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# Feasibility Study and Options Appraisal for Large Scale Energy Generation for Manchester City Council

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**1 EXECUTIVE SUMMARY ..... 5**

1.1 Background and Purpose ..... 5
1.2 Methodology ..... 5
1.3 Size of the requirement ..... 5
1.4 Council owned sites ..... 7
1.5 Further potential sites ..... 8
1.6 Greater Manchester Combined Authority Sites ..... 10
1.7 Market Schemes – UK wide opportunities ..... 10
1.8 PPA options ..... 11
1.9 Value for Money ..... 12
1.10 Options Appraisal ..... 13
1.11 Preferred option and PWLB risk ..... 14
1.12 No regrets actions and next steps ..... 14

**2 METHODOLOGY ..... 16**

2.1 Site Generation Hierarchy ..... 16
2.2 Key Considerations ..... 16

**3 SIZING THE COUNCIL'S RENEWABLE ENERGY GENERATION REQUIREMENT ..... 18**

3.1 Background ..... 18
3.2 Grid decarbonisation ..... 18
3.1 Renewable energy technology selection ..... 20
3.2 Calculating the appropriate size of a solar PV scheme to meet existing targets 20
3.3 Carbon Accounting Practice ..... 23
3.4 Size range and target size ..... 24

**4 REVIEW OF GROUND MOUNTED SOLAR PV OPPORTUNITIES ON LAND ASSETS OWNED BY THE COUNCIL ..... 25**

4.1 Overview ..... 25
4.2 Development of ground-mounted solar PV schemes ..... 25
4.3 Elements of development ..... 26
4.4 Heaton Park ..... 29
4.5 Land south of Wythenshawe Hospital ..... 31

**5 BATTERY STORAGE ..... 33**

5.1 Overview ..... 33
5.2 Potential for battery storage across the Council estate ..... 33
5.3 Next steps ..... 35

**6 ONSHORE WIND ..... 36**

6.1 Background ..... 36
6.2 Potential for onshore wind across the Council estate ..... 39
6.3 Onshore wind market review ..... 39
6.4 Next steps ..... 39
**7 OFFSHORE WIND ..... 40**
7.1 Background ..... 40
7.2 Offshore wind – suitability ..... 41
**8 SOLAR PV MARKET REVIEW ..... 42**
8.1 Background ..... 42
8.2 Opportunities within the Council's boundary ..... 42
8.3 Opportunities within the Greater Manchester Combined Authority boundary ..... 42
8.4 Out of area opportunities ..... 42
8.5 Solar PV market investments ..... 42
8.6 Useful life ..... 43
8.7 Technological improvements ..... 43
8.8 Structuring ..... 45
8.9 Positioning the Councils to respond to market opportunities ..... 45
8.10 Active Projects ..... 45
8.11 Public Works Loan Board Consultation ..... 46
8.12 Next steps ..... 47
**9 THE PPA ALTERNATIVE ..... 48**
9.1 Green Tariffs ..... 48
9.2 Direct PPAs with a generator ..... 49
**10 OPTIONS APPRAISAL ..... 51**
10.1 Options for Appraisal ..... 51
10.2 Preliminary appraisal – affordability ..... 51
10.3 NPV outputs ..... 53
10.4 Criteria and weighting for options appraisal ..... 54
10.5 Options Appraisal Outputs ..... 58
10.6 Options Appraisal Summary ..... 58
**11 RISKS AND OTHER CONSIDERATIONS IN DECISION MAKING ..... 59**
11.1 PWLB risk factor ..... 59
11.2 Asset acquisitions ..... 59
11.3 PPA opportunities ..... 60
11.4 Preferred Option ..... 60
11.5 Risk Management ..... 60

11.6 Value for Money ..... 63
**12 CONCLUSIONS AND RECOMMENDATIONS ..... 64**
12.1 Preferred option ..... 64
12.2 Recommendation ..... 64
12.3 Next steps and no regrets actions ..... 64
**APPENDIX 1 INCOME FROM ELECTRICITY GENERATION - SUBSIDIES AND POWER PURCHASE AGREEMENTS ..... 66**
**APPENDIX 2 – PROCUREMENT AND RISK MANAGEMENT ..... 70**
**APPENDIX 3 – SOLAR FARM ACQUISITION BRIEFING NOTE ..... 73**
**APPENDIX 4 – REVIEW OF GROUND MOUNTED SOLAR PV OPPORTUNITIES ON LAND ASSETS OWNED BY THE COUNCIL ..... 78**

# 1 Executive Summary

## 1.1 Background and Purpose

Manchester City Council ("the Council") has declared a climate emergency and set a science-based target to be zero carbon by 2038. It has already reduced its direct emissions by 48% from a 2009/10 baseline[1]. Ongoing work to reduce emissions further is set out within the Council's Climate Change Action Plan (CCAP) for 2020-25. The CCAP includes a target to halve emissions again within this 5-year period and sets a carbon budget for the period too.

Work is underway across several different strands to meet these emission reduction targets – from improving the energy efficiency of street lighting to decarbonising heat within the estate and investing in large scale renewable energy generation capacity. In October this year, Local Partnerships was appointed to carry out a feasibility study to investigate options for large-scale renewable energy generation - in line with Action 1.4 of the CCAP which sets a target to reduce $CO_2$ emissions by 7,000 t pa.

## 1.2 Methodology

This report is based on a desk-based review of opportunities on land assets owned by the Council, a review of potential market opportunities to acquire assets from third parties and a review of potential power purchase agreement (PPA) options. For the reasons set out in section 3.1 of this report the analysis of self-development and asset purchase concentrates on solar PV generation. PPA options consider all alternatives.

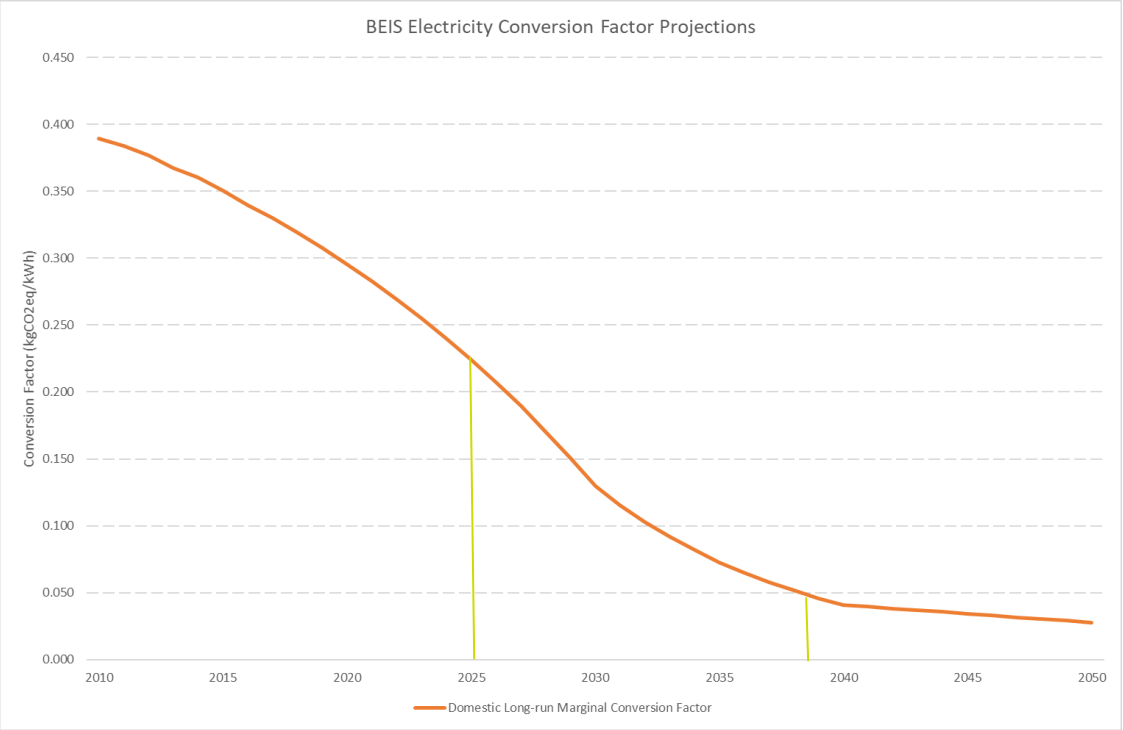
## 1.3 Size of the requirement

Carbon displaced through renewable energy generation can be described as the avoidance of carbon emissions through grid supplied electricity. The UK has seen significant reductions in the carbon intensity of grid supplied electricity over the last ten years resulting from the retirement of most of the UK coal fired power stations and the introduction of gas fired power stations and renewable energy.

For the UK to achieve net carbon zero emissions by 2050 the complete decarbonisation of the electricity supply will be needed. This will require several measures including a fourfold increase in renewable energy generation. As this happens the carbon intensity of grid supplied electricity falls (see Figure 1)

1 https://democracy.manchester.gov.uk/documents/s16275/Final%20MCC%20Climate%20Change%20Action%20Plan%202020-25.pdf

*Figure 1: Forecast for electricity grid decarbonisation 2010-2050*




Based on the requirement to avoid 7,000 tonnes of $tCO_2e$ by 2025, the Council would require a solar PV portfolio of 33 MW in addition to that already identified in its carbon savings programme. By the Council's net zero emissions date of 2038 the carbon intensity of grid supplied electricity has fallen significantly. In 2038 it is anticipated that the Council will have residual emissions of around 2,913 tonnes of $tCO_2e$ which would require a solar PV portfolio of around 60 MW to offset. The methodology for calculating the 2025 and 2038 requirements is set out in section 3.2.1 and 3.2.2.

The Council will only be able to offset emissions from electricity generation against its electricity consumption (i.e. scope 2 emissions). In setting a target requirement consideration also needs to be given to the future consumption of electricity by the Council. 2018/19 electricity consumption was around 49GWh (excluding schools). A further 4GWh/pa reduction is forecast from the street lighting programme, leaving a residual requirement of around 45 GWh/pa. No further assumptions have been made on volumes due to uncertainties, with volumes set to decrease as a consequence of energy efficiency and rationalisation of property, but also set to increase through the electrification of heat and transport.

At an irradiance level of 945 kwh/kwp (see section 3.2 for further details) the annual consumption would equate to around 47.6 MW.

Bringing together these assumptions the Council should consider adopting a target of around 45-50 MW of generation (solar PV or equivalent wind) in order to meet its ongoing requirement.

**Recommendation 1: The Council should consider adopting a target of 45-50 MW of solar PV generation (or equivalent wind) now as this will:**

a) **Provide a future proof solution which will also deal with residual emissions in 2038.**

b) **Allow a larger proportion of the Council's scope 2 electricity emissions to be reduced from an earlier point in time. This will help the Council in achieving its carbon budget target.**

c) **Maximise the potential of carbon reduction through generation or power purchase.**

Figure 2 below sets out how this requirement is likely to be met.

*Figure 2: Opportunities for renewable energy generation*


### 1.4 Council owned sites

The Council has already identified around 6.67 MW of rooftop and carport solar PV (see Table 1) that could realistically be delivered on its own assets.

*Table 1: Manchester City Council – Estate wide opportunities for renewable generation*

| Opportunity | Sites | Solar capacity (MW) |
|---|---|---|
| Potential roof mounted solar schemes (Phase 1 Buildings Carbon Reduction) | a) Wythenshawe Forum<br>b) The Sharp Project<br>c) Space Project<br>d) Hough End Leisure Centre<br>e) East Manchester Leisure Centre<br>f) Arcadia Sports Centre<br>g) Moss Side Leisure Centre<br>h) Belle Vue Sports Centre<br>i) Manchester Tennis and Football Centre | 0.165<br>0.790<br>0.494<br>0.188<br>0.179<br>0.166<br>0.101<br>0.375 |

| | | |
|---|---|---|
| | | 0.103 |
| Potential roof mounted solar schemes (Public Sector Decarbonisation Fund) | j) Arcadia Library & Leisure Centre<br>k) Manchester Aquatics Centre<br>l) Manchester Tennis and Football Centre<br>m) North City Family & Fitness Centre<br>n) Sharp Project Media Centre<br>o) Wythenshawe Forum<br>p) Zion Arts Centre<br>q) Space Studios | 0.082<br>0.367<br>0.165<br>0.146<br>0.273<br>0.142<br>0.102<br>1.20 |
| Potential roof mounted and carport schemes (ERDF Unlocking Clean Energy) | r) Hammerstone Road – roof mounted<br>s) Manchester Velodrome - carport | 0.717<br>0.915 |
| | **Total Solar PV** | **6.67** |

These schemes are already accounted for in relation to carbon accounting and therefore do not contribute towards the 7,000 tCO2e target.

### 1.5 Further potential sites

The Council has limited land available to support large-scale solar PV generation. The requirement identified in section 1.3 will require around 100 Ha of land to achieve, which would be hard to find in a densely built-up area.

Table 2 sets out the criteria that have been considered in assessing sites for potential suitability:

*Table 2 – screening tests for potential projects – Solar PV*

| Risk Category | Action and Information Sources |
|---|---|
| Viability | Size and orientation. For a scheme to offer sufficient financial return on investment to pay for a grid connection it is likely to need to be > 1MW. A site of this size would require 5 acres of land.<br><br>Shading from trees or adjacent buildings which would prevent the solar panels from working effectively. |
| Planning | Planning designations (greenbelt, Area of Outstanding Natural Beauty (AONB) etc).<br><br>Sites allocated for housing – local plan<br>Proximity to housing – we would recommend at least 300m.<br>Potential loss of amenity either through loss of established public use of a site.<br><br>Transport and access constraints.<br><br>Other development issues such as flooding, proximity to historic buildings, complex ecology etc. |

| Risk Category | Action and Information Sources |
|---|---|
| Land | Agricultural land grade 3b or below. Indicative land grade is provided by Natural England . (http://publications.naturalengland.org.uk/category/5954148537204736). <br><br> Land ownership including underlying interests and covenants, tenancies etc – Land Registry and deed packets <br> Does the land have direct access to the public highway? <br><br> Suitability of ground conditions and ground contamination/ stability. |
| Grid | Available and affordable grid connection capacity for the export of power generated |

We have examined a range of land holdings including 35 historic landfill sites across the city. Many of these closed landfill sites have been reclaimed as open space (for example, Clayton Vale and Tweedle Common) or are not suitable for development as a result of location issues where adjacent land uses effectively rule out development (also see Appendix 4). For example, Shack Liffe Green is nestled between the houses of Horncastle Road and Boggart Hole Clough Park. The site has received minimal intervention and as a result now has a very diverse habitat with ecological value.

We also identified potential opportunities for solar PV at Heaton Park and on Council owned land south of Wythenshawe Hospital. Further investigation of these sites suggests that there are issues which would prevent them providing solar PV capacity as follows:

- Heaton Park is a large, historic, Grade II listed municipal park and reservoir, containing a number of historic structures dating from its original use as a country estate. It is used for a mix of formal and informal recreational opportunities in a primarily informal landscape. Heaton Park is a site of heritage value and as such a heritage impact assessment will be required to determine any potential harm or opportunities on the listed buildings within the setting. Heaton Park is also designated as a green belt area. At the time of writing, grid capacity of around 8 MW was the available in the vicinity of the site.

  Discussions with the Council's planning department has precluded a development of this scale due to the impact on heritage assets. As an alternative a significantly smaller solar carport project was considered, but again this is likely to be unsuitable in planning terms.

- The land south of Wythenshawe Hospital under is included within Allocations 11 and 46 for employment within the Greater Manchester Spatial Framework Publication Plan 2020. These allocations and supporting planning documents have been through extensive consultation and as such it would be very difficult to make representation to amend the allocations for a ground mounted solar scheme to be brought forward on the site. The plan is currently going through all ten Greater Manchester Combined Authority councils for approval. The consultation on the final plan is scheduled from 1 December 2020 to 26 January 2021.

There remains potential for up to 2 MW of solar PV on both the car park and roof areas at the site, however it is likely that this will be required by the eventual occupiers of the site.

Further investigation of the planning constraints associated with these assets suggest that **none of this will contribute** to the overall requirement as the sites are unsuitable in planning terms.

A review of planning applications within the Council's area over the last two years has not provided any potential third-party schemes within the Council's boundary.

### 1.6 Greater Manchester Combined Authority Sites

Other councils within the Greater Manchester Combined Authority area are also exploring potential opportunities for solar farm sites. The ground mounted projects planned include solar farms at Chamber House farm in Rochdale (5 MW) and Kenyon Way in Salford (1.7 MW). The size of these schemes are not large enough to necessitate a collaboration with the Council and we have not been able to identify any third party developments which could be acquired.

### 1.7 Market Schemes – UK wide opportunities

We have identified no additional potential for schemes within the Greater Manchester area.

As the Council's requirement cannot be met from within its own asset base it is likely to need to acquire assets from the open market or enter into a suitable PPA. Section 8 of this report sets out how the Council can position itself to be able to respond to market opportunities as they arise. It is most likely that schemes available to purchase will be onshore solar PV for the reasons set out in section 3.1.

There is a substantial pipeline of new solar PV projects in the UK, but many of these projects are either already owned by, or committed to, existing investors. There are two types of developers of solar PV assets in the UK, those who are part of or commercially attached to the major funds (e.g. Greencoat, BlackRock and Octopus Renewables), and those who fund their own developments and sell projects. This report has been produced following dialogue with developers who sell projects.

There are examples of local authorities successfully purchasing Low and Zero Carbon (LZC) most notably Warrington Borough Council who have acquired around 100 MW of solar PV and storage assets from Gridserve.

The solar development market has focused in recent years on the development of larger schemes, typically larger than 30 MW capacity and mostly concentrated just under 50 MW in size. These schemes are a good fit with the Council's overall requirement.

During the course of this process, Local Partnerships has identified three potentially suitable projects for the Council to review. Other schemes may become available over time and these schemes may no longer be available when the Council is in a position to act, so implementation of an asset purchase scenario is likely to require new market

intelligence. We are not able to disclose commercially sensitive information in relation to projects identified, so these have been anonymised for the purpose of this report.

### 1.7.1 Project A – North West – 30 MW

Project is in development. Grid and land rights appear to have been secured by the developer. Planning is yet to be submitted. Earliest energisation date Q4 2023. Community development company.

### 1.7.2 Project B – The Midlands – 45 MW

Project has grid and land rights secured. Planning consent has been granted for the scheme. This scheme has a grid connection at 132kV which will add some complexity. Opportunity to purchase post construction. Earliest energisation date Q1 2022. Commercial developer.

### 1.7.3 Project C – Southern England – 46 MW

Project has grid and land rights secured. Planning consent has been granted for the scheme. Earliest energisation date Q3 2021. Commercial developer.

There will be competition for the acquisition of these projects, and the Council cannot therefore be certain at this stage of securing a particular project. The purpose of this report is not to identify and secure a project, it is to develop the Council's understanding of what is required to meet its objectives and the extent to which that is possible. This will enable the Council to take the necessary decisions to put in place measures which would allow it to engage with projects and move at the speed that is likely to be necessary to secure project rights. This report therefore does not contain a specific recommendation to pursue any particular option.

## 1.8 PPA options

Renewable energy PPA's are available either through major electricity suppliers or direct with generating stations. These are generally on terms ranging from 8-15 years. Renewable energy PPAs have some risks in carbon accounting terms in relation to permanence as the arrangement can be easily reversed at the end of the contract period.

### 1.8.1 Electricity supplier green PPAs

For this report we have reviewed options available from npower (the Council's current electricity supplier). Under these arrangements the Council are able to source their power directly from an identified renewable energy generating station, with pricing tied to the particular technology.

Various pricing options are available ranging from a fixed price option to options indexed at either CPI or RPI.

In addition to the carbon accounting risk in relation to permanence PPAs with major suppliers are harder to justify in terms of additionality as most of the schemes listed would have entered into a PPA with a large electricity supplier regardless of the specific demand from one customer. There is also the possibility of being accused of 'green washing' as by allocating particular renewable energy generation to a specific customer

the supplier is potentially increasing the carbon intensity factor for electricity supplied to its other customer who are not on a specifically 100% renewable energy tariff.

### 1.8.2 Direct PPAs with generating stations

It is possible to procure electricity directly from a generating station, through either a sleeved or a synthetic PPA. Either of these arrangements is compliant in terms of carbon accounting.

Whilst the permanence argument remains in relation to carbon accounting the additionality argument is much stronger when taking this alternative.

## 1.9 Value for Money

A financial appraisal of each of the options was undertaken and compared to the current state (do nothing scenario) using a net present value (npv) calculation. This modelling was undertaken by Local Partnerships on behalf of the council and utilises third party data from Aurora Energy Research (Aurora). The outputs of this modelling are shown in Table 3.

Local Partnerships are subscribers to Aurora, who are a market leading provider of energy price forecast information. Using high quality forecast information for forward energy prices provides the council with the highest likelihood of a robust npv calculation. Aurora's information is the basis of their business and clients are tied with strict contractual terms that prevent the release of forecasts to non-subscribers. Local Partnership's agreement with Aurora allows them to use the information in financial modelling and to release the outputs of that modelling in a form where the original data cannot be reverse engineered, but not to release the financial models as these contain the embedded data sets. We have therefore included the assumptions for the financial modelling and the outputs of the npv calculations in this report.

Local Partnerships and Aurora have undertaken a workshop with council officers to ensure that the council understands the basis of the data and the financial models that produce the npv information used in this report."

*Table 3: Outputs from NPV modelling*

Manchester City Council Scenario Comparisons (February 2021)

| | | | Total Cost (25 yrs) | Cost after 8 years | 25 year npv | 8 year npv |
|---|---|---|---|---|---|---|
| | **With sleeved PPAs** | | | | | |
| 1. | Do Nothing (assumes Aurora wholesale plus inflation) | | -£85,558,054 | -£21,965,089 | -£43,366,132 | -£17,091,133 |
| 2. | Fair Value Solar PPA Option | V Do Nothing | £15,808,392 | £2,593,361 | £7,235,495 | £1,966,242 |
| 3. | Fair Value Wind PPA Option | V Do Nothing | £22,385,253 | £5,528,952 | £11,169,161 | £4,258,268 |
| 4. | Solar Own/Operate Option Site 1 (southern England) | | | | | |
| 4. a) | Solar own and operate with 25 year finance (southern England) | V Do Nothing | £22,017,266 | £3,055,525 | £9,977,925 | £2,207,730 |
| 4. b) | Solar own and operate with 35 year finance (southern England) | V Do Nothing | £30,147,626 | £5,765,645 | £14,403,842 | £4,347,664 |
| 5. | Solar Own/Operate Option Site 2 (the Midlands) | | | | | |
| 5. a) | Solar own and operate with 25 year finance (the Midlands) | V Do Nothing | £20,225,002 | £1,081,277 | £8,263,154 | £629,010 |
| 5. b) | Solar own and operate with 35 year finance (the Midlands) | V Do Nothing | £28,230,442 | £3,749,757 | £12,621,068 | £2,736,065 |
| 6. | npower wind PPA (£48.50) indexation 2.0% | V Do Nothing | £20,089,059 | £3,232,759 | £9,293,783 | £2,382,890 |
| 7. | npower solar PPA (£47.10) indexation 2.0% | V Do Nothing | £16,988,517 | £3,773,486 | £8,076,710 | £2,807,458 |

From the table it is clear that all options represent value for money in relation to 'do nothing' and there is therefore a compelling reason to act.

Over a 25 year operation period both the asset acquisition options offer good value for money. If a shorter 8 year time horizon is considered then the a fair value (direct) PPA

with a third party or an asset acquisition of a site in southern England represent best value.

**Recommendation 2: All options have positive NPV outcomes when compared with 'do nothing'. There is therefore a solid value for money basis to either enter into a suitable PPA or asset purchase agreement.**

### 1.10 Options Appraisal

Four scenarios were taken forward into the options appraisal. These represented the best value alternatives from the NPV comparison exercise and include:

1. nPower wind PPA
2. Fair price wind PPA (direct with a generator)
3. An asset purchase of the site in southern England
4. An asset purchase of the site in the Midlands.

A total of seventeen criteria based around desirability, feasibility and viability were agreed with the Council and each option was scored against the criteria. Detail of this process can be found in section 10 and Appendix 5.
The output scoring from the options appraisal is set out in table 4.

*Table 4: Options appraisal scoring*

| Option | Description | Score | Rank |
|---|---|---|---|
| 1. | **nPower wind PPA.** A wind based PPA with nPower (current electricity supplier) linked to specific projects. This is for an 8 year duration and pricing has been obtained from nPower. | 61% | 4 |
| 2. | **Fair Price Wind.** A wind based PPA direct with a turbine operator. This assumes an 8 year duration with pricing based around the Aurora Energy Research fair pricing model. | 72% | 2= |
| 3. | **Asset Purchase (Southern England).** An asset purchase of a 49 MW solar farm post construction. The farm is based in southern England and terms have been discussed directly with the owners. Financing is through a 35 year PWLB loan at 1.46%. | 80% | 1 |
| 4. | **Asset Purchase (The Midlands).** An asset purchase of a 46 MW solar farm pre-construction. The farm is based in the Midlands and terms have been discussed directly with the owners. Financing is through a 35 year PWLB loan at 1.46%. | 73% | 2= |

From the options appraisal it can be seen that the purchase of a site in southern England represents both the best value for money and the best fit with the Council's objectives. There is little to choose between an asset purchase in central England and direct wind PPA.

### 1.11 Preferred option and PWLB risk

In November 2020 the Government published its response to a consultation on Public Works Loan Board (PWLB) lending terms. The consultation was aimed directly at preventing local authorities borrowing for projects which were purely or largely for yield and contained a specific note around investments being in the local economic area.

The asset purchase options are not in the Council's local economic area and it is highly unlikely that a suitable asset will ever become available in the Council's economic area. Furthermore, if investment in renewable energy generation is allowable (and within the local area it appears to be), then local authorities in the north of England are at a disadvantage to those in the south as irradiance levels (and therefore carbon saved and cost savings per £ spent) are less.

Before the Council can decide whether or not an asset purchase is its preferred option it needs to establish with HM Treasury whether or not it is permitted to make this investment under the new PWLB lending criteria.

**Recommendation 3: Having undertaken a thorough options appraisal exercise the Council is now able to articulate that asset purchase is a value for money option to achieve their carbon targets and should now explore with HM Treasury whether or not an asset purchase would be compliant with PWLB lending terms.**

### 1.12 No regrets actions and next steps

In order to deliver the strategy of reducing emissions by 7,000 $tCO_2e$ by 2025, the Council will need to determine its preferred way forward. In order to do that the following are recommended:

1. Develop an understanding of the likely future requirements for electricity over the next decade. This should provide a view as to the likely overall requirements and the degree of certainty which could be attached to this forecast. In all scenarios there is a benefit in having reliable information on which to base assumptions.

2. Follow up established conversations in relation to the use of PWLB to ascertain whether an out of area asset purchase would be allowable under the new prudential regime.

If the Council determines that it wants to pursue an asset purchase strategy, then it will need to put in place measures to allow it to implement that strategy including:

3. Establishing sufficient delegated decision-making powers to allow the Council to enter into an exclusivity agreement with a developer and invest in the necessary due diligence work to determine whether a project is a viable prospect.

4. Establish a supplier base to facilitate the due diligence work including technical specialists and lawyers.

5. Develop its financial and carbon modelling to ensure that all costs and benefits for a particular project are understood.

6. Determine whether or not to proceed further with due diligence in relation to any of the large-scale projects identified.

If the Council determines that it wants to pursue a PPA strategy, then it will need to put in place the following:

7. A clear policy in relation to carbon accounting, tested with the Council's advisors in this area, setting out how additionality, permanence and traceability will need to be demonstrated by any procurement.

8. A suitable procurement for a direct 'fair value' PPA agreement.

# 2 Methodology

## 2.1 Site Generation Hierarchy

This report has been developed with reference to the methodology set out below.

1. Express the carbon reduction target in terms of renewable energy generation capacity. Review overall Council electricity consumption and combine the two to provide an overall renewable energy target that achieves a 7,000t CO2e reduction in 2025.

2. Review Council owned assets to ascertain how much renewable energy generation could be accommodated on Council owned assets, in addition to that already identified. This took the form of a desk-based review of suitability from an asset list supplied by the Council and references land, planning and grid connection constraints.

3. Once the Council's own estate has been exhausted, look for other opportunities in the Greater Manchester Combined Authority area with other public sector bodies. These opportunities were highlighted by the Council and reviewed on a similar basis to the asset review.

4. Third party schemes in the Council area were searched for through the planning registers, although no suitable schemes were identified as having been submitted for planning within the last two years.

5. Look for surplus generation capacity in the open market to fulfil any shortfall in relation to capacity. This was done by direct approaches to renewable energy developers known to sell projects and project rights on the open market. Local Partnerships has Non-Disclosure Agreements (NDAs) with these developers which allows us to provide anonymised data to the Council (who do not currently have an NDA). Three projects were identified through this process (see section 8.10). These sites have not been subject to due diligence and the information provided in the term sheets has been used to generate the information for the report.

6. Review available PPA alternatives. This took the form of dialogue with Aurora Energy Research to gain market insights and intelligence and a meeting with the Council's current energy supplier nPower to discuss alternatives they could offer.

The schemes in section 8.10 have also been subject to outline financial appraisal to ensure the Council has a broad understanding of scheme economics.

## 2.2 Key Considerations

The options are quite different in their approach, in order to analyse them further the following considered:

1. Is the size of the scheme a match with the Council's requirements

2. Work required by the Council to deliver the scheme

3. Timing – likely date of first generation
4. Irradiation
5. Potential for community involvement
6. Risks
7. Carbon benefits (a function of size, irradiation and timing)
8. Investment criteria (a function of size, irradiation, capital cost and Power Purchase Agreement (PPA) assumptions).

To assist the Council in understanding the different characteristics, we have run workshops with key personnel to cover each of the topics in detail and to provide the opportunity for assumptions to be explored and risks to be analysed. Further information in relation to PPAs, subsidy and price support mechanisms are found in Appendix 1.

The approach taken to the acquisition or development of schemes will also have risk and procurement implications. To assist in the understanding of this further information is provided in Appendix 2 in relation to procurement.

# 3 Sizing the Council's renewable energy generation requirement

## 3.1 Background

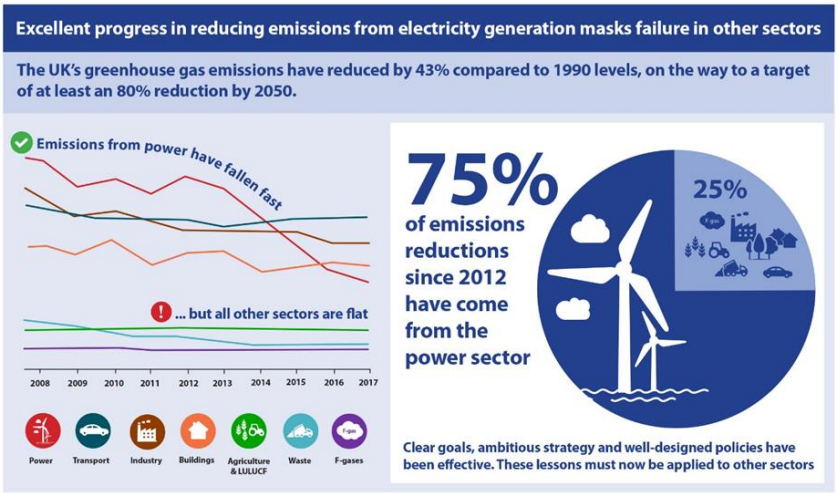
The Council has declared a climate emergency and set a science-based target to be zero carbon by 2038. It has already reduced its direct emissions by 48% from a 2009/10 baseline. Ongoing work to reduce emissions further is set out within the Council's Climate Change Action Plan (CCAP) for 2020-25. The CCAP includes a target to halve emissions again within this 5-year period and sets a carbon budget for the period too.

Work is underway across several different strands to meet these emission reduction targets – from improving the energy efficiency of street lighting to decarbonizing heat within the estate and investing in large scale renewable energy generation capacity. In October this year, Local Partnerships was appointed to carry out a feasibility study to investigate options for large-scale renewable energy generation - in line with Action 1.4 of the CCAP which sets a target to reduce $CO_2$ emissions by 7,000 t pa.

## 3.2 Grid decarbonisation

The UK has seen rapid decarbonisation of its electricity supply over the last eight years. Figure 3, produced by the Committee on Climate Change, sets out the progress towards decarbonisation made by the main sectors of the economy since 2012.

*Figure 3: UK progress towards decarbonisation*[2]




The UK Government has committed the UK to be a net zero emitter of greenhouse gases (GHG) by 2050. In order to achieve this commitment, decarbonisation of electricity generation will be a pre-requisite. The UK has continued to make progress with deployment of renewable energy and there are a number of measures in place (or in the

[2] Source: Committee on Climate Change 2018 progress report to Parliament – June 2018

pipeline) that should provide confidence that grid decarbonisation is likely to continue for the foreseeable future. These measures include:

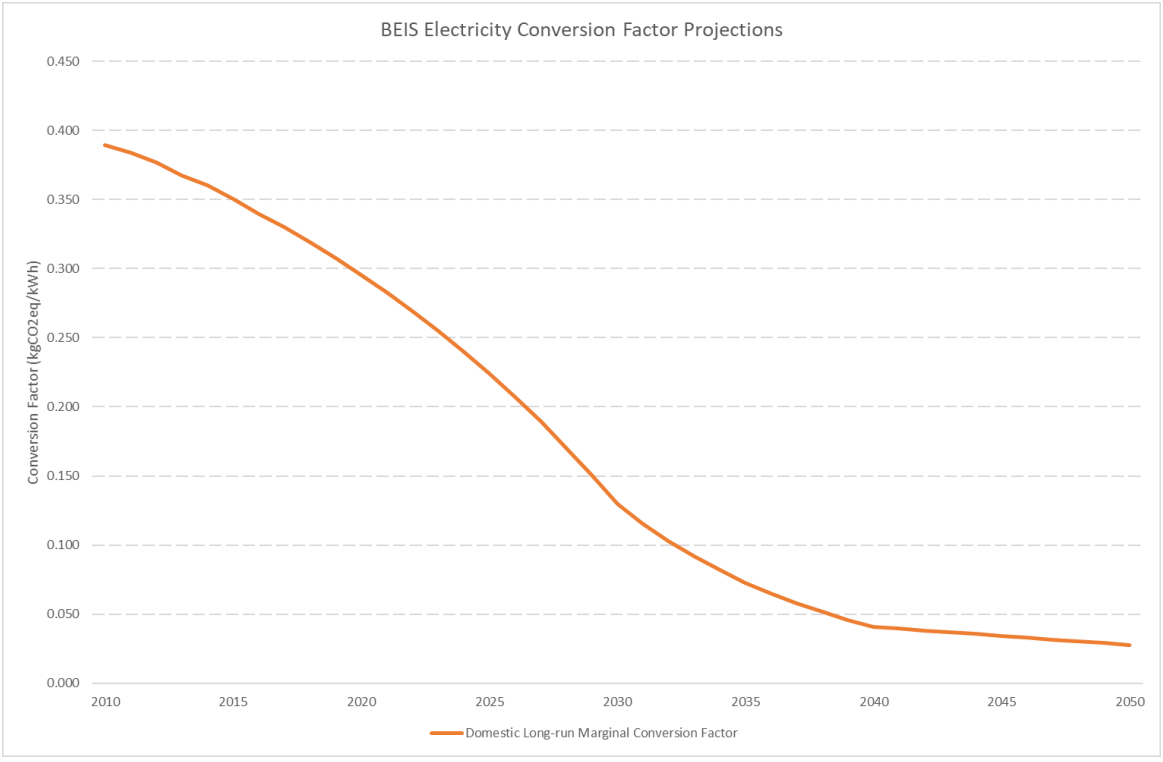
1. Offshore wind sector deal – aiming to triple current capacity to 30 GW by 2030. A further commitment to increase this to 40 GW by 2030 was included in the ten-point plan for a 'Green Industrial Revolution' made in November 2020[3].

2. Introduction of the Smart Export Guarantee Scheme – guaranteeing both an export market and a positive tariff at all times for small generators under 5MW.

3. Announcement that there will be a 12 GW allocation for mature technologies in the next round of Contract for Difference Auctions in late 2021. This in effect provides a mechanism for price guarantees for both onshore wind and solar PV schemes that are successful in the auction.

UK Government forecasts for the carbon intensity of the electricity supply were last produced by the Department of Energy and Climate Change in 2010. Decarbonisation has been happening at a rate slightly quicker than the forecast figures. The future forecasts are shown at Figure 4.

*Figure 4: Forecast for electricity grid decarbonisation 2010-2050*




Grid decarbonisation looks set to continue, but the rates of decarbonisation are likely to be less pronounced as almost all coal fired power stations have already been removed from the generation mix. In order to achieve net zero by 2050 the UK will have to increase its supply of renewable energy to around four times current levels. This is to allow for the removal of the gas fired power stations from the generation mix. These

3 The ten point plan for a green industrial revolution - GOV.UK

forecasts are now ten years old and current rates of grid decarbonisation are running approximately 13.5% ahead of the forecast figures.

### 3.1 Renewable energy technology selection

Solar PV and wind turbines represent the best value for money in UK renewable energy technology installations. There may be some small opportunities to generate power from other technologies, however the returns on investment are generally lower. We have not been made aware of any specific opportunities the Council has in relation to other technologies.

Development of new onshore wind turbines in England and Wales has been problematic since the introduction of new planning criteria in 2016 (see section 6.1), with the result that almost no new onshore wind capacity has been delivered in England or Wales in the last five years. Most new onshore turbines are in Scotland. Schemes in Scotland run the risk in the event of devolution that the Council has an investment outside of the country in which it is located. These schemes are also normally developed directly for investors and rarely come to the market. For these reasons it is considered unlikely that an onshore wind scheme would meet the Councils' requirements.

The Crown Estate is currently in the process of running its fourth leasing round, creating the opportunity for at least 7 GW of new offshore wind projects (see section 7.1). The Round 4 leasing process consists of five stages, the pre-qualification stage of which has already been completed. It is currently anticipated that Round 4 projects will become operational towards 2030. The size and delivery timing for offshore wind assets makes them unlikely to be a good fit with the Council's requirement.

These constraints, coupled with the largely urban nature of the Council's area, mean that our analysis for development or acquisition projects has focused on solar PV which represents the most realistic and affordable opportunities to meet the requirement. However, where a scheme may be improved by the incorporation of on-site storage then commentary on this has been provided.

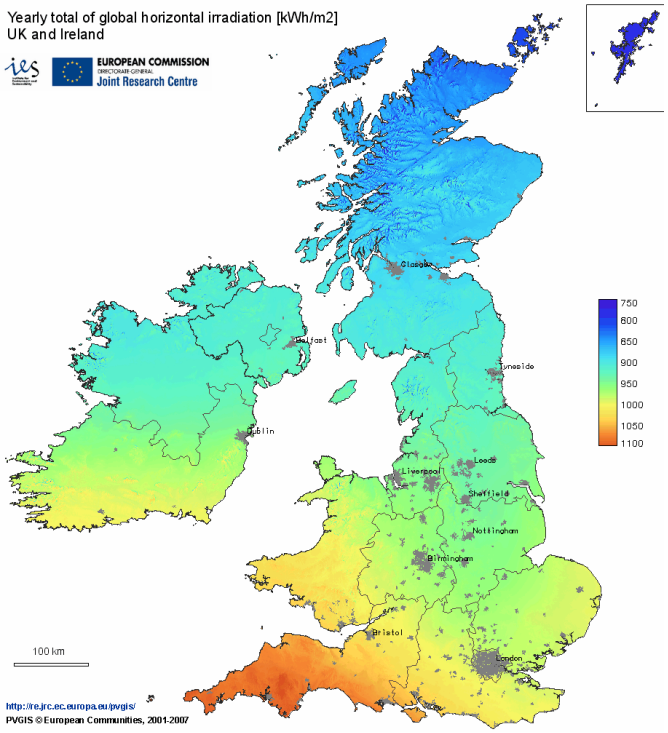
PPA options have also considered wind projects, although these are likely to be located in Scotland or offshore.

### 3.2 Calculating the appropriate size of a solar PV scheme to meet existing targets

The original brief was to offset 7,000 $tCO_2e$ in 2025. Figure 3 shows that the carbon intensity of grid supplied electricity falls from 0.224 Kg $CO_2e$/kWh in 2025 to 0.052 Kg $CO_2e$/kWh in 2038. The Council's offsetting requirement also falls during the period 2025 – 2038, with a residual requirement in 2038 of 2,913 $tCO_2e$. We have therefore calculated the equivalent solar PV requirement for both 2025 and 2038.

The other significant variable in calculating the size of the requirement is solar irradiance. Irradiance varies across the UK and significantly affects project economics, as higher irradiance is in effect free fuel. Figure 5 on page 16 shows irradiance levels across the UK. As it is not yet known where any potential scheme might be located we have assumed a generic figure of 945 kWh/kWp of installed solar PV in our calculations, which is similar to the figure in Manchester. Schemes in southern England may have significantly higher levels of irradiation.

*Figure 5 – UK solar irradiance levels (Source PVGIS)*




### 3.2.1 Solar equivalent sizing - 2025

By 2025 grid supplied electricity is forecast by BEIS to have a carbon intensity factor of 0.224 Kg/ kWh.

Converting the **7,000-tonne requirement** into the equivalent grid supplied electricity can be done as follows:

1 Kg/kWh = 1 tonne/ MWh therefore:

7,000 tonnes/ 0.224 = 31,250 MWh of grid supplied electricity equivalent

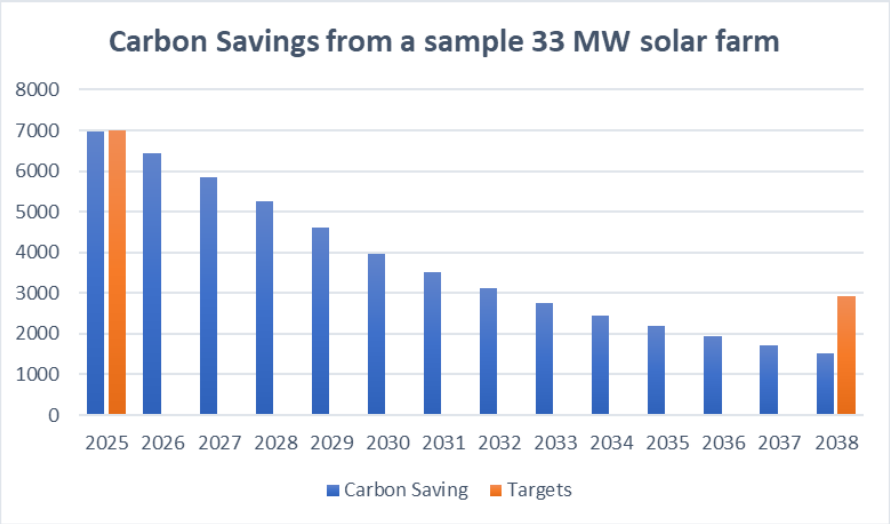
The projected irradiance for Manchester is in the region of 945 kwh/kwp[4].
For the requirement to be met by locally produced solar PV in 2025 the Council would therefore need:

31,250 x 1,000 (conversion MWh to kWh) / 945 = 33,069 kWp or the equivalent of around **33 MW solar.**

Figure 6 sets out how a 33 MW solar farm, sized to meet the 2025 target would fall short of the 2038 target.

[4] PVGIS Version 5 - CMSAF

*Figure 6: Carbon savings from a 33 MW solar farm against targets*



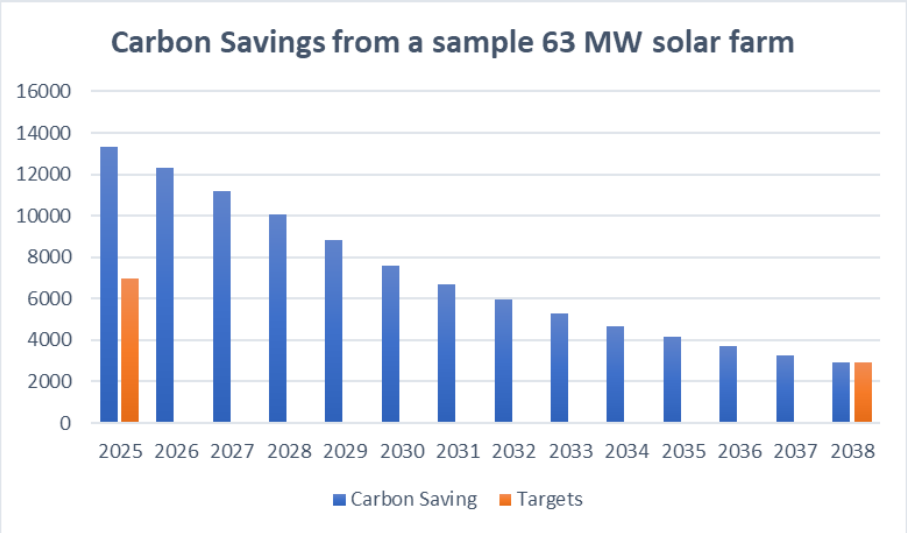

### 3.2.2 Solar equivalent sizing – 2038

By 2028 grid supplied electricity is forecast by BEIS to have a carbon intensity factor of 0.052 Kg/ kWh.

Following the same methodology set out above, but also allowing for the 0.4% annual degredation the 2038 **2,913-tonne requirement** is equivalent to a 63 MW solar requirement in the Manchester area.

Figure 7 sets out the carbon savings from 63 MW of solar against the targets in 2025 and 2038.

*Figure 7: Carbon savings from a 63 MW solar farm against targets*



### 3.2.3 Sizing by electrical consumption

The Council will only be able to offset emissions from electricity generation against it's electricity consumption (i.e. scope 2 emissions). In setting a target requirement we therefore also need to consider the future consumption of electricity by the Council. 2018/19 electricity consumption was around 49GWh (excluding schools). A further 4GWh/pa reductions are forecast from the street lighting programme, leaving a residual requirement of around 45 GWh/pa.

There is considerable uncertainty around future levels of consumption. The Council have ongoing energy efficiency programmes and will potentially also review their estates requirement following a year of homeworking through the Covid-19 lockdowns. These measures may see a significant decrease in electricity consumption, although analysis of previous years trends suggests that aside from the street lighting programme the Council has achieved year on year energy efficiency savings or around 2%.

Set against this the Council will need to use electricity for more things in the future if it is going to remove its scope 1 emissions (i.e. petrol, diesel and gas). It is likely that much of the fleet will need to be electrified and heating systems will require more electricity in the future.

45 GWh in 2038 would represent around 2,088 tCO2e in 2038. This is less than the 2,913 tCO2e identified in earlier work, and therefore assumes that the Council will achieve greater energy efficiency savings that previously identified.

Bearing in mind the uncertainty over electricity consumption we have used the 45 GWh/pa in the remainder of this report and focused on flexibility in our assessment of different alternatives.

At an irradiance level of 945 kwh/kwp (see section 3.2.1 for further details on methodology) the annual consumption would equate to around 47.6 MW of solar PV.

## 3.3 Carbon Accounting Practice

The Council will be able to account for the electricity produced from the renewable energy generators against its scope 2 emissions. These are the emission produced by the consumption of grid supplied electricity. It is not possible to use renewable energy generation to offset against scope 1 emissions in the UK.

Recommended practice in the UK is for organisations to undertake dual accounting for the use or generation of renewable energy. Under this methodology the initial assessment is undertaken using grid supplied electricity and then an adjustment is shown 'below the line' for the renewable energy. In this way it is possible to retain visibility over both total consumption of electricity (and the success or otherwise of energy efficiency measures) and the use of carbon.

In order for renewable energy to be reliably used in carbon accounting it is necessary to consider three things:

1. Whether or not the use of renewable energy directly contributes to additional renewable energy resource in the UK. Any scheme which would have gone ahead regardless of the arrangement should not be included in carbon

accounting measures. In particular the Council should be wary of supplies which are part of much wider arrangements where the allocation of a project to a particular customer would lead to the general supply for customers not on a 'green' tariff having a higher carbon intensity.

2. Permanence of the arrangement. Any initiative which can easily be reversed eg if budget cuts are required should not be included in carbon accounting measures.

3. Traceability. This means the extent to which it is possible to be certain that the electricity purchased has been generated at the point specified. This is governed in the UK by the Renewable Energy Generation of Origin (REGO) certifictes, a scheme which is administered by OFGEM. For the purposes of the remainder of this report it is assumed that all schemes will be able to provide suitable REGO certificates.

### 3.4 Size range and target size

The 2025 target requires a solar farm of around 33 MW, whereas to meet the 2038 target a much larger 63 MW solar farm would be required. These are both assuming an irradiance of 945 kWh/ kWp (Manchester area). If a suitable project could be found in an area with 10% higher irradiance, then the requirement would fall by the same amount.

If a larger project was selected, then it would meet the 2025 requirement and potentially the 2038 residual emissions target. A larger scheme would also have the benefit of contributing more to the earlier carbon budgets.

In order to contribute to CO2e reductions a scheme will have to be no larger than the Council's equivalent scope 2 emissions. We would therefore recommend that the correct size for the requirement is in the order of 45 MW – 50 MW of solar PV.

**Recommendation 1: The Council should consider adopting a target of 45-50 MW of solar PV generation (or equivalent wind) now as this will:**

**a) Provide a future proof solution which will also deal with residual emissions in 2038.**

**b) Allow a larger proportion of the Council's scope 2 electricity emissions to be reduced from an earlier point in time. This will help the Council in achieving its carbon budget target.**

**c) Maximise the potential of offsetting through generation or power purchase.**

**Background – Key Points**

The report sets out a requirement for the equivalent of 45-50 MW of solar PV.

Solar PV projects are more realistic than wind turbines due to planning restrictions.

# 4 Review of ground mounted solar PV opportunities on land assets owned by the Council

## 4.1 Overview

The use of large-scale ground mounted solar has been popular in the UK and represents around two thirds of the UK's overall installed solar capacity. Ground mounted solar PV schemes need scale to be cost effective as investment yields are typically relatively low (<6%).

Land recovered from former landfill activities can be used for ground mounted PV systems, but this increases the costs as mounting structures need to be surface mounted (as opposed to piled into the ground). It is also possible to install floating solar arrays on reservoirs, although these schemes are more expensive.

The requirement identified in section 3.4 will require in excess of 100 Ha of land to achieve. Our analysis (see Appendix 4) concludes that the Council has limited scope for ground-mounted solar that merit further investigation. The Council currently holds land interests at 35 historic landfill sites across the City. Many of these closed landfill sites have been reclaimed as open space (for example, Clayton Vale and Tweedle Common) or are not suitable for development as a result of location issues where adjacent land uses effectively rule out development. For example, Shack Liffe Green is nestled between the houses of Horncastle Road and Boggart Hole Clough Park. The site has received minimal intervention and as a result now has a very diverse habitat with ecological value.

Potential opportunities for solar PV exist at Heaton Park and on Council owned land south of Wythenshawe Hospital (see sections 4.4 and 4.5), however planning and other designations mean that these sites cannot realistically be brought forward for solar PV.

## 4.2 Development of ground-mounted solar PV schemes

In progressing ground mounted solar schemes on its own sites, the Council will need to consider the best approach to take to managing the development process. Detailed guidance on this can be found at Renewable Energy Good Practice guidance for the LGA.

Working with a third party brings skills and potential development finance but will require the benefits to be shared and a procurement will be necessary.

In this analysis we have not contemplated the Council developing sites on third party land as this would require the identification of suitable sites before any appraisal could take place. If the concept of ownership of large-scale ground mounted solar PV projects is agreeable this alternative could be considered as a potential delivery route, although it is resource intensive and carries significant development risk. Under the Prudential Code, local authorities cannot borrow from the PWLB or any other lender for speculative purposes.

The options for development of schemes on Council owned land are:

1. The Council acts as developer by directly managing the grid connection application and the submission of the planning application – this approach will maximise the financial benefits but carries the greatest risk in terms of development finance and failure to develop. The approach will require staff capacity and capability to manage the process.

2. Partnering with a solar developer who would take on some of the project risk. Given the relatively small size of the pipeline and the complexity of the procurement exercise that would be required, this route would be unlikely to provide best value.

3. Energy performance contracting – this approach uses a framework to appoint a suitable contractor who will then work up the scheme and manage the development process. Costs are incurred by the Councils for the development work, but financial returns are guaranteed.

### 4.3 Elements of development

Table 5 below sets out the initial screening tests that have been applied to Council owned sites in assessing their suitability to host solar PV projects.

*Table 5 – screening tests for potential projects – Solar PV*

| Risk Category | Action and Information Sources |
|---|---|
| Viability | Size and orientation. For a scheme to offer sufficient financial return on investment to pay for a grid connection it is likely to need to be > 1MW. A site of this size would require 5 acres of land.<br><br>Shading from trees or adjacent buildings which would prevent the solar panels from working effectively. |
| Planning | Planning designations (greenbelt, Area of Outstanding Natural Beauty (AONB) etc).<br><br>Sites allocated for housing – local plan<br>Proximity to housing – we would recommend at least 300m.<br><br>Potential loss of amenity either through loss of established public use of a site.<br><br>Transport and access constraints.<br><br>Other development issues such as flooding, proximity to historic buildings, complex ecology etc. |

| Risk Category | Action and Information Sources |
|---|---|
| Land | Agricultural land grade 3b or below. Indicative land grade is provided by Natural England . (http://publications.naturalengland.org.uk/category/5954148537204736). <br><br> Land ownership including underlying interests and covenants, tenancies etc – Land Registry and deed packets <br> Does the land have direct access to the public highway? <br><br> Suitability of ground conditions and ground contamination/ stability. |
| Grid | Available and affordable grid connection capacity for the export of power generated |

There are three basic elements for developing a solar farm; land rights, grid connection and planning.

### 4.3.1 Land rights

The schemes we have reviewed are on land owned by the Council. There are, however, other land considerations which any scheme would need to we have reviewed are on land owned by the Council. consider. These are as follows:

1. Any leases, licences, covenants or other rights over the land.

2. Any third-party land rights which will be needed to lay a cable between the site and the point of connection identified by the electricity grid network operator Electricity North West (ENW).

3. Any alternative uses for the land which the Council may have and whether a solar farm represents the optimum use of scarce resources.

### 4.3.2 Grid connection

In order for any scheme to work it needs access to a grid connection. This needs to be at a suitable scale and affordable cost. Grid access is provided by the local network operator via a formal process of a grid application. Prior to the grid application, informal advice can be sought either via surgeries or via a ‘budget estimate’ process. These informal processes are helpful, but do not provide certainty either in terms of price or guarantee that a connection will be available when required. The grid offer process takes around 65 working days and involves an up-front cost (of the order of £2,000 per site).

#### Types of grid connection offer

ENW grid connection offers provide two alternative prices; one is for ENW to undertake all connection works i.e. from the project site on to their network (usually known as ‘all works’ offer). The second offer is for ENW to undertake only those works on the network which others are not allowed to undertake (for example upgrading their transformers to facilitate the connection).

This second type of offer is known as a Competition in Connections (CIC) offer. This form of offer is likely to be cheaper but will require the procurement of an Independent Connection Provider (ICP) to undertake the remainder of the works. Developers typically pursue the use of an ICP for the following reasons:

- Greater choice
- Greater flexibility
- Faster delivery
- It can be more cost effective
- They are more likely to use language you understand and have knowledge from other projects, especially where dialogue with ENW is required to optimise the connection.

Greater efficiencies and economies of scale (cable and staffing costs) are more prevalent on longer connections. From our experience, ENW are very conservative on programme timescales resulting in higher contractor's costs (for weekly site establishment and management) in comparison to ICPs who typically drive the shortest and most efficient programme of works.

If the Council decided to accept a CIC offer, then it would require either the procurement of an ICP or for the ICP works to be procured as part of the solar farm construction contract. This may add to the complexity of procurement activities. Further complexities arise through the need for the cable route to be included in the planning submission (ENW has permitted development rights which do not extend to the CIC contractors) and the management of road opening licences (which will normally be managed by the ICP).

### 4.3.3 Planning

Information to submit a planning application for large scale solar PV usually takes around six months to collate and three months to determine.

Key planning considerations generally include:

- Landscape and visual impact/amenity impact
- Ecology
- Transport, construction and noise
- Glint and glare
- Rights of way
- Flood risk
- Specific local policy designations and constraints

Planning for renewable energy schemes does carry an inherent level of risk.

Biodiversity net gain (BNG) is an increasingly prevalent requirement in planning decisions. This will become mandatory under the forthcoming Environment Bill. Any planning submission is likely to be required to demonstrate a 10% gain under the legislation, using the recently issued metric from the Department for Environment, Food and Rural Affairs (DEFRA).

Local buy-in to any scheme will be important in the urban area. There are instances where buy-in has been enhanced by working with community development groups or offering Community Municipal Investments (CMIs). The Council could consider using a

CMI as an alternative to, or alongside the Public Works Loan Board (PWLB) to fund the schemes.

For example, West Berkshire Council has looked to tackle its climate emergency by investing in its first CMIs. The Council offered residents and community groups an opportunity to invest directly with them to help build a greener future for the district. The council was seeking to raise £1 million to fund new rooftop solar power on council-owned buildings around West Berkshire. The CMI successfully closed reaching its £1m target five days ahead of the proposed deadline, attracting 640 investors who each invested an average of around £1,500. Similarly, Warrington Borough Council launched a CMI bond to raise £1m to help finance the construction of a solar farm near Cirencester and its co-located battery storage facility (a 24 MW hybrid project).

## 4.4 Heaton Park

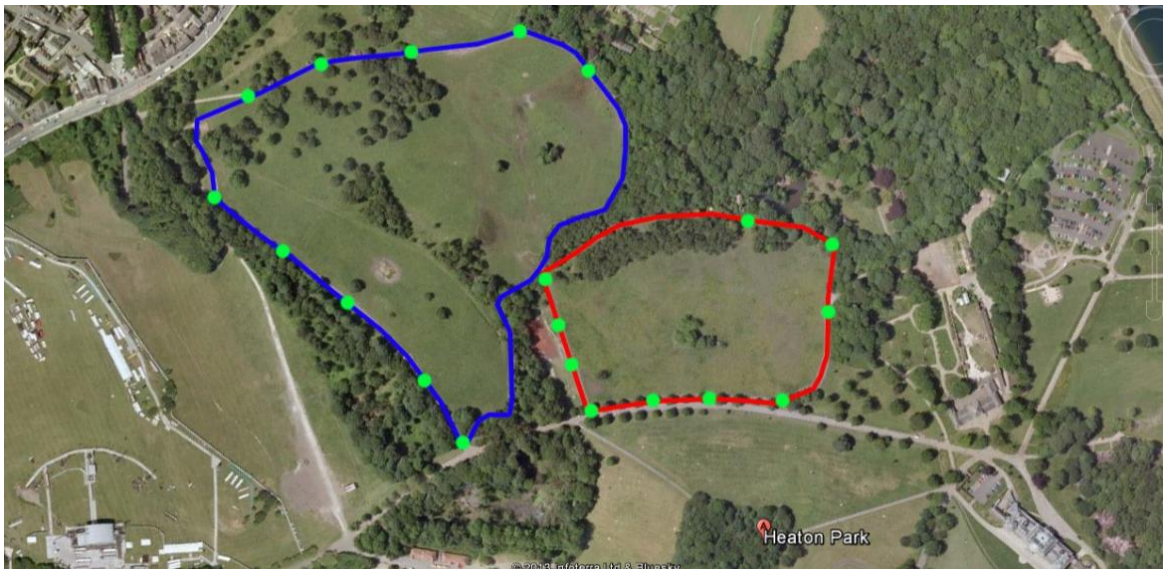
This is a desk-based analysis based on information that can be gained from websites, Google Earth and other electronic media. A site visit has not been undertaken by Local Partnerships as part of this assessment.

### 4.4.1 Site description

Heaton Park is a large, historic, Grade II listed municipal park, containing a number of historic structures dating from its original use as a country estate. It is used for a mix of formal and informal recreational opportunities in a primarily informal landscape.

The Council's Re:fit Service Provider, Ameresco, has identified two land parcels within Heaton Park as having potential for solar PV (see Figure 8). The area shown in red is approximately 4 Ha in size and at its closest point is 230m from Heaton Hall and orangery. There is a cluster of trees in the centre of the land parcel. The land is bounded by a tree lined perimeter path which forms part of a wider path network. Ameresco has indicated that the land parcel could support a 3.9 MWp solar PV scheme.

*Figure 8: Potential land parcels for PV development at Heaton Park*




The area shown in blue is a larger land parcel (circa 10.5 Ha) which is undulating with a gradual slope to a peak of mature trees. The land parcel is bounded by a tree lined

perimeter path which provides screening from Heaton Hall. There are three football pitches adjacent to the site. At its closest point the land is 510m from Heaton Hall.

Installation of a solar farm on the site would require considerable removal of trees. Consideration will also need be given to the existing site contours as it is likely that some levelling works would be required to facilitate the development of a solar panel array. Ameresco has indicated that the land parcel could support a 6.5 MWp solar PV scheme.

### 4.4.2 Planning

Key planning and design constraints for the site include:

1. Cultural Heritage and listing
2. Tree belts
3. Greenbelt
4. Nature and biodiversity considerations
5. Leisure and open space policies

The significance of Heaton Park, both as a heritage asset and a recreational resource mean that it is unlikely that any significant scheme could be brought forward at the site without significant harm.

Installing solar carports is becoming increasing popular for local authorities looking to generate renewable energy, and whilst it remains an expensive method of solar PV construction, a solar carport project at Heaton Park could provide the Council with the opportunity to generate renewable energy on the site whilst protecting the setting of the park. Ameresco has outlined a potential 500 kW scheme for one of the main car parks at Heaton Park. The Council recently obtained planning permission for a 915 kWp Solar carport at the National Cycling Centre, so is familiar with the technology. Discussion with the Council's planning department suggest that even a scheme of this size would not be suitable in planning terms.

United Utilities own the reservoir, meaning even if a floating solar scheme were possible in planning terms it would not be available to the Council.

### 4.4.3 Grid

A connections surgery call took place with ENW on 11 November 2020 to understand connections and capacity available in the vicinity of the site. An 11kV firm connection to support up to 8 MW of export was available circa 3.5km from the site. A budget connection cost was also provided by ENW, although firm costs will not be available until a formal offer is applied for and analysis of the connection route is completed.

### 4.4.4 Heaton Park Potential

The feedback from the Council's planning department means it is unlikely that any scheme could be brought forward at Heaton Park.

## 4.5 Land south of Wythenshawe Hospital

### 4.5.1 Site description

The land area under consideration (13.8 Ha) for a solar farm is located in the far south of Manchester, a short distance to the south of Wythenshawe Hospital. The area is bordered by Fairywell Brook to the southwest, which also forms the border with Trafford; by Dobbinetts Lane to the northwest; by a surface car park to the north; and, by Floats Road / Barnacre Avenue / Newall Road / Whitecarr Lane to the east and southeast.

### 4.5.2 Planning

The land under consideration is included within Allocations 11 and 46 within the Greater Manchester Spatial Framework Publication Plan 2020. The site has been allocated to provide around 2,400 high quality homes along with 60,000 square metres of employment land to provide high quality office space. These allocations and supporting planning documents have been through extensive consultation and as such it would be difficult to make representation to amend the allocations and therefore for a ground mounted solar scheme to be brought forward on the site. There is however the potential to target up to 2MW of solar car ports and rooftop solar as the site is developed.

### 4.5.3 Grid

A connections surgery call took place with ENW on 4 November 2020 to understand connections and capacity available in the vicinity of the site. ENW outlined that a firm connection to support up to 10 MWA of export was available circa 1.9km from the site (Green Lane (Altrincham) (33 kV / 11 kV)). The Council could also consider a private wire connection to provide a renewable energy supply to Wythenshawe Hospital.

### 4.5.4 Private Wire Connections

The term ‘private wire’ is used to describe a connection made directly to a customer’s premises. Private wires can significantly enhance investment yields as the customer avoids paying the network distribution charges for grid supplied electricity, which typically constitute around two thirds of their bill. This leaves scope for a higher price (relative to the wholesale price alternative) to be charged to the customer for the power supplied, whilst still representing a significant cost saving to the customer.

Further advice would need to be sought on the impact of any private wire connections in relation to carbon accounting practice and whether there would be any allowable reductions under this type of arrangement if the Council is not the customer.

### 4.5.5 Land to the south of Wythenshawe Hospital potential

As the land has been allocated for employment use it is very unlikely that it would come forward as a solar farm. There is however scope for up to 2 MW of solar (a combination of rooftop and carports). There is no certainty that the Council would act as developer and landlord at the site, so it may lose control of any solar potential through the development process. The economics of any scheme located on the site would be much improved by a ‘private wire’ direct to the occupiers. We therefore consider it unlikely that

any generation at this location would be utilised towards the Council's target and have discounted it form further analysis.

**Ground Mounted Solar PV – Key Points**

Our analysis has failed to find any significant sites with renewable energy generation potential which are under the Council's control and not already identified as part of the Council's existing programme for solar PV.

# 5 Battery Storage

## 5.1 Overview

Many councils have a diverse property portfolio which offers the opportunity to benefit from the growing demand for energy storage infrastructure. With recent advances in technology, falling costs and better regulation, local authority investment in this type of technology is becoming increasingly popular as a means of optimising existing assets and utilising renewable energy.

Battery storage systems do not provide direct carbon benefits, although they are required for the smooth operation of the electricity grid with the increasing prevalence of renewables. Standalone battery storage projects, unless the power is used by the Council, may be harder to justify as suitable for Public Works Loan Board (PWLB) funding.

Battery storage systems are becoming a popular addition to new and existing solar PV systems in a bid to increase the amount of self-consumption, mitigate against price cannibalisation risks and to reduce energy costs. For example, Exeter City Council is currently constructing a 1.2 MW ground mounted solar array co-located with energy storage technology, with a separate connection (private wire) to provide a renewable energy supply to its nearby operations depot.

Charging during daylight hours uses ‘free’ solar electricity and, if this energy is then discharged when electricity supply costs are higher this has the potential to offset the cost of grid supplied electricity.

## 5.2 Potential for battery storage across the Council estate

In March 2019, the new Greater Manchester 5-year Environment Plan was launched, setting a new target for the city region of carbon neutrality by 2038. The plan included a range of commitments for local authorities, including a target to develop 45 MW of energy storage over the next 5 years. Opportunities exist for large scale energy storage with the Council boundary which again requires further consideration of the land use at the sites identified. Table 6 sets out the opportunities which exist for large scale energy storage across the Council estate, which requires further consideration of the land use at the sites identified.

*Table 6: Large scale energy storage opportunities*

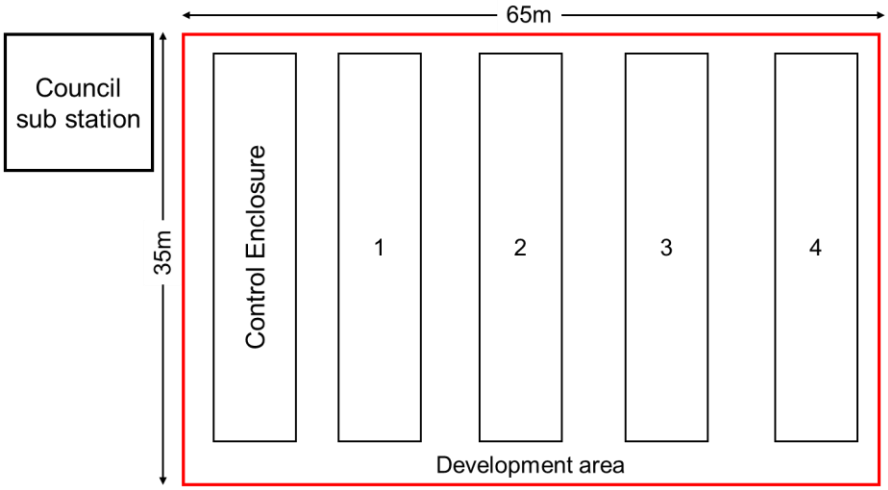
| Site | Substation Name | Distance from substation | Battery energy storage headroom |
|---|---|---|---|
| Bradford Gas Works | Bradford (33 kV / 6.6 kV) | 2.2km | 7.8 MW |
| Airport Woodhouse Park | Moss Nook Primary (33 kV / 11 kV) | 1.3km | 11.2MW |
| Land south of Wythenshawe Hospital | Green Lane (Altrincham) (33 kV / 11 kV) | 1.9km | 10.0 MW |

### 5.2.1 Land utilisation

A grid scale battery system consists of a group of containerised battery cells (usually Lithium Ion) that are connected to a major substation via a high voltage cable.

Figure 9, below, is a simplified and conservative system layout sketch for a 5 MW battery storage facility (including 4 x 1.26 MWh capacity enclosures and their associated transformers). This layout would occupy less than 0.25 Ha. A 2 MWh capacity battery storage system would typically be housed in 12.5m long containers which would reduce the development footprint further.

*Figure 9: Simplified and conservative system layout sketch for a 5MW battery storage facility*




Given the limited land requirement and access to a close grid connection point a battery storage facility could be included within the Council's overall employment use ambition for the land south of Wythenshawe Hospital.

As set out in section 4.5.3, the Council could consider a private wire connection to provide energy storage to Wythenshawe Hospital. A battery storage system would allow the hospital to control the timing and amount of electricity it purchases, sells or stores. This capability would enable the hospital to take advantage of a variety of opportunities to reduce electricity costs and generate revenues. Wythenshawe Hospital benefits from a recently installed Combined Heat and Power (CHP) unit which delivers almost all the power needed to run the hospital, as well as four new high-efficiency boilers. Supplementing the CHP with battery storage would give the hospital more flexibility over how to manage their energy.

A hospital's highest electricity usage typically occurs between 8 AM and 8 PM when demand for electricity and peak charges are high. Large-scale battery storage can help a hospital reduce peak costs by "shifting" all or part of its load to off-peak hours. By recharging a large-scale battery system during off-peak hours, the hospital pays the lowest rates for electricity. It can then use the stored electricity during the day to minimize the hospital's electricity purchases when charge rates are highest.

Both the Council and the hospital should seek specialist procurement advice in relation to any potential project.

### 5.2.2 Economics

We have estimated a cost of £2,535,000 for the installation of a 5 MW battery storage facility (including cell, balance of system and grid connection). Allowance would also need to be made for development costs e.g. planning application, surveys etc.

Revenue streams from storage projects are complicated and it is highly likely that the Council will need to work with an aggregator to ensure that they access the best sources of revenue at any given time.

Early battery storage projects were characterised by a revenue stack of 24/7 frequency response plus capacity market operated in a standalone fashion. Whilst this model was far from simple there are now several sources of revenue available, with the most lucrative options changing between capacity, ancillary services, trading and the Balancing Mechanism (BM).

Currently no one revenue stream holds the answer to a battery storage business case, revenue agility is required. An asset needs access to ancillary services, Distribution System Operator (DSO) services, reliable triad management, energy markets, BM, and any other services that emerge, to be truly optimised. Aggregators are currently indicating to potential clients annual revenues of £50,000 - £60,000 per MW for a 1-hour battery and £70,000 - £80,000 for a 2-hour battery. For a new build battery delivered from the early to mid-2020's we would expect an IRR between 9-10% to be achieved.

## 5.3 Next steps

- The Council needs to consider whether stand-alone battery storage would meet the new criteria for PWLB lending.
- The Council should consider the use of land for the three battery storage opportunities identified. Undertake engagement with stakeholders to achieve broad support and buy-in if a battery storage facility is considered a good use of the land available.
- The Council will need to submit a formal distribution grid connection application to secure grid capacity and engage with aggregators and technology suppliers to firm up costs and revenues.
- The Council should consider the addition of battery storage to any large-scale solar installation in order to hedge against price cannibalisation and improve viability.

**Battery Storage – Key Points**

Battery Storage projects will not directly contribute to the Council's carbon offsetting aims but are an essential part of the grid infrastructure required to deliver a decarbonised electricity system.

There is potential to investigate battery storage projects at the three sites identified. Battery storage should be considered on any large-scale solar projects to improve viability and hedge against price cannibalisation.

# 6 Onshore Wind

## 6.1 Background

Onshore wind turbines are also potential projects in which a local authority could invest. In wind energy projects, to produce renewable electricity and therby reduce their scope 2 carbon emissions. For example, is Bristol City Council became the first local authority in England to develop and own wind turbines. The two-turbine project was installed at the former Shell Tank site at Avonmouth and was commissioned in December 2013.

The most recent example is Cornwall Council's commercial investment into a single turbine (2.3 MW) project which became operational in September 2020. The turbine is sited on Cornwall Council land at Ventonteague, near Carland Cross, on the A30. The rationale for the turbine is to help Cornwall better manage its energy supply and power the equivalent of around 1,180 Cornish homes, representing a significant contribution towards the Council's climate emergency agenda. Cornwall Council own and operate the wind turbine. Earlier this year Orkney Islands Council submitted a planning application for a six-turbine wind farm which is in the process of being determined by Scottish Government. There are also micro wind turbine installation examples.

In comparison to solar PV, there are very few examples of local authority commercial scale development of onshore wind projects, with deployment being at the single or two turbine level and benefitting from niche land assets (such a Bristol City Council's project at Avonmouth). This is largely due to planning permission being one of the biggest barriers to project development for larger wind turbines and commercial wind farms. Project development is generally riskier than solar PV and can take up to several years to deliver.

Onshore wind is an established technology and offers one of the least-cost options for renewable energy supply; delivering electricity cheaper than conventional fossil-fuel technologies. Despite the strengths of onshore wind energy, widescale deployment of the technology in England and Wales last been largely restricted since 2015 due to the local and national planning requirements. Proposals often face local opposition, with visual impact, noise, site access and ecological impacts cited as reasons for objection. In the UK, 55% of historic onshore wind projects (between 1993 to 2019) were refused permission or abandoned (planning application withdrawn) by the developer.

Furthermore, legislation introduced under the Energy Act 2016 provided local authorities with the final say for all onshore wind energy projects and only allows wind turbines to be proposed for sites which have been identified within local or neighbourhood development plans. These changes effectively provided local communities with a veto to block the development of wind turbines.

In 2014 (the year before the planning changes were implemented) there were 156 onshore wind planning applications (51 in England). In contrast, only one application was submitted into the English planning system in 2020, with a capacity of 4.2 MW. This highlights the extent to which the local veto has all but stopped this form of development in England.

Historic planning consents in England have been at a total height of 125m. In recent years tip heights for schemes have generally increased to around 200m and the manufacturers are understandably concentrating on this larger market. In effect any

smaller schemes in England would therefore be unlikely to access the latest, most cost-effective turbines unless there is a softening of the planning consenting regime in England. Most commercial turbine manufactures (such as Enercon, GE, Nordex, Siemens Gamesa and Vestas) have phased out production of turbines below 150m to focus on the next generation of turbines at 180m tip heights and above. 180m tip height turbines have already been consented in Scotland, with projects at 200m+ also in the planning system.

Onshore wind turbines are typically located in areas with adequate wind speeds and in exposed locations free from obstacles like trees or buildings that can interfere with turbine performance. Table 7 outlines some of the key considerations for onshore wind site identification.

*Table 7: Screening criteria for wind development*

| Key consideration | Comment |
|---|---|
| Wind resource/ viability | A minimum average windspeed of 6m/s+ will be required to obtain a reasonable return. |
| Monitoring wind speed | Wind speed monitoring is advisable prior to developing a wind energy project, to obtain more accurate data on wind speeds at the height of the proposed turbine. Wind monitoring also allows energy output for the project to be estimated. For commercial developers seeking project finance, this monitoring will be undertaken for a full year. Planning permission is also likely to be required for the wind monitoring mast. |
| Spacing | If more than one turbine is being installed, a space of at least five times the diameter of the rotor should be allowed between turbines to optimise power output by reducing wind shadowing and or turbulence. |
| Access | Access for the installation also needs to be taken into account. More remote locations will typically have a better wind resource, however access for vehicles to construct the turbine foundations and transport the turbine blades and other components to the project site may be constrained. |
| Grid connection | One of the main challenges wind development faces generally is the cost of procuring access to local grid infrastructure. Underground or overhead power lines can be very expensive, so the closer the site is to a suitable connection point the better. |

Like for solar, sites identified for planned wind farms are subject to a formal application assessment. The National Planning Policy Framework aims to project Areas of Outstanding Natural Beauty, Sites of Special Scientific Interest and areas of high national heritage value from negative impacts of wind farm development. In addition to this, most commercial scale onshore wind turbine applications will require an Environmental Impact

Assessment (EIA), which assesses the potential visual impacts and changes to landscape and biodiversity that could result. Other areas the EIA covers includes:

- archaeology, hydrology and geology
- aviation and radar
- noise and shadow flicker impacts
- ecological impact

New onshore wind projects cannot receive planning permission unless an area is identified as suitable for wind energy in a local or neighbourhood plan. Table 8 sets out other key designated areas which need to be avoided along with some typical set back distances for onshore wind projects.

*Table 8: Key designated areas and set back distances for onshore wind development*

| Key consideration | Comment |
|---|---|
| Designated nature conservation areas | Designated nature conservation areas should be avoided. Where sites are used by birds, ecologists may recommend set back distances from the boundary of designated areas. |
| Designated landscape | Designated landscapes may or may not be suitable for wind turbines, depending on the reason for their designation and the impact that wind turbines may have on this. Views from designated landscapes to wind turbine sites will also need to be considered. |
| Bats | Hedgerows and woodland areas need to be avoided to reduce the potential impact on bats. Ecologists will recommend separation distances. |
| Residential properties | A setback distance of at least 600 - 800 metres from residential properties for large wind turbines is recommended. However, as local communities have a veto to block the development of wind turbines, engagement with the local community should on sought on setback distances. |
| Infrastructure | Minimum distances from roads, power lines, gas pipelines and other infrastructure, which are required by the Highways Agency and other infrastructure operators including National Grid. |
| Exclusion areas | Exclusion areas around airports, airfields and MOD land exists. Depending on the nature of the project, this should be determined in advance in consultation with the relevant body. |
| Communication equipment (telecoms) | Communications equipment need to be taken into account in consultation with the relevant telecoms operators such as Openreach. |

## 6.2 Potential for onshore wind across the Council estate

We have reviewed the Councils lands assets and were not able to identify any suitable areas that could potentially support one/two commercial size turbines, or the deployment of micro turbines.

## 6.3 Onshore wind market review

An analysis of the BEIS Renewable Energy Planning Database quarterly extract for September 2020 indicates that there are 84 onshore projects greater than 5MW that have been consented between 2016 and 2020 that are still awaiting construction. This pipeline totalling 3.6 GW is comprised of 65 projects only one of which is in England. The remainder are in Scotland (65), Northern Ireland (13) and Wales (5). In terms of the MCC requirement (range 20MW to 60MW) there are 45 projects all of which are outside England. This would mean that the Council would need to be open and able to invest outside England. Developers of these projects have not historically sold assets or are already committed to existing investors.

The announcement that there will be a Contract for Difference (CfD) pot 1 allocation in 2021 (see Appendix 1) will also provide further certainty in this market and drive competition. Large projects or portfolios of projects in high wind speed areas in Scotland and Wales are likely to be the main beneficiaries in the fourth allocation round.

## 6.4 Next steps

- The Council needs to determine whether it can invest outside England.

- Approaches could be made to wind turbine developers who have assets which have not been constructed, but as these are generally tied in to a particular investor it is unlikely that would be available for purchase.

**Onshore Wind – Key Points**

Onshore wind is one of the most established technologies and offers one of the least-cost options for renewable energy supply and delivers electricity cheaper than conventional fossil-fuel technologies.

We have reviewed the Councils lands assets and were not able to identify any suitable areas that could potentially support one/two commercial size turbines, or the deployment of micro turbines.

Only one onshore wind application was submitted into the English planning system in 2020, with a capacity of 4.2 MW.

There is potential for the Council to investigate the acquisition of consented projects which are still to be constructed, however any acquisition would be outside England and it is not likely there would be a significant number (if any) assets available for a transaction of this nature.

# 7 Offshore Wind

## 7.1 Background

The Crown Estate manages the seabed around England, Wales, and Northern Ireland. The Energy Act 2004 vests rights to The Crown Estate to license the generation of renewable energy on the continental shelf within the Renewable Energy Zone out to 200 nautical miles.

In 2001, The Crown Estate announced the first UK offshore wind leasing round and since has run two further leasing rounds in 2003 and 2008. Thirty-nine offshore wind farms have been built by the sector, comprised of 2,292 turbines with an operating capacity of 10.4 GW. In September 2020, the Crown Estate awarded lease agreements to six proposed offshore wind project extensions in the waters around England and Wales (totalling 2.8 GW).

The Crown Estate is currently in the process of running its fourth leasing round, creating the opportunity for at least 7 GW of new projects. Prospective developers have been given the opportunity to identify and propose project sites within four broad seabed Bidding Areas. The Round 4 leasing process consists of five stages, the pre-qualification stage of which has already been completed. Invitation to Tender Stage 2 and bidding cycles are expected to take place in early 2021.

The Crown Estate is expecting to enter into a wind farm agreement lease with successful bidders in Spring 2022. Once seabed rights have been awarded, project developers will apply for the required statutory development consents. This is required as each project will be at least 400 MW. Developers will also require consent for the construction of the wind farm's offshore cable connection to the onshore grid and associated onshore permissions.

The development and consenting stage of the process is managed by the wind farm developer. The main offshore UK developers are: EDF Renewables, EDP Renewables, E.ON, Equinor, Innogy, Ørsted, Red Rock Power, ScottishPower Renewables, SSE and Vattenfall. A guide to an offshore wind farm was published on behalf of The Crown Estate and the Offshore Renewable Energy Catapult[5] in 2019. This guide sets out the costs associated with the development, construction and operation of an offshore wind farm. Development costs alone (development and project management) for a 1 GW installation are estimated at £120m. There are no speculative developers in this market and most projects are developed and owned by these companies

Once consents are granted, developers will then need to take part in CfD auctions to bid for support to build and run the wind farm. It is currently anticipated that Round 4 projects will become operational towards 2030.

There is no real market to purchase offshore wind turbines other than to participate in the auction for leasehold rights and then go on to develop assets.

[5] https://ore.catapult.org.uk/wp-content/uploads/2019/04/BVGA-5238-Guide-r2.pdf

## 7.2 Offshore wind – suitability

Offshore wind is not considered to be a suitable investment to meet the Council's requirements due to the scale of investment, the capacity required to acquire and develop assets and the extended timescale for assets coming on stream. The extended timescale would mean that an acquisition of this nature would not deliver the Council's carbon budget requirements.

**Offshore Wind – Key Points**

The MCC requirement would represent less than 1% of the current Round 4 opportunity.

The pre-qualification stage for Round 4 has already been completed.

Development costs associated with offshore wind are significant and any partnering/acquisition opportunity (given the MCC requirement) is likely to be extremely limited.

Round 4 projects are not forecast to become operational until the end of the decade and this would not meet the Council's carbon budget requirements.

# 8 Solar PV Market Review

## 8.1 Background

In order to meet its targets to offset 7,000 tonnes of $CO_2e$ by 2025 the Council will need around 45-50 MW of solar PV generation (depending on location).

## 8.2 Opportunities within the Council's boundary

A review of Council owned sites and planning applications within the Council's area over the last two years has not provided any potential schemes within the Council's boundary.

## 8.3 Opportunities within the Greater Manchester Combined Authority boundary

Other councils in the Greater Manchester Combined Authority area are also exploring potential opportunities for solar farm sites. The ground mounted projects planned include solar farms at Chamber House farm in Rochdale (5 MW) and Kenyon Way in Salford (1.7 MW). Initial indications are that the size of the schemes are not large enough to benefit from a collaboration with the Council.

## 8.4 Out of area opportunities

We understand from discussions that the Council is open to financing an out-of-area investment if that is the best alternative and it is able to do so within the new PWLB lending criteria. Engagement with active solar PV has identified three potential projects that are in development and are available to purchase. The purpose of this section is to set out those opportunities and how the Council can position itself to be able to respond, either to these opportunities or to further market opportunities as they arise.

## 8.5 Solar PV market investments

The market for well developed, de-risked and subsidy backed solar PV projects remains high. This drives high prices and relatively low yields due to the secure nature of the income streams.

Local Partnerships has been tracking the pricing of operational disposals and have seen an upward value trend for operational (subsidy backed) solar PV transactions with prices of circa £1m per MW representing a current market benchmark. The majority of investors in the subsidised market are looking to move into the unsubsidised market. Those with large subsidised portfolios have substantial experience of managing merchant risk within these portfolios as a proportion of their income will be from trading wholesale power within their existing generation fleets.

We expect, and have already seen, that investors who need to continue to deploy capital into renewable generation and have experience in solar PV will invest in unsubsidised projects. The announcement that there will be a Contract for Difference (CfD) pot 1 allocation in 2021 (see Appendix 1) will also provide further certainty in this market and

drive competition. Without CfD, projects require a relatively long-term Power Purchase Agreement (PPA) to cover eight to ten years of operation at the start of the project in order to create financial certainty in the early years. Renewed interest from the funds has resulted in project developers returning to the market. There has been a significant shift towards larger projects with the smallest new projects typically exceeding 25 MW.

To date there have been relatively few transactions of operational subsidy-free solar projects. Gridserve purchased the first subsidy-free solar farm from developer Anesco as recently as August 2020 (for an undisclosed sum). From discussions with active solar PV developers we understand developers are targeting pricing in the range of £550,000 to £650,000 per MW for constructed and connected assets. This reflects the greater risk of variable income associated with subsidy free development in comparison to £1m per MW for subsidy backed operational projects. It is likely that any solar projects which secure CfD will be more valuable than those trading on a merchant basis. One of the main challenges renewable energy development faces is the cost of procuring access to local grid infrastructure. Grid connection cost is therefore a key driver of project viability generally and price expectation within the range where viability is established.

Private sector developers are able to access significantly lower construction pricing than has been seen to date in the public sector. Public sector construction pricing is similar to the costs quoted for completed projects, so serious consideration should be given to projects which can be bought as they become operational. These projects represent a cost-effective solution for the public sector with significantly better risk profiles than schemes in development or at shovel ready.

### 8.6 Useful life

In the pre-construction solar PV market we are seeing increased focus on the useful operating life of projects, with developers seeking to obtain planning consent for 40 years and including provisions to extend land leases to match. This has led to an increased understanding of the potential value and technical requirements of investors to apply this extended life. This will result in more aggressive assumptions being made by funds on the potential project duration when assessing the viability of projects.

### 8.7 Technological improvements

Panel manufactures have continued to increase the efficiency of their technology. The emerging technology within the industry (bifacial modules and single-axis solar trackers) provide greater land-use options and offer a higher yield. Bifacial solar panels generate power by exposing both sides of the cells to sunlight, increasing total energy generation. The technology is relatively new and reported outputs are higher but sufficient data is not yet available to allow reliable modelling to take place in the UK. This coupled with reducing panel costs and the significantly larger size of new developments is having a positive impact on the economics of subsidy free solar PV. We expect investors bidding into market opportunities to factor in these improvements.

Single access tracker systems are common in the United States but have not featured to any significant extent in the UK so far. Build and maintenance costs are higher, but so are yields. The Warrington BC/Gridserve sites are the first deployment of large-scale single access trackers in the UK (examples of technology are shown in Figure 10 and Figure 11 for information).

*Figure 10: Traditional fixed mounting structure solar farm with standard solar panels*[6]

*Figure 11: Single access tracking solar farm with bi-facial panels*[7]

[6] Image bsg-ecology.com
[7] First4solar.co.uk

## 8.8 Structuring

The buyer pool for large projects are all astute financial institutions who will employ different but effective structuring to ensure that their investors' tax exposure is limited. As such, assumptions on structuring are variable and can also impact value.

From discussions with active solar PV developers who sell assets there is recognition of the advantages that local authorities would bring to transactions (e.g. motivations for investment, low cost of borrowing, their own power purchase requirements, return expectations and the ability to look at longer term project time horizons). It is likely that local authorities would be competitive in bidding processes. Subject to acceptable valuation, there is also willingness to align transaction timelines with council approval processes.

## 8.9 Positioning the Councils to respond to market opportunities

The pipeline of UK solar farms (as at September 2020) was 10.6 GW across 442 sites. 24.8% of the entire ground-mount pipeline capacity in the UK is coming from sites planned to operate at between 40 and exactly 49.9 MW. 29.6% of projects fall into the 250 kW to 5 MW band. These smaller sites are often local-council, public sector or landowner-based projects. The key message for the Council is that developers don't have the capacity to build every consented project, but the Council will need to be flexible both on location and size of project.

From our engagement with active solar PV developers who sell assets, it is clear that smaller size projects are available (5-10 MW) however the viability of projects that we have appraised has been difficult to establish. We therefore recommend that the Council should shape its approval processes and governance around a single 40 – 50 MW stand-alone project (on a subsidy free basis), with the flexibility to invest in two smaller size projects should they be financially viable and the projects become available.

Appendix 3 sets out more detail about the nature of activities required in the purchase of a large solar farm. Transactions of this nature are relatively competitive and there is a need to be able to take decisions relatively rapidly. The Council should consider what preliminary and delegated authorities are required to allow it to properly analyse and progress a transaction of this nature.

## 8.10 Active Projects

We have identified three currently available projects across the UK.

### Project A – North West – 30 MW

Project is in development. Grid and land rights appear to have been secured by the developer. Planning is yet to be submitted. Earliest energisation date Q4 2023. Community development company.

### Project B – The Midlands – 45 MW

Project has grid and land rights secured. Planning consent has been granted for the scheme. This scheme has a grid connection at 132kV which will add some

complexity. Opportunity to purchase post construction. Earliest energisation date Q1 2022. Commercial developer.

### Project C – Southern England – 46 MW

Project has grid and land rights secured. Planning consent has been granted for the scheme. Earliest energisation date Q3 2021. Commercial developer.

Table 9 sets out the different solar irradiance at these locations and compares them to the irradiance in central Manchester, together with the $tCO_2e$ each scheme would offer between 2025 and 2038.

*Table 9:* Schemes irradiance and potential carbon savings (2025-2038)

| Location | Forecast Irradiance (kWh/kWp) | Delta to Manchester | $tCO_2e$ |
|---|---|---|---|
| Manchester | 945 | n/a | n/a |
| North West | 958 | +1% | 48,238 |
| The Midlands | 989 | +5% | 74,699 |
| Southern England | 1065 | +13% | 82,227 |

## 8.11 Public Works Loan Board Consultation

On 26th November 2020 the UK Government published its response to the consultation on future lending terms for PWLB[8]. The aim of the consultation was to *"..develop a proportionate and equitable way to prevent local authorities from using PWLB loans to buy commercial assets primarily for yield, without impeding their ability to pursue service delivery, housing, and regeneration under the prudential regime as they do now."*

The Government has now introduced new terms to apply to all loans arranged after 26 November 2020. Under these terms the s151 Officer will need to confirm that there is not an intention to buy investment assets primarily for yield, based on their professional interpretation of the guidance.

In relation to specific concerns raised by some respondents (item 3.99 of the response to the consultation) that they carry out some capital spending on green or renewable energy developments which support the local authority's policy objectives to achieve carbon neutrality but were not necessarily located within the authority's wider economic area, the Government response was: "*The government will not restrict local authorities' ability to carry out capital projects in neighbouring districts or the authority's wider economic area*

[8] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938043/Response_to_consultation_Public_Works_Loan_Board_future_lending_terms_1.pdf

*where these projects are for service delivery, housing, preventative action, or regeneration"*

### 8.12 Next steps

- Develop sufficient outline business case authority to set up a decision making framework which allows the Council to act with sufficient speed to maintain market interest in a transaction whilst remaining within the decision making framework of the Council.

- Obtain in-principle support to enter into an exclusivity period/undertake project due diligence as opportunities arise.

- Review the project specific information in relation to the three currently identified projects and determine whether to pursue an exclusivity agreement in relation to any of these opportunities.

**Market Opportunities – Key Points**

There are opportunities to purchase solar PV schemes directly from developers, but these are unlikely to be within the Council boundary area.

50 MW schemes are available in the current market although the Council may need to show flexibility around actual sizing. The numbers of projects coming to the market are relatively small and the Council needs to be prepared to move at speed and be flexible in how they meet their requirement.

A budget of £ 27 - 30m would allow the Council to purchase sufficient assets to meet the requirements set out in this report.

The Council's s151 officer will need to be satisfied that an investment of this nature meets the new PWLB lending criteria.

# 9 The PPA alternative

A number of local authorities are exploring the route of purchasing ‘green’ electricity in order to meet their current carbon budgets.

Section 3.3 sets out the basis for carbon accounting for scope 2 emissions (grid supplied electricity). If dual accounting is to be used then good practice suggests there needs to be a very clear rationale for the inclusion of other electricity sources and in particular; additionality (i.e. demonstrating you triggered new capacity), traceability (i.e. how you can demonstrate where the power is generated) and permanence (i.e. long term arrangements that cannot easily be reversed) will be required to justify inclusion.

The duration of a PPA is an important factor in whether it would be legitimate to account for the carbon savings, with longer term agreements being beneficial. Longer term agreements however come at the risk of mismatch between the Council’s requirements and the supply levels in the agreement. Longer term PPAs are likely to have a minimum supply requirement, below which the offtaker (i.e. the Council) will pay for power generated whether or not they are able to consume it.

If the Council were to pursue a green PPA there are two main scenarios i.e:

a) Purchase a ‘green tariff’ from a supplier

b) Direct purchase of electricity from a renewable energy generating station

## 9.1 Green Tariffs

A green tariff means that some or all of the electricity you buy is 'matched' by purchases of renewable energy that your energy supplier makes on your behalf. These could come from a variety of renewable energy sources such as wind farms and hydroelectric power stations. Renewable energy generation is demonstrated by the Renewable Energy Guarantees of Origin (REGO) certificates.

The Council’s current supplier, nPower, offer tariffs for 10-15 years linked back to specific, identifiable generating stations.

### 9.1.1 Applying the tests of additionality, traceability and permanence

Before a green tariff is included in an organisation’s carbon accounting it should meet the requirements of additionality, transparency and permanence.

#### I Additionality – green tariffs

Green tariffs rarely meet the additionality criteria as they may be part of an existing portfolio of assets. Furthermore, new green tariff customers will increase demand for green electricity which will be taken from the general portfolio of the provider, potentially making the general electricity supply from the provider to customers not on a green tariff more carbon intensive.

A green tariff is therefore unlikely to meet a specific additionality test even where it is from a clearly defined source. There is also nothing in the nPower agreement which

would preclude the supplier from applying for a CfD for the scheme. Where as scheme has CfD certainty it is very unlikely that the supply contract with the provider would be sufficient to meet the requirements of additionality.

#### II Traceability – green tariffs

Green tariffs should be able to provide REGO certificates for every unit of power consumed. Provided they are able to do this then potentially they do pass the transparency test, although it is preferable if the certificates are traceable to a single nominated source. REGO certificates can be traded independently of the source from which they originate which reduces their value in the eyes of some observers.

#### III Permanence – green tariffs

Permanence is the most difficult test for any form of PPA as they are often short term contracts, after which time there is no obligation on the accounting organisation to continue the arrangement. Whilst flexibility is often valued in PPAs it is to the detriment of accounting for the carbon saved.

There are no hard and fast rules for the length required of a PPA before it is considered to have a degree of permanence. Forecasts for decarbonisation of UK electricity range from 2030-2050 and arguably any green tariff would need to be for a period until grid decarbonisation has occurred i.e. 10-30 years. Most green tariffs are of a significantly shorter period than this.

### 9.2 Direct PPAs with a generator

It is possible to purchase electricity directly from renewable energy generators through a direct PPA agreement. This can either be synthetic or sleeved (see Appendix 1 for a description of the differences). A direct PPA with a specific asset that is not part of a larger pool of assets supplying a range of customers has a potentially stronger weighting in carbon accounting terms than a green tariff.

A PPA of this nature would require a procurement exercise to put it in place and could be on the basis of either a sleeved or synthetic PPA.

#### 9.2.1 Applying the tests of additionality, transparency and permanence to a PPA directly with a generator

#### I Additionality

Any tender exercise could state that the generation capacity was not subject to any forms of subsidy and was new build generation. This would potentially meet the criteria of additionality.

#### II Transparency

In addition to the REGOs the Council would benefit from a direct relationship with the energy generator to demonstrate the source of the electricity consumed.

### III Permanence

This will depend on the length of the PPA agreement. Current market PPAs are largely of the 5-8 year duration. Beyond this longer term arrangements are available but come at a premium of around 10%.

It may be possible to make a case for permanence in that the new generating asset would have been created because of the initial PPA, however it does not provide permanence to the decarbonisation of the Council's electricity supply.

# 10 Options Appraisal

This options appraisal has been based around the Treasury Green Book recommendations.

## 10.1 Options for Appraisal

The following options have been considered in this options appraisal:

1. Do nothing
2. Fair value solar PPA – direct with a solar farm operator
3. Fair value wind PPA – direct with a wind turbine operator
4. a) Asset purchase of 49 MW site in southern England with PWLB lending over 25 years
   b) Asset purchase of 49 MW site in southern England with PWLB lending over 35 years
5. a) Asset purchase of 46 MW site in the Midlands with PWLB lending over 25 years
   b) Asset purchase of 46 MW site in the Midlands with PWLB lending over 35 years
6. nPower wind PPA
7. nPower solar PPA

## 10.2 Preliminary appraisal – affordability

Before proceeding further with the options appraisal net present value (NPV) calculations were produced for all of the alternatives and compared to option 1 – 'do nothing'.

This modelling was undertaken by Local Partnerships on behalf of the council and utilises third party data from Aurora Energy Research (Aurora). Local Partnerships are subscribers to Aurora, who are a market leading provider of energy price forecast information. Using high quality forecast information for forward energy prices provides the council with the highest likelihood of a robust npv calculation. Aurora's information is the basis of their business and clients are tied with strict contractual terms that prevent the release of forecasts to non-subscribers. Local Partnership's agreement with Aurora allows them to use the information in financial modelling and to release the outputs of that modelling in a form where the original data cannot be reverse engineered, but not to release the financial models as these contain the embedded data sets. We have therefore included the assumptions for the financial modelling and the outputs of the npv calculations in this report.

Local Partnerships and Aurora have undertaken a workshop with council officers to ensure that the council understands the basis of the data and the financial models that produce the npv information used in this report."

### 10.2.1 NPV assumptions

All NPV calculations have been appraised over an 8 year and a 25 year period and compared to a 'do nothing' scenario based around ongoing purchase of wholesale

electricity. The 'do nothing' scenario relies on the Aurora Energy Research central power price curve for wholesale power. Table 10 shows the assumptions embedded in the NPV model.

*Table 10 – NPV assumption fields in the model*

| | Input Data | |
|---|---|---|
| MCC total requirement (excluding schools) | 45,000 | MWh |
| Site 1 (southern England) Installation Size | 46,092 | kW |
| Site 1 P50 Generation Specific annual yield | 1,065 | kwh/kwp |
| Site 2 (the Midlands) Installation Size | 45,000 | kW |
| Site 2 P50 Generation Specific annual yield | 989 | kwh/kwp |
| Deterioration | 0.40% | Module degredatior |
| Inflation | 2.0% | |
| Inflation base year | 2019 | |
| npv discount rate | 5.6% | |
| Differential between central and fair value | 2.0% | |
| Solar sleeving costs (£ 6/MWh) | £0 | per MWh |
| Wind sleeving costs (£ 7/MWh) | £0 | per MWh |

### 10.2.2 PPA Duration

An 8 year duration has been taken for the PPA agreements following a discussion with Aurora Energy Research, with the view being that prices for longer term PPAs would be higher than the values modelled. For the fair value PPAs it does not make a significant difference to the scenarios if the duration is longer as the prices revert to the Aurora solar central case less 2% adjustment for fair value. A more significant impact is seen in relation to the nPower PPAs, although the wind PPA offers considerably lower value in the short term where prices would be higher than modelled for the first four years.

The asset purchase models are unaffected as they are based on costs incurred rather than price paid. The gap between costs incurred and price paid increases over time so in all scenarios the asset purchase models look better over a longer duration.

### 10.2.3 Deterioration

The speed at which solar panel efficiency decreases over time. The assumed rate at 0.4% is within the industry standard rate, but less than the likely module guarantee rate of around 0.5% pa.

### 10.2.4 Inflation

2% CPI has been used throughout as this is the Government target figure. Base year relates to the base year for Aurora price information.

### 10.2.5 NPV discount rate

This is the Treasury Green Book rate adjusted for schemes which include inflation.

### 10.2.6 Differential between central and fair value

Adjustment applied to Aurora central solar price forecast curve to achieve the Aurora fair price. This price represents the price most likely to be paid by an offtaker when all factors are taken into account (such as transaction costs etc).

### 10.2.7 Sleeving Costs

Differential rates for wind and solar have been discussed with Aurora. We have not applied sleeving costs in the final models as they can be avoided by the use of a synthetic PPA agreement and destroy considerable value in all schemes (except the nPower options). Synthetic PPAs are compliant for greenhouse gas accounting (as confirmed with Anthesis).

### 10.2.8 Asset purchase schemes – traded balances.

As these schemes are not exactly sized to the Council's requirement there are differences between the energy produced and the energy consumed. With a synthetic PPA the Council will have PPAs in place with energy suppliers as well and these additional volumes can be included in these contracts. The models have therefore included for a revenue where there is over generation and for purchased electricity where there is under generation.

### 10.2.9 Operating and maintenance costs for asset purchase schemes.

The model allows for the following: £ 10,500 O&M contract including cyclical replacements, £ 1250 insurance, £ 2,800 rent, £ 2,000 rates, £ 2,500 asset management, £ 5,000 contingency and the Council's internal costs. All costs are per MW installed per year. The asset management service will in effect run the farm for you and manage the contractors, billing etc. The contingency amounts to around £ 230,000 pa and will allow the Council to have a member of staff who can deal with this and as well as providing general contingency to the investment. The costs allowed are all reasonably generous.

### 10.2.10 Finance period

The asset purchase scenarios have reviewed both a 25 year financing period and a 35 year financing period. A solar asset is anticipated to have a life of 35-40 years.

The 35 year asset financing scenarios have a residual balance on both schemes of around £ 11m at the end of year 25.

### 10.2.11 Post PPA assumptions for the 8 year PPA scenarios

For all of these scenarios (both nPower and the fair value agreement directly with an asset operator) the schemes revert to the fair value solar price curve for the respective technology after the end of the 8 year PPA period.

## 10.3 NPV outputs

Table 11 below sets out the outputs from the NPV exercise undertaken by Local Partnerships and utilising the confidential Aurora data.

*Table 11: outputs from NPV comparison exercise*

Manchester City Council Scenario Comparisons (February 2021)

| | | | Total Cost (25 yrs) | Cost after 8 years | 25 year npv | 8 year npv |
|---|---|---|---|---|---|---|
| **With sleeved PPAs** | | | | | | |
| 1. | Do Nothing (assumes Aurora wholesale plus inflation) | | -£85,558,054 | -£21,965,089 | -£43,366,132 | -£17,091,133 |
| 2. | Fair Value Solar PPA Option | V Do Nothing | £15,808,392 | £2,593,361 | £7,235,495 | £1,966,242 |
| 3. | Fair Value Wind PPA Option | V Do Nothing | £22,385,253 | £5,528,952 | £11,169,161 | £4,258,268 |
| 4. | Solar Own/Operate Option Site 1 (southern England) | | | | | |
| 4. a) | Solar own and operate with 25 year finance (southern England) | V Do Nothing | £22,017,266 | £3,055,525 | £9,977,925 | £2,207,730 |
| 4. b) | Solar own and operate with 35 year finance (southern England) | V Do Nothing | £30,147,626 | £5,765,645 | £14,403,842 | £4,347,664 |
| 5. | Solar Own/Operate Option Site 2 (the Midlands) | | | | | |
| 5. a) | Solar own and operate with 25 year finance (the Midlands) | V Do Nothing | £20,225,002 | £1,081,277 | £8,263,154 | £629,010 |
| 5. b) | Solar own and operate with 35 year finance (the Midlands) | V Do Nothing | £28,230,442 | £3,749,757 | £12,621,068 | £2,736,065 |
| 6. | npower wind PPA (£48.50) indexation 2.0% | V Do Nothing | £20,089,059 | £3,232,759 | £9,293,783 | £2,382,890 |
| 7. | npower solar PPA (£47.10) indexation 2.0% | V Do Nothing | £16,988,517 | £3,773,486 | £8,076,710 | £2,807,458 |

Several of the scenarios are effectively derivatives of the same option i.e. the fair value PPAs and the nPower PPAs together with the different finance options for the asset purchase options. The asset purchase options are not directly derivatives of each other as aside from variations in size and output the Midlands opportunity represents what might normally be available in the market where the southern England scheme is a particularly good one and may not be representative of what is available when the Council have decided on their preferred approach.

**Recommendation 2: All options have positive NPV outcomes when compared with 'do nothing'. There is therefore a solid value for money basis to either enter into a suitable PPA or asset purchase agreement.**

### 10.3.1 Options for Further appraisal

In order to keep the options appraisal to a manageable exercise, the best value alternatives of each of the derivatives have been taken forward into the next stage as follows:

1. A wind based PPA with nPower (current electricity supplier) linked to specific projects. This is for an 8 year duration and pricing has been obtained from nPower.
2. A wind based PPA direct with a turbine operator. This assumes an 8 year duration with pricing based around the Aurora Energy Research fair pricing model.
3. An asset purchase of a 49 MW solar farm post construction. The farm is based in southern England and terms have been discussed directly with the owners. Financing is through a 35 year PWLB loan at 1.46%.
4. An asset purchase of a 46 MW solar farm pre-construction. The farm is based in the Midlands and terms have been discussed directly with the owners. Financing is through a 35 year PWLB loan at 1.46%.

## 10.4 Criteria and weighting for options appraisal

The following criterial have been developed for the options appraisal based around the Green Book criteria of desirability, feasibility and viability.

The weighting figures are out of a maximum of 10 for each criteria (and balance to 100 overall and are shown in table 12). These represent the relative importance of different measures in reaching a decision and have been developed from the workshops run with the Council to develop their understanding of options and associated risks.

*Table 12 – Weighting and criteria for options appraisal*

| Criteria | Weighting |
|---|---|
| **Desirability** | |
| Reduction of CO2e emissions by 7,000 tCO2e by 2025 | 10 |
| Are CO2e savings lasting upto and beyond 2038 (this criteria is included as a measure of the permanence provided by the option)? | 7 |
| Is the option available to current MCC partners? | 2 |
| **Feasibility** | |
| What is the earliest implementation date? | 7 |
| How well does the option fit with the likely scope 2 emissions for MCC? | 6 |
| Does the option have reputational risks? | 7 |
| Does the option expose MCC to a risk of challenge through procurement? | 7 |
| Does the option expose MCC to a risk of challenge to its carbon accounting practice? | 8 |

| Criteria | Weighting |
|---|---|
| **Viability** | |
| What savings can be realised by the option during a typical 8 year PPA time horizon (NPV v do nothing)? | 8 |
| What savings can be realised by the option during a typical 25 year financing period for an asset purchase? | 8 |
| Are there savings available beyond 25 years? This measure is included to show whether an option provides cashable savings beyond year 25. | 4 |
| Are there viable mechanisms for adjusting supply volumes over time? | 8 |
| Does the option provide protection against energy price increases (short and long term)? | 3 |
| Are MCC able to resource the option with suitable capacity and capability? | 5 |
| What capital is required by MCC to implement the option? | 5 |
| What resources are required by MCC to manage the option on an ongoing basis? | 3 |
| Will the option positively impact the market? | 2 |

### 10.4.1 Scoring methodology

Each of the criteria has a documented methodology by which each option is scored, these are set out in table 13 below.

*Table 13 – Basis of scoring for each criteria*

| Criteria | Points allocation basis |
|---|---|
| Reduction of CO2e emissions by 7,000 tCO2e by 2025 | 10 points if 7,000 tCO2e reduction by 2025. Less one point for each -5%duction by 2025. Less one point for each -5% |
| Are CO2e savings lasting up to and beyond 2038 (this criterion is included as a measure of the permanence provided by the option) | 0.5 points for each year of certainty offered for each year from year 5 onwards (all schemes provide certainty for at least 5 years) |
| Is the option available to current MCC partners? | 1 point for up to 20% of partners supply that could be offered and 1 point for each additional 20%. To reflect flexibility remaining 5 points are as follows 5 points for agreement of 2 years or less, 4 points for 2-3 years, 3 points for 3-4 years, 2 points for 4-5 years, 1 point for 5-8 years |
| What is the earliest implementation date? | H2 2021 = 10 points, H1 2022 = 8 points, H2 2022 = 6 points, H1 2023 = 4 points, H2 2023 = 3 points, H1 2024 = 2 points, H2 2024 = 1 point |
| How well does the option fit with the likely scope 2 emissions for MCC? | First 8 years - within 10% = 6 points, within 25% = 4 points, less than 75% = 0 points. PLUS long term after year 8 - very flexible = 4 points, flexibility can be achieved (e.g. through sale or purchase outside the contract) =2 points, none = 0 points |
| Does the option have reputational risks? | Likely to occur and attract ongoing publicity as issue cannot easily be resolved = 0 points, could occur on a one off basis, but can be mitigated = 5 points, unlikely to occur = 10 points |
| Does the option expose MCC to a risk of challenge through procurement? | Existing framework can be used = 10 points, one off new procurement = 8 points, specialist advice to structure agreement = 6 points |

| Criteria | Points allocation basis |
|---|---|
| Does the option expose MCC to a risk of challenge to its carbon accounting practice? | Assumes all options can demonstrate that the energy is renewably produced via the issue of REGO certificates. Ability to demonstrate additionality = 5 points, PLUS ability to demonstrate permanence = 5 points |
| What savings can be realised by the option during a typical 8 year PPA time horizon (NPV v do nothing)? | (option value/value of best option)*10 |
| What savings can be realised by the option during a typical 25 year financing period for an asset purchase? | (option value/value of best option)*10 |
| Are there savings available beyond 25 years? This measure is included to show whether an option provides cashable savings beyond year 25. | Yes =10, No = 0 |
| Are there viable mechanisms for adjusting supply volumes over time? | Assessed in two parts. Part 1 - flexibility in years 0-8. +/- up to 10 % = 2 points, +/- 25% = 5 points. Part 2 - rebalancing. Ability to rebalance supply volume at year 8 = 5 points, no = 0 points |
| Does the option provide protection against energy price increases (short and long term)? | Yes =10, Yes, but only for first 8 years = 4, No = 0 |
| Are MCC able to resource the option with suitable capacity and capability? | Within existing capacity and skills = 10, will require some bought in capacity (up to £ 50k expenditure) = 6 points, will require significant additional support = 3 points |
| What capital is required by MCC to implement the option? | Capital requirement 10 points for nil capital investment. Less 1 point for each £ 5m capital investment required |
| What resources are required by MCC to manage the option on an ongoing basis? | Costs fully included or within existing resources = 10 points, - 3 points for each uncosted FTE required for support |
| Will the option positively impact the market? | Impact on the UK energy mix - up to 3 points. Sector leadership up to 7 points |

## 10.5 Options Appraisal Outputs

Utilising the weighting and criteria set out in section 10.4 each of the four options has been appraised. The weighting scheme provides a score as a % with higher scores being a closer fit with criteria than lower scores.

A full copy of the options appraisal matrix is in appendix 5 to this report (Excel Workbook).

The outputs from the scoring exercise are as follows (table 14):

*Table 14 – outputs of options appraisal scoring exercise*

| Option | Description | Score | Rank |
|---|---|---|---|
| 1. | **nPower wind PPA.** A wind based PPA with nPower (current electricity supplier) linked to specific projects. This is for an 8 year duration and pricing has been obtained from nPower. | 61% | 4 |
| 2. | **Fair Price Wind.** A wind based PPA direct with a turbine operator. This assumes an 8 year duration with pricing based around the Aurora Energy Research fair pricing model. | 72% | 2= |
| 3. | **Asset Purchase (Southern England).** An asset purchase of a 49 MW solar farm post construction. The farm is based in southern England and terms have been discussed directly with the owners. Financing is through a 35 year PWLB loan at 1.46%. | 80% | 1 |
| 4. | **Asset Purchase (The Midlands).** An asset purchase of a 46 MW solar farm pre-construction. The farm is based in the Midlands and terms have been discussed directly with the owners. Financing is through a 35 year PWLB loan at 1.46%. | 73% | 2= |

## 10.6 Options Appraisal Summary

As all options represent better value for money than do nothing there is a clear case for developing and implementing a new regime in relation to the Council's electricity procurement.

The scoring exercise for the options appraisal has a clear front runner in the site in southern England, however this site represents a particularly good option and may not always be replicable in the market place if the Council are not able to act quickly enough to secure this option.

There is little to choose between a wind based fair value PPA and a more usual asset purchase alternative, although the financial modelling assumptions for the asset acquisition are more conservative.

The pursuit of a PPA agreement with a major electricity supplier is unlikely to represent the best alternative due to both value for money and carbon accounting compliance.

# 11 Risks and other considerations in decision making

## 11.1 PWLB risk factor

The options appraisal has not taken account of the potential PWLB lending risk in relation to an out of area asset purchase. This has been taken out to allow the Council to understand the best option in terms of delivery of its objectives.

The PWLB risk remains and before the Council could pursue and asset purchase strategy it would need to seek assurances from HM Treasury that borrowing for this purpose would not breach the PWLB lending terms. In relation to investment for yield there is a clear case that an asset purchase would represent delivery of the Council's decarbonisation targets and would represent value for money compared to existing arrangements to procure electricity. The more significant risk lies with the criteria to invest in the 'economic area' and this would need to be explored further.

**Recommendation 3: Having undertaken a thorough options appraisal exercise the Council is now in a position to explore with HM Treasury whether or not an asset purchase would be compliant with PWLB lending terms.**

## 11.2 Asset acquisitions

Market engagement has identified three potentially suitable schemes which are currently available and could meet some or all of the Council's requirement. In order to progress opportunities, the Council will need to take sufficient early decisions to enable it to enter into an exclusivity agreement and undertake due diligence. Speed of decision making is key to success in acquiring projects in a competitive market.

A number of local authorities have successfully invested in renewable energy generating assets and there are likely to be opportunities for other local authorities to follow suit. Whether it is better to seek to develop an asset, or buy one from a commercial developer, will depend on the opportunities available and how each local authority responds to individual challenges.

Local authorities should not assume that it will be more cost effective to develop their own schemes. Solar PV and wind developers have worked hard to drive down costs in recent years and bring considerable leverage and expertise to the market. Some of these schemes are likely to offer better value for money, and at less effort, than development of schemes from scratch.

An asset purchase would tie the Council's electricity costs to the cost of operating the asset and servicing debt raised; representing a saving of around 10-15% of current electricity costs. Predicting the costs of financing and operation is relatively straightforward and an asset purchase would therefore provide a degree of cost certainty to the Council's energy planning as well as potential cost savings.

If the Council's electricity demand diminishes over time, there would be the ability to sell any surplus generation to a third party.

Schemes which combine solar PV with battery storage will generally provide a better match against the Council's electricity usage profile and improved savings as fixed cost infrastructure can be shared across the two technologies.

### 11.3 PPA opportunities

In considering a PPA option the Council will need to balance its desire for flexibility with the need to demonstrate permanence in order to meaningfully account for the carbon saved. An agreement directly with a generating station is preferable to a green tariff from a larger energy supplier.

### 11.4 Preferred Option

Whilst the southern England site appears to be the preferred option the question of PWLB risk remains unresolved. There is a strong possibility that by the time this issue is resolved the southern England site will no longer be available.

Without the southern England site there is little to choose between a directly procured fair value PPA and an asset purchase in terms of the options appraisal exercise.

### 11.5 Risk Management

The Council's attitude towards risk and reward is likely to be the determining factor in making a decision between the options of a fair value PPA and an asset purchase. Table 15 sets out the key risks and the solutions they apply to.

*Table 15: Summary of key risks*

| Risk Description | Asset Purchase | Fair Value PPA |
|---|---|---|
| Achieving the carbon benefits - production (i.e. the risk that specified volumes will not be available) | Low | Low |
| Flexibility risk – supply arrangement that no longer matches the Council's needs | Low/Medium | Medium/High |
| Wholesale electricity price inflation risk leading to higher than forecast electricity costs | Low | Medium – after end of PPA |
| Carbon accounting – additionality | Low | Low |
| Carbon accounting – permanence | Low | Medium/High |
| PWLB lending criteria | Possible | Low |

#### 11.5.1 Risk consequences and mitigation

This section sets out the impact of risks, the extent to which they are capable of being mitigated and the measures likely to be necessary.

### 11.5.2 Production Risks

These risks are associated with the ownership of an asset and whether it produces the electricity that was originally expected. The main causes of this risk are set out below together with methods of mitigation.

a. Failure to operate effectively or consistently. Mitigation is via a suitable operation and maintenance contract with an experienced contractor. The contract should include clear specifications of work and availability guarantees. Failure to produce the guaranteed levels of power should be covered in a two-year testing period at the end of the construction contract. Further mitigation can be afforded by the engagement of an asset manager.

b. Irradiance. Overall, there is no significant risk with irradiance as the data available has been collected over many years and is robust. There is however variance year on year in the levels or irradiance. Returns should match those in the original modelling in an average year – but some years will be better than others. Variance is likely to be less than 5% of gross yield.

c. Component failure. The construction contact should provide product warranties for all key components in the early years of the project and this should be managed as part of the operation and maintenance services contract. Ensuring the construction contract has suitable warranties is a key part of the technical evaluation of a project in due diligence.

### 11.5.3 Flexibility and permanence risks

Flexibility and permanence risks are closely related. The higher the degree of flexibility the lower the level of permanence. Permanence is dependent on how difficult it would be for the Council to reverse its decision and revert to standard grid supplied electricity. It is likely that the green tariff would not be able to demonstrate sufficient permanence to meet the criteria for carbon accounting, unless the contract is for an extended period.

The Council has a commitment to become a carbon neutral organisation by 2038, some 17 years into the future. The Council, in common with most local authorities, currently procures electricity over a much shorter timeframe.

The current short-term nature of electricity procurement does not require the Council to be able to accurately forecast its needs into the future. With estate rationalisation, building energy efficiency measures, electrification of heat and transport all due to take place in the coming years accurate forecasting is likely to be difficult.

All of the options are likely to require the Council to form a reasonable view on likely power requirements in 2038. The consequences under different arrangements are potentially different and are likely to be most manageable under the green tariff scenario. Under a direct PPA agreement it is likely there will be a ‘take or pay’ clause in the contract, committing the Council to a particular volume of supply for the period of the contract. There may be provisions for the council to sell surplus power to a third party if they do not require the power for their own consumption, but this arrangement could be complicated.

Under the asset purchase scenario there would be a need to have a PPA in place to sell power generated where this is in excess of Council requirements. This volume could

potentially be flexible. This leaves and element of price risk and a risk that the asset is significantly larger than the Council's actual requirement. in this circumstance there would be market opportunities to sell the asset either with or without the benefit of a PPA for the Council's ongoing electricity requirement.

### 11.5.4 Wholesale electricity price risk

Shorter term and more flexible arrangements carry the risk of prices rising faster than forecast and the Council incurring a higher level of spend as a consequence. Price forecast information shared with the Council suggests a real terms price increase in wholesale electricity prices in addition to inflationary increases until around 2035, thereafter there may be real terms reductions in electricity prices.

An asset purchase would tie the Council's electricity costs to a combination of the costs of operation and maintenance, debt and finance repayments and sleeving and balancing costs. This is potentially more predictable and less volatile than energy prices and may provide a higher degree of certainty at lower cost than the other alternatives.

The shorter the term any PPA or green tariff arrangement is, the greater the wholesale price risk. Agreements for 8-10 years may provide a significant variance to market when they end.

### 11.5.5 Additionality

Both the direct PPA and asset purchase options provide a strong argument for additionality and are therefore robust in carbon accounting terms.

### 11.5.6 Transparency and traceability

Directly linking supply to a single generating station provides the clearest link in carbon accounting terms and is met by both the direct PPA and the asset purchase options.

Green tariffs are more likely to rely on REGO certificates. Whilst a REGO certificate demonstrates that the supplier has purchased green energy to back this demand it does not provide any degree of assurance where that supply has actually come from (as certificates can be sold independently of supply). The separation of certificates and supplies also allows larger suppliers to direct more green power to direct green tariffs, whilst their standard supply mix becomes increasingly 'brown' as a direct consequence.

### 11.5.7 PWLB risk

There is no PWLB risk with the PPA options.

There is potential PWLB risk with the asset purchase option. The potential risk lies more around the location of the generating station than the nature of the activity. The ownership of renewable energy generation assets to cover the Council's own use is likely to meet the 'service delivery' criteria in the guidance. The more difficult issue relates to whether any asset would be deemed to be in the Council's Economic Area (and whether these criteria should be strictly applied as in doing so northern authorities would potentially be disadvantaged compared to those with higher levels of irradiance in the south).

### 11.6 Value for Money

Entering into a PPA or agreement asset purchase is likely to result in a cost reduction when compared to the Council's existing electricity supply arrangements.

Sleeving contracts offer significantly reduced value for money when compared with synthetic PPA agreements and unless there are compelling commercial reasons to use a sleeving contract a synthetic PPA would offer a preferred option.

Asset ownership reduces the price of electricity to the Council by eliminating the margin that would normally go to the owner of the generation asset. This would represent a saving of around 10% on the price currently paid for electricity.

If asset ownership is pursued then schemes in the south of England offer better value for money as the irradiance is higher (see section 3.2) and the £/tCO2e factor is therefore better.

# 12 Conclusions and Recommendations

## 12.1 Preferred option

This report sets out a total requirement of around 45 MW of solar PV or an equivalent PPA to enable the Council to meet its 2025 and 2038 targets.

The Council has two potentially attractive options available to it in order to meet the requirement; either the procurement of a suitable asset from a third party, or procurement of a PPA direct with a generating station suitable to meet carbon accounting requirements. There are no realistic options for the Council to meet the full requirement without pursuing one of these strategies. Both of these options represent value for money in relation to a 'do nothing' scenario.

Before a final decision can be made the Council need to understand the magnitude of the PWLB risk. If this risk is significant then the preferred option is clearly a direct PPA with a generating.

If PWLB does not represent a significant risk the Council needs to decide on its appetite for the long-term ownership of a generation asset. This option is likely to represent the best value for money but will require more resource to implement and maintain as well as introducing a new range of (manageable) risks.

## 12.2 Recommendation

Through this report we have made the following recommendations:

Recommendation 1: The Council should consider adopting a target of 45-50 MW of solar PV generation or equivalent direct PPA with a generating station (wind or solar).

Recommendation 2: All options have positive NPV outcomes when compared with 'do nothing'. There is therefore a solid value for money basis to either enter into a suitable PPA or asset purchase agreement and the Council should therefore change its current supply arrangements.

Recommendation 3: Having undertaken a thorough options appraisal exercise the Council is now able to articulate that asset purchase is a value for money option to achieve its carbon targets and should now explore with HM Treasury whether or not an asset purchase would be compliant with PWLB lending terms.

## 12.3 Next steps and no regrets actions

In order to deliver the strategy of reducing emissions by 7,000 $tCO_2e$ by 2025, the Council will need to determine its preferred way forward. In order to do that the following are recommended:

1. Develop an understanding of the likely future requirements for electricity over the next decade. This should provide a view as to the likely overall requirements and the degree of certainty which could be attached to this forecast. In all scenarios there is a benefit in having reliable information on which to base assumptions.

2. Follow up established conversations in relation to the use of PWLB to ascertain whether an out of area asset purchase would be allowable under the new prudential regime.

If the Council determines that it wants to pursue an asset purchase strategy, then it will need to put in place measures to allow it to implement that strategy including:

3. Establishing sufficient delegated decision making powers to allow the Council to enter into an exclusivity agreement with a developer and invest in the necessary due diligence work to determine whether a project is a viable prospect.

4. Establish a supplier base to facilitate the due diligence work including technical specialists and lawyers.

5. Develop its financial and carbon modelling to ensure that all costs and benefits for a particular project are understood.

6. Determine whether or not to proceed further with due diligence in relation to any of the large-scale projects identified.

If the Council determines that it wants to pursue a PPA strategy, then it will need to put in place the following:

7. A clear policy in relation to carbon accounting, tested with the Council's advisors in this area, setting out how additionality, permanence and traceability will need to be demonstrated by any procurement.

8. A suitable procurement for a direct 'fair value' PPA agreement.

# APPENDIX 1 Income from Electricity Generation - Subsidies and Power Purchase Agreements

## Generation subsidies

Subsidy schemes for the generation of renewable electricity have all recently closed. There are however two potential support mechanisms which may be of benefit to the Council if electricity generated is exported. These are Contracts for Difference (CfD) and the Smart Export Guarantee (SEG).

### Contracts for Difference

The Government has announced that there will be a 'pot 1' allocation of up to 12 GW in the CfD auction due to take place in late 2021. Pot 1 covers mature technology and includes solar PV and onshore wind. Wind projects generally have better economics than solar PV (especially wind projects in Scotland) and it is therefore unclear at this stage whether any solar PV projects will qualify for the price certainty that CfD brings. Arguably a CfD could also prejudice whether or not any scheme would be an allowable reduction in carbon accounting terms as it would be more problematic to sustain the proposition that the Councils' investment has led to the construction of new capacity.

### Smart Export Guarantee Scheme

On 1 January 2020, the Government introduced the Smart Export Guarantee (SEG) scheme, which will enable anaerobic digestion, hydro, micro-combined heat and power (micro-CHP, with an electrical capacity of 50 kW or less), onshore wind and solar PV exporters with up to 5 MW capacity to receive payment for exported electricity. The SEG scheme replaces the feed in tariff (FiT) scheme that closed in Q1 2019. The purpose of the scheme is to guarantee a market for small scale renewable energy generation projects which export power directly to the grid.

Under the SEG scheme all licenced energy suppliers with 150,000 or more customers must provide at least one SEG tariff. The Government has set out that, in order to provide space for the small-scale export market to develop, there will not be any specified minimum tariff rate other than that a supplier must provide payment greater than zero at all times of export. The SEG licensees therefore decide how they want their SEG export tariff to work in terms of its rate, type and length. Storage is also eligible to receive export payments, although suppliers will be able to exclude 'brown' electricity from those payments and require the generator to put metering in place that isolates 'green' exports.

Under the scheme exported power must be metered with a meter capable of reporting exports on a half-hourly basis and meters must also be registered for settlement – though the SEG design is flexible and does not necessarily require half-hourly readings.

## Power Purchase Agreements

All schemes will require some form of Power Purchase Agreement (PPA) to sell the electricity produced. It is unlikely that any scheme will secure a PPA at the outset for the life of the project, other than for self consumption by the Council. Different arrangements may apply during the lifespan of the project. This is particularly true under a private wire

arrangement when you need to consider when designing the infrastructure how you will export power to the grid if the arrangement subsequently changes.

Grid export PPAs come in two main forms, either relatively short-term arrangements generally with the major energy suppliers, or longer-term arrangements with a single (or small group) customer. Shorter term arrangements often offer a better spot price than the longer-term ones – but there is more exposure to general price volatility.

Longer term PPA agreements are generally with commercial third parties and seek to fix prices over a set period which helps protect those entering into the PPA (both buyer and seller) from market volatility. Large corporates, such as Google and Amazon have used corporate PPAs for their energy needs. There are currently 260 RE100 companies which have made a commitment to go 100% renewable and are taking actions such as entering into corporate PPA's to deliver on their RE100 and wider sustainability commitments.

Where power is sold as renewable energy the Renewable Energy Guarantees of Origin certificates (REGOs) will be sold with the electricity and therefore any greenhouse gas emissions savings will normally benefit the purchaser of the power rather than the owner of the renewable energy generator.

It is likely that the Council will be the PPA offtaker for an amount of supply equivalent to its electricity consumption. Any surplus power will need to be sold via a PPA agreement.. Key benefits gained from public bodies entering into a PPA with a third-party generator (or their own arm- length generator) are as follows:

**Secure energy price** - as part of any prudent risk management approach, entering into PPAs provides some insulation against volatile wholesale power markets;

**Long term hedge** – utilising a PPA gives access to longer date prices;

**Additionality/provenance** – purchasing directly from a new incremental green generator demonstrates commitment to reducing demand on carbon emitting fuel and provides clear linkage to supply for carbon accounting purposes;

**Support UK climate change policy** – the UK has made a legal commitment to net zero emissions by 2050. Many local councils have declared climate emergencies and have set targets to achieve carbon neutrality as early as 2030.

### PPA structures

Whilst PPA structures continue to evolve there are typically three contract structures:

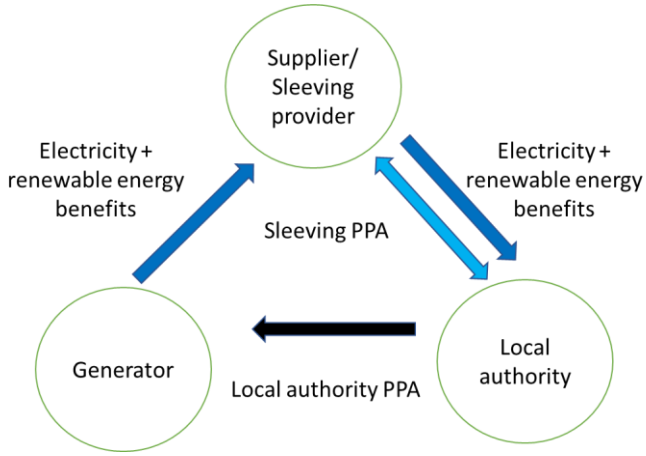
- Physical (also referred to as a 'sleeving' arrangement)
- Synthetic (or virtual)
- Private Wire

### Physical PPA

A Physical PPA is between a customer and a generator who are remote from one another. The public electricity network provides the connection and network charges apply. This form of contract provides a direct and verifiable connection between the electricity produced and the electricity consumed.

An overview of the contractual arrangement is shown in Figure 11 below:

*Figure 11: Contractual arrangements for a physical PPA with local authority as the off-taker*




- Under this structure the off-taker enters into a long term PPA with a renewable energy generator to take some or all of the energy generated by its plant (or portfolio of plants) with a defined amount of power sold at a fixed price per MWh. Typically, the PPA will contain provisions for the sale and purchase of electricity and the allocation of any applicable renewable energy benefits, and the provisions governing that sale and purchase.

- The PPA will also include obligations to provide or procure certain metering and regulatory activities that can only be undertaken by licensed electricity suppliers (such as npower, Centrica etc). As such, the off-taker will need to enter into a back-to-back agreement with its licensed supplier under which the licensed supplier commits to undertake these obligations.

- In parallel to this arrangement the off-taker will have an electricity supply agreement with its licensed supplier under which electricity may be supplied to meet the off-taker's energy demands from time to time. The terms of supply under this supply agreement will take into account the electricity purchased under the PPA and passed through to the licensed supplier under the licensed supplier agreement. This ensures that the off-taker has the benefit of the fixed pricing for renewable energy under the PPA but the reliability of a supply agreement with a licensed electricity supplier to meet its day-to-day energy demands.

- There is generally a charge for the sleeving PPA with the sleeving provider which amounts to around 5% of the value of the wholesale electricity traded.

Both wind and solar developers have built up extensive pipelines of renewable energy projects which can give off-takers flexibility around choosing a PPA start date and the ability to dovetail into their long-term energy buying/risk management strategies. Options also exist for individual public bodies to aggregate smaller volumes to benefit from pricing.

### Synthetic PPA

In a synthetic PPA structure no power is physically traded. Instead it is a purely financial structure where the off-taker and generator agree a defined 'strike price' to fix the cost of power between themselves for the power generated by a renewable energy facility. Each

party will then enter into separate agreements with their electricity/licenced supplier to sell/acquire electricity at the spot price.

A synthetic PPA works as a financial hedge in that if the spot price in a settlement period exceeds the PPA defined strike price, the generator pays the excess amount to the off-taker for power generated in that period. Where the market price for power is less than the strike price in a settlement period, then the off-taker pays the shortfall amount to the generator for power generated in that period.

A synthetic PPA is relatively simple to enact and provides price certainty to both parties. It can be harder to demonstrate a direct connection, but this should still constitute a valid carbon reduction for an authority participating as an off-taker, provided the contracts also secure the associated renewable energy accreditations.

### Private Wire PPA

Private wire PPAs are concerned with the sale of electricity from a generator to an off-taker. Under this PPA agreement, power will normally be sold directly from the generator's facility to the off-taker, rather than being notionally passed through a national power grid. Typically, the generating facility only supplies power to the off-taker and will be located at, or close to the off-takers assets. Private wire PPAs are often utilised in conditions where the off-taker wishes to secure its own source of power. In the case of a local authority for example, an energy intensive depot or industrial estate owned by the local authority.

# APPENDIX 2 – Procurement and risk management

For local authorities looking to own a renewable energy asset there are four basic options:

- Develop a project on owned land
- Develop a project on third party land
- Acquire project rights (land agreements, planning consent and grid connection offer) from a commercial developer prior to construction
- Acquire a fully built and commissioned project

Table 8 below sets out the pros and cons of different the different approaches.

*Table 8 – Options for Project Acquisition and Development*

| Option | Potential Advantages | Things to consider |
|---|---|---|
| Self-develop on your own land | • No rental payments<br>• No need to acquire land rights and establish clean title<br>• No onerous restrictions or lease end date<br>• Likely to be within the geographical boundary of the authority | • Is suitable land available<br>• Will you be forgoing an existing income stream?<br>• Do you have another use for the site?<br>• Reputational issues if the site is in proximity to housing or has been promised for another use<br>• Do you have the skills and capacity for the development?<br>• Are you prepared to risk the development costs?<br>• Design, procurement and construction risks to be managed |
| Develop a site on third party land | • Identify site for its suitability (both size and location) rather than its ownership<br>• Wider search area and therefore more chance of finding a viable grid connection or private wire | • Viability model will need to account for landowner rent<br>• Capacity to acquire the site<br>• Time constraints introduced through the land acquisition period (for example option periods)<br>• Asset lifespan limited by lease arrangements<br>• Do you have the skills and capacity for the development?<br>• Are you prepared to risk the development costs?<br>• Design, procurement and construction risks to be managed<br>• Whether the development is speculative and therefore not able to meet PWLB criteria |

| | | |
|---|---|---|
| Acquire project rights from a third party | • Removes development risk, avoiding potentially abortive costs and providing certainty<br><br>Land rights, accepted grid offer, and planning consent will be in place significantly reducing capacity required in the authority to deliver the project | • Viability model will need to account for the landowner rent and for costs of acquiring the project rights<br><br>• Asset lifespan limited by lease arrangements<br><br>• Design, procurement and construction risks still to be managed<br><br>• Project rights are well sought after in a competitive market. A local authority can potentially lack credibility as a purchaser compared to a financial institution who has undertaken several similar transactions<br><br>• Rights are unlikely to be available at a scale or location which is preferable to the authority (bear in mind for example managing construction of a project several hundred miles away) and flexibility may be required |
| Acquire a completed project from a third party | • Removes development and construction risks, avoiding potentially abortive costs and providing certainty<br><br>• Land rights, accepted grid offer, planning consent and functioning asset will be in place significantly reducing capacity required in the authority to deliver the project<br><br>• Private sector developers often prefer to sell post construction and commissioning<br><br>Private sector contractors can procure more freely and consequently often build at a price significantly lower than the public sector. Quality may also be higher due to ongoing relationships with construction companies | • Viability model will need to account for the landowner rent and for costs of acquiring the project – although this may be less than the combined cost of acquiring project rights and constructing the asset through public procurement<br><br>• Asset lifespan limited by lease arrangements<br><br>• Projects are well sought after in a competitive market. A local authority can potentially lack credibility as a purchaser compared to a financial institution who has undertaken several similar transactions<br><br>• Authorities will only have the ability to bid on existing projects and cannot therefore drive scale or location |

## Risk Management

Development of renewable energy projects carries a number of risks which need to be managed and mitigated. Key areas of risk are:

1. Development risks – particularly in relation to land rights, availability of grid connection, planning risks and viability. Whilst local authorities possess many of the necessary skills in relation to land rights and planning, they are likely to require specialist support in obtaining and managing grid connection offers and in assessing project viability.

2. Construction and procurement risks – these relate to ensuring that the asset delivers the levels of electrical production anticipated by the business case. Much of this risk can be mitigated by selection of an appropriate form of contract with suitable production guarantees, accompanied by the appointment of a competent technical advisor.

3. Operational risks – these largely relate to ensuring that revenues are as anticipated in the business case. Many of these risks can be mitigated against by appropriate forms of contract, strong technical support, contractual guarantees on availability and appointment of an asset manager.

4. Income risks - These are a combination of production and price. Production risks can be mitigated against by strong build and maintain contracts transferring as much production risk as possible to the contractor.

   Price risk is key in assessing viability. BEIS (Department for Business, Energy and Industrial Strategy) produce forecasts for wholesale electricity prices, but these are not technology specific. It is likely as renewable energy generation becomes more prevalent that differential pricing will prevail, with lower price being offered when there is over production. Local Partnerships use Aurora Energy Research (Aurora) forecast data in the production of financial information and we would recommend that the Council purchases appropriate data from Aurora if they want to proceed with either development or acquisition of a scheme.

# APPENDIX 3 – Solar Farm Acquisition Briefing Note

## Purpose

This briefing note is to provide the Council with background information about the processes and resource requirements associated with the acquisition, ownership and operation of a solar farm. It is not a definitive guide and has been provided to build general awareness and to aid understanding.

## Acquisition Process

At this stage we are concentrating on acquiring a site which will be purchased as it becomes operational, the process may vary (with additional steps) if a shovel ready scheme was being contemplated.

Figure 12 on page 44 sets out the most common route for a transaction of this nature to take, together with tasks to be undertaken during each stage of the process. In general, Stage 1 (initial appraisal) takes 4-8 weeks depending on the urgency of the vendor and speed at which the purchaser is willing to respond.

Stage 2 (due diligence) typically takes around 6-12 weeks to complete depending on how well kept the vendor's records are and how hard the purchaser pushes their contractors.

Stage 3 (completion and commissioning) of the process takes a further two years and ensures that the solar farm produces the electricity guaranteed under the terms of the design and construction contract.

*Figure 12: Acquisition process*

## Council Resources required

This section sets out the key tasks and likely time involvement required at the various stages of acquisition and during the operational phase of the project.

### I Acquisition Stage 1: Initial Appraisal

The purpose of this stage is to determine whether you want to make an indicative offer. Resources to support that include the ability to model the potential financial position and the ability to make the decision to make an offer.

The offer is only indicative and can be withdrawn by the purchaser at any time, right through until the point of completion. Equally the vendor can withdraw the site from the transaction, but the exclusivity agreement would prevent them from commencing discussions with any third parties during the exclusivity period. These agreements are generally well honoured within the renewables industry.

Council officers are currently determining the resources required to put the Council in a position to make an indicative offer and ensuring that necessary briefings and decisions are being properly taken.

### II Acquisition Stage 2: Due diligence

During this stage the Council will need resources to procure or appoint the following workstreams and to manage input:

1. Land legal advisors to review all land rights associated with the development. This will generally include full legal searches, review of lease and option documentation and the review of all other land rights required to ensure the scheme can be accessed and connected to the grid. Agreements with the network operator will also need to be reviewed to ensure they have been properly entered into. Some vendors (although not all) will provide a certificate of title which simplifies this process to an extent.

   If acquisition is via an assignment of project rights (as opposed to purchase of the SPV) then the land agreements will require assignment to a new target entity.

2. Planning consultants – to review the planning consent and any associated conditions and advise as to whether they have been fully complied with. Advice should be sought as to the extent of any gaps in the compliance and any ongoing requirements the operator of the site will need to comply with.

3. Technical Assessment. Ideally a technical advisor (TA) will be engaged as soon as possible to review the design and forecast output. The TA should provide a full design review and energy yield assessment. In addition, it would be advisable for the TA to monitor construction quality and oversee the testing and handover

procedure under the EPC contract.

4. Grid offer. The grid offer and acceptance should be checked by commercial lawyers to ensure that they have been validly accepted. The grid offer must be novated to the SPV. If acquisition is via an assignment of project rights (as opposed to purchase of the SPV) then a novation agreement will be required from the network operator.

5. Commercial legal and tax advice. This relates to the overall structure of the deal and preparation or review of the transaction documents. There is likely to be a significant commercial input to this dialogue, bringing together any due diligence concerns into conditions precedent being specified in the contracts.

Whilst the technical input can be procured, the Council will need the resource capacity to procure and instruct specialists, project manage the process, negotiate with the developer and write a business case prior to completion of any transaction. It is typical for transactions of this nature to require some negotiation and hands on resolution of issues during the transfer process. Understanding the risks and potential routes to resolution is key to ensuring the transaction either progresses to completion or is terminated at an appropriate stage.

The Council will also need to consider any potential milestone payments and determine whether it has the necessary skills and expertise to certify such payments. These can be supported by the TA if their role is sufficiently scoped.
Alongside the negotiation with the developer, the Council would also need to prepare for owning an operational solar farm – key activities would include:

1. Appointment of an energy supplier and offtaker for the site. Even if you are planning on acquiring the power you will need some form of offtake or sleeving contract. Meters at the site cannot be installed without a supplier appointed (so this may initially be put in place by the vendor – but you will need clear input to the process).

2. Review how and when you can start to purchase the power and put the necessary agreements in place. Put arrangement in place to sell any surplus power.

3. Write the business case and obtain the approvals for the transaction.

Bearing in mind the timescales (i.e. up to 12 weeks), it is a relatively intense process and will require a full-time dedicated officer, with further specialist internal and external support also being required.

### III Acquisition Stage 3: Completion and Commissioning

Once the full business case is approved and the contracts exchanged the solar farm will be operational.

The first two years of operation are critical as it is during this time that you can properly assess whether the solar farm is producing the energy guaranteed by the EPC contractor. The Council will need technical support during this period to assess the ongoing testing and to ensure that calculations are properly carried out. This could be

achieved either by extending the services provided by the TA to cover this period or by the appointment of an asset manager.

Asset managers work on behalf of the client and perform an ‘intelligent client’ function. A typical asset manager scope of services includes ongoing optimisation/ analysis, management of the O&M contractor, review of real time monitoring information and accounting, bookkeeping/ filing accounts etc. Generally, this costs around £2,000 - £3,000 per MW pa plus VAT. Whilst an asset management service is not cheap, the costs are often offset by improved performance and income.

The Council will need to determine whether they need and can afford an asset manager and procure a suitable one if required. An asset manager can also be used to help the Council scope an ongoing O&M contract and provide support during the procurement process if required.

Time commitments required will eventually reduce and this is typically achieved by procuring the right support to the project, although these contracts will still require management and periodic re-procurement.

Without an asset manager the solar farm will require around 1 day per week of staff time to monitor outputs, manage bills, etc. With an asset manager the requirement will be less, but there will still be an ongoing requirement of 1 day per month. In addition to this further resource will be required when any agreements need re-procurement, health and safety incidents occur, insurance incidents occur or if there is any other material change in circumstances.

# APPENDIX 4 – Review of ground mounted solar PV opportunities on land assets owned by the Council

| Site | Commentary regarding suitability for solar PV development |
|---|---|
| Clayton Vale | Clayton Vale is an area of green space in Clayton, Manchester, through which the River Medlock flows. Former landfill site which was redeveloped in 1986. The area is now a natural habitat for wildlife and it has been designated a Local Nature Reserve |
| Tweedle Hill/Plant Hill | Tweedle Common is a former landfill site that has been reclaimed as open space. It sits north of Plant Hill Road adjacent to Plant Hill School. It is characterised by relatively flat grass land and some tree planting. Westwards from Plant Hill Park is an expanse of three natural open spaces split by French Barn Lane and Chapel Lane. The site is enclosed on all sides by urban development. |
| Shack Liffe Green | A former landfill site which was reclaimed in the late 1970's. The site is nestled between the houses of Horncastle Road and Boggart Hole Clough Park. The site has received minimal intervention and as a result now has a very diverse habitat with ecological value. |
| Queens Road Tip | Ongoing urban development at the site. Forms part of Manchester Fort 2020 Vision and Development Framework. Consideration for battery storage. |
| Church Lane<br>Church Lane North | Both sites reclaimed as open space containing informal footpaths. Currently used for recreational usage and enclosed on all sites by residential properties. |
| Matthews Lane | Site forms part of Nutsford Vale which is a park and community wildlife space. The site is located between Matthews Lane and Longsight Road, behind the Gorton Mount and Grange Schools. Former landfill site which has been turned into an area of recreation and wildlife preservation which is managed by The Friends of Nutsford Vale. |

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|---|---|
| Cringle Road | Site is allocated as an Environmental Improvement Area. Enclosed by residential properties and Highfield Country Park. |
| Ivy Green Road | Restored former landfill site turned into green woodland space. Site joins onto other woods and meadows extending alongside the River Mersey. The site forms part of Chorlton Ees and Ivy Green Nature Reserve. |
| Parrs Wood Road | Site forms part of the nature reserve of Stenner Woods, Millgate Fields and the River Mersey. Millgate Fields are adjacent to Environment Agency Flood Zones 2 and 3. |
| Crescent Road | The area is predominantly residential in character. The land area forms part of the Abraham Moss College estate. No firm demand headroom at closest grid connection point (Cheetham Hill (33 kV / 6.6 kV)). |
| South of Blackley New Road | Former landfill site which was reclaimed and landscaped in the early 1980s. Site forms part of the wider Blackley Vale. Significant levelling works would be required to facilitate the any development. Large pond adjacent to the site. |
| Russett Road/Factory Lane | Parcel of land contains substantial tree coverage. Forms a tree corridor between residential properties. |
| Rear of Fairway | Land predominantly consists of substantial tree coverage offset from residential properties. Land contains a network of footpaths. Forms part of Moston Fairway nature reserve which is maintained by the Wildlife Trust. |
| Graver Lane | Parcel of land contains substantial tree coverage. Forms a tree corridor between residential properties. |
| Scotland Hall Road | Small land parcel adjacent to four high rise flats. Site area also contains a recreational ground. Enclosed by residential properties and railway line and neighbouring Clayton Vale. |
| Annie Leigh Playing Fields, Mount Road | Site forms part of Gorton recreational ground, consisting of a children's play area, multi-use games area and football pitches. |
| Barlow Hall Farm | Site contains substantial tree coverage and is adjacent to Chorlton Water Park, which is a local nature reserve. Installation of a solar farm on the site would require removal of significant areas of |

| | |
|---|---|
| | scrub vegetation. Grid connection would require crossing the River Mersey. Closest grid connection point is South Manchester 132 kV GSP. Connecting a small solar PV scheme at this voltage is unlikely to be viable. |
| Sand Street, Collyhurst | Small embanked land parcel adjacent high-rise flats. Site enclosed by residential properties. |
| Rear of Romer Avenue | Parcel of land contains substantial tree coverage. Forms a tree corridor between residential properties. |
| Fitzgeorge Street | Small land parcel near high rise flats. Enclosed by residential properties, a railway line and urban development. |
| Riverdale Road, Blackley | Parcel of land contains substantial tree coverage. Forms a tree corridor between residential properties. |
| Bluestone Road | Small land parcel which lies between a cemetery and allotments. |
| Joyce Street | Small land parcel. Enclosed by residential properties and a railway line. |
| High Bank | Small land parcel enclosed by residential properties. Land parcel contains recreational use sports pitches. |
| Abbey Hey Tip | Small land parcel which forms a corridor between surrounding residential properties. |
| Harpurhey Road | Small embanked land parcel. Adjacent to weir and reservoir. |
| Pike Fold Lane | Site contains substantial tree coverage with a network of paths. |
| Bradford Road, New Viaduct Street, Cambrian Street | Very small land parcel of scrub vegetation enclosed by gas works and railway line. No firm demand headroom at closest grid connection point (Eastlands (33 kV / 6.6 kV)). |
| Great Ancoats Street | Small land parcel containing significant tree coverage, enclosed by residential properties. |
| Crabtree Lane, Rear of Eva Bros | Very small land parcel enclosed by urban development and allotments. The site is fairly isolated, however there is no firm demand headroom at the closest grid connection point (Bradford (33 kV / 6.6 kV)). |

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|---|---|
| Princess Road / Kenworthy Farm | Land parcel enclosed by substantial tree coverage forming part of Kenworthy Wood. The site contains a network of walking paths and cycle tracks. Closest grid connection is South Manchester 132 kV GSP. Connecting a small solar PV scheme at this voltage is unlikely to be viable. |
| Princess Parkway | Site currently forms part of Northenden golf club. |
| Airport Woodhouse Park | Very small isolated land parcel. Consideration for battery storage. |
| Former Stockport Branch Canal Footpath | Canal footpath |
| Bradford Gas Works | Existing car park area adjacent to the Etihad Stadium. No firm demand headroom at closest grid connection point (Eastlands (33 kV / 6.6 kV)) to support solar PV. Consideration for battery storage connecting into the Bradford (33 kV / 6.6 kV) substation. |

| Site | Ground Mounted Solar PV | | | | Grid Management Services |
|---|---|---|---|---|---|
| | Land<br>Size, location and access | Planning | Technical | Grid<br>Firm demand availability for solar PV, connection length, connection voltage | Potential for Grid Management Services |
| Clayton Vale | | | | | |
| Tweedle Hill/Plant Hill | | | | | |
| Shack Liffe Green | | | | | |
| Queens Road Tip | | | | | |
| Church Lane | | | | | |
| Church Lane North | | | | | |
| Matthews Lane | | | | | |
| Cringle Road | | | | | |
| Ivy Green Road | | | | | |
| Parrs Wood Road | | | | | |
| Crescent Road | | | | | |
| South of Blackley New Road | | | | | |
| Russett Road/Factory Lane | | | | | |
| Rear of Fairway | | | | | |
| Graver Lane | | | | | |
| Scotland Hall Road | | | | | |
| Annie Leigh Playing Fields, Mount Road | | | | | |
| Barlow Hall Farm | | | | | |
| Sand Street, Collyhurst | | | | | |
| Rear of Romer Avenue | | | | | |
| Fitzgeorge Street | | | | | |
| Riverdale Road, Blackley | | | | | |
| Bluestone Road | | | | | |
| Joyce Street | | | | | |
| High Bank | | | | | |
| Abbey Hey Tip | | | | | |
| Harpurhey Road | | | | | |
| Pike Fold Lane | | | | | |
| Bradford Road, New Viaduct Street,Cambrian Street | | | | | |
| Great Ancoats Street | | | | | |
| Crabtree Lane, Rear of Eva Bros | | | | | |
| Princess Road / Kenworthy Farm | | | | | |
| Princess Parkway | | | | | |
| Airport Woodhouse Park | | | | | |
| Heaton Park | | | | | |
| Former Stockport Branch Canal Footpath | | | | | |
| Bradford Gas Works - **solar carport** | | | | | |
| Land south of Wythenshawe Hospital | | | | | |

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