LONDON BOROUGH OF HACKNEY

TECHNO-ECONOMIC FEASIBILTY STUDY

SOLAR ENERGY GENERATION FROM COUNCIL-OWNED ASSETS

FINAL REPORT
15.02.2021

SYZYGY REF 775
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Hackney

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GLOSSARY OF TERMS

DNO – Distributed Network Operator – the owner and operator of the local electricity network.

kWh – Kilowatt hours, energy unit

kWp – Kilowatt peak, installed power capacity of solar panels.

Irradiation – the power received from the Sun in the form of electromagnetic radiation. It is used to calculate the energy production in a solar PV system. Measured in kWh/m^2

LiDAR – Laser Imaging Detection and Ranging System. It is a method for measuring distances using a laser to reflect light off surfaces. It is frequently used for high resolution topographical surveys and can produces 3D surveys with millions of points across an area, producing x, y and z reference co-ordinates for each point.

MPAN – Meter Point Administration Number – a unique identifier for the electricity supply to a building.

MWh – Megawatt hours, energy unit of one thousand kilowatt hours

MWp – Megawatt peak, equal to one thousand-kilowatt peak

Net Zero – The principle of 'Net Zero' carbon emissions is an important sustainability concept. Simply put, a site is *Net Zero* in terms of its operational carbon emissions if the energy consumed in the everyday operation of the building are provided by onsite or offsite renewable energy generation, providing 'additionality'. Purchasing a 'green tariff' from a utility supplier will not contribute to the *Net Zero carbon* calculation as it does not lead to the installation of 'additional' renewable generation.

PPA – Power Purchase Agreement – a contract between two parties, one which generates electricity and one which is looking to purchase electricity.

PV – Photovoltaics – describes materials that are capable of generating electricity from the light falling on their surface.

UPRN Number – Unique Property Reference Number is a unique reference number for each spatial address in the UK.

1 INTRODUCTION

The London Borough of Hackney (Hackney Council) has ambitious plans to become a net zero carbon borough by 2040. They believe that there is potential across the council-owned building stock to install rooftop solar PV which will generate clean energy for consumption on site. This will help to reduce the council's carbon emissions, improve air quality, and create jobs. Hackney Council also hope to save money by paying less for electricity.

Syzygy Consulting (Syzygy) have been engaged as part of this vision, to execute the "Techno-Economic Feasibility study for solar Energy Generation from Council-Owned Assets". The objective of this study is to determine the feasibility of installing solar PV on Hackney Council owned buildings and to identify those buildings with the greatest potential, both in terms of solar generation capacity and financial returns.

The initial stage of the feasibility study was to review the desk-based, site selection methodology adopted by Hackney Council using the building stock database. The Site Selection Report (Nov 2020) sets out the details of the methodology adopted by Hackney Council, Syzygy's review of the dataset and methodology, and includes recommendations by Syzygy to improve the site selection process.

For the second stage of the feasibility study, Syzygy has continued to assess the final selection and add important information to the dataset. An estimated PV system size has been calculated for all buildings and they have then been grouped into tiers depending on the site potential. Business models have also been produced for each tier to help Hackney Council decide on which buildings/tiers to prioritise as part of their solar programme.

This report covers the work completed in the second stage of the feasibility study. It is advisable to read the site selection report before this report to gauge an understanding of the dataset and the characteristics that have been used to define the final selection of buildings.

The entire feasibility study has been desk-based and therefore the uncertainties associated with such an assessment have been accounted for in the technical and financial assumptions made and noted throughout.

2 REPORT OUTLINE

This report covers all areas of work carried out by Syzygy Consulting since November 2020 and should be read after the Site Selection Report. The Site Selection Report was produced to finalise and receive approval from Hackney Council for the final list of buildings to be considered in more detail for the remainder of the study.

Sections 0 and 0 discuss and summarise the methodology adopted by Syzygy Consulting to further analyse the buildings and group the buildings into tiers considering the solar PV system potential and energy consumption.

- Data Review and Analysis: estimating the solar PV system sizes and energy consumption of the buildings.
- Grouping Assets into Tiers

Sections 0 to 0 covers the input and output parameters of the business models for each tier by examining the project costs and financials, grid restrictions and findings from the soft market testing.

- Soft Market Testing
- Grid Capacity
- Business Case and Financial Modelling

Section 9 discusses options for implementing low carbon technologies to consume as much solar energy on site as possible. This includes an EV charging report produced using Syzygy's market leading software, evlab®.

3 EXECUTIVE SUMMARY

The objective of this study is to determine the feasibility of installing solar PV on Hackney Council owned buildings and to identify those buildings and estates with the greatest potential, both for solar generation capacity and for investment returns.

- Syzygy used a dataset provided by Hackney Council to determine a selection of buildings most suitable for solar PV considering the roof size, pitch, orientation, roof occupancy, material, age etc. Out of 396 commercial buildings and 2910 residential buildings a final list of **85 commercial buildings** and **454 residential buildings** were selected to assess in more detail.
- System sizes and energy consumption have been estimated for all buildings. Using this information, the **buildings have been grouped into four tiers** with tier 1 having the greatest potential for solar generation, onsite energy consumption and financial returns.
- The average system size is estimated to be **41kWp** for the commercial buildings and **116kWp** for the residential estates. The average solar energy consumption is estimated at **46%** for the commercial buildings and **22%** for the residential estates. The **tiers have been separated into commercial buildings and residential buildings** as these come with different considerations for Hackney Council's overall net zero strategy.
- This study has shown that there is significant solar generation potential across the Borough, with a combined system size of **6.7MW** across Tier 1 buildings, **5.4MW** across Tier 2 buildings and the opportunity to prevent **over 2,000 tonnes of CO_2 emissions in the first year** of operation.
- Soft market testing has been undertaken to establish the most suitable forms of funding for the project. Syzygy contacted privately funded Solar Developers, Community Energy Groups and Loan providers. All parties showed enthusiasm and interest in the scheme.
- Separate business models have been produced illustrating the different funding strategies. It has been concluded that adopting a mixture of funding sources for the first stage of the solar programme would be beneficial. This would spread the risk across funding organisations as well as providing Hackney Council the opportunity to test out different funding models.
- Business model tools have been produced for all tiers and using the different funding approaches. Hackney Council can use these tools to help make decisions on funding strategy and when incorporating other technologies into their net zero plan.
- The local DNO (UKPN) has been contacted by Syzygy regarding grid capacity and any constraints have been included in the site assessment. Because most of the individual systems are expected to be smaller than 100kWp, connecting to the grid should not generally entail high costs.
- Investment returns are not as high for the residential estates as for the commercial properties due to higher construction (access) costs and the relatively low onsite energy consumption. Therefore, Syzygy have investigated ways to increase the onsite energy consumption to improve the business case. Installation of technologies such as EV charging points & heat pumps will lead to greater energy usage as well as contributing to reductions in carbon emissions associated with the properties. A sleeved PPA or private wire to other local buildings is another option to help increase solar energy consumption within council properties.
- Following further detailed site investigations, Tiers 1 & 2 of the residential and commercial buildings could create a viable solar programme in the near future. The cost of solar PV products is decreasing and is expected to continue dropping. Tiers 3 & 4 tiers are therefore expected to become more financially viable in the years to come and should be reassessed after completion of the first two tiers.

RECOMMENDATIONS

The advantages and disadvantages of each funding option are summarised in Table 12 for Hackney Council to use as a basis for internal discussion and strategic planning for project execution. It is clear from this comparison, for example the self-funded (loan)_ approach offers better commercial returns, conversely the or a reduced risk profile.

1) It is clear from this comparison, for example the self-funded (loan)_ approach offers better commercial returns, conversely the Funded – developer led approach offers a reduced risk profile. It would therefore be remis of Syzygy to make a recommendation until such time as we have taken the opportunity to discuss Hackney Council's experience and availability of resources to manage the project execution themselves.
2) Hackney Council's appetite for taking on the financial risks of the project.

- Before making a decision on which funding option(s) to use, Syzygy recommends further assessment of the buildings in Tiers 1&2 to confirm the accuracy of the dataset used for determining the tiers and therefore the financial models. This study has been carried out at desk level and therefore site visits to each building will be required as part of this more detailed assessment.

4 KEY FINDINGS & FINANCIAL SUMMARY

Hackney Council's building stock has significant potential for rooftop solar PV. Out of the 396 commercial buildings and 2910 residential buildings, a final list of 85 commercial buildings and 454 residential buildings were chosen to have the highest potential based on their roof size, condition, roof shape etc.

Tier 1 & 2 groups for both the commercial buildings and residential estates show the best potential and financial returns which, after some refining, should be possible to rapidly implement.

There are two main funding options which Hackney Council can adopt to develop these tiers:

FUNDER OPTION - a third-party funds, constructs and manages the solar PV systems and agrees a PPA rate with Hackney Council for the solar electricity the council uses.

LOAN OPTION - Hackney Council use a loan to fund the project themselves and use the savings to help pay back the loan. The financial summaries of each option for Tiers 1 & 2 are included in Tables 1&2. Further details of the financial results can be found in Section 8.

Syzygy recommends undertaking the following before deciding on a funding or procurement strategy.

1) Further interrogate the dataset for its accuracy for Tiers 1 & 2 (commercial and residential groups), including but not limited to:
   - Confirm that the roof areas are correct for the buildings where Hackney Council do not own the entire building.
   - Confirm the roof replacement programme and roof condition.
   - Confirm that the categories for the commercial buildings in the council's dataset are correct as these categories were used to estimate the energy consumption trend for the buildings.
2) Carry out a feasibility study for other technologies, e.g. EV charging and heat pumps to determine the demand and financial feasibility.

FINANCIAL SUMMARY

Table 1 – Financial Summary for FUNDER Option (for full financial model see table 16 on Page 22)

	COMMERCIAL TIER 1	COMMERCIAL TIER 2	RESIDENTIAL TIER 1	RESIDENTIAL TIER 2
TOTAL SYSTEM SIZE (kWp)	1,4200	1,100	5,308	4,369
YR 1 CO2 SAVINGS (TONNES)	**270**	**209**	**982**	**809**
CO2 SAVINGS OVER 25 YEARS (TONNES)	4,461	3,455	16,221	13,352
CAPEX	£1,597,800	£1,491,401	£6,236,785	£5,428,078
SAVINGS FOR HACKNEY COUNCIL	**£616,869**	**£307,193**	**£592,409**	**£420,354**
ESTIMATED YEAR 1 NET YIELD TO FUNDER (%)	3.78%	0.56%	-0.63%	-2.57%
ESTIMATED PAYBACK PERIOD FOR FUNDER (yrs)	25	>30 yrs	>30 yrs	>30 yrs

Table 2 – Financial Summary for LOAN Option (for full financial model see table 16 on Page 23)

	COMMERCIAL TIER 1	COMMERCIAL TIER 2	RESIDENTIAL TIER 1	RESIDENTIAL TIER 2
TOTAL SYSTEM SIZE (kWp)	1,4200	1,100	5,308	4,369
YR1 CO2 SAVINGS (TONNES)	270	209	982	809
CO2 SAVINGS OVER 25 YEARS (TONNES)	4,461	3,455	16,221	13,352
ESTIMATED TOTAL LOAN REPAYMENTS	£1,499,729	£1,308,417	£6,420,717	£5,513,508
SAVINGS FOR HACKNEY COUNCIL (OVER 25 YRS)	£1,378,468	£142,076	£314,135	£249,333 (over 30 yrs)

The funding options are very flexible so a combined approach of funding can be chosen. There is also the opportunity to further split the tiers and use the funding options for the smaller groups of buildings, e.g. sub-Tiers.

A combined funding approach will spread the risk across different organisations. A pilot could be run for Hackney Council for the Tier 1 buildings to test which funding option would be the best for Tiers 2, 3 & 4 in the future. The cost of solar PV products is decreasing and is expected to continue dropping over the next few years. As a result, the lower tiers are expected to become more financially viable in the years to come and should be reassessed after practical completion of the first 2 tiers.

5 DATA REVIEW & ANALYSIS

Following the initial site selection from Hackney Council's dataset, Syzygy assessed the suitability of individual buildings further using both Google Earth and the London Solar Opportunity Map. Additional data was collected, and any errors identified in Hackney Council's dataset were corrected. All this information is recorded in the final dataset which has been provided to Hackney Council.

5.1 LONDON SOLAR OPPORTUNITY MAP

"The London Solar Opportunity Map (beta) (LSOM) is an interactive online solar mapping tool that allows Londoners to estimate the potential for both photovoltaic solar panels and solar thermal installations on buildings and open land around the capital" [1].

Syzygy have collected the data from the LSOM on the estimated solar potential for each of the buildings to compare with the dataset provided by Hackney Council, as well as to compare with Syzygy's methodology of predicting the solar PV potential for each building.

To make a clear comparison between both datasets, it is important to understand how the values were determined and whether there are any key factors that have not been considered. There is very little information on the website on how the LSOM map was developed so Syzygy attended an online webinar "Developing the London Building Stock Model - UCL Energy Seminar" (24th November 2020) to understand how the opportunity map was created and to ask questions regarding the production and constraints. Following this webinar the following limitations with the London Solar Opportunity Map were confirmed by UCL:

- The roof area has been calculated using LiDAR from the Environmental Agency to create a 3D model of all buildings, trees, hills and open space in and around London – how specifically the available area was calculated is however unclear.
- UCL confirmed that the north facing roofs have been included for calculating the solar PV potential.
- UCL confirmed that the modelling to account for clutter/occupancy of the roofs needs more work. Vertical features which are picked up as steep or vertical on the LiDAR are taken as clutter and have not been included, however this is only a minor portion of potential clutter on the roof.

The available space on the roof and the roof pitch are two extremely important parameters for determining the solar PV system sizes. Solar PV can only be installed where there is enough room to lay panels whilst leaving enough room for maintenance and access. **The LSOM is a powerful tool for landlords to references in the early stages of considering solar PV but the lack of details and information used to calculate the available roof meant that the LSOP was not deemed accurate enough to be used for this feasibility study.**

5.2 CORRECTIONS & FURTHER FILTERING TO DATASET

Another part of the data analysis process was to study the buildings in more detail and collect important building characteristics to aid with the study. Google Earth was used to check the building characteristics provided by Hackney Council, correct any errors in the dataset and collect information on the roof pitch and orientation.

Corrections to the dataset included, but were not limited to:

1. Roof area – roof areas measured on Google Earth which were significantly smaller than the area provided by Hackney Council were used to determine the solar PV System size.
2. Roof occupancy / clutter - e.g. air conditioning units & other plant.
3. Roof shape.

Information that has been added to the dataset are:

1. Roof orientation – this is paramount for determining the Solar Potential of a building.

[1] London Solar Opportunity Map, Mayor of London, link

2. Gaps in the dataset relating to roof shape, occupancy, area, and material.

Any changes made to the dataset have been recorded and have been provided to Hackney Council for their records.

LISTED BUILDINGS

There are seven listed buildings within this final list of commercial buildings. Hackney Council requested that these buildings be kept in this initial feasibility study as they are 'locally listed' buildings and do not required additional planning requirements (as distinct from 'nationally listed' buildings).

1. Hackney Picture House, E8, 1HE
2. Stoke Newington Library, N16 0JS
3. Clapton Library, E5 8RA
4. The Sam & Annie Cohen Wellbeing Centre, 161 Northwold Road, E5 8RL
5. 80 Eastway, E9 5JH (previously a swimming pool)
6. Wilton Estate Community Hall, E8 1BE
7. Spring Hill Rowing Club, E5 9BL

There were several residential blocks without UPRN numbers. A clear location of these buildings was not provided in time to include in the assessment, so these buildings have been removed.

The dataset was further filtered to remove any buildings with high risk of shading. A list of the buildings that were removed from the final selection is included in Appendix A.

The final number of Commercial Building remaining in the study following this data analysis stage is 85.

The final number of Residential Buildings remaining in the study following this data analysis stage is 454, across 105 estates.

6 TIERING OF ASSETS

Following the data analysis stage, the system sizes were calculated, and the buildings grouped into Tiers according to the overall feasibility for solar PV.

6.1 SOLAR PV POTENTIAL

Given the gaps in the parameters used in the production of the LSOM, and the potential inaccuracies of system sizes related to roof occupancy and pitch orientation, data from the LSOM was not used. Instead, the system size and solar potential for each building was calculated using the following methodology.

In general terms the solar potential of a solar PV system can be calculated using the following equation:

Total Energy Output (kWh) = System Size (kWp) x Solarisation (kWh/kWp)

6.1.1 SOLARISATION

Solarisation varies with location, orientation, and pitch angle relative to the sun. Considering these factors, the average solarisation at 5 points across the Borough was measured for the pitch orientations in the table below. The roof pitch orientation was collected for each building during the data collection phase and average solarisation values were then added as a separate column according to the relationship in the table below. A conservative pitch orientation was chosen to give a more prudent value for each building.

6.1.2 SYSTEM SIZE

The system size has been calculated using the following equations:

System Size (kW) = Solar potential per m2 (kW/m2) x Available roof area (m2)

Table 3 – Solarisation Values for Pitch Orientations

PITCH ORIENTATION	SOLARISATION KWH/KWP (POST LOSSES – 85%)	PITCH ANGLES
NE-SW	810	Average of 35° & 20°
NW-SE	812	Average of 35° & 20°
N-S	983	20°
E-W	795	35°
NE-SW, NW-SE	811	Average of 35° & 20°
N-S, E-W	1286	20° for S, 35° for EW
N	0	0
S	934	(10°)
E	811	(35°)
W	778	(35°)

SOLAR POTENTIAL

A solar potential per of 1kW/0.85m^2 has been used for this study and has been applied to each individual building. This value is considered a typical value considering the size of panels that are available in the market today and the likely mounting methods.

AVAILABLE ROOF AREA

As discussed in Section 3.3, there were discrepancies between the roof area provided in Hackney Council's dataset and the measurement of the total roof area on Google Earth. To calculate the potential system size, the smallest area between the roof area in the Hackney Council's dataset and the area measured on Google Earth has been used in this study. Using the smallest area between these two measurements mitigates the risk of considering an area greater than the roof area in Hackney Council ownership and therefore, provides a more conservative estimate for the possible system size.

There are buildings where the area in the Hackney dataset is indicated as significantly smaller than the entire roof area of the building. It likely that for these scenarios, only part of the building is owned by Hackney. For these buildings, the exact roof area owned by Hackney Council has been based solely on the data provided by Hackney Council.

The available roof area was then calculated by reducing the total area using multipliers relating to the occupancy of the roofs, the pitch and orientation of the roofs[1].

- North facing roofs are exempt from available area.
- Barely occupied or partly occupied roofs have been multiplied by the values from Table 4 to remove areas on the roof that are congested and where there may be insufficient space for solar panels.

For example, the roofs classified as "Barely Occupied" typically have approximately 90% of the total area free to install solar PV, therefore the total area is multiplied by 0.9.

The factors that have been applied to the total roof area are included in the tables below. The full list of buildings and calculated available area are included in the dataset provided to Hackney Council separately

6.1.3 COMPARISON WITH LONDON SOLAR OPPORTUNITY MAP

The system sizes have been calculated on a building-by-building basis. These systems can then be combined to determine a total system size and total potential roof area across Hackney Borough. These total system sizes are summarised in the table below alongside the sum of the values determined from the LSOM. The larger value of available area from the LSOM results in larger systems and ultimately larger predictions in solar energy generation. Using Syzygy's more cautious estimate has reduced the risk of the system sizes being over-estimated.

Table 4 – Factors applied to Total Roof Area to determine the Available Roof Area for Solar PV Installation

ROOF CHARACTERISTIC		MULTIPLIER APPLIED TO TOTAL AREA
ROOF SHAPE	ORIENTATION	
Pitched / Domed	N-S	0.5
Multi-pitched	N-S, E-W	0.25
ROOF OCCUPANCY		**MULTIPLIER APPLIED TO TOTAL AREA**
Clear		1
Barely Occupied		0.9
Partly Occupied		0.7
Busy		Removed from study

6.2 ENERGY CONSUMPTION & EXPORT ANALYSIS

The energy consumption of a building is an important factor when considering the feasibility of a solar PV project as typically the investment returns will improve as the on-site energy consumption increases.

If the use of electrical energy in the building (for lighting, lifts etc) does not coincide with the hours of solar production (i.e., Daylight hours), then excess

[1] The multipliers that have been applied to the total roof area are included in the tables below. The full list of buildings and calculated available area are included in the dataset provided to Hackney Council separately

energy is exported to the local electricity network. Understanding the energy consumption of a building over the course of a typical day helps determine how much solar energy is consumed versus that exported to the grid.

Table 5 – Solar Energy Potentials across entire Site Selection

	COMMERCIAL BUILDINGS		RESIDENTIAL BUILDINGS	
	SYZYGY'S METHODOLOGY	LSOM	SYZYGY'S METHODOLOGY	LSOM
TOTAL COMBINED SYSTEM SIZE (kWp)	3,436	3,892	10,374	11,546
TOTAL SOLAR ENERGY GENERATION (kWh)	3,023,537	3,529,483	8,752,781	10,530,757
TOTAL AVAILABLE ROOF AREA (m^2)	29,208	32,777	103,735	97,173
AVERAGE IRRADIATION (kWh/kWp)	886	896	385,136	411,177

Currently the retail price for electricity is 13p-15p per kWh. In comparison, payments for solar electricity exported to the grid are in the region of 5p per kWh, (in line with the wholesale market price of electricity). There are therefore greater savings to be made when utilising the solar energy on site versus the income generated when exporting to the grid.

Hackney Council provided energy consumption data for their entire building stock per month between April 2019 – March 2020. Following data cleansing, 289 residential buildings and 29 commercial buildings were deemed to have energy consumption data of a high enough quality to be used in this study.

6.2.1 HALF HOURLY DATA CALCULATION

The monthly energy consumption data provided by Hackney Council for each building was used to create typical profiles of daily and half hourly usage for comparison with the profile of the forecast solar energy production.

The commercial buildings were grouped into 10 categories based on their energy consumption and the predicted profile of energy use over a 24-hour period and the course of a week. These categories are listed in Table 6 below.

DAILY AND WEEKLY CONSUMPTION

Syzygy used data and statistics from their own database to model the half hourly data for each building type with Hackney Council's energy consumption data as a basis. Using a Syzygy database and other data sources, a daily and weekly pattern has been assigned to each category. The table below summarises the daily and weekly consumption for each category.

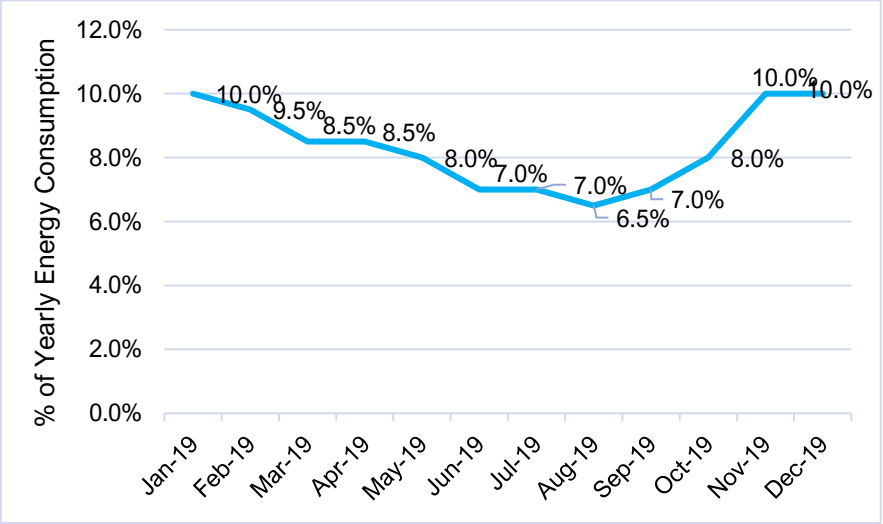
Table 6 – Typical energy consumption patterns for each building category

No.	SYZYGY BUILDING CATEGORY	TYPICAL ENERGY CONSUMPTION PATTERN
1	Community Centre	80% day / 20% night 6d/7 operation
2	Depot	60% day / 40% night 7d/7 operation
3	Nursery & Learning Centres	80% day / 20% night 5d/7 operation
4	Library	80% day / 20% night 6d/7 operation
5	Park Building	70% day / 30% night, 7d/7 operation
6	Sports Centres and Pools	70% day / 30% night, 7d/7 operation
7	Clothes Shop / Office	80% day / 20% night 5d/7 operation
8	Cinema	60% day / 40% night 7d/7 operation (day shifted to 10:30 to 22:00)
9	Supermarket	60% day / 40% night 7d/7 operation
10	Residential	50% day / 50% night 7d/7 operation

MONTHLY CONSUMPTION

Electricity consumption varies across the year as daylight hours and temperatures change. Typically, energy use is higher in the winter and lower in the summer. A comparison of the energy consumption provided by Hackney Council for all building types showed comparable trends. The graph below shows the trend adopted to calculate monthly consumption across all the buildings in this study.

Figure 1 – Typical Monthly Energy Consumption for Hackney Buildings (Syzygy Estimate)



Using the estimated daily, weekly and monthly trends and the energy consumption dataset, Syzygy used their proprietary model to compile half hourly data for each building category. For Commercial Buildings the energy consumption was calculated using kWh/m^2 of the Gross Internal Area (GIA) which is assumed to be similar to the roof area. For the residential buildings, the consumption was estimated by kWh/apartment. When energy consumption data was not available for a specific category of building, an estimation was made of kWh/m^2 based on Syzygy's database of previous projects. The table below summarises the average energy consumption calculated for each building category.

Table 7 - Average Energy Consumption by Category

SYZYGY CATEGORY FOR ENERGY USE	AVERAGE ENERGY CONSUMPTION (kWh/m²)
Community Centre	45
Depot	135
Clothes Shop / Office	79
Supermarket	370
Cinema	380
Nursery & Learning Centres	195
Library	145
Sports Centres and Pools	160
Park Building	79
Residential Estates	800kWh/flat

6.3 EXPORT ANALYSIS

Following the calculation of energy consumption, Syzygy used their Export Analysis Tool to model the percentage of export for each category of building.

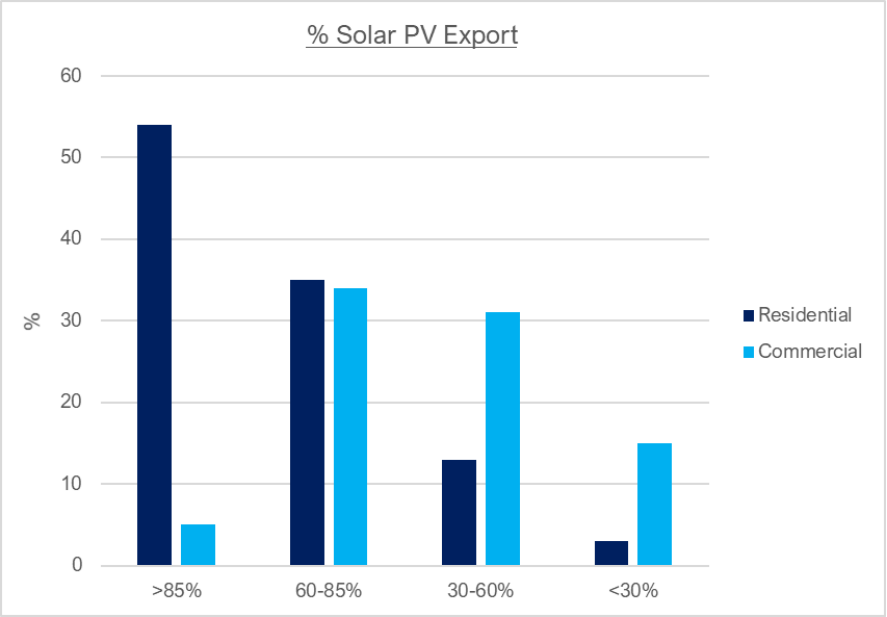
To simplify the modelling of the large number of buildings at this stage of feasibility, the solar PV generation half hourly data used in the export model assumed a location in London, and a south-facing solar array inclined at 10 degrees. Following this, the percentage of export was then calculated for each building as a function of the solar PV system size and the building consumption.

For the 85 commercial buildings the forecast export ranges from 2 - >85% with an average of 52%. 55 buildings are estimated to export >50% of the energy generated.

For the 105 residential estates the forecast export ranges from <10% to >85% with an average of 69% export. 95 residential estates were calculated to have >50% export and out of these 34 estates have >85% export.

There is less estimated export across the commercial buildings when compared to the residential estates as showing Figure 2.

Figure 2 - % Export for Commercial Buildings & Residential Estates



The full list of buildings and estates with the estimated export is included in Appendix C.

6.4 TIER RATING SYSTEM

RATING CATEGORIES

With the potential system size, energy consumption and export modelling estimated for each of the commercial buildings and residential estates, the assets were then grouped in tiers depending on their overall solar PV potential.

Each tier contains a group of buildings with similar characteristics which have then been fed into the Business Case Model to produce expected financial returns (Section 8) per tier. The following rating categories and rating values were applied to each building and residential estate.

Table 8 – Rating Categories and Rating Values for the Commercial Buildings

COMMERCIAL RATING CATEGORIES	RATING			
	1	2	3	4
Size Rating (total size) (kWp)	<20	20-40	40-70	>70
Onsite Energy Consumption (%)	<30	30-49	50-74	>75

Table 9 – Rating Categories and Rating Values for the Residential Estates

RESIDENTIAL RATING CATEGORIES	RATING			
	1	2	3	4
Size Rating - total size of estate (kWp)	<49	50-99	100-199	>200
Onsite Energy Consumption (%)	<10	10-20	20-50	>50
Average kWp for each building (kWp)	<15	15-25	25-35	>35

TIERING SCORES

The rating for each category were then combined to calculate an overall rating for each building in order to group the buildings into tiers.

Residential Example - High Hill Estate:

Total system size: **176kWp**

No. buildings: **3**

Average system size: **59kWp**

Onsite energy consumption: **37%.**

Scoring: **3** (size) x **3** (consumption) x **4** (average kWp per building)

Total score = **36**

The commercial buildings are rated in the same way by multiplying the size rating and consumption rating together.

Both the commercial buildings and residential estates have been grouped into four tiers. A summary of each tier is included in the tables below.

Table 10 – Commercial Building Tiers & Characteristics

TIER	RATING	TOTAL SYSTEM SIZE OF TIER (kWp)	NUMBER OF BUILDINGS	AVG. ONSITE ENERGY CONSUMPTION
1	8-16	1390	19	71%
2	4-7	1047	25	46%
3	3	594	17	38%
4	1-2	428	24	33%

Table 11 – Residential Estate Tiers & Characteristics

TIER	RATING	TOTAL SYSTEM SIZE OF TIER (kWp)	NO. OF ESTATES	NO. OF BUILDINGS	AVG. SYSTEM SIZE (kWp)	AVG. ONSITE ENERGY CONSUMPTION
1	24 – 48	5,308	24	148	36	29%
2	12 - 23	4,369	27	170	26	25%
3	4 - 11	1,831	28	82	22	26%
4	1-3	705	26	54	13	14%

7 SOFT MARKET TESTING

Syzygy have contacted multiple organisations in the market to understand what appetite there is to provide funding to a project of this size owned by a local authority. The combined system size for Tier 1 commercial buildings and residential buildings was used as a basis for the discussions.

7.1 DEVELOPERS

Syzygy discussed this solar PV opportunity with Free Green Electricity, Zestec Group, and Grid Move who are privately funded developers in the solar PV and zero carbon space. Feedback from these organisations was that there is appetite to fund this type of project.

PROJECT STRUCTURE

A developer would fund the entire project themselves, carry out their own feasibility study of the sites, manage the construction and would be responsible for the operation and maintenance of the systems for the lifetime of the project.

Following further evaluation, the funder would propose either a blended Power Purchase Agreement (PPA) of varying rates or a constant rate PPA (where all buildings pay the same) across all assets to Hackney Council buildings which would be the basis for the returns on their investment. Typically, the user of the solar electricity (Hackney Council) can negotiate a rate which is lower than the rate they pay to their usual electricity supplier.

The developers who Syzygy have spoken to regarding this solar PV project would expect to achieve an investment return of at least 4% but ideally 5-6% over a payback period of 15-25 years.

These organisations specialise in optimising systems to get the returns they are looking for. For example, Free Green Electricity specialise in car park canopies which could be used across the borough.

7.2 COMMUNITY ENERGY GROUPS

Syzygy contacted Community Energy London and Repowering, both London-based community energy groups. Their feedback was that there is appetite to be involved but that raising enough funds for a project on this scale may be difficult. Grants are available for renewable energy and green projects so if they are successful in winning a grant, the community groups have money to spend. Each Energy Group decides collectively where they spend their money and which projects, they believe will have the best returns, both financially and socially.

PROJECT STRUCTURE

Community Energy Groups have a similar model to the private funders. They raise funds for the project, manage the construction and the operations phase and charge the occupier (Hackney Council) for the electricity via a PPA. The biggest difference between the community energy funds and the larger, commercial developers is that the community energy groups would encourage as much local community involvement as possible. This could take the form of community funding.

The expected returns are not as high, as low as 3%, with a payback period 15-25 years even up to 30 years depending on how the group structures the funding.

7.3 LOANS

Syzygy met with Amber Infrastructure who are manage the Mayor of London's Energy Efficiency Fund and also the Public Works Loan Bureau (PWLB).

For MEEF to agree to a loan, the project must be projected to save at least 1 tonne of CO2 for each £7,000 loaned.

For a project £1.5million this equates to savings of approximately 228 tonnes of CO_2. The commercial buildings saved 15-20 times that for Tiers 1 and 2,

as do the residential tiers 1 & 2, so the CO_2 savings are in line with the requirements of the MEEF loan.

PROJECT STRUCTURE

It is proposed that Hackney Council borrow the money and use it to fund the upfront project costs (enabling and construction). Hackney Council would then pay the loan back over the loan period using the savings generated from using the solar PV electricity in the buildings rather than their usual grid supply.

Amber Infrastructure suggested that the interest on a MEEF loan for the Tier 1 buildings up to 5MW total system size would be 0.85 – 0.95%. The PWLB would charge 1.2%.

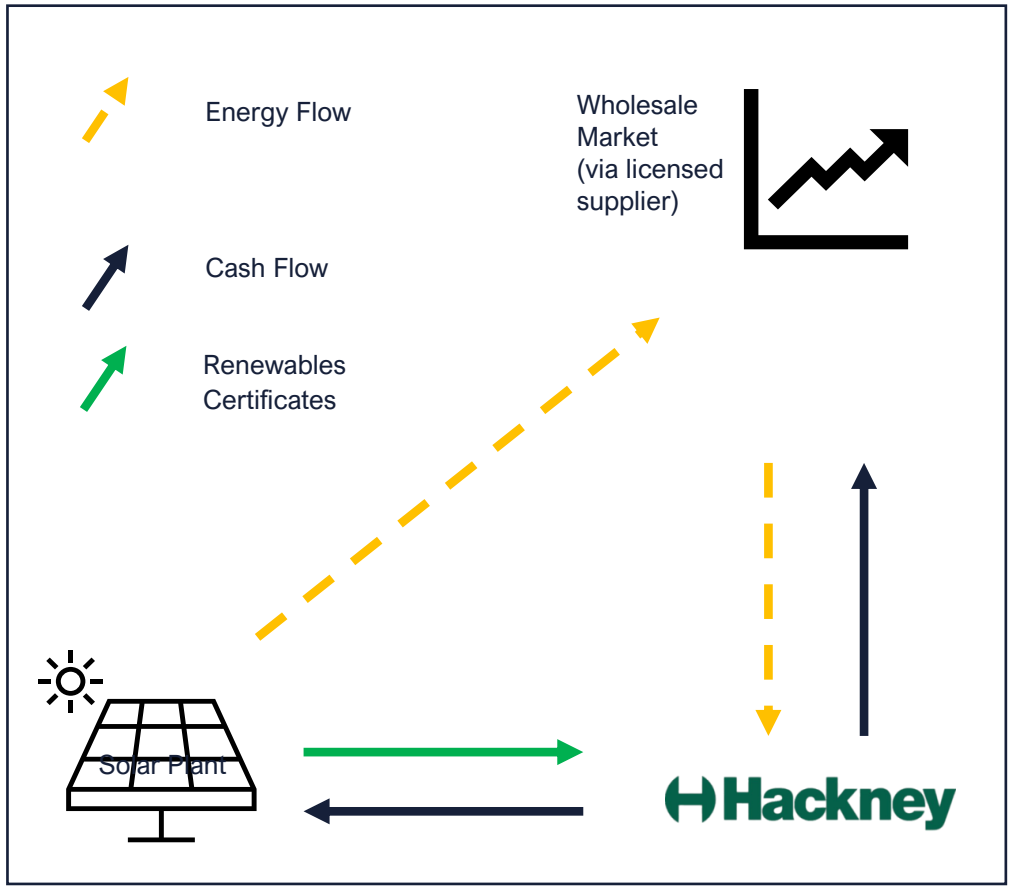
Either loan must be paid back over a maximum of 17 years.

7.4 SLEEVED PPA's

Through a sleeved PPA, a licensed electricity supply company handles the transfer of money and energy from a renewable energy project to the energy buyer (in this case Hackney Council) for a 'sleeving fee'. This type of arrangement would allow Hackney Council to purchase any energy generated on their buildings but not consumed within them to feed other council-owned buildings. Thus, increasing the amount of solar electricity consumed by the council from their own generating plant.

Developers, Community Groups or Hackney Council can work with an electricity supplier, with support from Syzygy, to set up a Sleeved PPA for electricity that would otherwise have been exported to the electricity wholesale market.

Figure 3 - Sleeved PPA Illustration



7.5 COMPARISON OF FUNDING OPTIONS

There are advantages and disadvantages associated with each funding option. The main factor to consider is who takes on the risk and who benefits financially from the project. Typically, the party that funds the project and takes on the risk of operating and maintaining the system will be rewarded with the best savings or financial returns. Each funding option is not rigid however and there is the opportunity to explore all funding options by splitting the tiers further into subsets which can be funded in different ways.

Table 12 – Comparison of Funding Options

FUNDING OPTION	ADVANTAGES	DISADVANTAGES
DEVELOPER	• Hackney Council have the flexibility to negotiate PPA rates. • Funder manages everything and takes on all risk. • Hackney Council will benefit from Funder's experience in delivery. • Opportunity to earn money through sale of electricity. For example, private wire to EV charging	• Hackney Council have less control. • Hackney Council will not own the asset over the payment period. • Committed to a PPA price • Funder will look for the best returns so may not develop all buildings

COMMUNITY ENERGY GROUP	• Similar advantages to funder/developer but also with the following:
	  ○ Opportunity for community involvement (e.g., crowdfunding)
	  ○ Opportunity to create local employment
		• Will struggle to fund and develop the whole tier of buildings.
		• Will not have the same expertise as developers.
		• Likely to be slower

LOAN	• Hackney Council have full ownership of the assets. • Have control over which buildings have solar PV – this can link into the borough's wider strategy of EV charging and electrifying heat. • Opportunity to earn money through sale of electricity – for example, to commercial tenants, EV charging, use of sleeved PPAs. • Creates local employment to execute the project and manage assets. • Opportunity for the greatest savings as grid energy consumption will be reduced and replaced with onsite solar energy generation. • Savings for Hackney Council significantly more attractive, in the region of 2-3 times greater over the funded approach for Tier 1 buildings.	• Hackney Council take on all the risk. • Need to manage internally or outsource all stages of project (or pay someone to do so)

8 BUSINESS MODEL AND FINANCIAL ANALYSIS

Feedback from the Soft Market testing showed that there are two viable funding strategies for the solar PV project. Syzygy has produced a financial model specific to each of these options.

1) **Third Party Funding** – this can either be by a private developer or a community energy group.

Loan – this can be either a loan from the government (PWLB), from an energy fund (MEEF) or equivalent. The advantages and disadvantages associated with each of these options is discussed in Section 7.1.4

Tiers 1-4 have been modelled separately for both the residential and commercial buildings to show the difference in project costs and financial returns specific to each building category, tier and funding strategy. There are therefore a total of eight business models for the commercial buildings and eight business models for the residential buildings.

Each business model has been produced assuming project execution in 2021/2022 and therefore does not consider price fluctuations associated with materials supplier, labour or any other factors that might impact the capital expenditure (e.g. exchange rate – most materials would be imported from outside the UK).

8.1 FACTORS INFLUENCING PROJECT COSTS

There are several factors that will impact the costs of each solar PV installation from the enabling phase through to the project's end of life.

ENABLING COSTS (PRE-CONSTRUCTION)

STRUCTURAL & CONDITION SURVEYS

Each building/roof will require a survey to ensure that the roof is in good condition and has structural capacity for the solar array. The cost of this structural assessment is driven by the available structural information for the building e.g. recent surveys, as-built drawings, calculations or photos of the roof (in its present-day condition) and ease of access should the structural engineer need to carry out a site survey.

GRID CONNECTION

Prior to connecting a solar PV system to the grid, an application must be made to the Distribution Network Operator (DNO) for a Grid Connection Offer. DNOs are obliged to make an offer to all generators.

A detailed application referring to the building's unique electricity supply number (MPAN) is sent to the DNO (in this case UKPN) so that they can determine whether additional grid infrastructure or reinforcement is required to accommodate the additional electricity supply from the solar generator. At a minimum, the DNO may wish to witness the testing of the final connection of the solar PV system to the grid. This usually costs c.£1000.

If any additional grid infrastructure is required, the DNO will provide a quote and the owner of the generator then has the option to either pay for the upgrades or discuss lower cost options. In some cases, the costs of grid connection are so high that it does not make economic sense to progress the project.

Syzygy have been in touch with UKPN and have been informed that they are aware of only two areas within Hackney Borough with potential grid capacity constraints. However, it should be noted that individual grid applications will be required for each site to determine this for certain. Details of these areas have been discussed in Section 5.

PLANNING

Most solar installations likely to be developed within this programme would fall within Permitted Development Rights for planning. These rights apply to installations where the system size is <1000 kWp, solar panels are installed in line with the pitch of the roof (or <200mm in height above a flat roof) and at least one metre away from the roof edge. If an installation falls outside of these stipulations (e.g. installation of a solar car port), a full planning

application will be required and there will be a cost associated with this to cover both the planning fees and the management of each application.

CONSTRUCTION COSTS

SYSTEM SIZE

The size of system will impact the relative costs of the project i.e. the capital required per kWp of installation capacity. Larger systems will be cheaper per kWp than smaller projects due to economies of scale e.g. bulk purchase of materials and savings made by the contractor for mobilisation, welfare etc. For the purposes of this study, each of the tiers for Hackney Council have been considered as one system and therefore savings have been accounted for versus installation of a small system on a single building.

TEMPORARY ACCESS

The cost of access to each building for construction will be very site dependant and must be further validated following this feasibility study. The factors that will impact the temporary access are:

- Height of the building
- Edge protection – if there is existing edge protection currently valid certification will be required before it is relied upon. If edge protection does not exist, then temporary edge protection would be installed where possible.
- The roof shape will impact what sort of roof access is required.

Syzygy has been in touch with a scaffolding broker to gauge approximate costs for access for each of the buildings. Using the estimates supplied (in addition to previous Syzygy projects), Syzygy were able to cost the access for each building depending on the roof shape, average height of the buildings, and roof area.

WELFARE FACILITIES, STORAGE AND WASTE DISPOSAL

Space for storage, waste disposal and welfare facilities will be required on a site-by-site basis. Residential estates can be considered as a single site, whereas the commercial buildings are likely to be treated as individual sites. Should more than one building be in close proximity then one welfare, storage and waste facility may suffice, but this detail will need to be refined as the project progresses.

PERMANENT ACCESS

Each solar PV system will require maintenance and this in turn requires permanent access solutions (e.g.CAT ladders, safety wire systems). Considerations which will impact the cost of permanent access are:

- Existing safety systems on the roofs – if there is already sufficient protection that is in good condition then no additional safety systems need be installed.
- Size and shape of the roof – The larger the roof, the higher the cost for a permanent access solution. For pitched, tiled roofs (typical for low rise residential) there is no need to install permanent safety systems, however additional costs will be associated with the maintenance as temporary safety systems (e.g. scaffold or access machinery such as cherry pickers) will be required.
- Height of the building – the higher the building, the higher the cost of permanent access.

OPERATING COSTS

MAINTENANCE

Each of the solar PV systems will require monitoring and maintenance over the lifetime of the project to make sure that the system is performing as expected. As with the construction costs, the relative price of this will reduce as the system size increases due to economies of scale. However, as there will be multiple small systems each will need to be monitored individually and the economies of scale will not be as great.

Syzygy usually recommend that the installation contractor is responsible for the maintenance (and monitoring) for at least the first 5 years. This is a decision is for the funder/owner of the system as will the frequency of visits for inspection and cleaning which all come at a cost. Generally, an annual visit and clean is recommended at minimum.

BUSINESS RATES

In 2017 the Valuation Office (VO) introduced changes to business rates associated with rooftop solar installations. If the solar energy generated is for "self-consumption", i.e. if Hackney Council installed the system and use the electricity themselves, then the solar equipment is classed as 'Plant and Machinery' and higher business rates are applied. If the solar plant is owned by a separate entity it is rated as an asset in its own right and lower rates apply. Hackney Council have informed Syzygy that a Special Purpose Vehicle (SPV) will be set up to own the solar plant and thus avoid the higher business rates.

LOAN INTEREST RATES

Should Hackney Council decide to fund the project via a loan, there will be interest to pay and a commitment to a set repayment period. The interest rate will be dependent on the total loan value, payback period and the provider.

8.2 BUSINESS MODEL PARAMETERS

The factors affecting cost discussed above have been incorporated in the Business Models for each tier. These costs are summarised in tables 11 to 14. All business model inputs have been estimated taking into account the significant variability across the building stock. There is potential for the capital estimates to improve following a more detailed assessment of the buildings and site visits in the next stage of the project.

ENABLING & MANAGEMENT COSTS

Syzygy have carried out the enabling works for a large number of solar PV installations and have used experience from previous projects to estimate these costs for the commercial and residential business models.

CONSTRUCTION COSTS - BOTTOM-UP VS TOP-DOWN ESTIMATES

Given the importance of the capex for determining the financial returns of the project, it is important to estimate this cost as accurately as possible.

Two approaches have been used to estimate the construction costs:

1. TOP-DOWN APPROACH – uses a typical construction cost for each building according to the individual system size. These costs have been taken from Syzygy's robust database of past projects and combines all costs associated with the installation (access, welfare etc) into a relative cost per kWp.
2. BOTTOM-UP APPROACH – considers factors associated with and prices each installation individually but treats the whole tier as one larger system for the purposes of labour and materials costs.

The costs applied for each of these approaches is included in Appendix D. The following table includes the estimated construction costs for each of the Tiers using the top down and bottom-up approach. The higher value of the two approaches was used in the associated business model (highlighted in blue).

Permanent access will be required for buildings that do not already have it and where it is possible to install. Permanent access information is not available for each of the individual buildings; therefore, a conservative assumption has been made that all buildings will require it. £70 / kWp has been used for the permanent access for the commercial buildings and a cost of £90 / kWp has been used for the residential buildings.

ENERGY CONSUMPTION

The estimated energy consumption has been discussed in detail in section 6.2. The energy consumption for each of the Tiers has been taken from the export analysis for each of the buildings specific to that Tier (Table 6 & Table 7).

Table 13 – Enabling Costs for Business Models

	COMMERCIAL (TIER 1-4)	RESIDENTIAL (TIER 1-4)	COMMENTS
STRUCTURAL ASSESSMENT	~ £1,800 / building	~ £1,800 / building	This is an estimated average. Some buildings will require more substantial structural surveys which may cost closer to £3,000. Some will cost less if the structure is sound or no site visit is required. This value has been taken assuming a structural engineer would be assessing multiple buildings.
PLANNING	£200 / building	£200 / building	Typical fees associated with a planning application and time to manage each application. This cost may not be applicable as the building is council-owned; however the costs have been included in this feasibility study.
GRID COSTS	~ £1,000 / MPAN (building)	~ £1,000 / MPAN (building)	£1,000 is the typical cost of a grid connection witness test, assuming no additional grid infrastructure is required. There are two areas in the borough that may have grid capacity constraints, and these have been accommodated for in the business model.
PROJECT MANAGEMENT FEE	£10,000 / building	£10,000 / estate	This project management fee is anticipated to cover all costs associated with managing the project up until practical completion, including the management of enabling works, entire procurement process and construction oversight.

Table 14 – Table of Construction Costs – costs used in model are highlighted.

	TIER	TOP-DOWN ESTIMATE FOR PROJECT COSTS	BOTTOM-UP ESTIMATE FOR PROJECT COSTS
COMMERCIAL	1	£1,597,800	£1,583,740
	2	£1,418,000	£1,491,401
	3	£833,000	£934,544
	4	£817,200	£905,614
RESIDENTIAL	1	£6,164,240	£6,236,785
	2	£5,323,760	£5,428,078
	3	£2,448,550	£2,625,081
	4	£1,204,550	£1,392,081

POST CONSTRUCTION

Typically, financial models for solar PV systems consider a project lifespan of 25 years which equals the length of a typical product performance warranty. Panel performance degradation is expected to be between 0.5-0.7% per year and therefore after 25 years, the panels are expected to be at <90% efficiency. Solar panels have no moving parts and would generally be expected to exceed this lifespan; therefore it is not unusual to model solar installations over a 40-year lifetime. For the purposes of this study, Syzygy have modelled for 25 years unless the returns require a longer payback period.

The costs shown in Table 15 have been used in the business model for the annual expenses for the life of the project and are based on typical market pricing for these services.

8.3 BUSINESS MODEL - FINANCIAL RESULTS

Tables 16 & 17 summarise the business model outputs for each tier for commercial buildings and residential estates and for both funding options. The complete tables for business model inputs and results are included in Appendix E.

As discussed, the proportion of onsite energy consumption has a major impact on the returns and savings for the project. To demonstrate this impact, the financials have been modelled assuming 95% consumption for all tiers and these values are included as blue in the tables. For the funder model, both the funder and Hackney Council will benefit from greater onsite energy consumption. For the loan model Hackney Council will benefit from more savings if more solar energy is utilised.

Table 15 – Operational costs over the project lifespan

OPERATIONAL COSTS	COMMERCIAL BUILDINGS (TIER 1-4)	RESIDENTIAL BUILDINGS (TIER 1-4)	COMMENTS
MONITORING COSTS	~ £1,000 per building per annum	~ £1,000 per building per annum	These monitoring costs are considered typical of an annual fee assuming economies of scale and managing all buildings using one platform built by the same contractor.
MAINTENANCE COSTS	~ £1,000 per building per annum	~ £1,000 per building per annum	These maintenance costs are typical of maintaining systems <100kWp. These costs include preventative maintenance and possibly some reactive maintenance depending on the contract.
INVERTER REPLACEMENT	£55/kWh Replaced every 13 years	£55/kWh Replaced every 13 years	Inverters have product warranties of 10-12 years so it is reasonable to expect that some inverters will require replacing every c.13 years.
BUSINESS RATES	LOW	LOW	Syzygy were informed by Hackney Council that a special purpose vehicle will be set up to avoid high business rates
LOAN INTEREST RATES *(USED FOR LOAN MODEL ONLY)*	0.95%[Note 1]	0.95%	Based on values from taken from soft market testing.

Note 1 - The percentage of loan repayment used in the business model is based on the higher value quoted for the MEEF.

Table 16 – Financial Results for FUNDER Model

	COMMERCIAL BUILDINGS				RESDIENTIAL BUILDINGS			
	TIER 1	TIER 2	TIER 3	TIER 4	TIER 1	TIER 2	TIER 3	TIER 4
TOTAL SYSTEM SIZE (kWp)	1,4200	1,100	600	460	5,308	4,369	1,831	705
TOTAL SYSTEM OUTPUT (kWh)	1,066,988	826,540	450,840	345,644	3,880,148	3,193,739	1,338,461	515,355
CO2 SAVINGS (TONNES) (YR 1)	**270**	**209**	**114**	**88**	**982**	**809**	**339**	**130**
CAPEX	£1,597,800	£1,491,401	£934,544	£905,614	£6,236,785	£5,428,078	£2,625,081	£1,392,081
PPA RATE / KWH PAID BY COUNCIL TO FUNDER	**12p**	**12p**	**12p**	**12p**	**13p**	**13p**	**13p**	**13p**
AVERAGE CONSUMPTION ON SITE (%)	70%	45%	38%	32%	29%	25%	26%	14%
SAVINGS FOR HACKNEY COUNCIL (25 YRS)	**£616,869**	**£307,193**	**£141,495**	**£91,351**	**£592,409**	**£420,354**	**£183,212**	**£37,984**
YEAR 1 NET YIELD TO FUNDER (%)	3.78%	0.56%	-0.25%	-3.02%	-0.63%	-2.57%	-3.00%	-5.78%
PAYBACK PERIOD FOR FUNDER (yrs)	25	>30 yrs	>30 yrs	>30 yrs	>30 yrs	>30 yrs	>30 yrs	>30 yrs
IRR FOR FUNDER (%)	0.42%	-2.89%	-4.54%	-9.83%	-7.95%	-13.23%	-8.37%	-8.96%
YEAR 1 NET YIELD TO FUNDER (%) w. 95% CONSUMPTION	**5.04%**	**2.64%**	**1.81%**	**-1.21%**	**2.86%**	**0.93%**	**-0.01%**	**-3.23%**
SAVINGS FOR HACKNEY COUNCIL (OVER 25 YRS) w. 95% CONSUMPTION	**£837,179**	**£648,519**	**£353,737**	**£271,199**	**£1,940,653**	**£1,597,346**	**£669,430**	**£257,754**

Assumptions: On site solar usage based on Tables 10 & 11, CPI inflation (2%) applied to the PPA rate and annual project costs, Energy Market (13p/kWh) and market inflation (3%), CAPEX costs based on the costs in Section 8.2.

Table 17 – Financial Results for LOAN Model

	COMMERCIAL BUILDINGS				RESDIENTIAL BUILDINGS			
	TIER 1	TIER 2	TIER 3	TIER 4	TIER 1	TIER 2	TIER 3	TIER 4
TOTAL SYSTEM SIZE (kWp)	1,4200	1,100	600	460	5,308	4,369	1,831	705
TOTAL SYSTEM OUTPUT (kWh)	1,066,988	826,540	450,840	345,644	3,880,148	3,193,739	1,338,461	515,355
CO2 SAVINGS (TONNES) (YR 1)	**270**	**209**	**114**	**88**	**982**	**809**	**339**	**130**
CAPEX Note 1	£1,393,800	£1,216,001	£763,694	£650,614	£5,967,209	£5,124,078	£2,328,681	£1,121,281
ESTIMATED TOTAL LOAN REPAYMENTS Note 2	£1,499,729	£1,308,417	£821,735	£700,061	£6,420,717	£5,513,508	£2,505,661	£1,206,498
LOAN PAYBACK PERIOD	17	17	17	17	17	17	17	17
AVERAGE CONSUMPTION ON SITE (%)	70%	45%	38%	32%	29%	25%	26%	14%
SAVINGS FOR HACKNEY COUNCIL (25 YRS FOR COMMERCIAL & 30 YRS FOR RESIDENTIAL)	£1,378,468	£142,076	-£48,750	-£231,515	£1,735,496	£249,333	-£1,052,418	-£1,819,751
SAVINGS FOR HACKNEY COUNCIL w. 95% CONSUMPTION (25 YRS FOR COMMERCIAL & 30 YRS FOR RESIDENTIAL)	**£2,197,844**	**£1,411,531**	**£740,620**	**£437,372**	**£11,951,071**	**£9,167,345**	**£2,631,631**	**-£154,567**

Assumptions: On site solar usage based on Tables 10 & 11, CPI inflation (2%) applied to the PPA rate and annual project costs, Energy Market (13p/kWh) and market inflation (3%), CAPEX costs based on the costs in Section 8.2.

***Note 1** – CAPEX is smaller for the loan as it is assumed the cost of PM fees and planning application costs will be covered under Hackney Council's overheads.*

***Note 2** – Based on 0.95% interest*

9 OTHER TECHNOLOGIES

The London Borough of Hackney has ambitious plans to become a net-zero carbon borough by 2040 and part of this strategy involves the roll out of electric vehicle charging, electrification of heat, and electricity storage. As discussed in the previous sections, and as evident from the business models, the more energy consumed on site, the more favourable the financial returns. Syzygy have therefore explored the opportunity to utilise the excess energy produced by the solar PV systems which would otherwise be exported to the grid.

A more in-depth feasibility study would be required for each of these technologies to determine the feasibility and potential on a site-by-site basis.

9.1 ENERGY STORAGE

The costs of energy storage technologies are typically still too high to incorporate with solar PV projects and generate satisfactory financial returns. Battery prices are reducing, however in the short term (i.e. within the next 12 months) they are not anticipated to drop enough to become financially viable for projects of this type. Energy storage should certainly be considered as Hackney Council continues to roll out their solar PV strategy.

For this feasibility study, Syzygy have not incorporated energy storage.

9.2 ELECTRIC VEHICLE CHARGING POINTS

Hackney Council are aiming to roll out an electric fleet of vehicles for their council members. They are also committed to driving behavioural change across the borough by building the charging infrastructure required in order to help encourage Electric Vehicle (EV) ownership among residents.

There is the opportunity to install EV charging points in the residential estate and community building car parks for residents, council workers and visitors.

The average amount of solar electricity export for the residential buildings is c.70%. There could be reduced by installing EV charging points on the estates.

A separate detailed feasibility study is required to identify the locations, demand, supply capacity and financial viability of installing EV charging points across the borough. For this report, Syzygy carried out a high-level assessment of the demand for EV charging points across the borough and also calculated, assuming 50% utilisation during the day, how many charging points would be needed to utilise the excess solar electricity at each site which would otherwise be exported to the grid.

evlab®

evlab® was created by Syzygy Consulting and is a market leading software designed for real estate owners and local authorities. It allows Syzygy to identify the most appropriate locations to install EV charging points and provides a recommendation for the number and type of chargers for each location.

evlab® has a unique algorithm using more than 300,000 datapoints from various robust data sources to provide a unique, data-driven, market analysis for any location in the UK. Using a GIS-based layer approach, local electric vehicle driver registration data is mapped out, overlaid with existing charging points, local data, and combined with land data (among which are building, residential and business density). This immediately outlines areas where EV charging demand outstrips supply. A detailed scoring system backed by market and socio-economic local indicators is then used to forecast the current and future charging demand and determine appropriate charger speeds.

Outputs of the software include:

1. Key sites where new EV charging infrastructure should be deployed.
2. Location-specific recommendations on number and appropriate speed of chargers to deploy in the current year, five and ten years hence based on current and expected demand.

3. Futureproofing recommendations including expected adoption rates and future EV charging requirement.

Further take-aways from the evlab® report:

1. Analyse local market EV ownership data
2. Establish local market demand for charging service
3. Supply capacity requirement for future-proofing the site

Syzygy carried out a high level evlab® lab simulation across the Borough of Hackney and concluded the following:

- There are approximate 350 EV chargers across the borough, a lot of which are slow chargers (this does not include street chargers).
- There are >40,000 parking spaces in the borough – there are therefore a large number of locations available for EV charging should there be demand.
- According to Syzygy's assessment, there is demand for EV charging across the Borough, with a current requirement for c.1600 EV charging points.

Further details of the evlab® report are included in Appendix G. The report was produced used estimated parameters across the borough and is meant for an initial understanding of the EV demand at a high level. A much more detail assessment will be required using real time data across the borough in addition to dividing the borough into smaller more manageable areas and sites.

NUMBER OF EV CHARGPOINTS REQUIRED TO INCREASE ONSITE ENERGY CONSUMPTION TO 95%

Using an average charge point utilisation of 50%, the energy consumption of both a fast and rapid charger has been compared with the export analysis for each commercial building and residential estate to estimate how many EV chargers would be required per site to utilise the excess solar electricity that would otherwise be exported to the grid.

The full table of results of this for each site are included in Appendix C. These values do not consider the cost of installing the EV charger and do not considered the demand in detail as these need to be considered in a more detailed feasibility assessment focusing on just EV charging. The values purely represent the comparison between the amount of excess electricity from the solar PV and the energy consumption of chargers at 50% utilisation during daylight hours.

9.3 HEAT PUMPS

To use as much of the solar energy on site as possible, the installation of heat pumps could also be considered. As with the EV charging points, the feasibility of heat pumps across Hackney Council's building stock will require a more detailed study. Factors to be considered include heat demand, footprint of building, number of floors and energy efficiency of the building.

Heat pumps vary in size significantly based on the above factors so a small scale, individual 5kW air source heat pump (ASHP) has been used in the Syzygy analysis as this is a typical size for a 100m^2 house.

Using an average utilisation of 50%, the energy consumption for the 5kW heat pump has been compared with the export analysis for each commercial building and each residential estate to estimate how many 5kW heat pumps would be required per site to utilise the excess solar electricity that would otherwise be exported to the grid.

The full table of results from this assessment are included in Appendix C. The values do not consider the cost of the heat pumps and do not consider the heat demand but purely represent the comparison between electricity exported from the solar PV and the estimated consumption of a 5kW charger for the day during the winter months.

Notably, the number of heat pumps and EV charging points in the table must be treated separately. That is, if a building exports enough electricity for two heat pumps or one EV charger this means that *either* one EV charger can be installed, or two heat pumps, but not both.

10 REPORT ASSUMPTIONS

DATA REVIEW & ANALYSIS ASSUMPTIONS

There were several discrepancies between Hackney Council's dataset and the information identified by Syzygy during the data collection and analysis process. To continue with the study, the following assumptions were made:

1. Cases where Hackney Council's roof area is larger than the building area on Google Earth – the assumption has been made that the area provided by Hackney Council must include the whole land area owned by Hackney Council rather than just the roof.
2. Cases where Hackney Council's roof area is significantly smaller than the building roof area – the assumption has been made that Hackney Council only own part of the building and that the roof area provided is correct for the portion that they own.
3. Roof materials – the information provided by Hackney Council is assumed to be correct for all the buildings.
4. Building Location – the location provided by Hackney Council as GPS are assumed to be correct for all the buildings.

TIERING ASSUMPTIONS

The following assumptions have been made during when grouping the buildings into tiers:

1) The energy consumption data received from Hackney Council is accurate and indicative of the building's energy use.
2) The energy consumption data is per building and for common parts served by Hackney Council only.
3) The commercial categories provided in Hackney Council's dataset are accurate.

INDEXATION

The business models consider increases in project costs which will be affected by inflation and other indexing parameters. Increases in electricity prices are linked to the energy market rate and consumed energy under a PPA agreement is linked to an index agreed between the electricity supplier and the consumer.

Typically, the inflation of energy market prices is higher than CPI or RPI which are used to index energy sold via PPA agreements. For Syzygy's business models for this feasibility study, the PPA energy and project costs (monitoring, maintenance etc) have been inflated at 2% year on year and 3% has been used to annually inflate the delivered market price for electricity.

APPENDICES

APPENDIX A – LIST OF FILTERED BUILDINGS

COMMERCIAL BUILDINGS

- The following buildings were removed because they either have a felt roof, green roof or already have solar installed:
    1. KML21 - Dalston CLR James Library and Archives Centre
    2. KML33 - Haggerston Community Hall
    3. KML120 - Redmond Community Centre
    4. KML122 – 7 Woodberry Grove N4 1SN
    5. KML139 – 29 Forest Road E8 3BY
    6. KML287 - Clapton Park Boiler Room
    7. KML300 - Residence Tower, Woodberry Grove
    8. KML305 - Azalea Court Community Hall
    9. KML385 – Manor House, N4 2TG
    10. KML387 – Unit A Clissold Quarter
    11. KML391 – Unit D Clissold Quarter
- The following buildings were removed due to shading:
    12. KML105 - Millfields Recreation Ground
    13. KML123 - Woodberry Down Community Club
    14. KML261 – Egnlefield Road N1 4LS (also covered in roof lights)
    15. KML350 - Summit Estate Community Hall
    16. KML381 - Colville Estate Community Hall
    17. KML288 - Kate Greenaway Former Library
    18. KML100 – Chaucer Court
    19. KML161 – Trelawney Estate Community Hall

- The following buildings were removed as the area of roofs is <100m^2, or the roof is too cluttered:
    20. KML65 - Hawksley Court Community Centre
    21. KML334 – 19 Northfield Road N16 5RL
    22. KML32 - 22 Dalston Lane E8 3AZ
    23. KML91 - Chats Palace, Brooksby's Walk
    24. KML 205 – Defoe House
    25. KML 227 – 18-24 Ashwin Street

RESIDENTIAL BUILDINGS

1. KML95 already has solar panels on it and has been removed from the study.
2. KML345 (Queensbridge Road, Holly Street Estate, E8 3JB) removed as the roof too cluttered.
3. KML 16, 17 & 18 (1-8, 9-38 & 39-46 Shelley House) merged into one as their coordinates are identical.
4. KML8 and KML306 (128-137 and 138-149 Fawcett Estate) have been merged as they are included in the same buildings on the London Solar Opportunity Map
5. KML 317 & 318 merged as they have identical pin locations and are part of the same building (1-35 & 36-85 Follingham Court, Drysdale Place)
6. KML 320 & 321 merged as they have identical pin locations and are part of the same building (1-12 & 12-32a Aske House, Fanshaw Street)
7. KML 170 & 171 merged as they have identical pin locations and are part of the same building (1-12 & 31-36 Priestley Close)
8. KML 291 & 292 merged as they have identical pin location and are part of the same building (33-47 ODD Abersham Road, 81-95 ODD Cecilia Road)
9. KML 347 & 348 merged as they have identical pin location and are part of the same building (33-47 ODD Abersham Road, 81-95 ODD Cecilia Road)

APPENDIX B – ENERGY CONSUMPTION TABLES

DETERMINATION OF SYZYGY SUB-CATEGORIES APPLIED TO BUILDING TYPES

ENERGY CONSUMPTION DATASET CATEGORY	HACKNEY COUNCIL BUILDING STOCK CATEGORY NAME	SYZYGY CATEGORY (FOR ENERGY USE)
Centres	VCS Lettings (Voluntary & Community Centre) & Information Centres	Community Centre
Day Centres	VCS Lettings (Voluntary & Community Centre) & Information Centres	Community Centre
Depots	Depots	Depot
Housing depot	Depots	Depot
Learning Trust	Education Non-Schools	Nursery & Learning Centres
Leisure	Community Buildings	Community Centre
Libraries	Libraries	Library
Nursery & Children Centres	Education Non-Schools	Nursery & Learning Centres
Parks	Park Buildings	Park Building
Social Services	VCS Lettings (Voluntary & Community Centre) & Information Centres	Community Centre
Youth Centres	VCS Lettings (Voluntary & Community Centre) & Information Centres	Community Centre
Housing	Housing	Residential
Library	Libraries	Library
Sports Centre & Pool	Sports Centres and Pools	Sports Centres and Pools
Office	Commercial Lettings - Shop	Clothes Shop / Office
	Commercial Lettings - Art Studios	Community Centre
Cinema	Commercial Lettings - Cinema	Cinema
Centres	Commercial Lettings - Community Centre	Community Centre
Office	Commercial Lettings - Offices	Clothes Shop / Office
Nursery & Children Centres	Commercial Lettings - Nursery	Nursery & Learning Centres
Homes	Commercial Lettings - Residential	Residential
Supermarket	Commercial Lettings - Supermarket	Supermarket

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EXPORT MODELLING FOR EACH BUILDING CATEGORY

RATIO PV GENERATION / SITE CONSUMPTION	1. COMMUNITY CENTRE	2. DEPOTS	3. NURSERY AND LEARNING CENTRES	4. LIBRARIES	5. PARK BUILDINGS	6. SPORTS CENTRES AND POOLS	7. CLOTHES SHOP / OFFICES	8. CINEMA	9. SUPERMARKETS	10. RESIDENTIAL CATEGORY
10%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20%	0.3%	2.1%	0.3%	0.3%	0.0%	0.0%	0.3%	6.2%	2.1%	5.9%
30%	3.3%	13.0%	3.7%	3.3%	5.4%	5.4%	3.7%	19.5%	13.0%	19.7%
40%	11.2%	24.2%	11.6%	11.2%	15.1%	15.1%	11.6%	30.8%	24.2%	31.3%
50%	19.7%	33.4%	20.0%	19.7%	24.3%	24.3%	20.0%	39.7%	33.4%	40.3%
60%	27.3%	40.8%	27.6%	27.3%	32.0%	32.0%	27.6%	46.7%	40.8%	47.4%
70%	33.9%	46.8%	34.1%	33.9%	38.5%	38.5%	34.1%	52.3%	46.8%	53.0%
80%	39.4%	51.8%	39.7%	39.4%	43.9%	43.9%	39.7%	56.9%	51.8%	57.5%
90%	44.2%	55.9%	44.4%	44.2%	48.5%	48.5%	44.4%	60.7%	55.9%	61.3%
100%	48.2%	59.4%	48.5%	48.2%	52.4%	52.4%	48.5%	63.8%	59.4%	64.4%
110%	51.8%	62.4%	52.0%	51.8%	55.8%	55.8%	52.0%	66.5%	62.4%	67.1%
120%	54.9%	64.9%	55.1%	54.9%	58.8%	58.8%	55.1%	68.8%	64.9%	69.4%
130%	57.7%	67.2%	57.8%	57.7%	61.3%	61.3%	57.8%	70.8%	67.2%	71.3%
140%	60.1%	69.1%	60.2%	60.1%	63.6%	63.6%	60.2%	72.6%	69.1%	73.1%
150%	62.2%	70.9%	62.4%	62.2%	65.6%	65.6%	62.4%	74.1%	70.9%	74.6%
160%	64.2%	72.4%	64.3%	64.2%	67.4%	67.4%	64.3%	75.5%	72.4%	76.0%
170%	65.9%	73.8%	66.0%	65.9%	69.1%	69.1%	66.0%	76.8%	73.8%	77.2%
180%	67.5%	75.1%	67.6%	67.5%	70.5%	70.5%	67.6%	77.9%	75.1%	78.3%
190%	69.0%	76.2%	69.1%	69.0%	71.9%	71.9%	69.1%	78.9%	76.2%	79.3%
200%	70.3%	77.3%	70.4%	70.3%	73.1%	73.1%	70.4%	79.8%	77.3%	80.3%
210%	71.5%	78.2%	71.6%	71.5%	74.2%	74.2%	71.6%	80.7%	78.2%	81.1%
220%	72.6%	79.1%	72.7%	72.6%	75.2%	75.2%	72.7%	81.5%	79.1%	81.9%
230%	73.7%	79.9%	73.7%	73.7%	76.2%	76.2%	73.7%	82.2%	79.9%	82.6%
240%	74.6%	80.7%	74.7%	74.6%	77.1%	77.1%	74.7%	82.8%	80.7%	83.2%
250%	75.5%	81.4%	75.6%	75.5%	77.9%	77.9%	75.6%	83.5%	81.4%	83.8%
260%	76.4%	82.0%	76.4%	76.4%	78.6%	78.6%	76.4%	84.0%	82.0%	84.4%
270%	77.1%	82.6%	77.2%	77.1%	79.4%	79.4%	77.2%	84.6%	82.6%	84.9%
280%	77.9%	83.2%	77.9%	77.9%	80.0%	80.0%	77.9%	85.1%	83.2%	85.4%
290%	78.5%	83.7%	78.6%	78.5%	80.6%	80.6%	78.6%	85.5%	83.7%	85.9%
300%	79.2%	84.2%	79.2%	79.2%	81.2%	81.2%	79.2%	86.0%	84.2%	86.3%

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APPENDIX C - FULL LIST OF BUILDINGS, TIERS AND ENERGY CONSUMPTION

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COMMERCIAL BUILDINGS TIERS 1-4

ENERGY CONSUMPTION & OTHER TECHNOLOGIES

	Building System Size v.s Energy Consumption														Ratings			OTHER TECHNOLOGIES - Numbers related to the potential utilisation of the the Solar PV Energy during sunight hours only **			
Tier .	KML Number	X	Y	Energy concumption data	Syzygy Building category	Roof Shape	Pitch / Solar Panel Orientation	Available Roof Area (m2)	PV size (kWp)	PV generation (kWh/yr)	Site Energy Consumption (kWh/yr)	Ratio PV gen / Site consumption	Rounded ratio	% export	% Energy used on site	Size Rating	Consumption Rating	Rating Combined	Energy left over after building consumption (kWh)	No of potential EV chargers to utilise the solar PV electricity (assuming 50% utilisation of 7kW chargers= 12,800kWh)	No of potential EV chargers (assuming 50% utilisation of 22kW charger = 20,000kWh)	Estate identified for Heat Pump (from Hackney Council)	No of potential heat pumps per building (assumed 3,500kWh consumption per year)
1	373	-0.04	51.5557	N	Supermarket	Pitched	NW-SE	760	89	72,561	281,200	26%	30%	13%	87%	4	4	16	9440	<1	<1		2
	349	-0.039	51.5555	N	Supermarket	Pitched	NE-SW	600	71	57,210	222,000	26%	30%	13%	87%	4	4	16	7443	<1	<1		2
	45	-0.055	51.5449	N	Cinema	Pitched	E-W	635	75	59,373	241,300	25%	30%	20%	80%	4	4	16	11588	<1	<1	Yes	3
	84	-0.055	51.547	N	Supermarket	Flat	S	533	63	58,522	394,050	15%	20%	2%	98%	3	4	12	1241	<1	<1		0
	254	-0.072	51.5704	Y	Library	Flat	S	392	46	43,081	161,737	27%	30%	3%	97%	3	4	12	1427	<1	<1	Yes	0
	119	-0.061	51.5351	N	Depot	Pitched	N-S	543	64	62,767	209,250	30%	30%	13%	87%	3	4	12	8166	<1	<1	Yes	2
	264	-0.083	51.5616	N	Library	Multipitched	N-S, E-W	351	41	34,737	75,400	46%	50%	20%	80%	3	4	12	6841	<1	<1	Yes	1
	93	-0.056	51.5445	N	Library	Flat	S	783	92	86,052	113,535	76%	80%	39%	61%	4	3	12	33919	2	1	Yes	9
	4	-0.08	51.5304	Y	Library	Monopitched	E	728	86	69,447	92,590	75%	80%	39%	61%	4	3	12	27374	2	1		7
	278	-0.076	51.5331	N	Clothes Shop / Office	Multipitched	N-S, E-W	847	100	83,823	99,128	85%	90%	44%	56%	4	3	12	37219	2	1		10
	178	-0.069	51.5321	Y	Sports Centres and Pools	Monopitched	E	362	43	34,544	58,910	59%	60%	32%	68%	3	3	9	11066	<1	<1	Yes	3
	147	-0.058	51.5363	N	Clothes Shop / Office	Pitched	N-S	458	54	52,933	72,285	73%	80%	40%	60%	3	3	9	21001	1	1		6
	73	-0.042	51.549	Y	Library	Flat	S	403	47	44,235	52,181	85%	90%	44%	56%	3	3	9	19530	1	<1	Yes	5
	55	-0.055	51.5697	N	Nursery & Learning Centres	Multipitched	NE-SW, NW-SE	276	32	26,346	107,692	24%	30%	4%	96%	2	4	8	968	<1	<1		0
	26	-0.041	51.5382	N	Nursery & Learning Centres	Pitched	NW-SE	257	30	24,495	100,059	24%	30%	4%	96%	2	4	8	900	<1	<1		0
	295	-0.075	51.5316	N	Depot	Multipitched	N-S, E-W	194	23	19,224	49,950	38%	40%	24%	76%	2	4	8	4657	<1	<1		1
	277	-0.075	51.5323	N	Clothes Shop / Office	Flat	S	2250	265	247,275	197,500	125%	130%	58%	42%	4	2	8	142917	11	7		40
	365	-0.034	51.5503	N	Community Centre	Flat	S	749	88	82,315	48,150	171%	180%	68%	32%	4	2	8	55586	4	2		15
	237	-0.063	51.5635	N	Community Centre	Pitched	NW-SE	698	82	66,662	34,911	191%	200%	70%	30%	4	2	8	46865	3	2		13
2	127	-0.057	51.536	N	Clothes Shop / Office	Pitched	N-S	235	28	27,132	52,930	51%	60%	28%	72%	2	3	6	7493	<1	<1		2
	380	-0.068	51.5319	N	Sports Centres and Pools	Monopitched	S	234	28	25,754	37,494	69%	70%	38%	62%	2	3	6	9912	<1	<1	Yes	2
	238	-0.062	51.5636	N	Depot	Multipitched	NE-SW, NW-SE	274	32	26,178	41,155	64%	70%	47%	53%	2	3	6	12256	<1	<1	Yes	3
	56	-0.075	51.5421	N	Community Centre	Multipitched	N-S, E-W	189	22	18,705	18,900	99%	100%	48%	52%	2	3	6	9023	<1	<1		2
	17	-0.063	51.5375	N	Depot	Multipitched	NE-SW, NW-SE	490	58	46,752	66,150	71%	80%	52%	48%	3	2	6	24217	1	1	Yes	6
	66	-0.055	51.5675	N	Clothes Shop / Office	Multipitched	NE-SW, NW-SE	423	50	40,359	37,130	109%	110%	52%	48%	3	2	6	20980	1	1		5
	307	-0.07	51.5413	N	Community Centre	Multipitched	N-S, E-W	449	53	44,424	38,475	115%	120%	55%	45%	3	2	6	24393	1	1		6
	276	-0.079	51.5332	N	Community Centre	Flat	S	429	50	47,127	38,593	122%	130%	58%	42%	3	2	6	27170	2	1		7
	170	-0.059	51.5384	N	Community Centre	Multipitched	N-S, E-W	574	68	56,782	38,250	148%	150%	62%	38%	3	2	6	35341	2	1		10
	284	-0.065	51.5523	N	Community Centre	Multipitched	N-S, E-W	424	50	41,918	28,237	148%	150%	62%	38%	3	2	6	26090	2	1		7
	34	-0.041	51.5444	N	Community Centre	Flat	S	527	62	57,932	33,887	171%	180%	68%	32%	3	2	6	39120	3	1		11
	172	-0.049	51.5479	N	Community Centre	Flat	S	456	54	50,139	29,329	171%	180%	68%	32%	3	2	6	33858	2	1		9
	325	0	0	Y	Depot	Multipitched	N-S, E-W	144	17	14,275	51,479	28%	30%	13%	87%	1	4	4	1857	<1	<1	Yes	0
	283	-0.088	51.5318	N	Depot	Pitched	N-S	60	7	6,884	22,950	30%	30%	13%	87%	1	4	4	896	<1	<1		0
	369	-0.038	51.5449	Y	Depot	Flat	S	98	12	10,770	34,988	31%	40%	24%	76%	1	4	4	2609	<1	<1	Yes	0
	81	-0.045	51.5447	N	Community Centre	Pitched	E	172	20	16,371	15,435	106%	110%	52%	48%	2	2	4	8479	<1	<1		2
	112	-0.054	51.5427	N	Community Centre	Domed	N-S	229	27	26,511	22,914	116%	120%	55%	45%	2	2	4	14557	1	<1		4
	76	-0.048	51.5494	N	Community Centre	Pitched	N-S	221	26	25,570	19,890	129%	130%	58%	42%	2	2	4	14742	1	<1		4
	106	-0.076	51.5687	N	Community Centre	Pitched	E-W	252	30	23,562	16,200	145%	150%	62%	38%	2	2	4	14665	1	<1		4
	159	-0.04	51.5472	N	Community Centre	Multipitched	N-S, E-W	176	21	17,369	11,700	148%	150%	62%	38%	2	2	4	10810	<1	<1		3
	16	-0.064	51.5375	Y	Community Centre	Multipitched	NE-SW, NW-SE	260	31	24,807	13,713	181%	190%	69%	31%	2	2	4	17111	1	<1		4
	158	-0.044	51.5462	N	Community Centre	Multipitched	NE-SW, NW-SE	237	28	22,631	11,859	191%	200%	70%	30%	2	2	4	15910	1	<1		4
	111	-0.05	51.5406	N	Community Centre	Flat	S	898	106	98,686	44,898	220%	220%	73%	27%	4	1	4	71683	5	3		20
	326	-0.082	51.539	N	Community Centre	Flat	S	743	87	81,656	37,150	220%	220%	73%	27%	4	1	4	59312	4	2		16
	152	-0.072	51.565	N	Residential	Monopitched	S	704	83	77,370	26,400	293%	300%	86%	14%	4	1	4	66772	5	3	Yes	19
3	320	-0.06	51.5627	N	Library	Pitched	NW-SE	167	20	15,897	26,825	59%	60%	27%	73%	1	3	3	4346	<1	<1		1
	179	-0.075	51.5503	N	Community Centre	Pitched	N-S	21	2	2,372	3,690	64%	70%	34%	66%	1	3	3	803	<1	<1		0
	108	-0.053	51.5418	Y	Community Centre	Pitched	N-S	83	10	9,575	13,053	73%	80%	39%	61%	1	3	3	3774	<1	<1		1
	274	-0.078	51.5568	Y	Community Centre	Monopitched	E	140	16	13,364	20,433	65%	70%	34%	66%	1	3	3	4527	<1	<1		1
	199	-0.062	51.5629	N	Community Centre	Pitched	N-S	110	13	12,756	14,175	90%	90%	44%	56%	1	3	3	5632	<1	<1		1
	273	-0.063	51.5429	N	Community Centre	Pitched	N-S	87	10	10,118	11,244	90%	90%	44%	56%	1	3	3	4467	<1	<1		1
	234	-0.08	51.5311	Y	Community Centre	Domed	N-S	75	9	8,678	11,125	78%	80%	39%	61%	1	3	3	3420	<1	<1		0
	343	-0.029	51.5476	N	Community Centre	Pitched	NW-SE	450	53	42,964	20,250	212%	220%	73%	27%	3	1	3	31208	2	1		8
	67	-0.055	51.5688	N	Community Centre	Pitched	NE-SW	440	52	41,954	19,800	212%	220%	73%	27%	3	1	3	30474	2	1		8
	345	-0.029	51.5472	N	Community Centre	Domed	NE-SW, NW-SE	514	60	49,042	23,130	212%	220%	73%	27%	3	1	3	35623	2	1		10
	241	-0.071	51.5514	N	Residential	Pitched	E-W	450	53	42,075	15,000	281%	290%	86%	14%	3	1	3	36130	2	1		10
	377	-0.029	51.5445	Y	Community Centre	Pitched	E-W	470	55	43,945	2,640	1665%	1670%	>85% export	10%	3	1	3	39551	3	1		11
	71	-0.043	51.5482	N	Community Centre	Flat	S	511	60	56,117	22,978	244%	250%	76%	24%	3	1	3	42381	3	2		12
	299	-0.09	51.5723	N	Community Centre	Flat	S	430	51	47,257	19,350	244%	250%	76%	24%	3	1	3	35689	2	1		10
	79	-0.056	51.5419	N	Community Centre	Flat	S	370	44	40,663	16,650	244%	250%	76%	24%	3	1	3	30709	2	1		8
	243	-0.071	51.5514	N	Residential	Multipitched	N-S, E-W	366	43	36,207	16,260	223%	230%	83%	17%	3	1	3	29898	2	1		8
	242	-0.071	51.5514	N	Residential	Multipitched	N-S, E-W	366	43	36,207	16,260	223%	230%	83%	17%	3	1	3	29898	2	1		8
4	379	-0.04	51.555	Y	Community Centre	Pitched	N-S	109	13	12,585	13,114	96%	160%	64%	36%	1	2	2	8078	<1	<1		2
	102	-0.09	51.5314	N	Community Centre	Pitched	E	144	17	13,738	12,952	106%	110%	52%	48%	1	2	2	7115	<1	<1		2
	107	-0.049	51.5422	Y	Community Centre	Pitched	N-S	120	14	13,884	13,053	106%	110%	52%	48%	1	2	2	7191	<1	<1		2
	126	-0.068	51.551	Y	Community Centre	Pitched	E	65	8	6,205	5,954	104%	110%	52%	48%	1	2	2	3214	<1	<1		0
	213	-0.05	51.5632	N	Community Centre	Pitched	N-S	54	6	6,259	5,409	116%	120%	55%	45%	1	2	2	3437	<1	<1		0
	185	-0.076	51.5338	N	Community Centre	Pitched	N-S	135	16	15,575	12,115	129%	130%	58%	42%	1	2	2	8980	<1	<1		2
	232	-0.073	51.5598	N	Community Centre	Pitched	N-S	104	12	12,034	9,361	129%	130%	58%	42%	1	2	2	6938	<1	<1		1
	83	-0.069	51.5556	N	Community Centre	Flat	S	166	20	18,290	7,489	244%	130%	58%	42%	1	2	2	10545	<1	<1		3
	156	-0.089	51.5308	N	Community Centre	Pitched	N-S	56	7	6,444	5,013	129%	130%	58%	42%	1	2	2	3715	<1	<1		1
	309	-0.06	51.5692	N	Park Building	Multipitched	NE-SW, NW-SE	133	16	12,733	10,543	121%	130%	61%	39%	1	2	2	7810	<1	<1	Yes	2
	36	-0.082	51.5586	N	Community Centre	Multipitched	N-S, E-W	155	18	15,290	9,270	165%	170%	66%	34%	1	2	2	10082	<1	<1		2
	101	-0.041	51.5581	N	Community Centre	Multipitched	N-S, E-W	79	9	7,845	4,756	165%	170%	66%	34%	1	2	2	5173	<1	<1		1
	197	-0.066	51.5386	N	Community Centre	Flat	S	153	18	16,817	9,837	171%	180%	68%	32%	1	2	2	11356	<1	<1		3
	168	-0.083	51.5282	N	Community Centre	Flat	S	88	10	9,616	5,625	171%	180%	68%	32%	1	2	2	6494	<1	<1		1
	15	-0.063	51.5375	Y	Community Centre	Multipitched	NE-SW, NW-SE	294	35	28,080	13,713	205%	210%	72%	28%	2	1	2	20082	1	1		5
	290	-0.053	51.5635	N	Community Centre	Pitched	E-W	210	25	19,635	9,450	208%	210%	72%	28%	2	1	2	14042	1	<1		4
	316	-0.059	51.5734	N	Community Centre	Pitched	NW-SE	184	22	17,577	8,284	212%	220%	73%	27%	2	1	2	12767	<1	<1		3
	301	-0.073	51.5336	N	Community Centre	Flat	S	325	38	35,718	14,625	244%	250%	76%	24%	2	1	2	26975	2	1		7
	259	-0.068	51.5581	N	Community Centre	Flat	S	318	37	34,908	14,293	244%	250%	76%	24%	2	1	2	26363	2	1		7
	145	-0.042	51.5567	Y	Community Centre	Pitched	E-W	270	32	25,198	7,068	357%	360%	>85% export	10%	2	1	2	22679	1	1		6
	360	-0.029	51.5455	Y	Community Centre	Multipitched	N-S, E-W	172	20	16,975	2,640	643%	650%	>85% export	10%	2	1	2	15278	1	<1		4
	272	-0.064	51.5448	N	Community Centre	Flat	S	91	11	10,011	4,554	220%	220%	73%	27%	1	1	1	7271	<1	<1		2
	219	-0.083	51.5721	N	Community Centre	Flat	S	112	13	12,344	5,054	244%	250%	76%	24%	1	1	1	9322	<1	<1		2
	201	-0.093	51.5665	Y	Community Centre	Flat	S	103	12	11,372	3,994	285%	290%	79%	21%	1	1	1	8931	<1	<1		2

Note-1 the roof area listed is the smallest area from Hackney Council's Dataset and Syzygy's measurements and is the total roof area. The available roof area has been calculated considering the pitch, occupancy & shading and is used to calculate the system size but is not include in this summary table.

RESIDENTIAL ESTATES TIERS 1-4

ENERGY CONSUMPTION & OTHER TECHNOLOGIES

SYZYGY
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	Estate System Size v.s Energy Consumption															Ratings				OTHER TECHNOLOGIES - Numbers related to the potential utilisation of the the Solar PV Energy during sunight hours only **				
TIER	Estate Name	No. Buildings	X	Y	No of buildings with Energy Consumption Data	kWp Total	kWp/ Building	Total PV energy produced (kWh/yr)	kWh/flat average (from consumption data)	Total number of flats	Total Energy Consumption	PV gen / Site consumption ratio	% of PV exported	% Energy used on site	% of grid demand reduction	Size Rating	Consumption Rating	kWp / building	Rating Combined	Energy Left Over (kWh)	No of potential EV chargers (assuming 50% utilisation of 7kW chargers= 12,800kWh)	No of potential EV chargers (assuming 50% utilisation of 22kW charger = 20,000kWh)	Estate identified for Heat Pump (from Hackney Council)	No of potential heat pumps per building (assumed 3,500kWh consumption per year)
1	FRAMPTON PARK ESTATE	19	-0.0534	51.542	3	735	39	628,826	585	653	382,012	165%	77%	23%	39%	4	3	4	48	485,664	37	24	Yes	7
	DOWNS ESTATE	5	-0.0655	51.5526	4	256	51	211,914	832	209	173,784	122%	71%	29%	37%	4	3	4	48	151,184	11	7	Yes	8
	LINZELL ESTATE	5	-0.0381	51.5513	1	183	37	147,803	3,863	67	258,853	57%	47%	53%	32%	3	4	4	48	70,005	5	3		4
	NISBET HOUSE	3	-0.0412	51.5472	3	112	37	97,025	771	302	232,862	42%	36%	64%	29%	3	4	4	48	35,006	2	1		3
	High Hill Estate	3	-0.0541	51.5681	2	176	59	140,597	1,571	99	155,511	90%	63%	37%	35%	3	3	4	36	88,413	6	4		8
	NYE BEVAN ESTATE	7	-0.043	51.5571	6	204	29	164,486	1,928	122	235,255	70%	53%	47%	33%	4	3	3	36	87,142	6	4		3
	MORLAND ESTATE	3	-0.0633	51.5431	0	124	41	112,255	805	71	57,164	196%	80%	20%	39%	3	3	4	36	90,099	7	4		8
	LORDSHIP SOUTH ESTATE	7	-0.0831	51.5629	6	382	55	309,725	536	197	105,627	293%	86%	14%	41%	4	2	4	32	267,301	20	13		10
	CLAPTON PARK	13	-0.0405	51.5542	10	489	38	397,229	479	301	144,253	275%	85%	15%	41%	4	2	4	32	339,281	26	16	Yes	7
	GASCOYNE ESTATE	8	-0.0405	51.5438	0	282	35	254,073	805	113	90,980	279%	85%	15%	41%	4	2	4	32	217,009	16	10	Yes	7
	TRELAWNEY ESTATE	6	-0.0523	51.546	6	162	27	152,195	1,276	166	211,850	72%	55%	45%	33%	3	3	3	27	84,235	6	4		4
	WOODBERRY DOWN ESTATE	5	-0.0915	51.5727	5	153	31	129,984	481	160	76,903	169%	77%	23%	39%	3	3	3	27	100,391	7	5		5
	WEBB ESTATE	4	-0.0624	51.5709	4	134	34	109,046	1,152	58	66,839	163%	77%	23%	39%	3	3	3	27	84,220	6	4		6
	BROADWAY ESTATE	1	-0.0604	51.5368	1	108	108	90,718	485	76	36,870	246%	84%	16%	40%	3	2	4	24	76,052	5	3		21
	TROWBRIDGE ESTATE	13	-0.0291	51.5461	4	366	28	304,979	1,224	111	135,814	225%	83%	17%	40%	4	2	3	24	251,835	19	12	Yes	5
	SUFFOLK ESTATE	1	-0.0669	51.5361	1	55	55	43,852	610	104	63,396	69%	53%	47%	33%	2	3	4	24	23,232	1	1		6
	WHISTON ESTATE	12	-0.0639	51.5349	11	339	28	275,479	388	239	92,810	297%	86%	14%	41%	4	2	3	24	237,745	18	11		5
	PROVOST ESTATE	7	-0.0878	51.5299	1	239	34	201,006	284	245	69,642	289%	86%	14%	41%	4	2	3	24	172,606	13	8		7
	LONDESBOROUGH ESTATE	2	-0.0796	51.557	1	111	55	87,853	471	72	33,917	259%	84%	16%	41%	3	2	4	24	74,145	5	3		10
	WAYMAN COURT	2	-0.0609	51.5438	2	52	26	44,827	4,789	26	124,523	36%	31%	69%	27%	2	4	3	24	14,045	1	<1		2
	REGENT ESTATE	9	-0.0698	51.5365	9	229	25	184,424	505	141	71,273	259%	84%	16%	41%	4	2	3	24	155,648	12	7	Yes	4
	FAWCETT ESTATE	8	-0.0611	51.5699	7	222	28	179,763	525	122	63,989	281%	86%	14%	41%	4	2	3	24	154,365	12	7		5
	BROAD COMMON ESTATE	4	-0.0633	51.5693	4	146	37	125,546	493	90	44,401	283%	86%	14%	41%	3	2	4	24	107,807	8	5		7
	LANDFIELD ESTATE	1	-0.066	51.558	1	50	50	39,738	2,496	12	29,948	133%	73%	27%	38%	2	3	4	24	29,042	2	1		8
2	SHERRY'S WHARF ESTATE	5	-0.0341	51.5546	3	115	23	98,027	1,155	65	75,091	131%	73%	27%	38%	3	3	2	18	71,643	5	3	Yes	4
	ST PHILLIPS ESTATE	3	-0.0678	51.5434	3	86	29	79,897	731	72	52,596	152%	76%	24%	38%	2	3	3	18	60,723	4	3		5
	HAWKSLEY COURT ESTATE	6	-0.0816	51.56	5	157	26	132,934	528	87	45,903	290%	86%	14%	41%	3	2	3	18	114,152	8	5		5
	PARKSIDE ESTATE	6	-0.0487	51.5373	6	119	20	104,356	506	136	68,821	152%	76%	24%	38%	3	3	2	18	79,312	6	3		3
	MOUNTFORD ESTATE	7	-0.067	51.5512	2	135	19	109,658	859	68	58,434	188%	79%	21%	39%	3	3	2	18	87,011	6	4		3
	NEW KINGSHOLD ESTATE	3	-0.0538	51.5386	3	75	25	67,980	990	39	38,607	176%	78%	22%	39%	2	3	3	18	53,258	4	2	yes	5
	LEA VIEW ESTATE	4	-0.0598	51.5679	4	76	19	67,660	1,086	208	225,858	30%	20%	80%	24%	2	4	2	16	13,363	1	<1		0
	MORRIS BLITZ COURT	1	-0.069	51.5558	1	75	75	63,462	591	51	30,119	211%	82%	18%	40%	2	2	4	16	51,955	4	2		14
	WARBURTON ESTATE	2	-0.0598	51.5386	2	99	49	81,895	381	100	38,144	215%	82%	18%	40%	2	2	4	16	67,045	5	3		9
	RHODES ESTATE	13	-0.071	51.5451	0	248	19	204,211	805	87	70,046	292%	86%	14%	41%	4	2	2	16	176,240	13	8		3
	PITFIELD ESTATE	3	-0.0833	51.5282	1	49	16	43,128	3,156	34	107,316	40%	36%	64%	29%	2	4	2	16	15,560	1	<1		1
	HILL COURT ESTATE	2	-0.0817	51.5668	2	79	40	72,145	393	72	28,322	255%	84%	16%	41%	2	2	4	16	60,888	4	3		8
	VALETTE HOUSE	1	-0.0544	51.5452	1	56	56	46,762	356	47	16,730	280%	85%	15%	41%	2	2	4	16	39,940	3	1	yes	11
	JACK DUNNING ESTATE	19	-0.0502	51.5497	9	530	28	466,562	372	296	110,257	423%	>85% export	10%	c.40% reduction	4	1	3	12	419,905	32	20		6
	YORKSHIRE GROVE ESTATE	13	-0.0777	51.5571	12	422	32	369,083	311	150	46,628	792%	>85% export	10%	c.40% reduction	4	1	3	12	332,175	25	16	Yes	7
	Shellgrove Estate	18	-0.0775	51.5512	6	483	27	394,621	416	211	87,793	449%	>85% export	10%	c.40% reduction	4	1	3	12	355,159	27	17		5
	Millfields Estate	13	-0.0437	51.5583	6	371	29	297,556	540	93	50,182	593%	>85% export	10%	c.40% reduction	4	1	3	12	267,800	20	13		5
	HERBERT BUTLER ESTATE	16	-0.0349	51.548	1	407	25	340,024	226	172	38,828	876%	>85% export	10%	c.40% reduction	4	1	3	12	306,022	23	15		5
	MILTON GARDENS ESTATE	11	-0.0823	51.5542	8	282	26	231,819	365	177	64,564	359%	>85% export	10%	c.40% reduction	4	1	3	12	208,637	16	10	Yes	5
	BLACKSTONE ESTATE	3	-0.0622	51.541	3	65	22	63,635	511	149	76,074	84%	59%	41%	34%	2	3	2	12	37,837	2	1		3
	BANBURY ESTATE	1	-0.0444	51.5399	1	26	26	24,079	1,396	45	62,810	38%	31%	69%	27%	1	4	3	12	7,544	<1	<1		2
	THE MOUNT	4	-0.0573	51.5631	4	79	20	71,890	906	52	47,124	153%	76%	24%	38%	2	3	2	12	54,637	4	2		3
	NEWCOMBE HOUSE	1	-0.0579	51.5578	1	42	42	35,405	348	51	17,769	199%	80%	20%	39%	1	3	4	12	28,417	2	1		8
	JACK WATTS ESTATE	6	-0.0535	51.5629	0	109	18	90,880	805	50	40,257	226%	83%	17%	40%	3	2	2	12	75,043	5	3		3
	KYVERDALE ROAD PROPERTIES	2	-0.0679	51.5644	2	64	32	52,129	3,532	6	21,190	246%	84%	16%	40%	2	2	3	12	43,702	3	2		6
	GOLDSMITH ESTATE	4	-0.0632	51.5344	4	71	18	57,889	475	79	37,527	154%	76%	24%	38%	2	3	2	12	43,997	3	2		3
	KEIR HARDIE ESTATE	3	-0.0602	51.5681	3	50	17	45,313	573	52	29,773	152%	76%	24%	38%	2	3	2	12	34,438	2	1		3
3	SHEPHERD MARKET ESTATE	3	-0.0918	51.5323	1	100	33	85,884	223	69	15,372	559%	>85% export	10%	c.40% reduction	3	1	3	9	77,296	6	3	Yes	7
	SHANNON COURT	4	-0.0753	51.5598	4	111	28	91,322	277	59	16,352	558%	>85% export	10%	c.40% reduction	3	1	3	9	82,190	6	4		5
	BOSCOBEL HOUSE	1	-0.0603	51.5461	1	22	22	20,771	5,208	26	135,406	15%	6%	94%	19%	1	4	2	8	1,223	<1	<1	Yes	0
	EVERING ROAD PROPERTIES	2	-0.0619	51.5604	2	95	48	82,614	2,900	8	23,199	356%	>85% export	10%	c.40% reduction	2	1	4	8	74,352	5	3		10
	BANISTER HOUSE	1	-0.0465	51.5482	1	21	21	20,201	9,691	21	203,506	10%	0%	100%	10%	1	4	2	8	0	<1	<1		0
	FOLLINGHAM COURT	2	-0.0791	51.5284	2	32	16	25,245	590	87	51,354	49%	40%	60%	30%	1	4	2	8	10,178	<1	<1		1
	BENTHAL COURT	2	-0.066	51.5588	2	74	37	59,689	146	32	4,661	1281%	>85% export	10%	c.40% reduction	2	1	4	8	53,720	4	2		7
	ASPLAND ESTATE	2	-0.0582	51.5479	2	41	21	33,512	3,228	15	48,425	69%	53%	47%	33%	1	3	2	6	17,754	1	<1		2
	ARDEN ESTATE	7	-0.0809	51.5329	7	161	23	133,934	251	125	31,401	427%	>85% export	10%	c.40% reduction	3	1	2	6	120,541	9	6	Yes	4
	LABURNUM ESTATE	7	-0.0745	51.5355	7	155	22	128,012	497	41	20,384	628%	>85% export	10%	c.40% reduction	3	1	2	6	115,211	9	5		4
	DATCHLER ESTATE	6	-0.0662	51.5701	0	139	23	112,563	805	39	31,400	358%	>85% export	10%	c.40% reduction	3	1	2	6	101,307	7	5		4
	WENLOCK BARN ESTATE	5	-0.0907	51.5306	5	75	15	68,450	802	69	55,364	124%	71%	29%	37%	2	3	1	6	48,833	3	2	Yes	2
	SHRUBLAND ESTATE	7	-0.0682	51.5385	7	131	19	121,179	263	32	8,404	1442%	>85% export	10%	c.40% reduction	3	1	2	6	109,061	8	5		4
	ADLEY STREET ESTATE	8	-0.0357	51.5506	0	129	16	104,641	805	32	25,764	406%	>85% export	10%	c.40% reduction	3	1	2	6	94,177	7	4		3
	LEVER COURT	1	-0.0463	51.544	0	34	34	27,908	805	15	12,077	231%	83%	17%	40%	1	2	3	6	23,227	1	1		6
	YORK ROW ESTATE	5	-0.0764	51.5331	3	100	20	84,562	285	83	23,635	358%	>85% export	10%	c.40% reduction	3	1	2	6	76,106	5	3		4
	PENSHURST ROAD PROPERTIES	1	-0.0423	51.5398	0	26	26	21,525	805	12	9,662	223%	83%	17%	40%	1	2	3	6	17,774	1	<1		5
	RICHMOND ROAD ESTATE	1	-0.0639	51.5434	0	21	21	20,305	805	17	13,687	148%	75%	25%	38%	1	3	2	6	15,153	1	<1		4
	FERRON ROAD PROPERTIES	1	-0.0584	51.5578	0	19	19	19,108	805	17	13,687	140%	73%	27%	38%	1	3	2	6	13,965	1	<1		3
	ATHLONE CLOSE PROPERTIES	1	-0.0557	51.5521	1	15	15	12,249	497	31	15,399	80%	58%	42%	34%	1	3	2	6	7,045	<1	<1		2
	MIDDLETON ROAD PROPERTIES	1	-0.0751	51.5406	1	19	19	15,334	9,787	1	9,787	157%	76%	24%	38%	1	3	2	6	11,654	<1	<1		3
	Elsdale Street Estate	1	-0.0477	51.5425	1	47	47	37,783	221	13	2,874	1315%	>85% export	10%	c.40% reduction	1	1	4	4	34,005	2	1		9
	DARVILLE ROAD PROPERTIES	1	-0.0712	51.5589	1	45	45	35,904	1,408	4	5,631	638%	>85% export	10%	c.40% reduction	1	1	4	4	32,314	2	1		9
	WYKE ESTATE	1	-0.0424	51.5461	0	41	41	33,182	805	13	10,467	317%	>85% export	10%	c.40% reduction	1	1	4	4	29,864	2	1		8
	ATHESTAN HOUSE	1	-0.0808	51.5571	1	38	38	29,920	75	13	981	3049%	>85% export	10%	c.40% reduction	1	1	4	4	26,928	2	1		7
	CHURCHWELL COURT	1	-0.0543	51.5505	1	35	35	28,106	293	12	3,520	799%	>85% export	10%	c.40% reduction	1	1	4	4	25,295	1	1		7
	SOMERFORD GROVE ESTATE	4	-0.0738	51.5541	4	25	6	24,991	2,585	20	51,696	48%	40%	60%	30%	1	4	1	4	10,075	<1	<1		0
	DAUBENEY ROAD PROPERTIES	5	-0.0374	51.5503	0	81	16	64,048	805	20	16,103	398%	>85% export	10%	c.40% reduction	2	1	2	4	57,643	4	2		3
4	STONEBRIDGE ESTATE	12	-0.0738	51.5365	12	118	10	104,344	438	65	28,446	367%	>85% export	10%	c.40% reduction	3	1	1	3	93,910	7	4		2
	PRIESTLY CLOSE	5	-0.069	51.5744	5	38	8	37,313	834	50	41,679	90%	61%	39%	35%	1	3	1	3	22,860	1	1		1
	MANOR ROAD PROPERTIES	1	-0.084	51.5658	1	32	32	31,818	225	35	7,858	405%	>85% export	10%	c.40% reduction	1	1	3	3	28,636	2	1		8
	CHARDMORE ROAD PROPERTIES	1	-0.0621	51.5684	1	30	30	24,457	245	24	5,885	416%	>85% export	10%	c.40% reduction	1	1	3	3	22,012	1	1		6
	ALMAC ROAD PROPERTIES	1	-0.0506	51.5542	1	27	27	21,549	317	9	2,854	755%	>85% export	10%	c.40% reduction	1	1	3	3	19,394	1	<1		5
	KENWORTHY ROAD PROPERTIES	1	-0.0363	51.5458	0	26	26	20,786	805	6	4,831	430%	>85% export	10%	c.40% reduction	1	1	3	3	18,708	1	<1		5
	HEWLING ESTATE	2	-0.0831	51.5526	2	47	23	45,817	334	36	12,041	381%	>85% export	10%	c.40% reduction	1	1	2	2	41,235	3	2		5
	APPLEBY ESTATE	6	-0.0744	51.5338	6	75	12	61,312	289	37	10,676	574%	>85% export	10%	c.40% reduction	2	1	1	2	55,181	4	2		2
	AINSWORTH ROAD PROPERTIES	1	-0.0513	51.5399	1	23	23	18,593	342	4	1,367	1360%	>85% export	10%	c.40% reduction	1	1	2	2	16,734	1	<1		4
	ALBION GROVE PROPERTIES 2	1	-0.0818	51.5571	1	23	23	18,427	298	6	1,787	1031%	>85% export	10%	c.40% reduction	1	1	2	2	16,584	1	<1		4
	BRODIA ROAD PROPERTIES	1	-0.0778	51.5612	1	22	22	17,672	236	21	4,956	357%	>85% export	10%	c.40% reduction	1	1	2	2	15,904	1	<1		4
	MIDDLETON HOUSE	1	-0.0698	51.5402	1	21	21	16,363	184	20	3,682	444%	>85% export	10%	c.40% reduction	1	1	2	2	14,726	1	<1		4
	SHACKLEWELL ROW PROPERTIES	2	-0.0715	51.5524	2	24	12	20,432	393	18	7,079	289%	86%	14%	41%	1	2	1	2	17,545	1	<1		2
	CLARENCE ROAD PROPERTIES	1	-0.0558	51.5524	0	15	15	12,202	805	2	1,610	758%	>85% export	10%	c.40% reduction	1	1	2	2	10,982	<1	<1		3
	GRAHAM ROAD PROPERTIES	1	-0.0608	51.5461	1	9	9	8,643	1,918	2	3,836	225%	83%	17%	40%	1	2	1	2	7,137	<1	<1		2
	HOMERTON ROAD PROPERTIES	1	-0.035	51.5501	0	8	8	7,925	805	4	3,221	246%	84%	16%	40%	1	2	1	2	6,644	<1	<1		1
	MARSH HILL PROPERTIES	1	-0.0355	51.5499	0	8	8	7,925	805	4	3,221	246%	84%	16%	40%	1	2	1	2	6,644	<1	<1		1
	BROADWAY MARKET ESTATE	3	-0.0647	51.5388	3	45	15	36,121	827	14	11,579	312%	>85% export	10%	c.40% reduction	1	1	1	1	32,509	2	1		3
	ABERSHAM ROAD ESTATE	4	-0.0692	51.5506	2	44	11	38,056	131	28	3,673	1036%	>85% export	10%	c.40% reduction	1	1	1	1	34,250	2	1		2
	GREEN LANES PROPERTIES	1	-0.0889	51.5546	1	14	14	11,537	1,547	1	1,547	746%	>85% export	10%	c.40% reduction	1	1	1	1	10,384	<1	<1		2
	DE BEAUVOIR SQUARE PROPERTIES	1	-0.0796	51.5417	1	12	12	10,392	3,431	1	3,431	303%	>85% export	10%	c.40% reduction	1	1	1	1	9,352	<1	<1		2
	FASSETT ROAD PROPERTIES	1	-0.065	51.5466	1	10	10	9,545	262	6	1,572	607%	>85% export	10%	c.40% reduction	1	1	1	1	8,591	<1	<1		2
	LENTHALL ROAD PROPERTIES	1	-0.0684	51.5426	1	9	9	9,111	588	3	1,764	517%	>85% export	10%	c.40% reduction	1	1	1	1	8,200	<1	<1		2
	ALLEN ROAD PROPERTIES	2	-0.0809	51.5554	2	12	6	12,033	220	12	2,645	455%	>85% export	10%	c.40% reduction	1	1	1	1	10,830	<1	<1		1
	RICHMOND ROAD PROPERTIES	1	-0.0684	51.5429	0	8	8	8,099	805	2	1,610	503%	>85% export	10%	c.40% reduction	1	1	1	1	7,289	<1	<1		2
	WALSINGHAM ROAD PROPERTIES	1	-0.0613	51.5593	1	5	5	5,207	167	4	667	780%	>85% export	10%	c.40% reduction	1	1	1	1	4,686	<1	<1		1

SYZYGY
THE FUTURE | REALIGNED

APPENDIX D – INPUTS FOR BOTTOM UP AND TOP-DOWN ESTIMATION OF CONSTRUCTION COSTS

CONSTRUCTION COSTS

	TIER	AVERAGE SIZE SYSTEM	COMBINED SIZE (KWP)	TOP-DOWN ESTIMATE (£/KWP)	BOTTOM-UP ESTIMATE (£/KWP)
COMMERCIAL	1	70	1,420	870	650
	2	40	1,100	900	700
	3	35	600	950	770
	4	18	460	1000	810
RESIDENTIAL	1	36	5,300	940	550
	2	25	4,370	950	560
	3	22	1,830	960	600
	4	13	700	1020	720

TEMPORARY ACCESS COSTS FOR BOTTOM-UP ESTIMATION

TEMPORARY ACCESS	COST (£ / KWP)
Flat	40
Pitched Metal / Pitched Other	150
Pitched Tiled	300

WELFARE COSTS FOR BOTTOM-UP ESTIMATION

ITEM	COST
Storage	£700 / site
Welfare	£3,000 / site
Waste Disposal	£800 / site

Site for commercial buildings = per building

Site for residential buildings = per estate

APPENDIX E – FULL BUSINESS MODEL PARAMETERS AND FINANCIAL RESULTS

COMMERCIAL BUILDINGS

Using Energy Consumption from Hackney Meter Readings

TOP DOWN ESTIMATE

BOTTOM UP ESTIMATE

Assuming 95% consumption

TOP DOWN ESTIMATE

BOTTOM UP ESTIMATE

	DETAIL	UNITS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
MAIN	Country		UK	UK	UK	UK	UK	UK	UK	UK		UK	UK	UK	UK	UK	UK	UK	UK
	Technology		Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV		Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV
	Run		Commercial - Tier 1	Commercial - Tier 2	Commercial - Tier 3	Commercial - Tier 4	Commercial - Tier 1	Commercial - Tier 2	Commercial - Tier 3	Commercial - Tier 4		Commercial - Tier 1	Commercial - Tier 2	Commercial - Tier 3	Commercial - Tier 4	Commercial - Tier 1	Commercial - Tier 2	Commercial - Tier 3	Commercial - Tier 4
	System Capacity	kWp	1,420	1,100	600	460	1,420	1,100	600	460		1,420	1,100	600	460	1,420	1,100	600	460
	Year of Construction	Yr	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	Combine Results?	Y/N	YES	NO	NO	NO	NO	YES	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO
	[Run ID]		755 |Run 1 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 30% exported | azimuth , deg pitch	755 |Run 2 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 55% exported | azimuth , deg pitch	755 |Run 3 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 62% exported | azimuth , deg pitch	755 |Run 4 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 68% exported | azimuth , deg pitch	755 |Run 5 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 30% exported | azimuth , deg pitch	755 |Run 6 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 55% exported | azimuth , deg pitch	755 |Run 7 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 62% exported | azimuth , deg pitch	755 |Run 8 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 68% exported | azimuth , deg pitch		755 |Run 10 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 11 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 12 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 13 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 14 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 15 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 16 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 17 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch
	Number of Buildings		20	27	17	25	20	27	17	25		20	27	17	25	20	27	17	25
	Average System Size		71	41	35	18	71	41	35	18		71	41	35	18	71	41	35	18
	Number of Estates																		
	Potential Number of EV Chargers											14	16	11	10	14	16	11	10
CAPEX	Construction Cost	/kWp	870	900	950	1,000	650	700	770	810		870	900	950	1,000	650	700	770	810
	Permanent Access	/kWp	70	70	70	70	70	70	70	70		70	70	70	70	70	70	70	70
	Enabling, Procurement & PM Costs (Syzygy)	£	200,000	270,000	170,000	250,000	200,000	270,000	170,000	250,000		200,000	270,000	170,000	250,000	200,000	270,000	170,000	250,000
	Structural	£	36,000	48,600	30,600	45,000	36,000	48,600	30,600	45,000		36,000	48,600	30,600	45,000	36,000	48,600	30,600	45,000
	Temp Access, Welfare Waste & Storage	£					298,340	293,401	209,544	175,814		0	0	0	0	298,340	293,401	209,544	175,814
	Planning	£	4,000	5,400	3,400	5,000	4,000	5,400	3,400	5,000		4,000	5,400	3,400	5,000	4,000	5,400	3,400	5,000
	Grid Costs	£	23,000	27,000	17,000	25,000	23,000	27,000	17,000	25,000		23,000	27,000	17,000	25,000	23,000	27,000	17,000	25,000
SYSTEM INF	Panel Capacity	Wp	350	350	350	350	350	350	350	350		350	350	350	350	350	350	350	350
	Panel Size	m2	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65		1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
	Panel Degradation Per Annum	%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
	Solarisation (Pre Losses)	kWh/kWp	884	884	884	884	884	884	884	884		884	884	884	884	884	884	884	884
	Output (Post Losses)	kWh/kWp	751.4	751.4	751.4	751.4	751.4	751.4	751.4	751.4		751.4	751.4	751.4	751.4	751.4	751.4	751.4	751.4
OPEI PROJECT	Energy Consumed On Site	%	70%	45%	38%	32%	70%	45%	38%	32%		95%	95%	95%	95%	95%	95%	95%	95%
	Delivered Market Price	/kWh	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300		0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300
	On-Site Energy Sale Rate (PPA)	/kWh	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200		0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200
	Export Energy Sale Rate (PPA)	/kWh	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450		0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450
	Maintenance Costs	£	20,000	27,000	17,000	25,000	20,000	27,000	17,000	25,000		20,000	27,000	17,000	25,000	20,000	27,000	17,000	25,000
	Monitoring Costs	£	20,000	27,000	17,000	25,000	20,000	27,000	17,000	25,000		20,000	27,000	17,000	25,000	20,000	27,000	17,000	25,000
UK	Rates - Charged?	Y/N	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	YES	YES	YES	YES
	Rates - Approach	{list}	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES		LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES
	Rates - Period for Calculation	{list}	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021		01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021
	Rates - Rateable Value Paid	%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%		50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%
INDEXA	Indexation - Delivered Market Price	{list}	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI		EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI
	Indexation - On-Site Sale	{list}	CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI		CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI
	Indexation - Cost	{list}	CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI		CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI
MI SC	CO2 Saving	kg/kWh	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532		0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532

RESIDENTIAL BUILDINGS

Using Energy Consumption from Hackney Meter Readings | **Assuming 95% consumption using other technologies**

	DETAIL	UNITS	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
MAIN	Country		UK	UK	UK	UK	UK	UK	UK	UK		UK	UK	UK	UK	UK	UK	UK	UK
	Technology		Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV		Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV	Solar PV
	Run		Residential - Tier 1	Residential - Tier 2	Residential - Tier 3	Residential - Tier 4	Residential - Tier 1	Residential - Tier 2	Residential - Tier 3	Residential - Tier 4		Residential - Tier 1	Residential - Tier 2	Residential - Tier 3	Residential - Tier 4	Residential - Tier 1	Residential - Tier 2	Residential - Tier 3	Residential - Tier 4
	System Capacity	kWp	5,308	4,369	1,831	705	5,308	4,369	1,831	705		5,308	4,369	1,831	705	5,308	4,369	1,831	705
	Year of Construction	Yr	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
	Combine Results?	Y/N	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO
	[Run ID]		755 |Run 20 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 71% exported | azimuth , deg pitch	755 |Run 21 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 75% exported | azimuth , deg pitch	755 |Run 22 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 74% exported | azimuth , deg pitch	755 |Run 23 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 86% exported | azimuth , deg pitch	755 |Run 24 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 71% exported | azimuth , deg pitch	755 |Run 25 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 75% exported | azimuth , deg pitch	755 |Run 26 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 74% exported | azimuth , deg pitch	755 |Run 27 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 86% exported | azimuth , deg pitch		755 |Run 29 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 30 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 31 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 32 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 33 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 34 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 35 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	755 |Run 36 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch
	Number of Buildings		148	170	82	54	148	170	82	54		148	170	82	54	148	170	82	54
	Average System Size		36	26	22	13	36	26	22	13		36	26	22	13	36	26	22	13
	Number of Estates		24	27	28	26	24	27	28	26		24	27	28	26	24	27	28	26
	Potential Number of EV Chargers																		
CAPEX	Construction Cost	/kWp	940	950	960	1,020	550	560	600	720		940	950	960	1,020	550	560	600	720
	Permanent Access	/kWp	90	90	90	90	90	90	90	90		90	90	90	90	90	90	90	90
	Enabling, Procurement & PM Costs (Syzygy)	£	240,000	270,000	280,000	260,000	240,000	270,000	280,000	260,000		240,000	270,000	280,000	260,000	240,000	270,000	280,000	260,000
	Structural	£	266,400	306,000	147,600	97,200	266,400	306,000	147,600	97,200		266,400	306,000	147,600	97,200	266,400	306,000	147,600	97,200
	Temp Access, Welfare Waste & Storage	£					2,142,665	1,808,228	835,691	399,031						2,142,665	1,808,228	835,691	399,031
	Planning	£	29,600	34,000	16,400	10,800	29,600	34,000	16,400	10,800		29,600	34,000	16,400	10,800	29,600	34,000	16,400	10,800
	Grid Costs	£	161,000	170,000	82,000	54,000	161,000	170,000	82,000	54,000		161,000	170,000	82,000	54,000	161,000	170,000	82,000	54,000
SYSTEM INF	Panel Capacity	Wp	350	350	350	350	350	350	350	350		350	350	350	350	350	350	350	350
	Panel Size	m2	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65		1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
	Panel Degradation Per Annum	%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
	Solarisation (Pre Losses)	kWh/kWp	860	860	860	860	860	860	860	860		860	860	860	860	860	860	860	860
	Output (Post Losses)	kWh/kWp	731	731	731	731	731	731	731	731		731	731	731	731	731	731	731	731
OPE) PROJECT	Energy Consumed On Site	%	29%	25%	26%	14%	29%	25%	26%	14%		95%	95%	95%	95%	95%	95%	95%	95%
	Delivered Market Price	/kWh	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300		0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300
	On-Site Energy Sale Rate (PPA)	/kWh	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300		0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300
	Export Energy Sale Rate (PPA)	/kWh	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450		0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450
	Maintenance Costs	£	148,000	170,000	82,000	54,000	148,000	170,000	82,000	54,000		148,000	170,000	82,000	54,000	148,000	170,000	82,000	54,000
	Monitoring Costs	£	148,000	170,000	82,000	54,000	148,000	170,000	82,000	54,000		148,000	170,000	82,000	54,000	148,000	170,000	82,000	54,000
UK	Rates - Charged?	Y/N	YES	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	YES	YES	YES	YES	YES
	Rates - Approach	{list}	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES		LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES	LOW RATES
	Rates - Period for Calculation	{list}	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021		01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021	01-Jan-2021 to 31-Mar-2021
	Rates - Rateable Value Paid	%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%		50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%	50.5%
INDEX/	Indexation - Delivered Market Price	{list}	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI		EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI	EnPI
	Indexation - On-Site Sale	{list}	CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI		CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI
	Indexation - Cost	{list}	CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI		CPI	CPI	CPI	CPI	CPI	CPI	CPI	CPI
MI SC	CO2 Saving	kg/kWh	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532		0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532	0.2532

CLIENT | Hackney Council **PROJECT |** Hackney Council Solar PV **SITECODE |** 755

SYZYGY
THE FUTURE | REALIGNED

COMMERCIAL - Hackney Energy Consumption

TOP DOWN

	1	2	3	4	5	6	7	8
	Solar PV 1,420 kWp 755 |Run 1 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 30% exported | azimuth , deg pitch	Solar PV 1,100 kWp 755 |Run 2 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 55% exported | azimuth , deg pitch	Solar PV 600 kWp 755 |Run 3 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 62% exported | azimuth , deg pitch	Solar PV 460 kWp 755 |Run 4 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 68% exported | azimuth , deg pitch	Solar PV 1,420 kWp 755 |Run 5 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 30% exported | azimuth , deg pitch	Solar PV 1,100 kWp 755 |Run 6 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 55% exported | azimuth , deg pitch	Solar PV 600 kWp 755 |Run 7 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 62% exported | azimuth , deg pitch	Solar PV 460 kWp 755 |Run 8 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 68% exported | azimuth , deg pitch
	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY
	GBP	GBP	GBP	GBP	GBP	GBP	GBP	GBP
PROJECT COSTS								
CONSTRUCTION COST (ESTIMATION)	£1,334,800	£1,067,000	£612,000	£492,200	£1,022,400	£847,000	£504,000	£404,800
ENABLING, PROCUREMENT & PM COSTS	£200,000	£270,000	£170,000	£250,000	£200,000	£270,000	£170,000	£250,000
MISC. FEES (LEGALS / SURVEYS / PD)	£36,000	£48,600	£30,600	£45,000	£334,340	£342,001	£240,144	£220,814
PLANNING / GRID COSTS	£27,000	£32,400	£20,400	£30,000	£27,000	£32,400	£20,400	£30,000
TOTAL PROJECT BUDGET	**£1,597,800**	**£1,418,000**	**£833,000**	**£817,200**	**£1,583,740**	**£1,491,401**	**£934,544**	**£905,614**
YEAR ONE								
SYSTEM OUTPUT	1,066,988	826,540	450,840	345,644	1,066,988	826,540	450,840	345,644
CO2 SAVINGS (TONNES)	270	209	114	88	270	209	114	88
ON-SITE ENERGY SALE (PPA)	£89,627	£44,633	£20,558	£13,273	£89,627	£44,633	£20,558	£13,273
GROSS INCOME	£104,031	£65,090	£33,137	£23,849	£104,031	£65,090	£33,137	£23,849
OPERATION & MAINTENANCE	-£40,000	-£54,000	-£34,000	-£50,000	-£40,000	-£54,000	-£34,000	-£50,000
BUSINESS RATES	-£3,564	-£2,761	-£1,506	-£1,155	-£3,564	-£2,761	-£1,506	-£1,155
TOTAL OPERATING COSTS	-£43,564	-£56,761	-£35,506	-£51,155	-£43,564	-£56,761	-£35,506	-£51,155
NET INCOME	**£60,467**	**£8,329**	**-£2,369**	**-£27,305**	**£60,467**	**£8,329**	**-£2,369**	**-£27,305**
YR1 NET YIELD	**3.78%**	**0.59%**	**-0.28%**	**-3.34%**	**3.82%**	**0.56%**	**-0.25%**	**-3.02%**
FORECAST PAYBACK								
PAYBACK PERIOD (YRS)	24.7				24.5			
FULL PERIOD PROJECT ECONOMICS								
ANALYSIS PERIOD (YRS)	25	30	35	40	25	35	35	35
ON-SITE ENERGY SALE (PPA)	£2,683,812	£1,336,506	£615,603	£397,442	£2,683,812	£1,336,506	£615,603	£397,442
GROSS INCOME	£3,115,139	£2,223,695	£1,302,654	£1,084,025	£3,115,139	£2,518,136	£1,302,654	£952,126
OPERATION & MAINTENANCE	-£1,380,262	-£1,806,365	-£1,130,882	-£1,633,602	-£1,380,262	-£1,806,365	-£1,130,882	-£1,633,602
BUSINESS RATES	-£114,156	-£112,002	-£75,287	-£69,736	-£114,156	-£138,027	-£75,287	-£57,720
TOTAL OPERATING COSTS	-£1,494,417	-£1,918,367	-£1,206,169	-£1,703,337	-£1,494,417	-£1,944,391	-£1,206,169	-£1,691,322
NET INCOME	£1,620,722	£305,328	£96,484	-£619,313	£1,620,722	£573,745	£96,484	-£739,196
IRR (ZERO RESIDUAL VALUE)	**0.42%**	**-5.13%**	**-4.25%**	**-6.45%**	**0.48%**	**-2.89%**	**-4.54%**	**-9.83%**
INCOME VS COST	1.0	0.2	0.1	-0.8	1.0	0.4	0.1	-0.8
INDICATIVE VALUE (DCF / 6.25% DISCOUNT RATE)								
INDICATIVE VALUE (NPV)	£719,694	£79,329	-£32,890	-£364,013	£719,694	£110,857	-£32,890	-£374,291
FORECAST PROFIT ON COST (NPV)	-£878,106	-£1,338,671	-£865,890	-£1,181,213	-£864,046	-£1,380,544	-£967,434	-£1,279,905
FORECAST PROFIT ON COST (NPV) (%)	-55.0%	-94.4%	-103.9%	-144.5%	-54.6%	-92.6%	-103.5%	-141.3%
LEASE EXPIRY (YRS)	25	25	25	25	25	25	25	25
EARLY EXIT SCENARIO (DCF / 6.25% DISCOUNT RATE)								
EXIT YEAR	5	5	5	5	5	5	5	5
DISCOUNT RATE (APPLIED TO REMAINING CASH FLOW)	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
IRR TO VENDOR	-9.4%	-42.3%	#NUM!	#NUM!	-9.2%	-38.1%	#NUM!	#NUM!
SALE PROCEEDS	£718,067	£73,363	-£33,361	-£375,548	£718,067	£116,681	-£33,361	-£389,670
NET INCOME & CAPITAL RECEIVED DURING PROJECT	£309,153	£39,891	-£14,088	-£143,363	£309,153	£39,891	-£14,088	-£143,363
CASH ON CASH RETURN	64.3%	8.0%	-5.7%	-63.5%	64.9%	10.5%	-5.1%	-58.9%

COMMERCIAL - 95% Energy Consumption

TOP DOWN

BOTTOM UP

	10	11	12	13	14	15	16	17
	Solar PV 1,420 kWp 755 |Run 10 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 1,100 kWp 755 |Run 11 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 600 kWp 755 |Run 12 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 460 kWp 755 |Run 13 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 1,420 kWp 755 |Run 14 - Commercial - Tier 1 | UK | SALE OF ENERGY | 1,420kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 1,100 kWp 755 |Run 15 - Commercial - Tier 2 | UK | SALE OF ENERGY | 1,100kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 600 kWp 755 |Run 16 - Commercial - Tier 3 | UK | SALE OF ENERGY | 600kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 460 kWp 755 |Run 17 - Commercial - Tier 4 | UK | SALE OF ENERGY | 460kWp |12/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch
	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY
	GBP	GBP	GBP	GBP	GBP	GBP	GBP	GBP
PROJECT COSTS								
CONSTRUCTION COST (ESTIMATION)	£1,334,800	£1,067,000	£612,000	£492,200	£1,022,400	£847,000	£504,000	£404,800
ENABLING, PROCUREMENT & PM COSTS	£200,000	£270,000	£170,000	£250,000	£200,000	£270,000	£170,000	£250,000
MISC. FEES (LEGALS / SURVEYS / PD)	£36,000	£48,600	£30,600	£45,000	£334,340	£342,001	£240,144	£220,814
PLANNING / GRID COSTS	£27,000	£32,400	£20,400	£30,000	£27,000	£32,400	£20,400	£30,000
TOTAL PROJECT BUDGET	**£1,597,800**	**£1,418,000**	**£833,000**	**£817,200**	**£1,583,740**	**£1,491,401**	**£934,544**	**£905,614**
YEAR ONE								
SYSTEM OUTPUT	1,066,988	826,540	450,840	345,644	1,066,988	826,540	450,840	345,644
CO2 SAVINGS (TONNES)	270	209	114	88	270	209	114	88
ON-SITE ENERGY SALE (PPA)	£121,637	£94,226	£51,396	£39,403	£121,637	£94,226	£51,396	£39,403
GROSS INCOME	£124,037	£96,085	£52,410	£40,181	£124,037	£96,085	£52,410	£40,181
OPERATION & MAINTENANCE	-£40,000	-£54,000	-£34,000	-£50,000	-£40,000	-£54,000	-£34,000	-£50,000
BUSINESS RATES	-£3,564	-£2,761	-£1,506	-£1,155	-£3,564	-£2,761	-£1,506	-£1,155
TOTAL OPERATING COSTS	-£43,564	-£56,761	-£35,506	-£51,155	-£43,564	-£56,761	-£35,506	-£51,155
NET INCOME	**£80,473**	**£39,324**	**£16,904**	**-£10,973**	**£80,473**	**£39,324**	**£16,904**	**-£10,973**
YR1 NET YIELD	**5.04%**	**2.77%**	**2.03%**	**-1.34%**	**5.08%**	**2.64%**	**1.81%**	**-1.21%**
FORECAST PAYBACK								
PAYBACK PERIOD (YRS)	18.9				18.8			
FULL PERIOD PROJECT ECONOMICS								
ANALYSIS PERIOD (YRS)	25	25	25	30	25	25	25	30
ON-SITE ENERGY SALE (PPA)	£3,642,316	£2,821,513	£1,539,007	£1,179,905	£3,642,316	£2,821,513	£1,539,007	£1,179,905
GROSS INCOME	£3,714,204	£2,877,200	£1,569,382	£1,318,036	£3,714,204	£2,877,200	£1,569,382	£1,318,036
OPERATION & MAINTENANCE	-£1,380,262	-£1,806,365	-£1,130,882	-£1,633,602	-£1,380,262	-£1,806,365	-£1,130,882	-£1,633,602
BUSINESS RATES	-£114,156	-£88,430	-£48,235	-£46,837	-£114,156	-£88,430	-£48,235	-£46,837
TOTAL OPERATING COSTS	-£1,494,417	-£1,894,795	-£1,179,117	-£1,680,439	-£1,494,417	-£1,894,795	-£1,179,117	-£1,680,439
NET INCOME	£2,219,787	£982,405	£390,265	-£362,403	£2,219,787	£982,405	£390,265	-£362,403
IRR (ZERO RESIDUAL VALUE)	**2.84%**	**-2.23%**	**-4.70%**	**-12.45%**	**2.91%**	**-2.55%**	**-5.36%**	**-12.56%**
INCOME VS COST	1.4	0.7	0.5	-0.4	1.4	0.7	0.4	-0.4
INDICATIVE VALUE (DCF / 6.25% DISCOUNT RATE)								
INDICATIVE VALUE (NPV)	£981,042	£443,833	£179,653	-£174,128	£981,042	£443,833	£179,653	-£174,128
FORECAST PROFIT ON COST (NPV)	-£616,758	-£974,167	-£653,347	-£991,328	-£602,698	-£1,047,568	-£754,891	-£1,079,742
FORECAST PROFIT ON COST (NPV) (%)	-38.6%	-68.7%	-78.4%	-121.3%	-38.1%	-70.2%	-80.8%	-119.2%
LEASE EXPIRY (YRS)	25	25	25	25	25	25	25	25
EARLY EXIT SCENARIO (DCF / 6.25% DISCOUNT RATE)								
EXIT YEAR	5	5	5	5	5	5	5	5
DISCOUNT RATE (APPLIED TO REMAINING CASH FLOW)	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
IRR TO VENDOR	-2.9%	-16.4%	-23.0%	#NUM!	-2.8%	-17.3%	-24.8%	#NUM!
SALE PROCEEDS	£987,091	£434,651	£171,906	-£188,170	£987,091	£434,651	£171,906	-£188,170
NET INCOME & CAPITAL RECEIVED DURING PROJECT	£412,204	£199,547	£85,189	-£59,239	£412,204	£199,547	£85,189	-£59,239
CASH ON CASH RETURN	87.6%	44.7%	30.9%	-30.3%	88.4%	42.5%	27.5%	-27.3%

CLIENT | **Hackney Council**

SYZYGY
THE FUTURE | REALIGNED

RESIDENTIAL - Hackney Energy Consumption

TOP DOWN | BOTTOM UP

	20	21	22	23	24	25	26	27
	Solar PV 5,308 kWp 755 |Run 20 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 71% exported | azimuth , deg pitch	Solar PV 4,369 kWp 755 |Run 21 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 75% exported | azimuth , deg pitch	Solar PV 1,831 kWp 755 |Run 22 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 74% exported | azimuth , deg pitch	Solar PV 705 kWp 755 |Run 23 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 86% exported | azimuth , deg pitch	Solar PV 5,308 kWp 755 |Run 24 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 71% exported | azimuth , deg pitch	Solar PV 4,369 kWp 755 |Run 25 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 75% exported | azimuth , deg pitch	Solar PV 1,831 kWp 755 |Run 26 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 74% exported | azimuth , deg pitch	Solar PV 705 kWp 755 |Run 27 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 86% exported | azimuth , deg pitch
	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY
	GBP	GBP	GBP	GBP	GBP	GBP	GBP	GBP
PROJECT COSTS								
CONSTRUCTION COST (ESTIMATION)	£5,467,240	£4,543,760	£1,922,550	£782,550	£3,397,120	£2,839,850	£1,263,390	£571,050
ENABLING, PROCUREMENT & PM COSTS	£240,000	£270,000	£280,000	£260,000	£240,000	£270,000	£280,000	£260,000
MISC. FEES (LEGALS / SURVEYS / PD)	£266,400	£306,000	£147,600	£97,200	£2,409,065	£2,114,228	£983,291	£496,231
PLANNING / GRID COSTS	£190,600	£204,000	£98,400	£64,800	£190,600	£204,000	£98,400	£64,800
TOTAL PROJECT BUDGET	**£6,164,240**	**£5,323,760**	**£2,448,550**	**£1,204,550**	**£6,236,785**	**£5,428,078**	**£2,625,081**	**£1,392,081**
YEAR ONE								
SYSTEM OUTPUT	3,880,148	3,193,739	1,338,461	515,355	3,880,148	3,193,739	1,338,461	515,355
CO2 SAVINGS (TONNES)	982	809	339	130	982	809	339	130
ON-SITE ENERGY SALE (PPA)	£146,282	£103,797	£45,240	£9,379	£146,282	£103,797	£45,240	£9,379
GROSS INCOME	£270,252	£211,585	£89,811	£29,324	£270,252	£211,585	£89,811	£29,324
OPERATION & MAINTENANCE	-£296,000	-£340,000	-£164,000	-£108,000	-£296,000	-£340,000	-£164,000	-£108,000
BUSINESS RATES	-£13,322	-£10,966	-£4,596	-£1,769	-£13,322	-£10,966	-£4,596	-£1,769
TOTAL OPERATING COSTS	-£309,322	-£350,966	-£168,596	-£109,769	-£309,322	-£350,966	-£168,596	-£109,769
NET INCOME	**-£39,070**	**-£139,380**	**-£78,785**	**-£80,446**	**-£39,070**	**-£139,380**	**-£78,785**	**-£80,446**
YR1 NET YIELD	**-0.63%**	**-2.62%**	**-3.22%**	**-6.68%**	**-0.63%**	**-2.57%**	**-3.00%**	**-5.78%**
FORECAST PAYBACK								
PAYBACK PERIOD (YRS)								
FULL PERIOD PROJECT ECONOMICS								
ANALYSIS PERIOD (YRS)	30	30	35	40	30	30	35	40
ON-SITE ENERGY SALE (PPA)	£4,380,291	£3,108,108	£1,354,677	£280,861	£4,380,291	£3,108,108	£1,354,677	£280,861
GROSS INCOME	£9,381,706	£7,396,900	£3,610,832	£1,429,554	£9,381,706	£7,396,900	£3,610,832	£1,429,554
OPERATION & MAINTENANCE	-£9,851,219	-£11,195,054	-£5,380,687	-£3,508,448	-£9,851,219	-£11,195,054	-£5,380,687	-£3,508,448
BUSINESS RATES	-£540,459	-£444,851	-£229,751	-£106,878	-£540,459	-£444,851	-£229,751	-£106,878
TOTAL OPERATING COSTS	-£10,391,679	-£11,639,905	-£5,610,439	-£3,615,326	-£10,391,679	-£11,639,905	-£5,610,439	-£3,615,326
NET INCOME	-£1,009,973	-£4,243,005	-£1,999,607	-£2,185,773	-£1,009,973	-£4,243,005	-£1,999,607	-£2,185,773
IRR (ZERO RESIDUAL VALUE)	**-7.93%**	**-13.22%**	**-8.30%**	**-8.90%**	**-7.95%**	**-13.23%**	**-8.37%**	**-8.96%**
INCOME VS COST	-0.2	-0.8	-0.8	-1.8	-0.2	-0.8	-0.8	-1.6
INDICATIVE VALUE (DCF / 6.25% DISCOUNT RATE)								
INDICATIVE VALUE (NPV)	-£682,262	-£2,027,097	-£1,079,220	-£1,085,058	-£682,262	-£2,027,097	-£1,079,220	-£1,085,058
FORECAST PROFIT ON COST (NPV)	-£6,846,502	-£7,350,857	-£3,527,770	-£2,289,608	-£6,919,047	-£7,455,175	-£3,704,301	-£2,477,139
FORECAST PROFIT ON COST (NPV) (%)	-111.1%	-138.1%	-144.1%	-190.1%	-110.9%	-137.3%	-141.1%	-177.9%
LEASE EXPIRY (YRS)	25	25	25	25	25	25	25	25
EARLY EXIT SCENARIO (DCF / 6.25% DISCOUNT RATE)								
EXIT YEAR	5	5	5	5	5	5	5	5
DISCOUNT RATE (APPLIED TO REMAINING CASH FLOW)	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
IRR TO VENDOR	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
SALE PROCEEDS	-£751,384	-£2,146,222	-£1,122,628	-£1,125,101	-£751,384	-£2,146,222	-£1,122,628	-£1,125,101
NET INCOME & CAPITAL RECEIVED DURING PROJECT	-£217,664	-£736,570	-£414,766	-£420,199	-£217,664	-£736,570	-£414,766	-£420,199
CASH ON CASH RETURN	-15.7%	-54.1%	-62.8%	-128.3%	-15.5%	-53.1%	-58.6%	-111.0%

RESIDENTIAL - 95% Energy Consumption

TOP DOWN | BOTTOM UP

	29	30	31	32	33	34	35	36
	Solar PV 5,308 kWp 755 |Run 29 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 4,369 kWp 755 |Run 30 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 1,831 kWp 755 |Run 31 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 705 kWp 755 |Run 32 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 5,308 kWp 755 |Run 33 - Residential - Tier 1 | UK | SALE OF ENERGY | 5,308kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 4,369 kWp 755 |Run 34 - Residential - Tier 2 | UK | SALE OF ENERGY | 4,369kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 1,831 kWp 755 |Run 35 - Residential - Tier 3 | UK | SALE OF ENERGY | 1,831kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch	Solar PV 705 kWp 755 |Run 36 - Residential - Tier 4 | UK | SALE OF ENERGY | 705kWp |13/kWp (On-Site Sale) | 4.5/kWp (Export Sale) | 5% exported | azimuth , deg pitch
	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY	SALE OF ENERGY
	GBP	GBP	GBP	GBP	GBP	GBP	GBP	GBP
PROJECT COSTS								
CONSTRUCTION COST (ESTIMATION)	£5,467,240	£4,543,760	£1,922,550	£782,550	£3,397,120	£2,839,850	£1,263,390	£571,050
ENABLING, PROCUREMENT & PM COSTS	£240,000	£270,000	£280,000	£260,000	£240,000	£270,000	£280,000	£260,000
MISC. FEES (LEGALS / SURVEYS / PD)	£266,400	£306,000	£147,600	£97,200	£2,409,065	£2,114,228	£983,291	£496,231
PLANNING / GRID COSTS	£190,600	£204,000	£98,400	£64,800	£190,600	£204,000	£98,400	£64,800
TOTAL PROJECT BUDGET	**£6,164,240**	**£5,323,760**	**£2,448,550**	**£1,204,550**	**£6,236,785**	**£5,428,078**	**£2,625,081**	**£1,392,081**
YEAR ONE								
SYSTEM OUTPUT	3,880,148	3,193,739	1,338,461	515,355	3,880,148	3,193,739	1,338,461	515,355
CO2 SAVINGS (TONNES)	982	809	339	130	982	809	339	130
ON-SITE ENERGY SALE (PPA)	£479,198	£394,427	£165,300	£63,646	£479,198	£394,427	£165,300	£63,646
GROSS INCOME	£487,929	£401,613	£168,311	£64,806	£487,929	£401,613	£168,311	£64,806
OPERATION & MAINTENANCE	-£296,000	-£340,000	-£164,000	-£108,000	-£296,000	-£340,000	-£164,000	-£108,000
BUSINESS RATES	-£13,322	-£10,966	-£4,596	-£1,769	-£13,322	-£10,966	-£4,596	-£1,769
TOTAL OPERATING COSTS	-£309,322	-£350,966	-£168,596	-£109,769	-£309,322	-£350,966	-£168,596	-£109,769
NET INCOME	**£178,606**	**£50,647**	**-£284**	**-£44,964**	**£178,606**	**£50,647**	**-£284**	**-£44,964**
YR1 NET YIELD	**2.90%**	**0.95%**	**-0.01%**	**-3.73%**	**2.86%**	**0.93%**	**-0.01%**	**-3.23%**
FORECAST PAYBACK								
PAYBACK PERIOD (YRS)					32.9			
FULL PERIOD PROJECT ECONOMICS								
ANALYSIS PERIOD (YRS)	25	25	35	35	35	35	35	35
ON-SITE ENERGY SALE (PPA)	£14,349,228	£11,810,809	£4,949,781	£1,905,841	£14,349,228	£11,810,809	£4,949,781	£1,905,841
GROSS INCOME	£14,610,651	£12,025,986	£5,961,477	£2,295,380	£17,282,097	£14,224,846	£5,961,477	£2,295,380
OPERATION & MAINTENANCE	-£9,851,219	-£11,195,054	-£5,380,687	-£3,508,448	-£9,851,219	-£11,195,054	-£5,380,687	-£3,508,448
BUSINESS RATES	-£426,717	-£351,229	-£229,751	-£88,462	-£666,041	-£548,216	-£229,751	-£88,462
TOTAL OPERATING COSTS	-£10,277,936	-£11,546,283	-£5,610,439	-£3,596,911	-£10,517,260	-£11,743,270	-£5,610,439	-£3,596,911
NET INCOME	£4,332,715	£479,702	£351,038	-£1,301,531	£6,764,837	£2,481,576	£351,038	-£1,301,531
IRR (ZERO RESIDUAL VALUE)	**-2.15%**	**-15.91%**	**-4.15%**	**-10.49%**	**0.59%**	**-2.50%**	**-4.33%**	**-10.58%**
INCOME VS COST	0.7	0.1	0.1	-1.1	1.1	0.5	0.1	-0.9
INDICATIVE VALUE (DCF / 6.25% DISCOUNT RATE)								
INDICATIVE VALUE (NPV)	£1,972,174	£299,613	-£53,731	-£636,820	£2,308,942	£576,807	-£53,731	-£636,820
FORECAST PROFIT ON COST (NPV)	-£4,192,066	-£5,024,147	-£2,502,281	-£1,841,370	-£3,927,843	-£4,851,271	-£2,678,812	-£2,028,901
FORECAST PROFIT ON COST (NPV) (%)	-68.0%	-94.4%	-102.2%	-152.9%	-63.0%	-89.4%	-102.0%	-145.7%
LEASE EXPIRY (YRS)	25	25	25	25	25	25	25	25
EARLY EXIT SCENARIO (DCF / 6.25% DISCOUNT RATE)								
EXIT YEAR	5	5	5	5	5	5	5	5
DISCOUNT RATE (APPLIED TO REMAINING CASH FLOW)	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
IRR TO VENDOR	-16.0%	-43.9%	#NUM!	#NUM!	-13.2%	-33.6%	#NUM!	#NUM!
SALE PROCEEDS	£1,915,838	£195,180	-£67,018	-£668,963	£2,378,540	£576,028	-£67,018	-£668,963
NET INCOME & CAPITAL RECEIVED DURING PROJECT	£903,580	£242,256	-£10,411	-£237,431	£903,580	£242,256	-£10,411	-£237,431
CASH ON CASH RETURN	45.7%	8.2%	-3.2%	-75.2%	52.6%	15.1%	-2.9%	-65.1%

CLIENT |	Hackney Council	SITECODE |	755
PROJECT |	Hackney Council Solar PV	DATE |	27/01/2021

SYZYGY
THE FUTURE | REALIGNED

	1	2	3	4
	Solar PV 1,420 kWp TIER 1 - 70% ONSITE CONSUMPTION - LOAN	Solar PV 1,100 kWp TIER 2 - 45% ONSITE CONSUMPTION - LOAN	Solar PV 0,600 kWp TIER 3 - 38% ONSITE CONSUMPTION - LOAN	Solar PV 0,460 kWp TIER 4 - 32% ONSITE CONSUMPTION - LOAN
BUDGET				
TOTAL PROJECT BUDGET (IF A LOAN INCLUDES THE INTEREST OVER THE PAYBACK PERIOD)	**£1,499,729**	**£1,308,417**	**£821,735**	**£700,061**
LOANS				
LOAN AMOUNT	**£1,393,800**	**£1,216,001**	**£763,694**	**£650,614**
LOAN PAYBACK PERIOD (YRS)	**17**	**17**	**17**	**17**
ANNUAL REPAYMENT (YR1)	**-£94,450**	**-£82,402**	**-£51,751**	**-£44,089**
ANNUAL REPAYMENT (FINAL)	**-£81,988**	**-£71,529**	**-£44,923**	**-£38,271**
YEAR 1				
SYSTEM OUTPUT (KWH)	**1,066,988**	**826,540**	**450,840**	**345,644**
CO2 SAVINGS (TONNES)	**270**	**209**	**114**	**88**
REDUCTION IN GRID DEMAND (%)	34%	17%	8%	5%
NET / OFFSET (%)	48%	37%	20%	16%
PPA - EXPORT ENERGY SALE	£14,404	£20,457	£12,578	£10,577
OPERATIONAL SAVINGS	£97,096	£48,353	£22,271	£14,379
PPA - CONSUMED ENERGY SALE	£0	£0	£0	£0
GROSS INCOME	**£111,500**	**£68,809**	**£34,850**	**£24,955**
SAVINGS VS MARKET RATE	£0	£0	£0	£0
OPERATION & MAINTENANCE	-£20,000	-£20,000	-£8,451	-£8,364
BUSINESS RATES	-£3,564	-£2,761	-£1,506	-£1,155
LOAN REPAYMENTS	-£94,450	-£82,402	-£51,751	-£44,089
TOTAL OPEX	**-£118,014**	**-£105,163**	**-£61,708**	**-£53,607**
NET INCOME (YR01) (incl. total loan `repayments)	**-£6,514**	**-£36,354**	**-£26,858**	**-£28,651**
NET INCOME (YR01) (incl. loan interest only)	**£75,474**	**£35,176**	**£18,065**	**£9,620**
YR1 NET YIELD	**5.03%**	**2.69%**	**2.20%**	**1.37%**
PAYBACK PERIOD (YRS)	**16**	**24**	**29**	**36**
FULL PERIOD PROJECT ECONOMICS				
ANALYSIS PERIOD (YRS)	25	25	30	40
SYSTEM OUTPUT (KWH)	**25,074,218**	**19,423,690**	**12,544,623**	**12,477,748**
CO2 SAVINGS (TONNES)	**4,461**	**3,455**	**2,196**	**2,140**
PPA - EXPORT ENERGY SALE	£431,327	£612,565	£469,524	£568,224
SAVINGS ON ELECTRICITY	£3,300,681	£1,643,699	£971,176	£957,602
PPA - CONSUMED ENERGY SALE	£0	£0	£0	£0
GROSS INCOME	**£3,732,008**	**£2,256,265**	**£1,440,700**	**£1,525,826**
SAVINGS VS MARKET RATE	£0	£0	£0	£0
OPERATION & MAINTENANCE	-£739,656	-£717,341	-£438,821	-£632,473
BUSINESS RATES	-£114,156	-£88,430	-£61,092	-£69,736
LOAN REPAYMENTS	-£1,499,729	-£1,308,417	-£821,735	-£700,061
TOTAL OPEX	**-£2,353,540**	**-£2,114,188**	**-£1,321,647**	**-£1,402,270**
[O] NET INCOME (PERIOD) (incl. total loan repayments)	**£1,378,468**	**£142,076**	**£119,053**	**£123,556**
[O] NET INCOME (PERIOD) (loan interest only)	**£2,772,268**	**£1,358,077**	**£882,747**	**£774,170**
IRR (ZERO RESIDUAL VALUE)	**4.69%**	**0.25%**	**-0.92%**	**-3.18%**
ASSUMPTIONS				
ANNUAL ENERGY CONSUMPTION	2,222,222	2,222,222	2,222,222	2,222,222
% GENERATED ENERGY CONSUMED ON SITE	70%	45%	38%	32%
PPA - EXPORTED ENERGY SALE RATE	£0.0450	£0.0450	£0.0450	£0.0450
DELIVERED MARKET PRICE	£0.1300	£0.1300	£0.1300	£0.1300
PPA - CONSUMED ENERGY SALE RATE	£0.0000	£0.0000	£0.0000	£0.0000

CLIENT |	Hackney Council	SITECODE |	755
PROJECT |	Hackney Council Solar PV	DATE |	27/01/2021

SYZYGY
THE FUTURE | REALIGNED

	1	2	3	4
	Solar PV 5,308 kWp TIER 1 - 29% ONSITE CONSUMPTION - LOAN	Solar PV 4,369 kWp TIER 2 - 25% ONSITE CONSUMPTION - LOAN	Solar PV 1,831 kWp TIER 3 - 26% ONSITE CONSUMPTION - LOAN	Solar PV 0,705 kWp TIER 4 - 14% ONSITE CONSUMPTION - LOAN
BUDGET				
TOTAL PROJECT BUDGET (IF A LOAN INCLUDES THE INTEREST OVER THE PAYBACK PERIOD)	**£6,420,717**	**£5,513,508**	**£2,505,661**	**£1,206,498**
LOANS				
LOAN AMOUNT	**£5,967,209**	**£5,124,078**	**£2,328,681**	**£1,121,281**
LOAN PAYBACK PERIOD (YRS)	**17**	**17**	**17**	**17**
ANNUAL REPAYMENT (YR1)	**-£404,366**	**-£347,232**	**-£157,802**	**-£75,983**
ANNUAL REPAYMENT (FINAL)	**-£351,012**	**-£301,416**	**-£136,981**	**-£65,958**
YEAR 1				
SYSTEM OUTPUT (KWH)	**3,880,148**	**3,193,739**	**1,338,461**	**515,355**
CO2 SAVINGS (TONNES)	**982**	**809**	**339**	**130**
REDUCTION IN GRID DEMAND (%)	51%	36%	16%	3%
NET / OFFSET (%)	175%	144%	60%	23%
PPA - EXPORT ENERGY SALE	£123,971	£107,789	£44,571	£19,944
OPERATIONAL SAVINGS	£146,282	£103,797	£45,240	£9,379
PPA - CONSUMED ENERGY SALE	£0	£0	£0	£0
GROSS INCOME	**£270,252**	**£211,585**	**£89,811**	**£29,324**
SAVINGS VS MARKET RATE	£0	£0	£0	£0
OPERATION & MAINTENANCE	-£36,000	-£40,500	-£42,000	-£39,000
BUSINESS RATES	-£13,322	-£10,966	-£4,596	-£1,769
LOAN REPAYMENTS	-£404,366	-£347,232	-£157,802	-£75,983
TOTAL OPEX	**-£453,688**	**-£398,697**	**-£204,398**	**-£116,753**
NET INCOME (YR01) (incl. total loan `repayments)	**-£183,436**	**-£187,112**	**-£114,587**	**-£87,429**
NET INCOME (YR01) (incl. loan interest only)	**£167,576**	**£114,304**	**£22,394**	**-£21,471**
YR1 NET YIELD	**2.61%**	**2.07%**	**0.89%**	**-1.78%**
PAYBACK PERIOD (YRS)	**27**	**30**	**>40**	**>40**
FULL PERIOD PROJECT ECONOMICS				
ANALYSIS PERIOD (YRS)	30	30	30	30
SYSTEM OUTPUT (KWH)	**107,965,118**	**88,865,788**	**37,242,677**	**14,339,753**
CO2 SAVINGS (TONNES)	**18,899**	**15,556**	**6,519**	**2,510**
PPA - EXPORT ENERGY SALE	£4,627,546	£4,023,507	£1,663,725	£744,473
SAVINGS ON ELECTRICITY	£6,378,786	£4,526,173	£1,972,744	£409,003
PPA - CONSUMED ENERGY SALE	£0	£0	£0	£0
GROSS INCOME	**£11,006,332**	**£8,549,680**	**£3,636,469**	**£1,153,476**
SAVINGS VS MARKET RATE	£0	£0	£0	£0
OPERATION & MAINTENANCE	-£2,309,660	-£2,341,989	-£1,996,795	-£1,694,946
BUSINESS RATES	-£540,459	-£444,851	-£186,432	-£71,783
LOAN REPAYMENTS	-£6,420,717	-£5,513,508	-£2,505,661	-£1,206,498
TOTAL OPEX	**-£9,270,836**	**-£8,300,347**	**-£4,688,888**	**-£2,973,227**
[O] NET INCOME (PERIOD) (incl. total loan repayments)	**£1,735,496**	**£249,333**	**-£1,052,418**	**-£1,819,751**
[O] NET INCOME (PERIOD) (incl. loan interest only)	**£7,702,705**	**£5,373,411**	**£1,276,263**	**-£698,470**
IRR (ZERO RESIDUAL VALUE)	**-0.15%**	**-1.46%**	**-4.95%**	**>-10%**
ASSUMPTIONS				
ANNUAL ENERGY CONSUMPTION	2,222,222	2,222,222	2,222,222	2,222,222
% GENERATED ENERGY CONSUMED ON SITE	29%	25%	26%	14%
PPA - EXPORTED ENERGY SALE RATE	£0.0450	£0.0450	£0.0450	£0.0450
DELIVERED MARKET PRICE	£0.1300	£0.1300	£0.1300	£0.1300
PPA - CONSUMED ENERGY SALE RATE	£0.0000	£0.0000	£0.0000	£0.0000

APPENDIX F - GRID CAPACITY

UK Power Networks (UKPN) are the DNO for the London area and are responsible for the grid infrastructure of that region. Syzygy have been in communication with UKPN regarding the grid capacity across Hackney Borough. UKPN have notified Syzygy that there is potential risk for either a grid capacity or a fault level issues at the following primary substations (grid connection point which cover substantial areas).

Table 18 – UKPN areas with potential grid limitations

UKPN primary with fault level issue / no capacity	**Grid Connections which could be affected**
Edwards Lane A	Stoke Newington Library (40kWp)
King Henry's Walk	No buildings close to this substation
Whiston Road	Whiston Estate (Tier 1)

UKPN have stated that without a full assessment for each grid application they cannot say that there will not be issues. However, it can be assumed that as most system sizes are ~100kWp the grid should have capacity for most connections.

These limitations do not mean that connection to the grid is not possible. If there are any limitations, then additional grid infrastructure can be built at additional costs or export to the grid can be limited. Estimated costs for these works have been included in the business models for these buildings/estates as a precaution.

SYZYGY
THE FUTURE | REALIGNED

APPENDIX G - evlab® REPORT

evlab
Leading the charge

Report generated for

Hackney Council Local Area

Client	Project Ref	Date
Hackney Council	755	14.12.2020

01 Site Summary and Recommendations

Overview

Hackney is one of the 32 London boroughs. It was assumed in the analysis that Hackney council currently has c. 46,000 car parking spaces with 350 existing EV charging bays. An average of 80% occupancy rate across the council was assumed. The report presents an analysis of Hackney Council and its local market for electric vehicles today and out to 2030 as the market develops. evlab® uses a proprietary algorithm that produces a site score based on several data-backed variables - this indicates the area's strength as a charging location versus the UK average. The report sets out the size and speed of charging service required and how many charging bays the council should be prepared for in the future.

evlab® site score

127%

Demand for EV charging is higher than the UK average and indicates it should be prioritised

Recommended charging provision for the council (2021)

1600-1700 Bays

Recommended speeds

Mix of AC Fast (7-22kW) and DC Rapid (50kW+)

Local EV market – Strong

Concentration of locally owned plug-in EVs is ahead of the UK average, share of 'Full Electric' cars is lower than the UK market average.

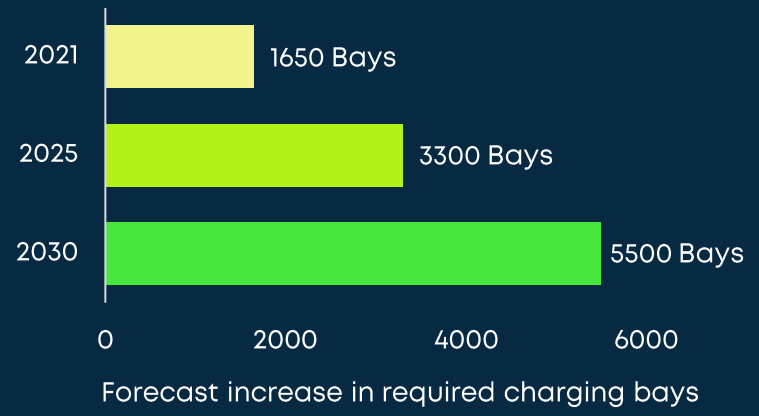
Local EV charging infrastructure – Below average

Higher density of EV chargers than the UK average but very low average charging speed indicates poor local infrastructure.

Forecast growth in EV adoption – Above Average

Hackney Council located near a ULEZ zone, and GDP per capita is in line with UK average.

Future EV charging bays requirement



Next steps

Site survey / Funding strategy / Technology & Operator selection / Project costing / Procurement / Project delivery

02 Local EV Market

Demand Score: 166%

EV ownership
Strong

Local market has been defined as all the postal districts that are located fully or partly in Hackney Council. Within the local market there are 2,301 EVs. Local EV penetration (2.51%) is significantly higher than UK EV penetration (1.13%).

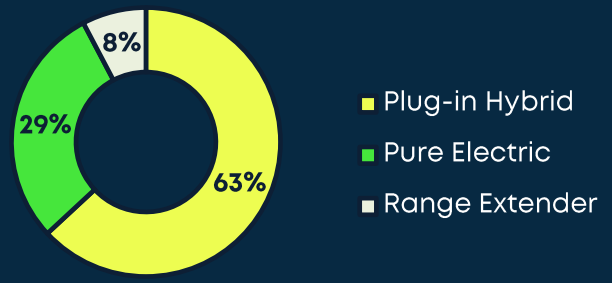
Electric Vehicles Registered by Postal Districts

Postal Districts	No of registered EVs	Postal Districts	No of registered EVs
E1	252	E10	145
E2	410	N1	471
E5	151	N4	172
E8	211	N5	162
E9	128	N16	199

Network Reliance
Below Average

Pure electric vehicles rely more heavily on public charging networks. The share of Pure electric vehicles in the local market (29.20%) is significantly lower than the UK market (42.01%).

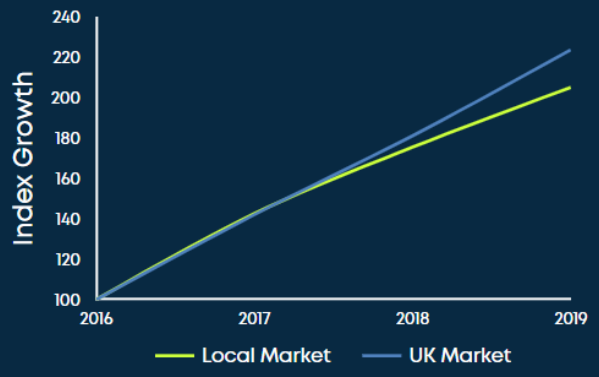
Electric Vehicles by Energy Source in Local Market



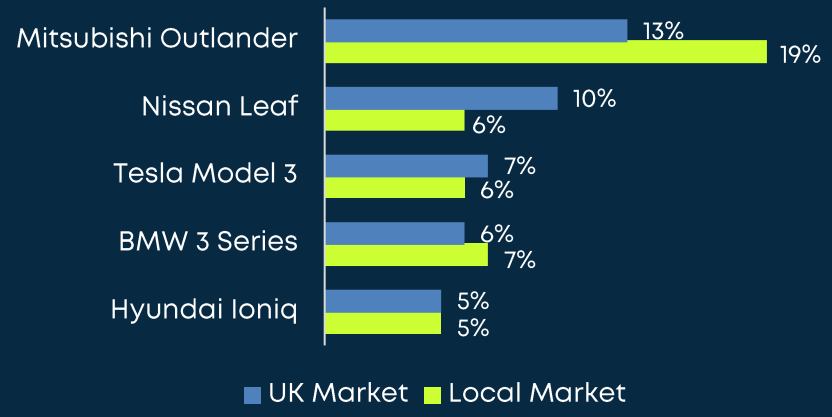
Market Growth
Below Average

For the last three years, the local EV market has grown more slowly (27.51%) than the UK market (31.03%).

3 Year EV Market Index Growth



Most Popular EVs



03 Local Charging Network

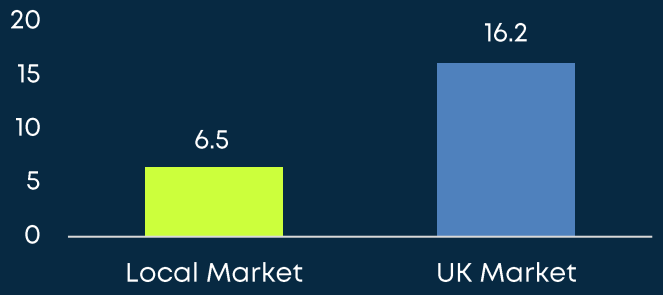
Supply Score: 83%

Supply of Charging Infrastructure

Strong

Local charging network has been defined as all the postal districts that are located fully or partly in Hackney Council. The availability of local chargers is significantly higher than the UK average.

Number of registered EVs per charger

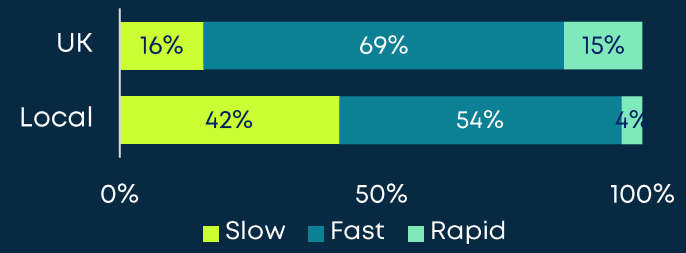


Average Network Speed

Weak

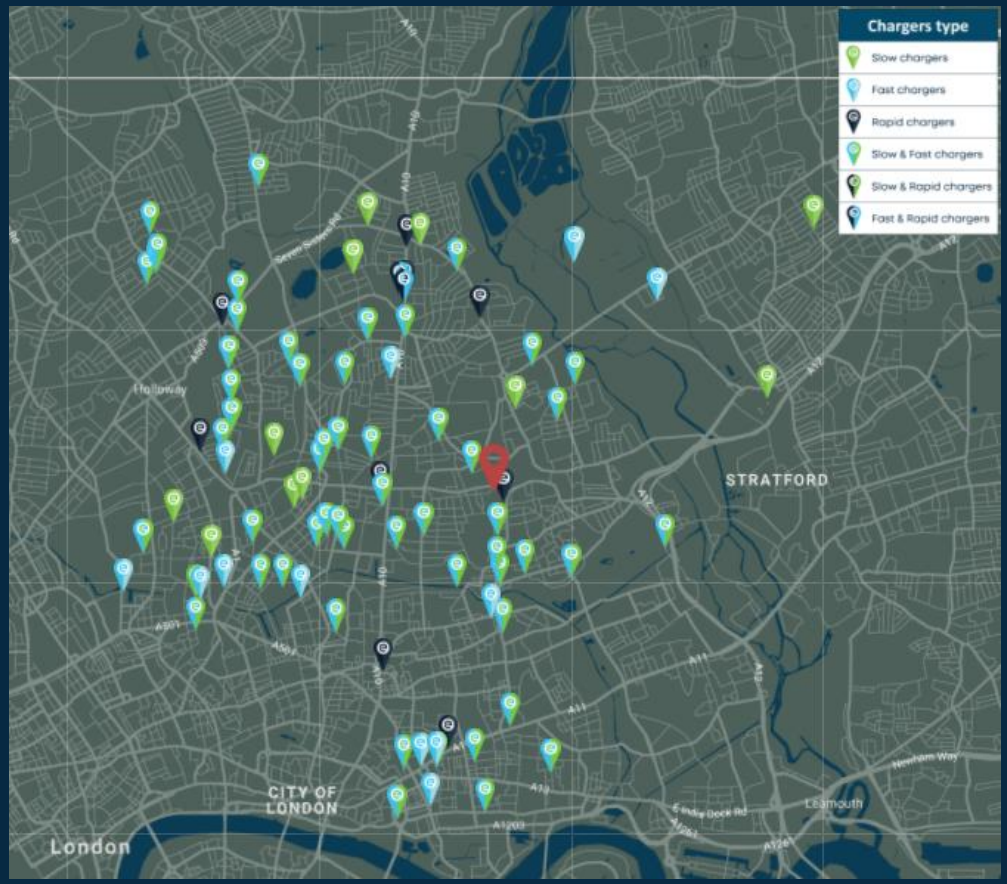
The average local network charging speed is 59% slower than the average UK network charging speed.

Distribution of chargers speed in UK vs local market



No of Public Chargers in the Council

351 charging bays



05 Local Area Indicators

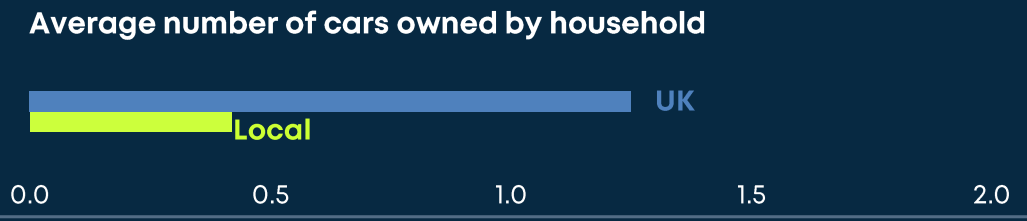
EV Adoption Score: 110%

530,035 People

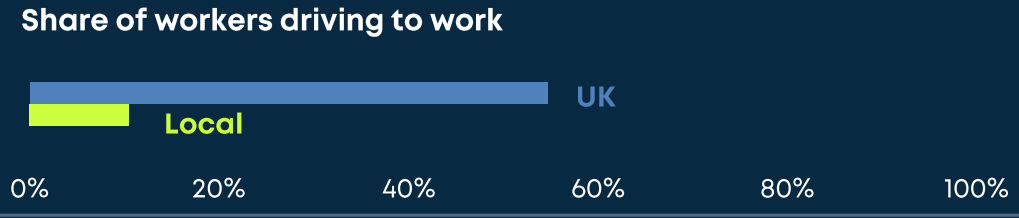
218,396 Households

Close to Ultra Low Emission Zone (ULEZ)

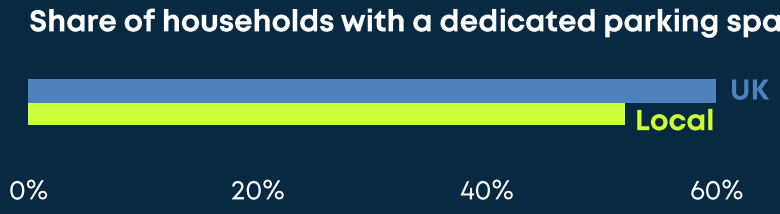
Car Ownership
Below Average



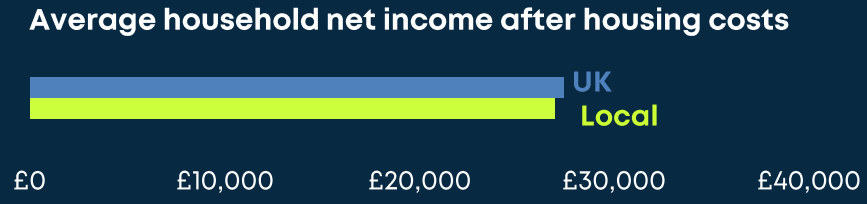
Drive to Work
Below Average



Parking
Below Average



Economic Indicator
Average



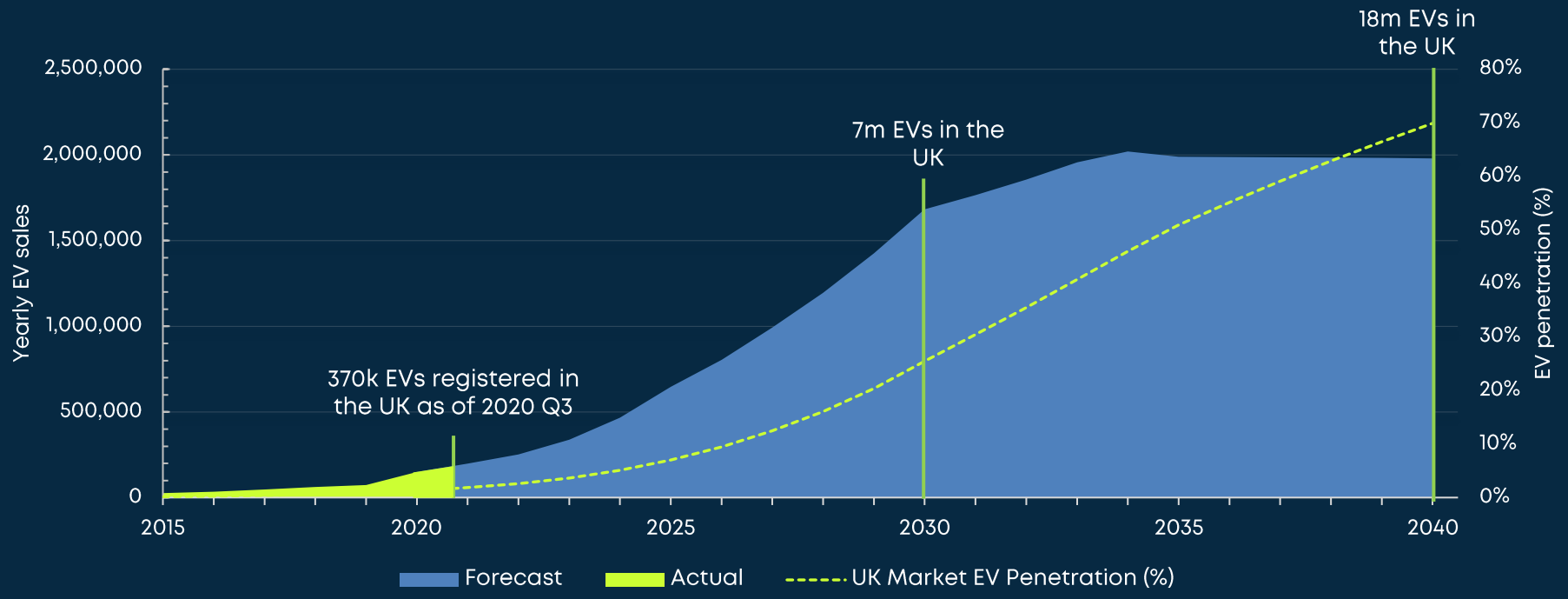
06 Projected Charging Infrastructure Requirement

Forecast

UK EV penetration forecasts, combined with an assessment of the local market and the site strength (evlab® score), have been used to forecast how many EV charging bays will be required at the subject site for 2021 and out to 2030.

Year	Number of bays required
2021	**1,650**
2025	**3,300**
2030	**5,500**

UK Electric Vehicle Market Penetration & Annual Sales Forecasts



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