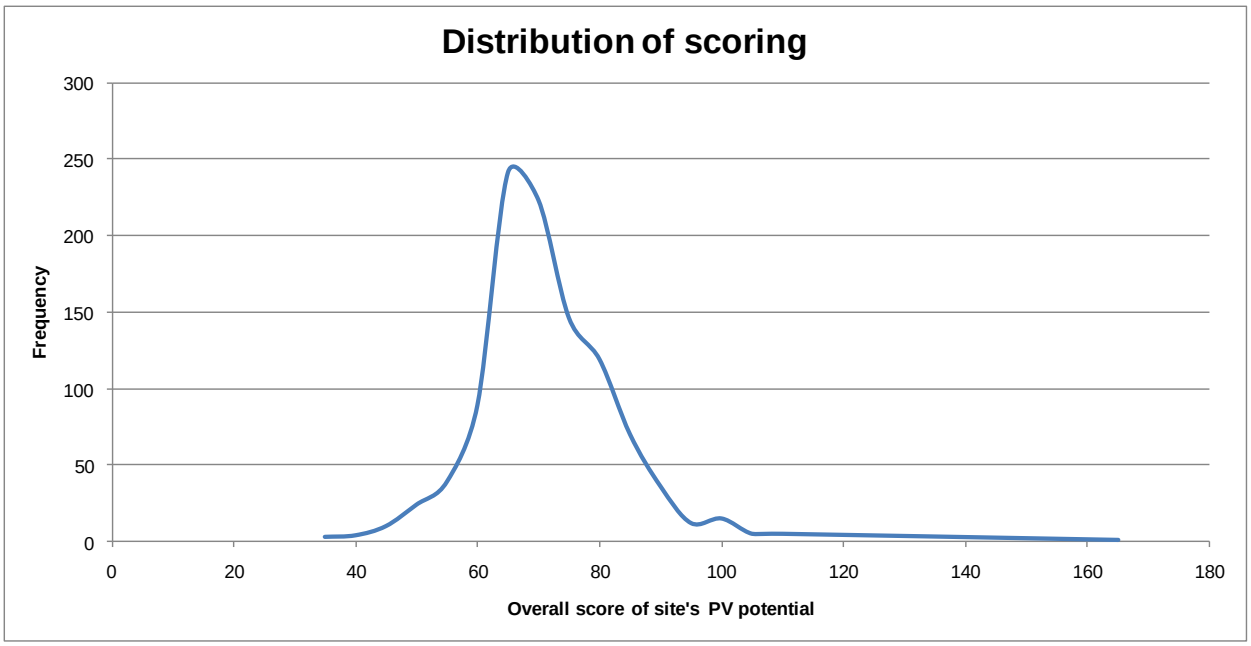
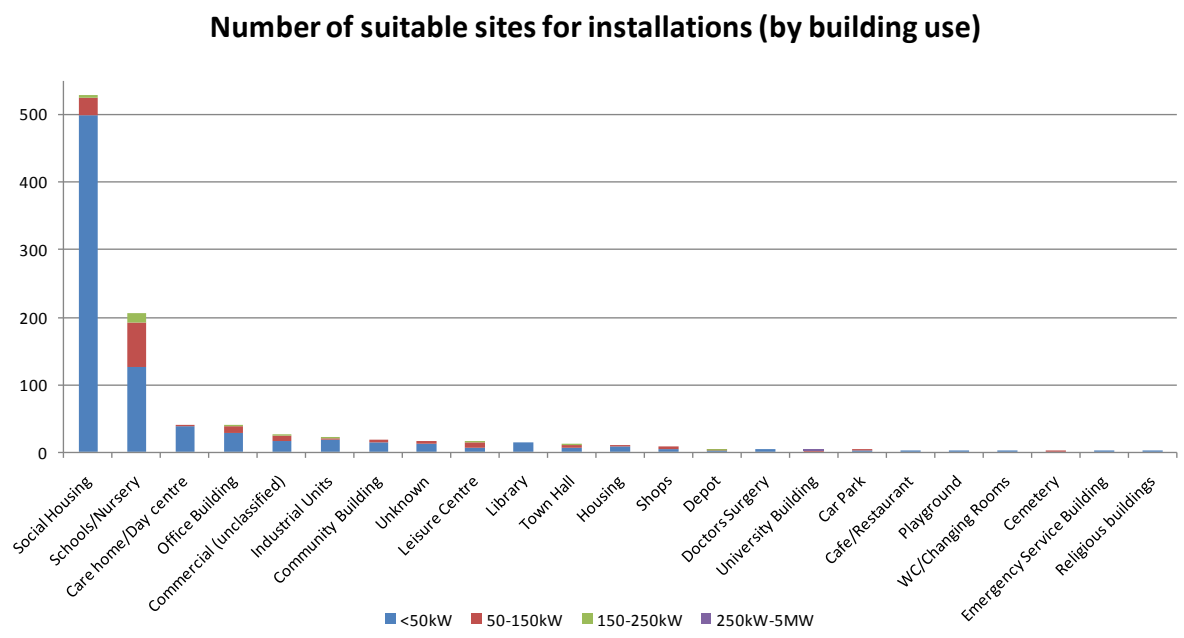


Figure 6-2 below shows that the majority of sites in the longlist are social housing and education, and the majority of PV capacities associated with these is <50kW.

Figure 6-2 Number of installations by FIT capacity and building type for longlisted sites

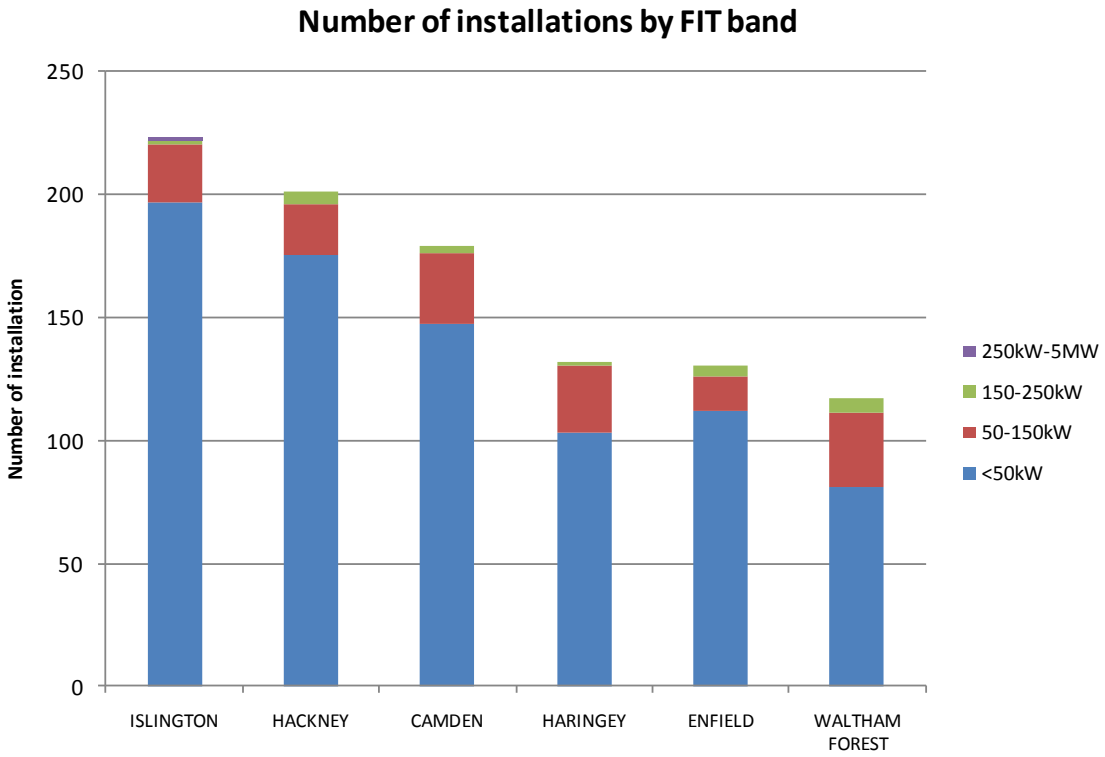


FIT - Generation tariff for PV		
Scale	**Proposed rate under consultation p/kWh**	**Original rate p/kWh**
≤4 kW retrofit	41.3	41.3
>4-10kW	36.1	36.1
>10 - 50kW	31.4	31.4
>50-100kW	19	31.4
>100-150kW	19	29.3
>150-250kW	15	29.3
>250kW - 5MW	8.5	29.3

Table 6-1: The generation tariff rates as stated in section 2.4.1

Figure 6-3 below shows that the majority of sites in the longlist are located in Islington, and the majority of PV capacities associated with these is <50kWp. Waltham Forest has the greatest number of installations between 50-150kWp and 150-250kWp. Figure 6-1 shows the different generation tariff bandings into which the PV installations have been classified.

Figure 6-3 Number of installations by FIT capacity and borough for longlisted sites



As described in the previous section of this report, the longlisted sites have been ranked according to their scoring, to give a shortlist consisting of the top twenty sites. These are shown in Table 6-2. The total PV capacity for these sites is around 4,780kWp, which is of the same order of magnitude as initially envisaged in the project brief. The total PV capacity for all sites analysed in the longlist is 52,170kWp. The shortlisted sites consist of a wide range of building types, from industrial to educational, to leisure, but the predominant building types are educational and industrial.

Figure 6-4, shown below, is an opportunity map showing potential across the boroughs, produced using GIS software. The greatest number of installations are in the >50kWp FIT bracket, but there are also a significant number of 50-150kWp systems. The highest concentration of installations lie in Islington, Hackney and Camden.

A table of satellite images for a selection of the top twenty sites is provided in the Appendices. This identified that some of the building type information provided is incorrect – the actual building type has been suggested in the table. Therefore, building type may need to be verified for sites of interest.

Figure 6-4 Opportunity map across north London boroughs

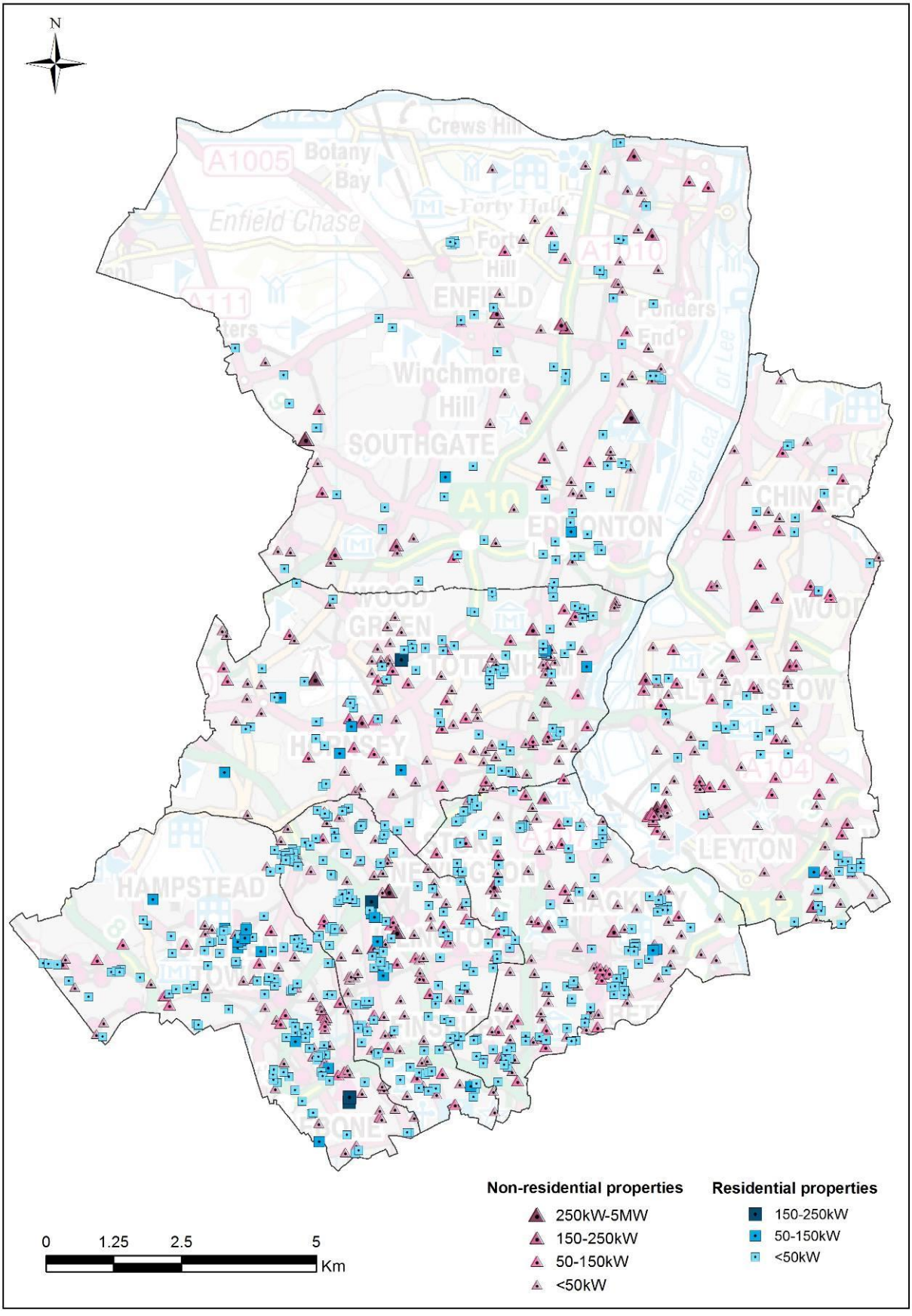


Table 6-2 Top twenty sites

PV potential ranking: top twenty										
Ranking	Building name	Address	Borough	Building type	Size (kWp)	Annual generation (kWh)	FIT tariff bracket	Annual revenue	Crime rate	Conservation area
1	Re-use and Recycle Centre	1 Cottage Road	Islington	Industrial Units	250	217,553	150-250kW	£ 32,633	189	No
2	Camley Street 106	106 Camley Street London Nw1 0pf	Camden	Commercial (unclassified)	250	197,541	150-250kW	£ 29,631	215	No
3	Former Hornsey Central Depot	High Street	Haringey	Depot	250	195,980	150-250kW	£ 29,397	154	No
4	Lea Valley High School - PFI	Lea Valley High School Bullsmoor Lane	Enfield	Schools/Nursery	250	226,323	150-250kW	£ 33,948	179	No
5	Britannia Leisure Centre	Hyde Road	Hackney	Leisure Centre	150	133,112	50-150kW	£ 25,291	225	No
6	Chestnuts park	St. Ann's Road	Haringey	Community Building	150	131,233	50-150kW	£24,934	169	No
7	Longshaw Primary School	Longshaw Road	Waltham Forest	Schools/Nursery	250	199,625	150-250kW	£ 29,944	150	No
8	Tower Building, Inc The Rocket & Graduate Centre	166-220 Holloway Road	Islington	University Building	630	513,884	250kW-5MW	£ 43,680	187	No
9	Rush Croft Sports College	Rushcroft Road	Waltham Forest	Schools/Nursery	250	194,293	150-250kW	£ 29,144	178	No
10	Va Schools - St. Annes Catholic High School For Girls (N13)	St. Annes Catholic Upper School (N13) Oakthorpe Road	Enfield	Schools/Nursery	221	192,844	150-250kW	£ 28,927	166	No

PV potential ranking: top twenty										
Ranking	Building name	Address	Borough	Building type	Size (kWp)	Annual generation (kWh)	FIT tariff bracket	Annual revenue	Crime rate	Conservation area
11	Lancasterian Primary School	King's Road	Haringey	Schools/Nursery	250	189,109	150-250kW	£ 28,366	279	No
12	Frederick Bremer School	Siddeley Road	Waltham Forest	Schools/Nursery	353	187,481	150-250kW	£28,122	214	No
13	Cathall Leisure Centre (Inc Offices At Rear)	441 Cathall Road	Waltham Forest	Leisure Centre	150	119,378	50-150kW	£22,682	198	No
14	Civic Centre	Civic Centre Silver Street	Enfield	Office Building	192	150,899	150-250kW	£22,635	119	No
15	Petchey Academy	135 Downs Park Road	Hackney	Schools/Nursery	250	202,661	150-250kW	£30,399	398	No
16	79, Camden Road	London NW1 9ES	Camden	Office Building	150	117,242	50-150kW	£22,276	239	No
17	Stoke Newington Secondary	Clissold Road	Hackney	Schools/Nursery	228	181,605	150-250kW	£27,241	164	No
18	7, York Way	York Way	Camden	Depot	126	112,110	50-150kW	£26,410	215	No
19	Kelmscott School	Markhouse Road	Waltham Forest	Schools/Nursery	208	176,066	150-250kW	£21,301	241	No
20	Broomfield Secondary School	Wilmer Way	Enfield	Schools/Nursery	220	174,462	150-250kW	£26,169	131	No

7 Training package

The purpose of the training package is to provide the cross borough steering group with the skills and understanding in how to use the evaluation tool, such that it can be applied to additional sites in the future. This will include an explanation of suggested methodologies to obtain the required data behind each of the criteria, such as ways to establish or estimate roof areas.

The training will be provided to the steering group, and any additional key personnel, as necessary. It will be given as a Powerpoint presentation, with copies made available to the attendees, and will cover the following:

- Background to solar renewables, including a policy update on the Feed In Tariff and Renewable Heat Incentive
- Overview of the design requirements for solar renewables
- Explanation of how the evaluation tool is used – this will include methodology flowcharts
- Explanation of how data can be collected where GIS functionality is not available
- Group exercise using case studies from the opportunities analysis which will be used as worked examples; we propose that if several computers can be made available, then the officers each carry out an exercise in order to reinforce the learning points and to prompt questions
- Discussion session on the use of the tool, facilitated by Camco, with questions and answers captured by Camco for circulation after the session.

8 Conclusions and next steps

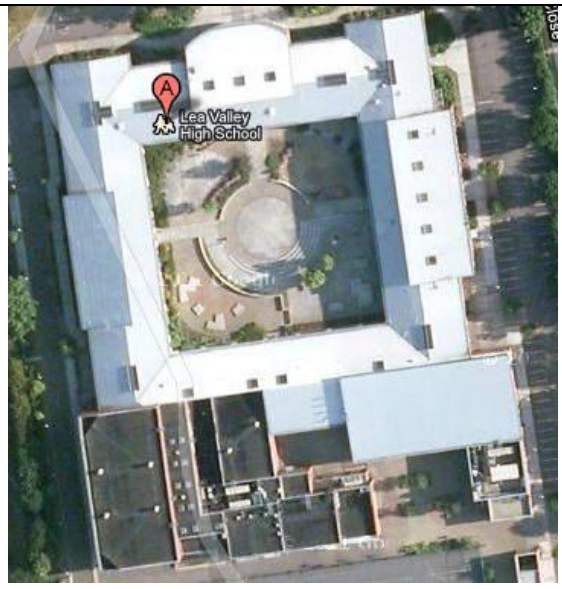
The analysis undertaken in this first work stream of the project has shown that there is enormous potential in the study area, and that this potential is spread across a range of building types and locations, although the greatest concentration is in the south of the assessment area.

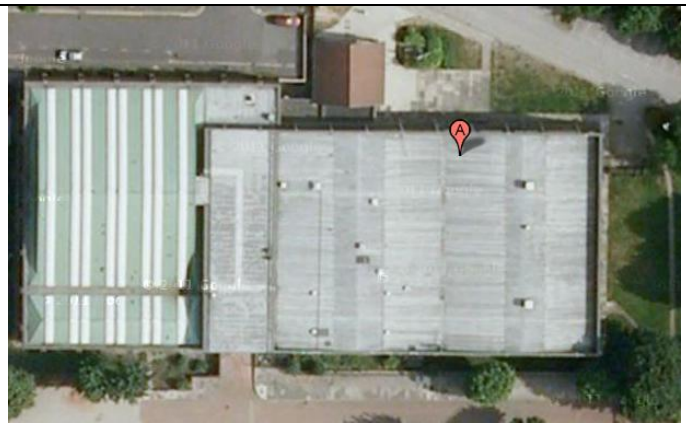
The total PV capacity identified in the longlisted sites is around 52MWp, and around 5kWp for the twenty shortlisted sites. The majority of the shortlisted sites are in the range 150-250kWp, with the potential to generates significant revenue from FIT. However, consideration will need to be given to the potential risk and uncertainty associated with the government's fast track review of installations over 50kWp.

The prioritisation of sites is dependent on both a high level analysis of technical potential, and a simplified means of assessing qualitative characteristics, such as risk of vandalism. Other information, such as tenancy and roof condition, was not included in the analysis of sites because this information was not available. Therefore, this should be taken into account when reviewing the results of this analysis, and further verification of site specific characteristics will be required.

As part of the next phase of work, the results of this analysis will be used to determine financial return for the key sites, as well as finance and delivery options analysis.

Appendix A: Satellite images of a selection of top twenty sites

PV potential ranking: top ten		
Ranking	**Building location**	**Aerial view**
1	Waste recycling centre 1, COTTAGE ROAD ISLINGTON N7 8TP Note: This is described as an animal home but Google Maps and the address point shows that this is a waste recycling centre	
2	106 CAMLEY STREET LONDON CAMDEN NW1 0PF	
3	Lea Valley High School ENFIELD EN3 6TW	

PV potential ranking: top ten		
4	Longshaw Primary School WALTHAM FOREST E4 6LH	
5	Chestnuts Park HARINGEY N15 5BN	
6	Britannia Leisure Centre HACKNEY N1 5JU	

Appendix B: Building specific GIS analysis – detailed methodology

Below is a detailed description of the photo interpretation process carried out by the GeoInformation Group as part of the building specific GIS analysis.

Solar potential for buildings

The solar potential is calculated based on an estimation of roof slope type and the aspect of a sloping roof. A flat roof is assumed to have a southerly aspect.

The roof slope type and the aspect are interpreted from an aerial photograph in a process called photo interpretation (PI). PI is not an accurate measurement but is a general interpretation of features into a particular class or group.

The solar radiation value provided is the maximum potential for a calendar year. It does not take into account weather effects which may reduce the maximum potential value.

The solar radiation is also affected by shadow effects from surrounding buildings or tall trees. Each building is given a code to indicate whether or not it is affected by shadow from one of these sources. The duration that a shadow impacts on a building will depend on exactly where the solar panels are installed and so is not included in the solar potential.

Source Data Used

For this project building footprint used was supplied by the client.

The aerial imagery used in the PI process was from the Cities Revealed London 2010 dataset, dated 23rd May 2010. The dataset has a 10cm resolution.

Types of Buildings

The types of buildings assessed ranged from blocks of flats, both tower blocks and point blocks to commercial buildings of various sizes and complexity and community buildings including schools and churches.

The roof types ranged from simple flat roofs through to complex roofs with multiple elements, some of which were sloping and with many different aspects.

Examples of the different roof types and the way they are classified are shown in Appendix 1.

Types of Information

Three types of information are collected during the photo interpretation process:

1. Aspect Line – the line representing the best aspect of a sloping roof
2. Roof slope type – flat, sloping or complex
   (Attribute name “Roof_Type”)
3. Suitable area – area suitable for solar panel installation (minimum area of approx 4 m x 4 m)
   (Attribute name “Suitable”)
4. Shadow effects – likelihood of shadow on the building
   (Attribute name “Shadow”)

Roof Slope Type

The roof slope type classification is as follows:

1. Flat
2. Low slope (10° – 25°)
3. Slope (25°+)
4. Complex – no single dominant roof component

9. No building on aerial imagery

Suitable Area

The suitable area classification is as follows:

1. Suitable area for a solar panel installation almost certainly exists (minimum area 4 m x 4 m), with only a few minor features on the roof surface.
2. Possible area for a solar panel installation exists – may be too small or have too many roof features.
3. No suitable area is judged to exist for an installation (less than 4 m x 4 m, or too many obstructions).
9. No building on aerial imagery

No judgement about roof materials is made, so the existence of a suitable area does not mean an installation can take place.

Aspect Line

Each building has at least one aspect line. For complex buildings there may be more than one (see below).

For a sloping roof, the angle of the aspect line lies along the ridgeline of the main slope element of the roof, which is the roof element on which the solar installation is most likely. For many roofs there are secondary slope elements, often at right angles to the main element which may also be suitable for a solar installation.

For flat roof elements, the angle of the aspect line is not significant.

Shadow effects

If the roof of the building is likely to be affected by a tall building or tall trees nearby this is coded as follows in the field ‘shadow’ as follows:

1. Likely building shadow
2. Likely tree shadow
4. No apparent shadow effects
9. No building on aerial imagery

No assessment is made of the duration that a shadow will affect the roof area.

Interpretation Rules

Where possible a single roof element is chosen, being the one most likely for a solar installation.

This is selected where it exists on the basis of being a slope, rather than flat, and having an aspect between 90° and 270° from north.

For large buildings with multiple aspects and complex roofs more than one aspect line might be added, for the user to make a more informed assessment.

Areas suitable for a full installation are judged based on the roof detail. Where there is a lot of small detail, like chimneys or air conditioning units, and it is not clear if a solar panel of a size 4 m by 4 m could be installed then the area class is reduced from 1 to 2.

Complex Buildings

For buildings with complex roof structures (multiple different roof elements) the process is as follows:

Where there is a single sloping roof element with an aspect between 90 and 270 which is large enough for a solar installation only one aspect line is captured.

Where there is a single sloping roof element with an aspect between 90 and 270 which MAY BE large enough for a solar installation one aspect line is captured unless there is also a large flat area, in which case a second line is captured.

Where there are various elements, both sloping and flat which may be suitable for an installation, the roof slope type code 4 is used and the suitability for a full installation or otherwise is indicated using the size class.

Maximum potential solar energy

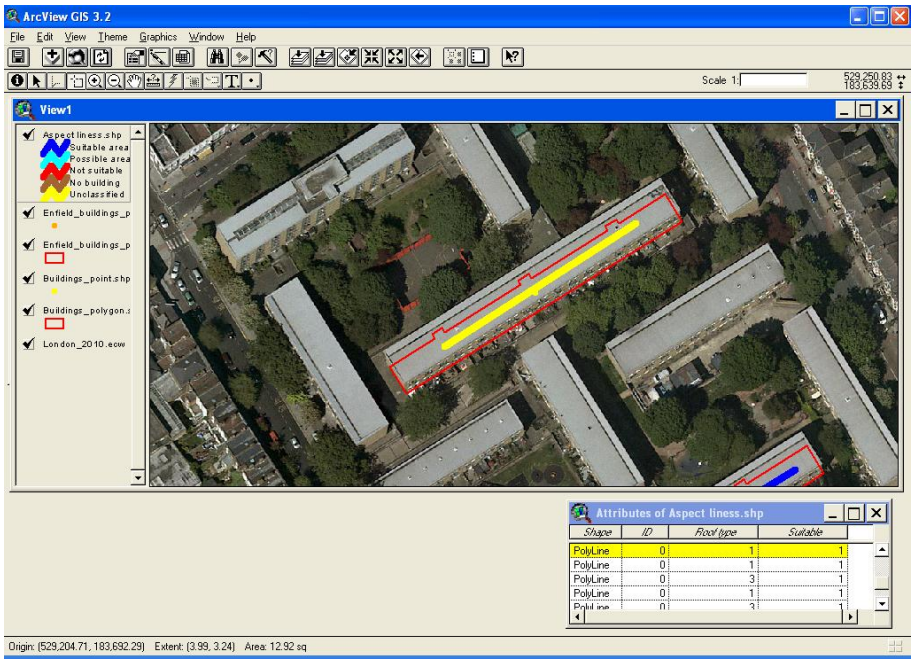
The total maximum potential solar irradiation falling on a one square metre horizontal surface is measured in watt hours per square metre (Wh/m^2).

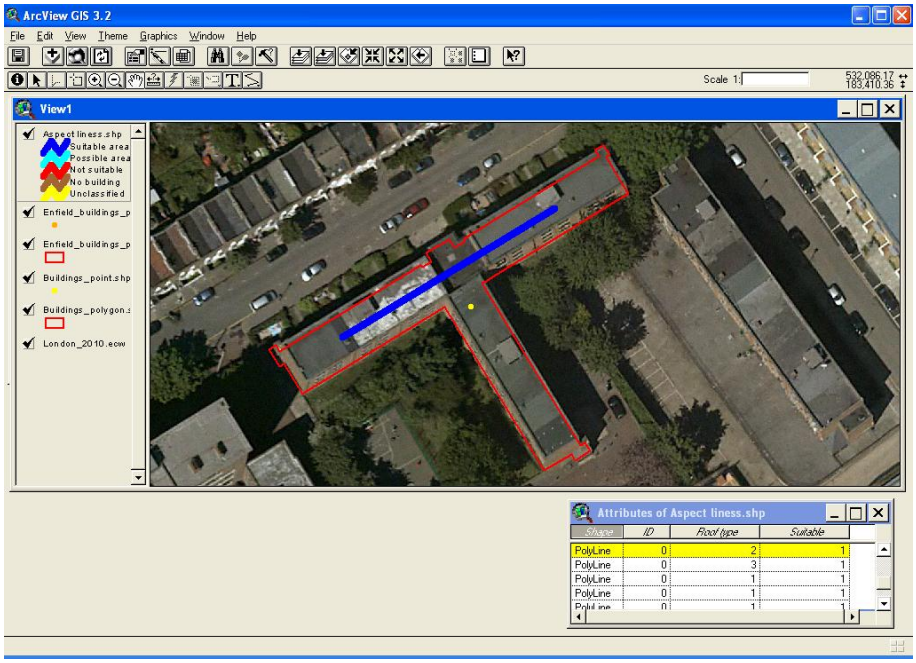
Total values for each month and a year total are provided in the table.

Examples of different roof types and how the aspect line is drawn

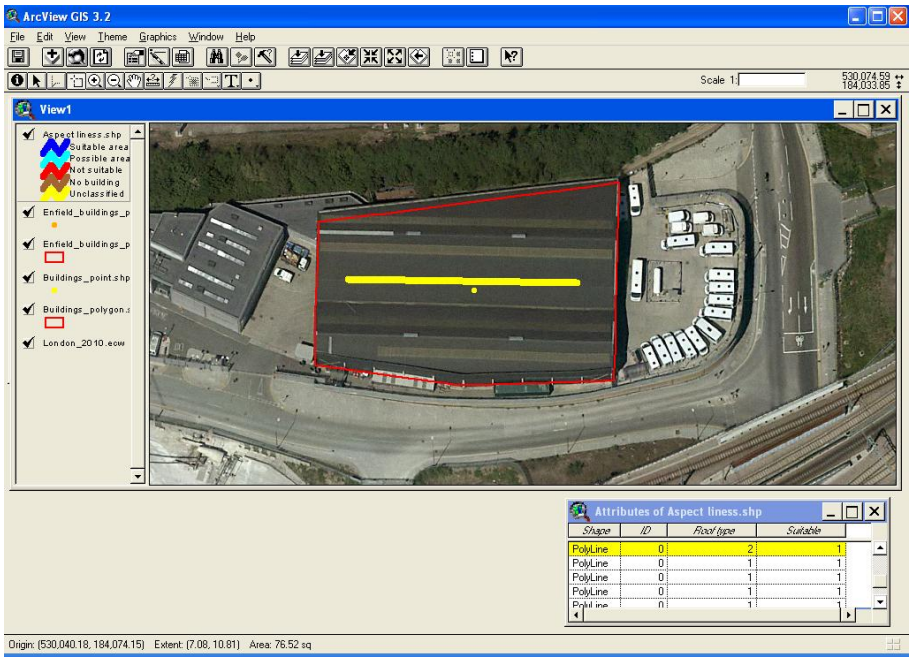
Roof Slope Type

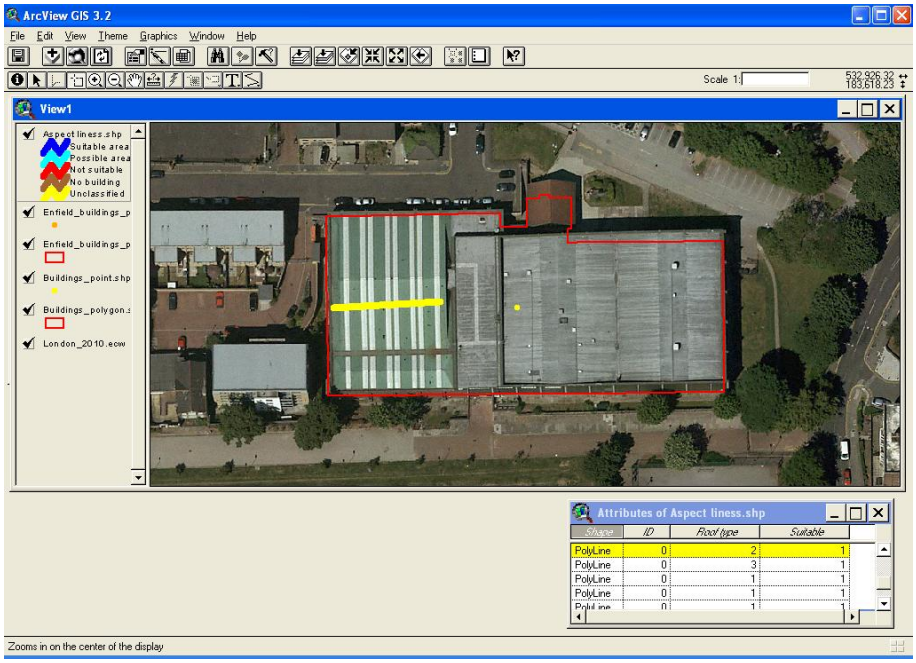
1. Flat



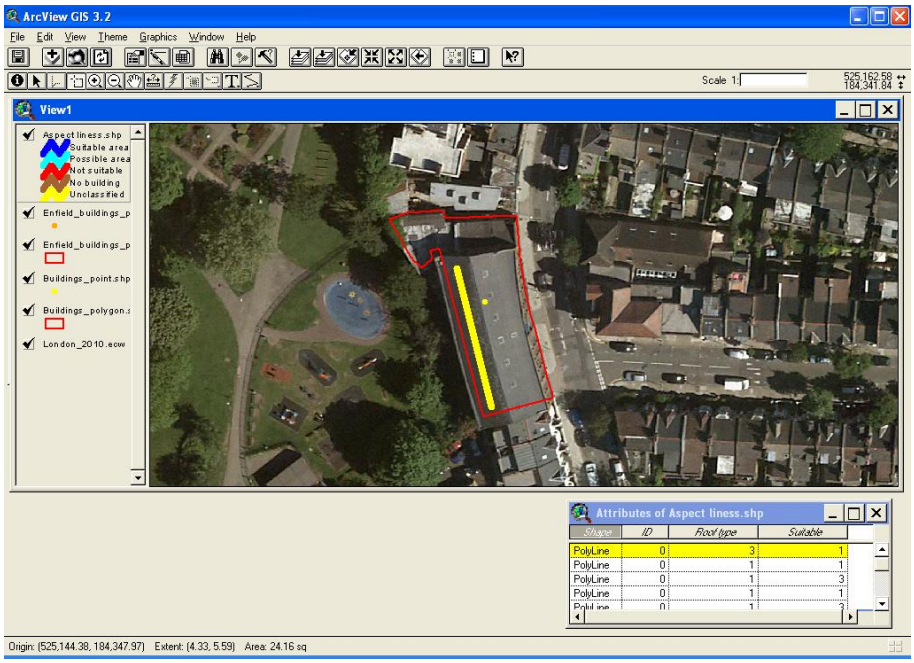


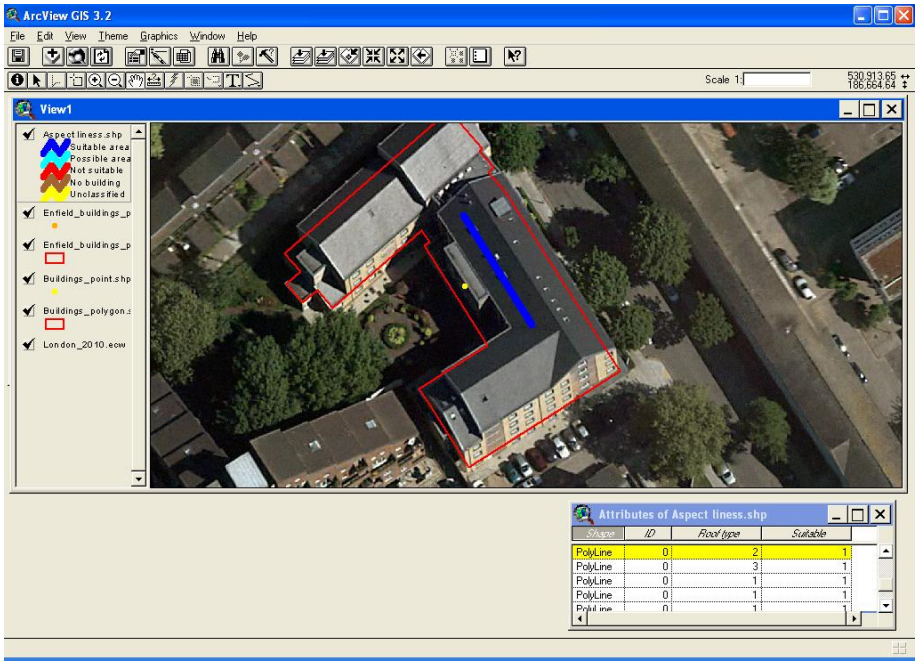
2. Low slope (10° – 25°)



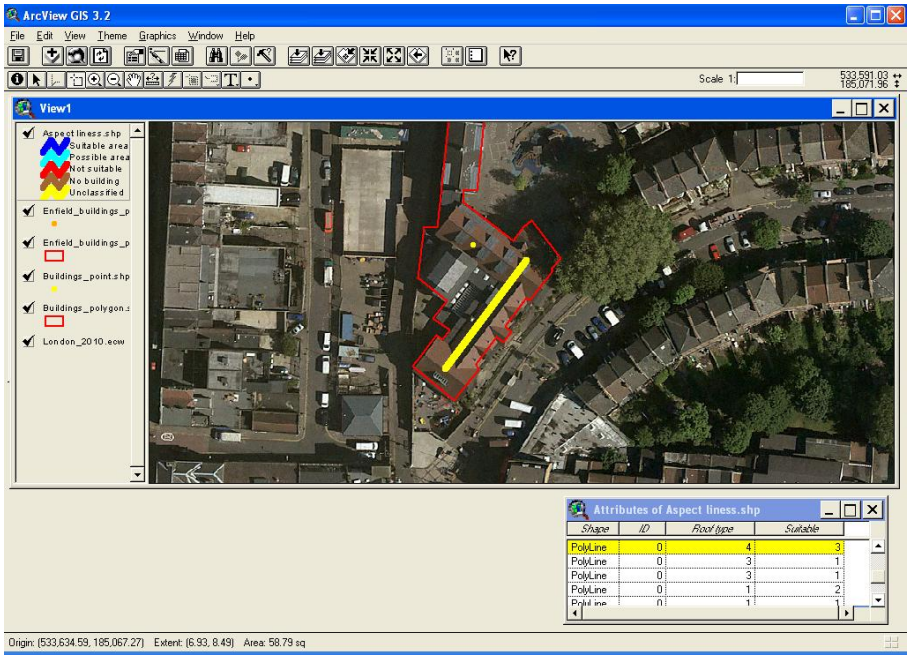


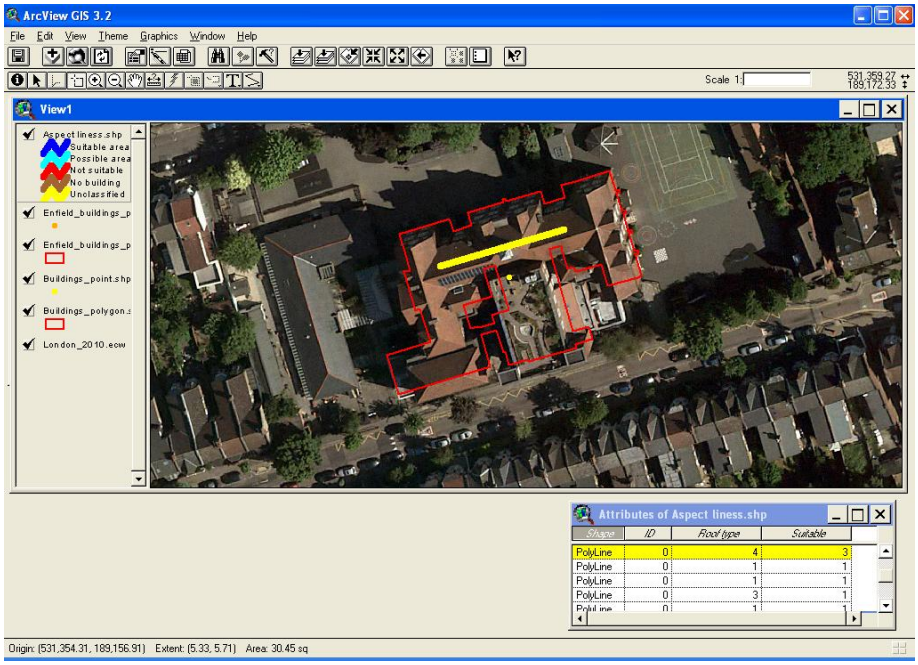
3. Slope (25°+)


ArcView GIS 3.2
File Edit View Theme Graphics Window Help
View1
Aspect liness.shp
Suitable area
Possible area
Not suitable
No building
Unclassified
Enfield_buildings_p
Enfield_buildings_p
Buildings_point.shp
Buildings_polygon.s
London_2010.ecw
Attributes of Aspect liness.shp
Shape ID Roof type Suitable
PolyLine 0 3 1
PolyLine 0 1 1
PolyLine 0 1 3
PolyLine 0 1 1
Origin: (525,144.38, 184,347.97) Extent: (4.33, 5.59) Area: 24.16 sq

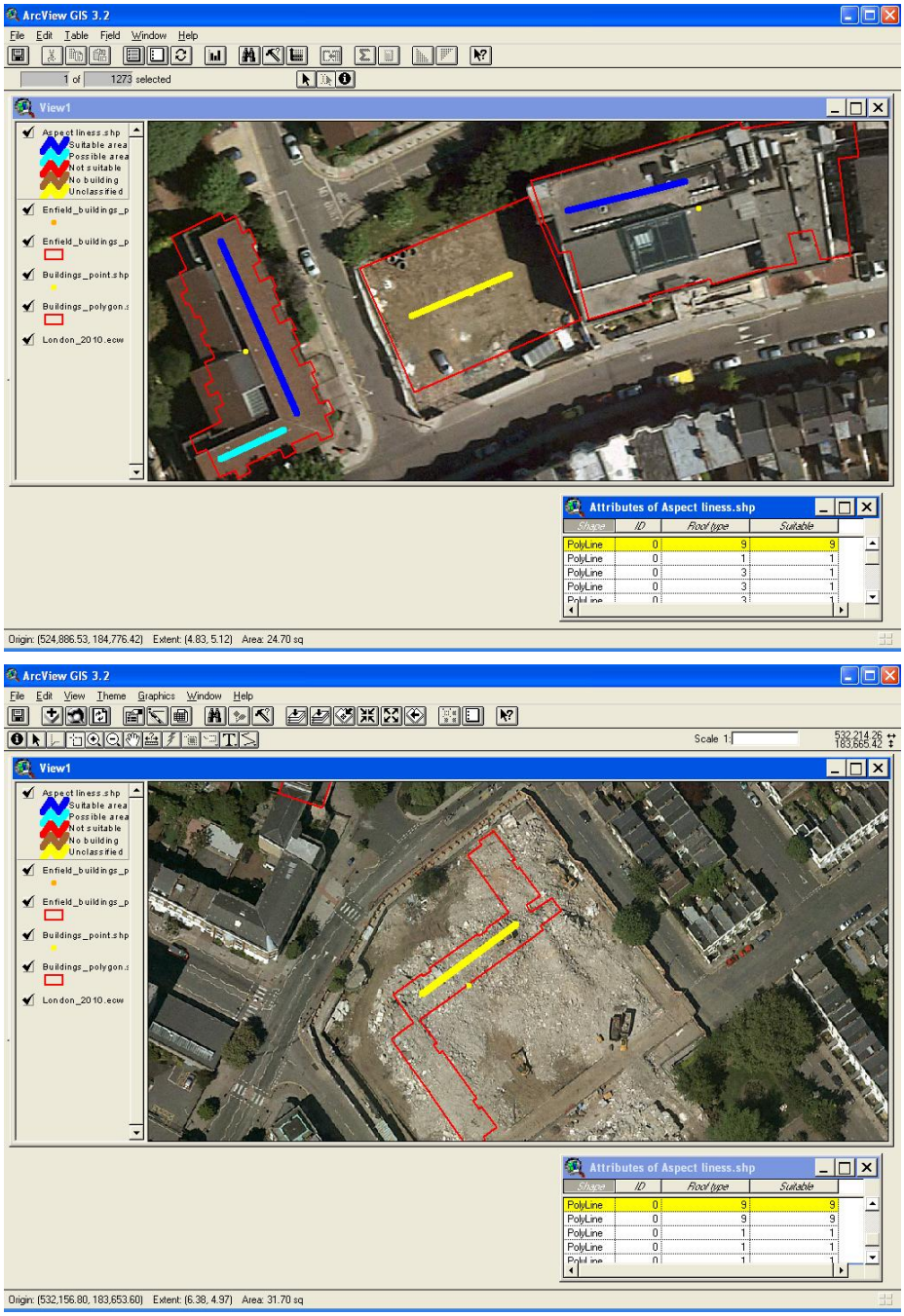

ArcView GIS 3.2
File Edit View Theme Graphics Window Help
View1
Aspect liness.shp
Suitable area
Possible area
Not suitable
No building
Unclassified
Enfield_buildings_p
Enfield_buildings_p
Buildings_point.shp
Buildings_polygon.s
London_2010.ecw
Attributes of Aspect liness.shp
Shape ID Roof type Suitable
PolyLine 0 2 1
PolyLine 0 3 1
PolyLine 0 1 1
PolyLine 0 1 1

4. Complex – no single dominant roof component



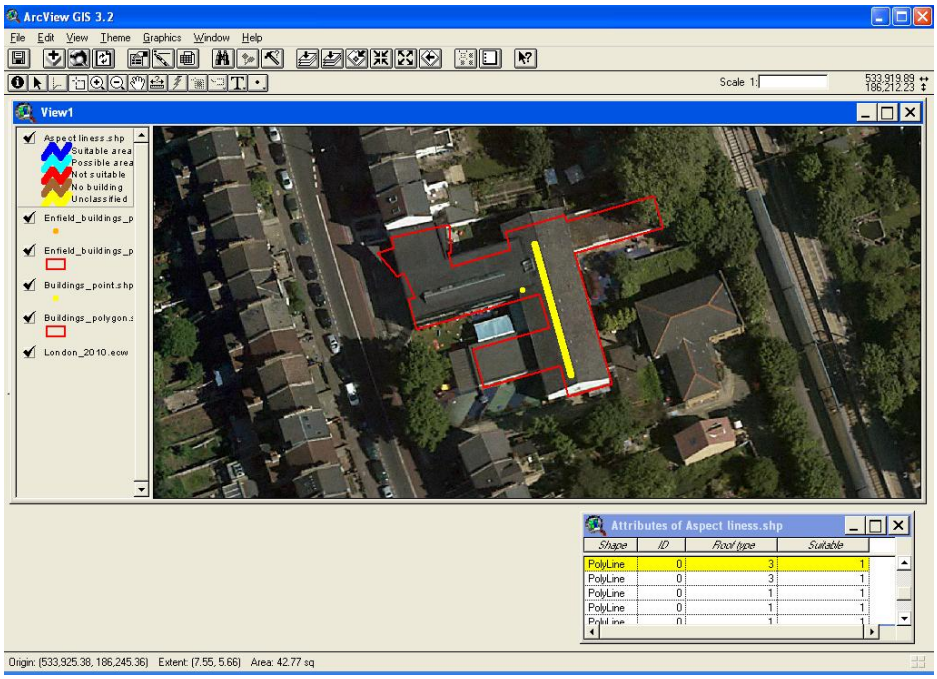


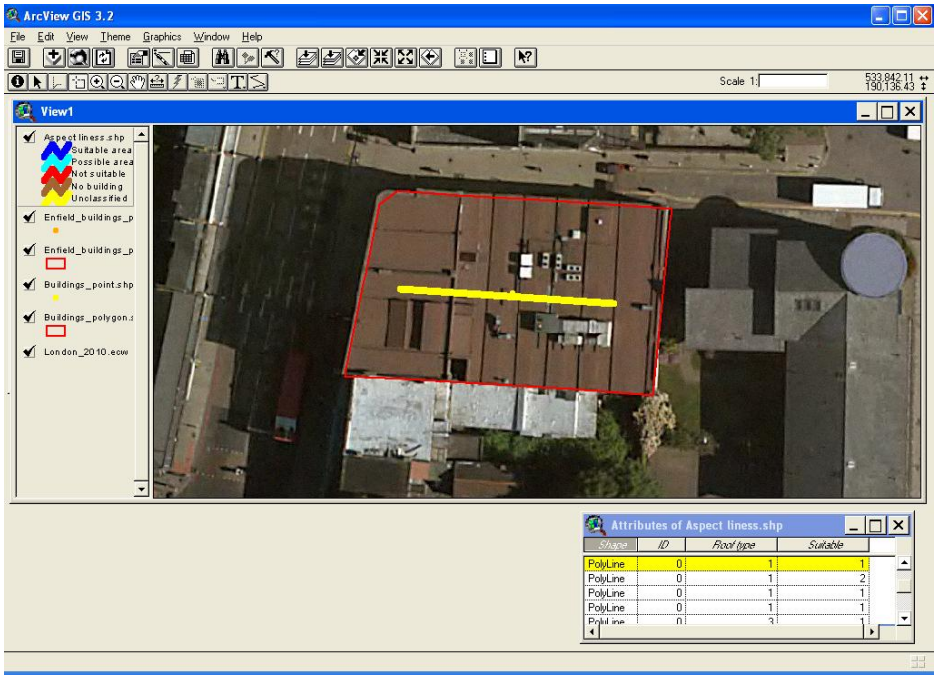
9. No building on aerial imagery



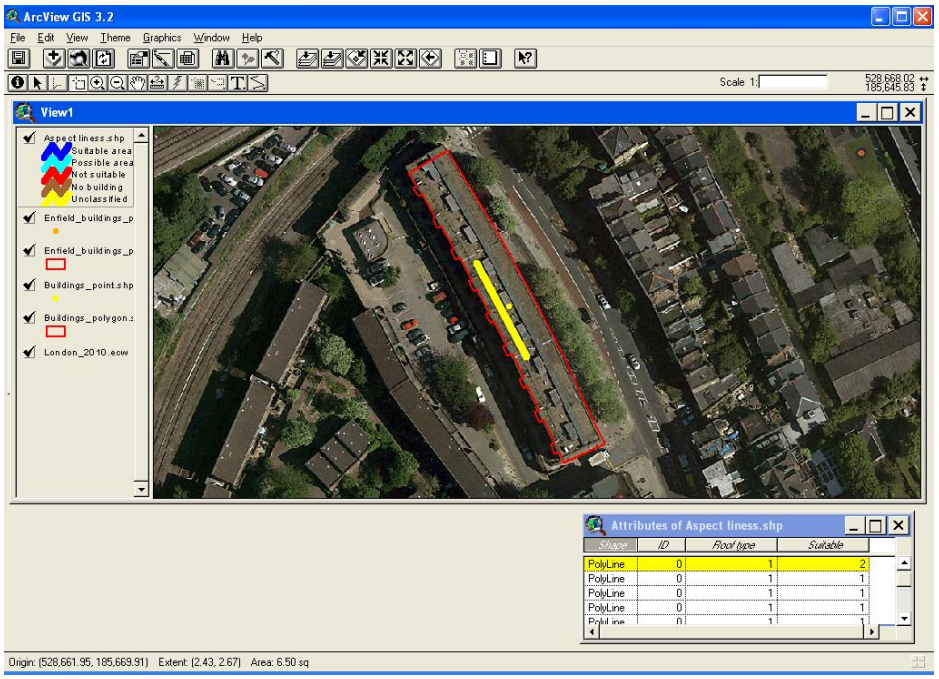
Suitable Area

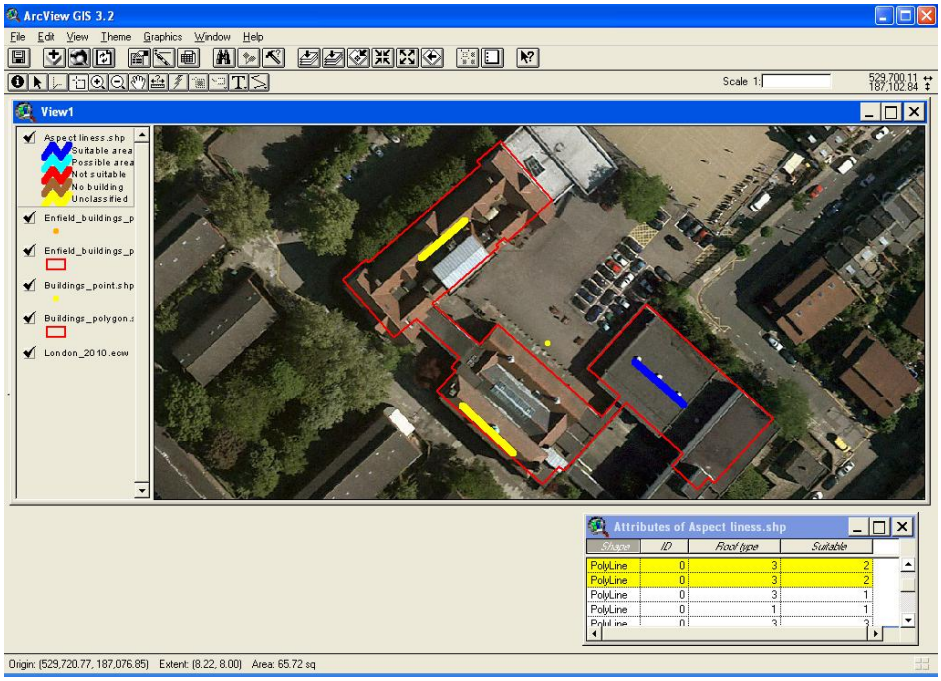
1. Suitable area for a solar panel installation almost certainly exists (minimum area 4 m x 4 m), with only a few minor features on the roof surface.



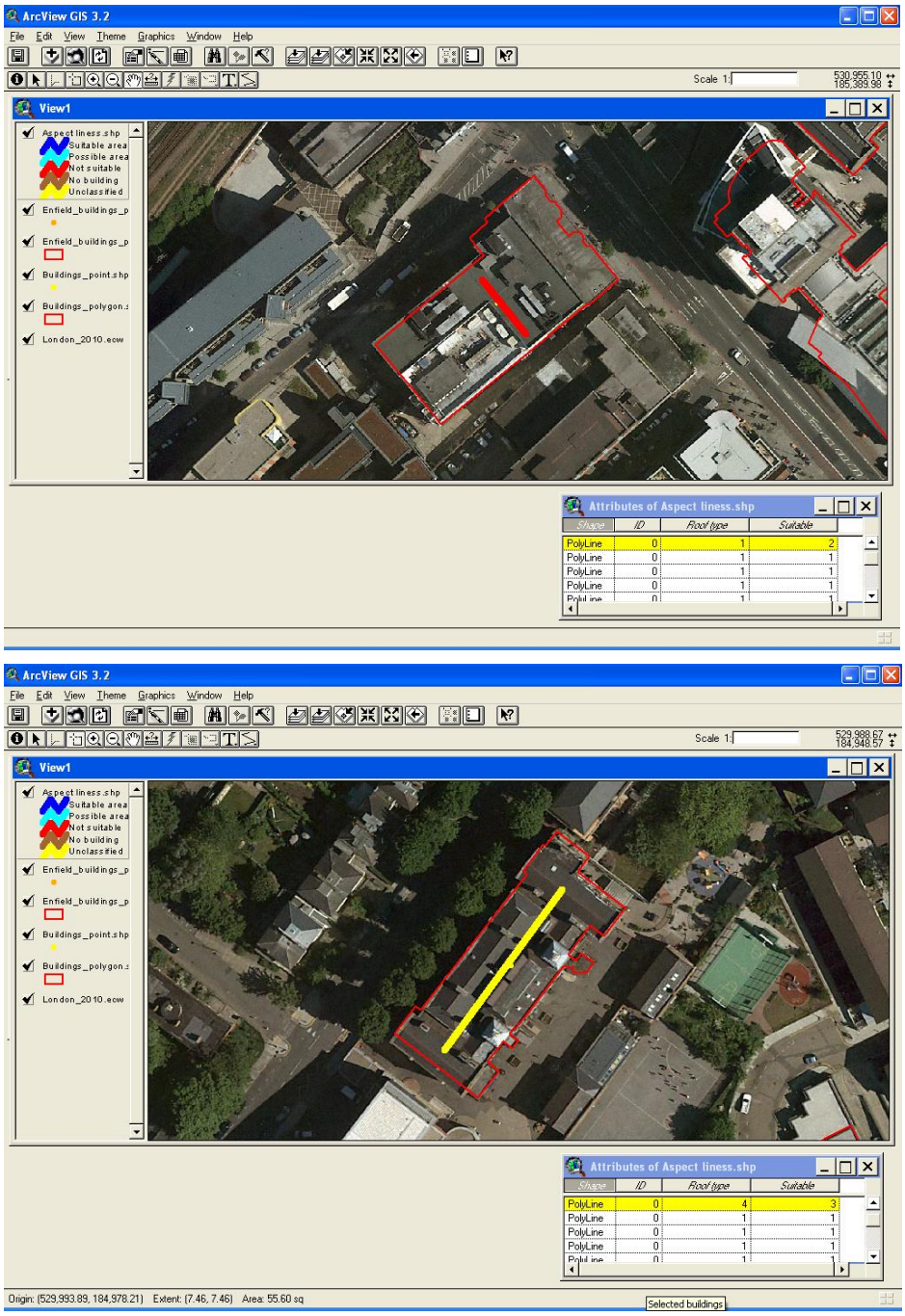


2. Possible area for a solar panel installation exists – may be too small or have too many roof features.



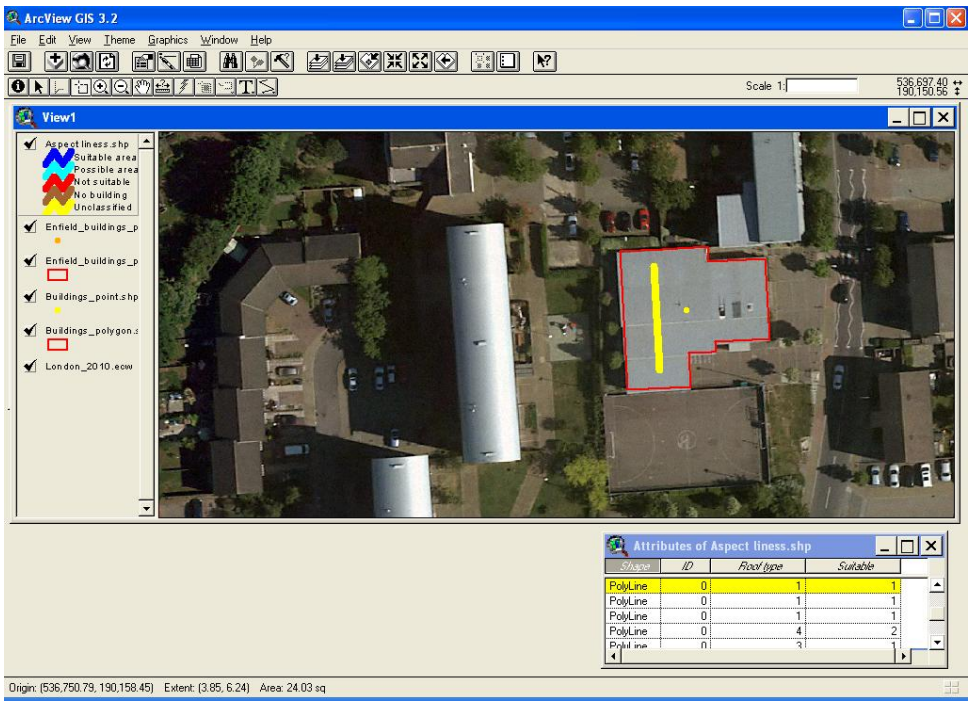


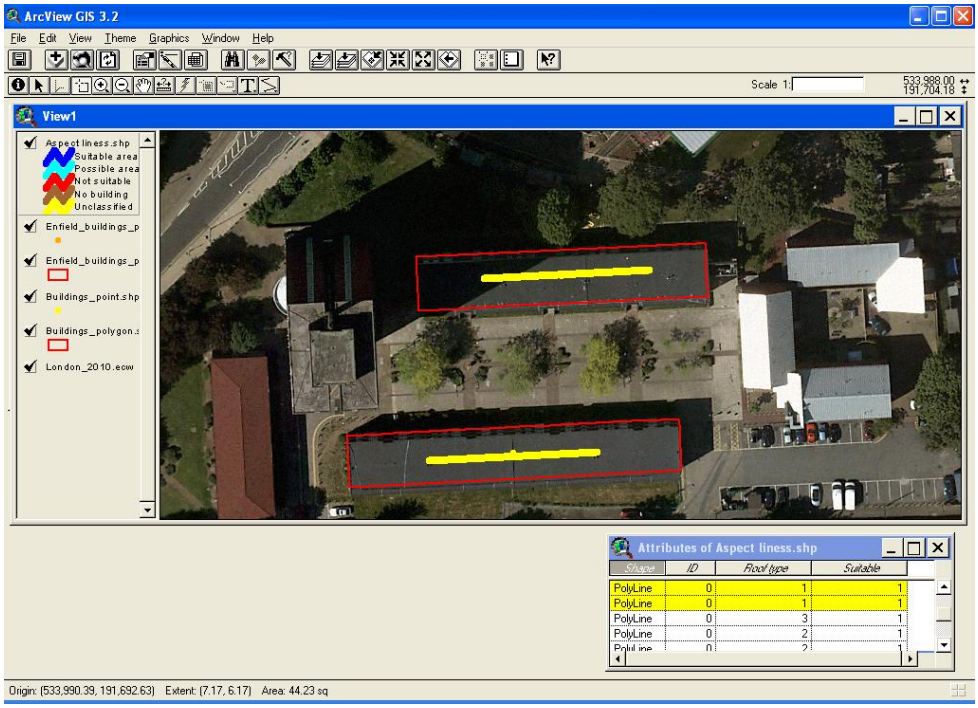
3. No suitable area is judged to exist for an installation (less than 4 m x 4 m, or too many obstructions).



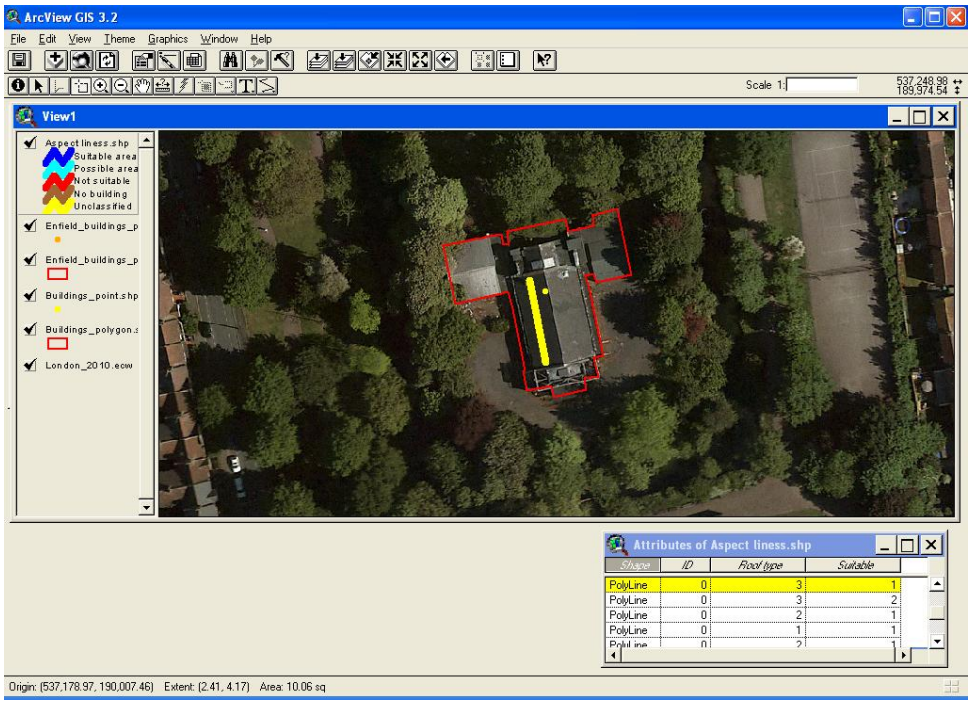
Shadow effects

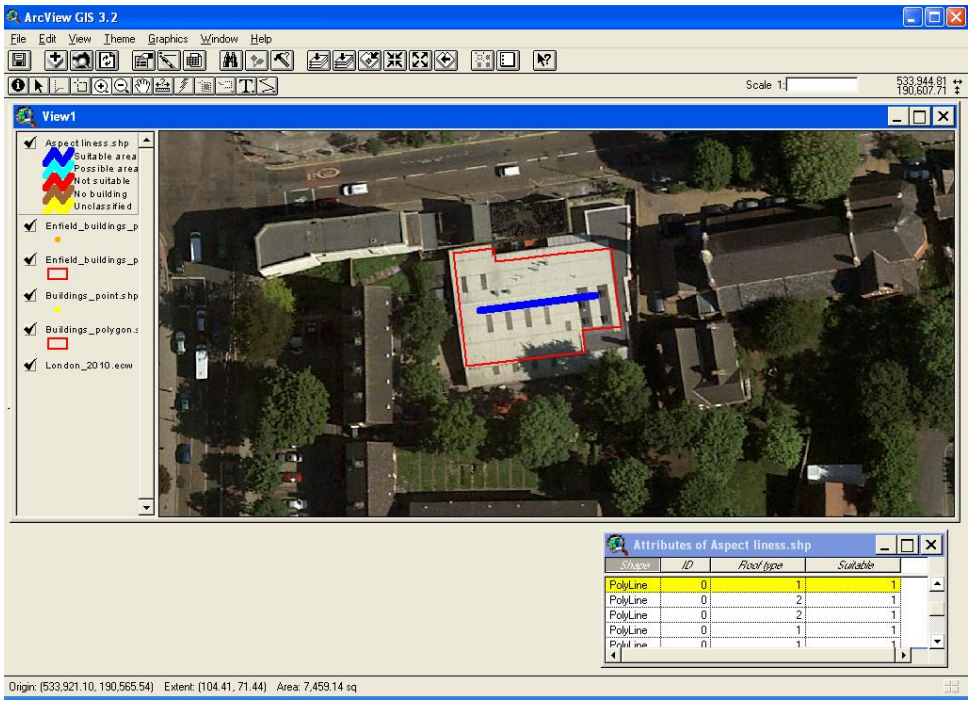
1. Likely building shadow



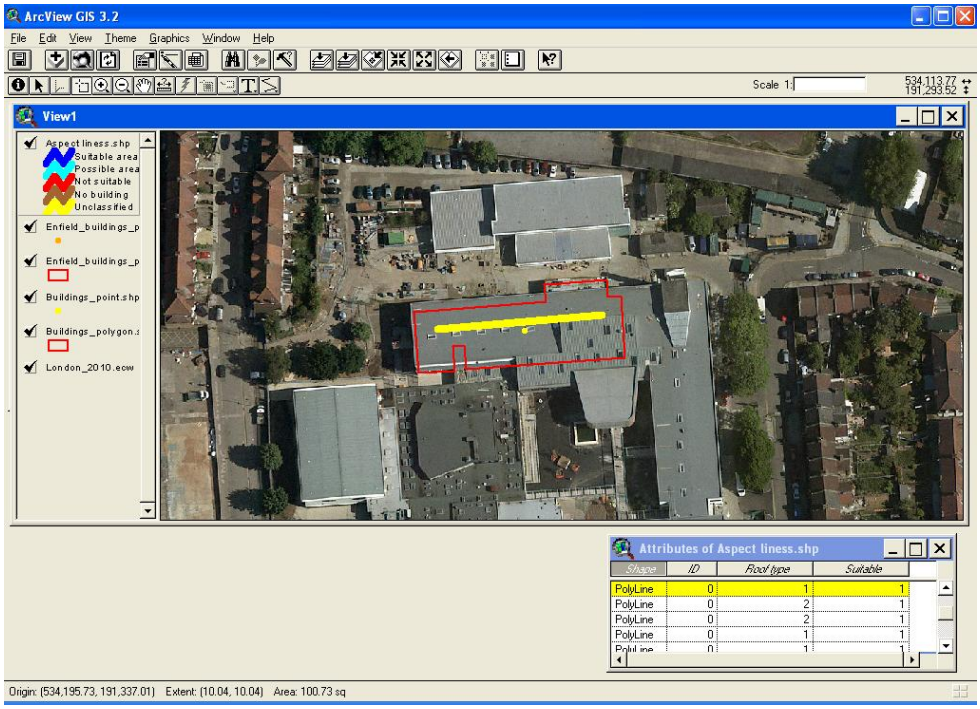


2. Likely tree shadow





3. No apparent shadow effects



Appendix C: Top twenty PV sites identified in each borough

Enfield: Top twenty sites for PV installations								
Address	Building Type	Crime Rate	Planning Constraints	Total Size	Annual generation	Annual carbon savings	FIT Tariff bracket	Annual FIT Revenue
	List	Value	Yes/No	kWp	kWh	$kgCO_2$		£
LEA VALLEY HIGH SCHOOL BULLSMOOR LANE	Schools/Nursery	179	No	250	226,323	119,725	150-250kW	£ 33,948
ST. ANNES CATHOLIC UPPER SCHOOL (N13) OAKTHORPE ROAD	Schools/Nursery	166	No	221	192,844	102,015	150-250kW	£ 28,927
CIVIC CENTRE SILVER STREET	Office Building	119	No	192	150,899	79,826	150-250kW	£ 22,635
BROOMFIELD SECONDARY SCHOOL WILMER WAY	Schools/Nursery	131	No	220	174,462	92,290	150-250kW	£ 26,169
WAVERLEY SCHOOL THE RIDE	Schools/Nursery	185	No	150	131,176	69,392	50-150kW	£ 24,923
OAKTHORPE PRIMARY SCHOOL TILE KILN LANE	Schools/Nursery	277	No	150	130,838	69,213	50-150kW	£ 24,859
RAGLAN INFANT SCHOOL WELLINGTON ROAD	Schools/Nursery	104	No	150	115,640	61,174	50-150kW	£ 21,972
LATYMER ALL SAINTS PRIMARY SCHOOL HYDETHORPE AVENUE	Schools/Nursery	255	No	150	114,079	60,348	50-150kW	£ 21,675
CHURCHFIELD PRIMARY SCHOOL LATYMER ROAD	Schools/Nursery	157	No	145	112,684	59,610	50-150kW	£ 21,410
BUSINESS INNOVATION CENTRE, INNOVA SCIENCE PARK ELECTRIC AVENUE	Office Building	148	No	92	82,406	43,593	50-150kW	£ 15,657
THE NEW EDMONTON LEISURE CENTRE THE BROADWAY	Leisure Centre	255	No	46	36,593	19,358	<50kW	£ 11,490
KEYS MEADOWS PRIMARY SCHOOL TYSOE AVENUE	Schools/Nursery	148	No	118	82,763	43,782	50-150kW	£ 15,725
ENFIELD LAWN TENNIS CLUB, 71 THE RIDGEWAY	Community Building	78	No	36	30,785	16,285	<50kW	£ 9,666
JOHN WILKES HOUSE	Office Building	185	No	37	29,704	15,714	<50kW	£ 9,327
ST. GEORGES CE PRIMARY SCHOOL	Schools/Nursery	179	No	50	44,207	23,386	<50kW	£ 13,881
SOUTHGATE SCHOOL	Schools/Nursery	104	No	50	43,827	23,184	<50kW	£ 13,762
COPPICE WOOD LODGE, 10 GROVE ROAD	Care home/Day centre	131	No	50	43,756	23,147	<50kW	£ 13,740
WORCESTERS SCHOOL	Schools/Nursery	140	No	93	71,758	37,960	50-150kW	£ 13,634
RAGLAN JUNIOR SCHOOL	Schools/Nursery	104	No	50	43,294	22,903	<50kW	£ 13,594
HONEYSUCKLE HOUSE, 1A OAKTHORPE ROAD	Care home/Day centre	166	No	50	42,935	22,713	<50kW	£ 13,482

Camden: Top twenty sites for PV installations								
Address	Building Type	Crime Rate	Planning Constraints	Total Size	Annual generation	Annual carbon savings	FIT Tariff bracket	Annual FIT Revenue
	List	Value	Yes/No	kWp	kWh	$kgCO_2$		£
106 CAMLEY STREET LONDON NW1 0PF	Commercial (unclassified)	215	No	250	197,541	104,499	150-250kW	£ 29,631
79 CAMDEN ROAD LONDON NW1 9ES	Office Building	239	No	150	117,242	62,021	50-150kW	£ 22,276
7 YORK WAY LONDON N7 9QG	Depot	215	No	126	112,110	59,306	50-150kW	£ 21,301
SWISS COTTAGE SPORTS CENTRE ADELAIDE ROAD LONDON NW3 3	Leisure Centre	185	No	150	106,068	56,110	50-150kW	£ 20,153
CLIFTON HOUSE 93 EUSTON ROAD LONDON NW1 2R	Office Building	276	No	109	84,194	44,539	50-150kW	£ 15,997
43 CAROL STREET LONDON NW1 0HT	Commercial (unclassified)	758	No	138	107,369	56,798	50-150kW	£ 20,400
DEANE HOUSE, GREENWOOD PLACE. LONDON NW5	Commercial (unclassified)	260	No	91	71,390	37,765	50-150kW	£ 13,564
319200 65 MAYGROVE ROAD (INCL LAND TO THE RE	Commercial (unclassified)	140	No	89	70,513	37,301	50-150kW	£ 13,397
SITE F5 104 CAMLEY STREET LONDON NW1 0PF	Commercial (unclassified)	215	No	90	70,462	37,274	50-150kW	£ 13,388
CAMDEN TOWN HALL JUDD STREET LONDON WC1H 9JE	Office Building	276	Yes	137	110,830	58,629	50-150kW	£ 21,058
FLAT 1, 78 HOLMES ROAD, LONDON, NW5 3AP	Social Housing	260	No	150	119,891	63,422	50-150kW	£ 22,779
306667 68 CHALTON STREET	Commercial (unclassified)	215	No	45	38,423	20,326	<50kW	£ 12,065
SWISS COTTAGE SCHOOL AVENUE ROAD LONDON NW3	Schools/Nursery	185	No	117	86,874	45,957	50-150kW	£ 16,506
32 LAWN ROAD LONDON NW3	Commercial (unclassified)	149	No	50	35,247	18,646	<50kW	£ 11,068
TALACRE SPORTS CENTRE, PRINCE OF WALES ROAD LONDON NW5	Leisure Centre	231	No	150	117,664	62,244	50-150kW	£ 22,356
SITE F4, 102CAMLEY STREET LONDON NW1 0PF	Commercial (unclassified)	215	No	41	33,114	17,517	<50kW	£ 10,398
161A GRAFTON ROAD LONDON NW5	Social Housing	149	No	137	109,855	58,113	50-150kW	£ 20,872
23 PAKENHAM STREET LONDON WC1X OLB	Commercial (unclassified)	276	No	49	32,120	16,991	<50kW	£ 10,086
13 WELLESLEY ROAD, LONDON, NW5 4PN	Social Housing	149	No	139	107,680	56,963	50-150kW	£ 20,459
326500 131A WEEDINGTON ROAD	Social Housing	149	No	133	106,655	56,420	50-150kW	£ 20,264

Hackney: Top twenty sites for PV installations								
Address	Building Type	Crime Rate	Planning Constraints	Total Size	Annual generation	Annual carbon savings	FIT Tariff bracket	Annual FIT Revenue
	List	Value	Yes/No	kWp	kWh	$kgCO_2$		£
BRITANNIA LEISURE CENTRE HYDE ROAD	Leisure Centre	225	No	150	133,112	70,416	50-150kW	£ 25,291
PETCHEY ACADEMY 135 DOWNS PARK ROAD	Schools/Nursery	398	No	250	202,661	107,208	150-250kW	£ 30,399
STOKE NEWINGTON SECONDARY CLISSOLD ROAD	Schools/Nursery	164	No	228	181,605	96,069	150-250kW	£ 27,241
YESODEY HATORAH	Schools/Nursery	175	No	203	156,961	83,033	150-250kW	£ 23,544
TYSSEN SCHOOL, OLDHILL STREET	Schools/Nursery	139	No	147	115,163	60,921	50-150kW	£ 21,881
BENTHAL INFANTS & JUNIORS, BENTHAL ROAD	Schools/Nursery	212	No	150	111,877	59,183	50-150kW	£ 21,257
263 MARE STREET	Town Hall	321	No	107	83,974	44,422	50-150kW	£ 15,955
GRAZEBROOK PRIMARY SCHOOL, LORDSHIP ROAD	Schools/Nursery	130	No	145	108,437	57,363	50-150kW	£ 20,603
ANDREWS ROAD	Depot	321	No	50	43,871	23,208	<50kW	£ 13,775
19-24 MARE STREET	Unknown	321	No	129	98,511	52,112	50-150kW	£ 18,717
SPRINGFIELD PRIMARY SCHOOL, CASTLEWOOD ROAD	Schools/Nursery	139	No	120	93,536	49,481	50-150kW	£ 17,772
KELTAN HOUSE, 89-115 MARE STREET	Town Hall	321	No	50	39,412	20,849	<50kW	£ 12,375
JUBILEE PRIMARY SCHOOL, FILEY AVENUE	Schools/Nursery	139	No	118	88,030	46,568	50-150kW	£ 16,726
QUEENSBRIDGE SPORTS & COMMUNITY CENTRE, 30 HOLLY STREET	Leisure Centre	321	No	50	36,358	19,233	<50kW	£ 11,416
275 MARE STREET	Town Hall	292	No	204	154,294	81,621	150-250kW	£ 23,144
SHACKLEWELL PRIMARY SCHOOL, SHACKLEWELL ROW	Schools/Nursery	398	No	133	98,600	52,159	50-150kW	£ 18,734
KINGS HALL LEISURE CENTRE, 39 LOWER CLAPTON ROAD	Leisure Centre	303	Yes	203	122,838	64,981	150-250kW	£ 18,426
SPRINGFIELD	Depot	139	No	41	32,766	17,333	<50kW	£ 10,289
70/72/72A DE BEAUVOIR CRESCENT	Unknown	225	No	93	81,502	43,115	50-150kW	£ 15,485
HACKNEY TOWN HALL, MARE STREET	Town Hall	292	No	147	114,367	60,500	50-150kW	£ 21,730

Haringey: Top twenty sites for PV installations								
Address	Building Type	Crime Rate	Planning Constraints	Total Size	Annual generation	Annual carbon savings	FIT Tariff bracket	Annual FIT Revenue
	List	Value	Yes/No	kWp	kWh	$kgCO_2$		£
FORMER HORNSEY CENTRAL DEPOT, HIGH STREET	Depot	154	No	250	195,980	103,673	150-250kW	£ 29,397
CHESTNUTS PARK, ST. ANN'S ROAD	Community Building	169	No	150	131,233	69,422	50-150kW	£ 24,934
LANCASTERIAN PRIMARY SCHOOL, KING'S ROAD	Schools/Nursery	279	No	250	189,109	100,038	150-250kW	£ 28,366
WOMENS & CHILDRENS CENTRE, SOMERFORD GROVE	Community Building	279	No	127	96,303	50,944	50-150kW	£ 18,298
HORNSEY SCHOOL FOR GIRLS, INDERWICK ROAD	Schools/Nursery	154	No	150	120,844	63,926	50-150kW	£ 22,960
ALEXANDRA PARK SCHOOL, BIDWELL GARDENS	Schools/Nursery	140	No	150	120,328	63,654	50-150kW	£ 22,862
HIGHGATE WOOD UPPER SCHOOL, MONTENOTTE ROAD	Schools/Nursery	205	No	150	118,556	62,716	50-150kW	£ 22,526
PARK VIEW ACADEMY, LANGHAM ROAD	Schools/Nursery	175	No	150	117,618	62,220	50-150kW	£ 22,347
TIVERTON PRIMARY SCHOOL, PULFORD ROAD	Schools/Nursery	196	No	150	113,091	59,825	50-150kW	£ 21,487
KINGFISHER PLACE, CLARENDON ROAD OFF COBURG ROAD	Industrial Units	455	No	114	87,922	46,511	50-150kW	£ 16,705
ASHLEY ROAD DEPOT, ASHLEY ROAD	Industrial Units	271	No	86	67,355	35,631	50-150kW	£ 12,797
GARMAN ROAD INDUSTRIAL AREA, 67-75 GARMAN ROAD	Industrial Units	279	No	50	39,582	20,939	<50kW	£ 12,429
APEX HOUSE 820 SEVEN SISTERS ROAD	Office Building	282	No	50	39,203	20,738	<50kW	£ 12,310
GARMAN ROAD INDUSTRIAL AREA, 77-79 GARMAN ROAD	Industrial Units	279	No	50	39,177	20,724	<50kW	£ 12,301
FERRY LANE PRIMARY SCHOOL, JARROW ROAD	Schools/Nursery	271	No	122	89,591	47,393	50-150kW	£ 17,022
ROKESLY JUNIOR SCHOOL, ROKESLY AVENUE	Schools/Nursery	154	No	116	88,918	47,037	50-150kW	£ 16,894
ENTERPRISE ROW RANGEMOOR ROAD	Industrial Units	282	No	47	36,371	19,240	<50kW	£ 11,420
23 SOUTH GROVE	Industrial Units	169	No	38	33,288	17,609	<50kW	£ 10,452
GARMAN ROAD INDUSTRIAL AREA, 63 GARMAN ROAD	Industrial Units	279	No	41	31,500	16,664	<50kW	£ 9,891
14 LYMINGTON AVENUE	Shops	455	No	115	93,486	49,454	50-150kW	£ 17,762

Islington: Top twenty sites for PV installations								
Address	Building Type	Crime Rate	Planning Constraints	Total Size	Annual generation	Annual carbon savings	FIT Tariff bracket	Annual FIT Revenue
	List	Value	Yes/No	kWp	kWh	$kgCO_2$		£
RE-USE AND RECYCLE CENTRE	Industrial Units	189	No	250	217,553	115,085	150-250kW	£ 32,633
TOWER BUILDING, INC THE ROCKET & GRADUATE CENTRE, 166-220 HOLLOWAY ROAD	University Building	187	No	630	513,884	271,845	250kW-5MW	£ 43,680
CALLY POOL, 299 CALEDONIAN ROAD	Leisure Centre	276	No	123	96,341	50,964	50-150kW	£ 18,305
THE ZONE, HOLLOWAY SCHOOL	Schools/Nursery	208	No	150	121,003	64,011	50-150kW	£ 22,991
HERTSLET RD FOR	Social Housing	385	No	250	199,895	105,745	150-250kW	£ 29,984
NEWINGTON GREEN PRIMARY, MATTHIAS ROAD	Schools/Nursery	187	No	148	115,516	61,108	50-150kW	£ 21,948
SCIENCE CENTRE, 29 HORNSEY ROAD	University Building	187	No	145	114,692	60,672	50-150kW	£ 21,791
LEARNING CENTRE, 236-250 HOLLOWAY ROAD	University Building	187	No	133	111,671	59,074	50-150kW	£ 21,217
BRIDE ST-LIVERPOOL RD	Schools/Nursery	519	No	146	118,814	62,852	50-150kW	£ 22,575
6-40 HOLLOWAY ROAD	Office Building	182	No	97	76,163	40,290	50-150kW	£ 14,471
HIGHBURY QUADRANT PRIMARY HIGHBURY NEW PARK	Schools/Nursery	187	No	134	96,383	50,987	50-150kW	£ 18,313
4-10 NORTH ROAD	Office Building	189	No	50	40,020	21,170	<50kW	£ 12,566
FORTUNE PARK MORELAND ST	Schools/Nursery	475	No	150	106,678	56,433	50-150kW	£ 20,269
ISLINGTON TOWN HALL, UPPER STREET	Office Building	519	Yes	150	120,376	63,679	50-150kW	£ 22,871
292 ESSEX ROAD	Office Building	213	No	50	39,194	20,734	<50kW	£ 12,307
40-60 BREWERY ROAD	Office Building	276	No	47	36,059	19,075	<50kW	£ 11,322
ARCHWAY LEISURE, MACDONALD ROAD	Leisure Centre	246	No	50	36,003	19,046	<50kW	£ 11,305
HUGH MYDDELTON PRIMARY, MYDDLETON STREET	Schools/Nursery	444	No	133	99,889	52,841	50-150kW	£ 18,979
EDEN GRO 11	Social Housing	189	No	137	112,377	59,447	50-150kW	£ 21,352
72 BREWERY ROAD	Office Building	276	No	41	32,872	17,389	<50kW	£ 10,322

Waltham Forest: Top twenty sites for PV installations								
Address	Building Type	Crime Rate	Planning Constraints	Total Size	Annual generation	Annual carbon savings	FIT Tariff bracket	Annual FIT Revenue
	List	Value	Yes/No	kWp	kWh	$kgCO_2$		£
LONGSHAW PRIMARY SCHOOL, LONGSHAW ROAD	Schools/Nursery	150	No	250	199,625	105,601	150-250kW	£ 29,944
RUSH CROFT SPORTS COLLEGE, RUSHCROFT ROAD	Schools/Nursery	178	No	250	194,293	102,781	150-250kW	£ 29,144
FREDERICK BREMER SCHOOL, SIDDELEY ROAD	Schools/Nursery	214	No	353	187,481	99,177	150-250kW	£ 28,122
CATHALL LEISURE CENTRE (INC OFFICES AT REAR), 441 CATHALL ROAD	Leisure Centre	198	No	150	119,378	63,151	50-150kW	£ 22,682
KELMSCOTT SCHOOL, MARKHOUSE ROAD	Schools/Nursery	241	No	208	176,066	93,139	150-250kW	£ 26,410
HALL LANE CAR PARK, 21-31 HALL LANE	Car Park	332	No	150	121,163	64,095	50-150kW	£ 23,021
24 RIGG APPROACH	Industrial Units	307	No	106	91,883	48,606	50-150kW	£ 17,458
HANDSWORTH PRIMARY SCHOOL, HANDSWORTH AVENUE	Schools/Nursery	150	No	150	117,956	62,399	50-150kW	£ 22,412
HILLYFIELD PRIMARY SCHOOL, HIGHAM HILL ROAD	Schools/Nursery	196	No	150	117,770	62,300	50-150kW	£ 22,376
WALTHAMSTOW TOWN HALL, 701 FOREST ROAD	Town Hall	214	No	125	90,104	47,665	50-150kW	£ 17,120
KELMSCCOTT LEISURE CENTRE, 243 MARKHOUSE ROAD	Leisure Centre	241	No	100	87,010	46,028	50-150kW	£ 16,532
SELWYN PRIMARY SCHOOL, 102 CAVENDISH ROAD	Schools/Nursery	163	No	125	109,743	58,054	50-150kW	£ 20,851
BROOKFIELD HOUSE SCHOOL, ALDERS AVENUE	Schools/Nursery	163	No	137	105,687	55,908	50-150kW	£ 20,080
LARKSWOOD PRIMARY SCHOOL	Schools/Nursery	178	No	144	105,608	55,866	50-150kW	£ 20,065
AVELING PARK SCHOOL	Schools/Nursery	214	No	247	209,215	110,675	150-250kW	£ 31,382
ASSEMBLY HALL, TOWN HALL SITE	Town Hall	214	No	50	44,877	23,740	<50kW	£ 14,091
CHINGFORD HALL COMMUNITY PRIMARY SCHOOL	Schools/Nursery	332	No	131	101,772	53,837	50-150kW	£ 19,337
ALPHA BUSINESS CENTRE	Industrial Units	241	No	50	40,768	21,567	<50kW	£ 12,801
BELMONT PARK SCHOOL	Schools/Nursery	285	No	122	94,382	49,928	50-150kW	£ 17,932
LEYTON LEISURE LAGOON	Leisure Centre	277	No	123	65,799	34,807	50-150kW	£ 12,502

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