Matlock Town Council RCEF Project

Stage 1 Feasibility Report

EXECUTIVE SUMMARY

Matlock Town Council is investigating ways it can develop projects that will help the town transition towards net zero and recently began working with Derbyshire Dales Community Energy (DDCE) to explore the potential of developing community owned energy projects. MTC were awarded an RCEF Stage 1 grant to undertake a feasibility study to identify two potential sites within the town that are suitable for electricity generation. In addition, the project aimed to support DDCE in becoming an incorporated entity that would be able to develop any community energy projects arising from the study. The focus of this study and report is Matlock Town, but a significant wider objective is that this will act as a catalyst for further developments across Derbyshire Dales where to date there has been limited community energy activity.

The project team initially identified eight potential sites. These sites were then grouped into primary and secondary sites based on a number of factors including site engagement, potential generation, location and orientation. After initial site engagement, it was decided to focus only on the primary, leading to our final sizing recommendations. All four primary sites were visited and technically assessed.

The analysis showed that the two sites most suitable for the installation of rooftop solar PV are Twigg Stores and Highfields Upper School. For Twigg Stores, a system size of 55kW is recommended and for Highfields Upper, a system size of 180kW. The sites not prioritised at this stage could still be considered as options for a future pipeline of projects for DDCE.

This document details our assessment of the two sites. It considers technical requirements, including consumption patterns, grid constraints and spatial limitations. The financial assessment covers the anticipated CAPEX, OPEX and REPEX costs of each potential system, as well as the potential revenue streams for DDCE and IRR for its investors. We have made a number of recommendations on how these projects could be progressed with DDCE as the project developer. The importance of ongoing and meaningful community engagement is discussed. In addition, we highlight the key success factors for a functional community energy project including ensuring DDCE has the right blend of skills and experience

As per the project brief, a financial model has been developed that DDCE will be able to use to assess the financial viability of any future community energy projects. This will help ensure that DDCE has the tools to develop a pipeline of projects and ensure there is an ongoing legacy out of this Matlock RCEF study.

On 13th January 2022, a new Community Benefit Society was registered with and incorporated by the Financial Conduct Authority. DDCE thus moved from being an unincorporated Association to a fully incorporated Industrial & Provident society for the benefit of the community.

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1. INTRODUCTION

The Rural Community Energy Fund (RCEF) is a £10 million programme funded through the Department for Business, Energy and Industrial Strategy that supports rural communities in England to develop renewable energy projects, which in turn provide economic and social benefits to the community. RCEF provides support to rural communities in two stages. Stage one grants of up to £40,000 for a feasibility study for a renewable energy project and stage two grants of up to £100,000 for business development and planning of feasible schemes. This report has been commissioned under stage one.

Matlock Town Council (MTC) is the local council for Matlock, a small, rural town which also serves as the administrative centre for both Derbyshire Dales District Council and Derbyshire County Council. It is therefore an important regional hub.

In line with its climate emergency declaration, MTC has been looking at ways it can develop projects that will help the town transition towards net zero. In 2020, it began working with Derbyshire Dales Community Energy (DDCE) to explore the potential of developing community owned energy projects in the town. DDCE's remit is to help local communities in the Derbyshire Dales develop community owned, renewable energy projects.

To this end, MTC were awarded an RCEF Stage 1 grant to undertake a feasibility study to:

1. Identify two potential sites within the town that are suitable for electricity generation.
2. Identify suitable customers / offtakers for the electricity from such sites who would be willing to enter into a long term PPA.
3. Evaluate the planning implications for such sites.
4. Define the most suitable structure for a community energy group (CEG) considering the project financing implications (e.g. share capital, social impact funding), business model and potential community benefit arising from the projects.
5. Assess the local community's appetite for engagement / involvement in any scheme.

The focus of this feasibility study is Matlock Town, but a significant wider objective is that this would act as a catalyst for further developments across Derbyshire Dales.

2. TECHNICAL ASSESSMENT

The technical assessment includes an analysis of the feasibility of a solar PV installation for the two chosen sites in the Matlock area: Twigg Stores and Highfields Upper. This section outlines our technology selection criteria, a shortlist and our recommendations based on the technology assessment for both sites in scope.

2.1 Technical summary and recommendations

The project group initially identified eight potential sites. These sites were then grouped into primary and secondary sites based on a number of factors including site engagement, potential generation, location and orientation. After initial site engagement, it was decided to focus only on the primary, leading to our final sizing recommendations. All four primary sites were visited and technically assessed.

Organisation	Description	Site
Primary sites		
Twigg	a family owned and managed steel fabrication company	Steelyard
		Store
Highfields School	Community secondary school and a member of the East Midlands Education Trust	Upper School
Secondary sites		
Arc Leisure	Leisure centre owned by Derbyshire Dales District Council and managed and operated by Freedom Leisure	Arc Leisure Centre
Platform Housing	Social housing provider with sites across the country	Gateway Court
		Victoria Court
		Denesfield Court

Based on our analysis, we believe that the two sites most suitable for solar PV are Twigg Stores and Highfields Upper. For Twigg Stores, we recommend a system size of 55kW. For the Highfields Upper, a system size of 180kW is preferred. Deprioritised sites could still be considered as options for future additions into the scheme. The technical assessment of these sites is detailed in Appendix A.

Table 1 shows our recommended option at each site; in the detailed site descriptions later within this report, our analysis presents three options for each site.

TABLE 1 GENERATION STATISTICS OF THE PREFERRED SOLAR PV SITES

Generation statistics	Twigg Stores	Highfields Upper School
System size (kW)	55	180
Carbon saved (tCO_2e/yr)	9	34
Annual electricity generation (MWh)	46.86	164.70
Proportion of total electricity provided (%)	63	43
Proportion of total roof area (%)	66	48
Initial Incremental Cost (£)	68,750	225,000
Annual O&M cost (£)	336	1098

2.1.1 Technology selection criteria

There are many factors to consider when assessing the viability of renewable energy systems, and in order to select the most suitable solutions for the town, Avieco, Leapfrog and Matlock Town Council agreed on the following:

TABLE 2 SITE CRITERIA

Criteria	Threshold	Notes
Technical Suitability		
Meets the energy needs of the town	Maximised – ideally sell 100% of generation to selected buyers (via a PPA to site or third party through a sleeving PPA)	For solar PV, the aim is to maximise available capacity to meet as much of the site's total daytime electricity usage and to sell additional generation via a secondary PPA or to back to grid
Meets the energy needs of the local energy network	Low or no impact on the local energy network	Considerations include available capacity within the local grid for additional generation technologies and further works to the local infrastructure
Planning requirements	Permitted development preferred	Solar PV complies with local planning requirements so in most instances should not require a planning application
Financial performance	Ranked in order of financial performance	The aim here is to ensure a positive business case for Matlock

2.2 PV summary

Any onsite renewable system should be matched to the energy needs of the site and the network capabilities, as well as be attractive to the residents. There has been a strong preference in favour of roof mounted solar from the beginning of the project.

There are multiple factors that affect sizing decisions for renewable generation systems; our approach accounts for these by iterating the technical capacity, local demand, grid capacity and business case to arrive at the optimal size based on all these factors. The advantages of solar PV are listed in the below table.

Table 3 Advantages and risks/opportunities of solar pv

Advantages	Risks/Opportunities
Low carbon energy source	Electricity supply determined by weather. Solar PV generates electricity during the daytime. Sites that use energy during the day can take advantage of this.
Minimal maintenance requirements	PV panels potentially visually disruptive and could require large ground area. Roof mounted PV will be used in this project as it is less visually intrusive, also providing an efficient use of space.
Long operational lifespan	Solar PV has a high upfront capital cost. Sale price of electricity can be negotiated with consumer to ensure good payback over the asset lifetime.
No additional fuels required	Larger installations and ground mount arrays could require planning permission. All PV systems will be roof mounted within this study and are considered permitted development, and therefore, do not require planning permission.
Familiar technology	High levels of trust and high availability of skills and materials required.

Solar photovoltaic (PV) panels capture energy from sunlight and convert it to electricity. Panels can be mounted on building rooftops or installed as stand-alone ground-mounted systems. This technology is well established and widely used in the UK. Solar PV installations are quick and easy to install, making it a good solution for the town.

The potential for generating electricity through solar panels is determined by the amount of sunlight falling upon that location. The orientation of the installation relative to the due south (for the northern hemisphere) and the distance from the equator, both determine the energy production per kWp installed (called the "Kk value").

Kk values for Matlock vary between 713 kWh/kWp & 894 kWh/kWp depending on specific location and roof orientation, which means that for every kWp of solar panels installed, 713-894 kWh are generated per year.

2.3 Site descriptions

The two chosen sites, Twigg Stores and Highfields Upper, are both located within the Matlock town area. Matlock is a small rural town with a population of approximately 11,000 in the Derbyshire Dales District of Derbyshire. The town comprises mainly housing, as is to be expected, but also contains large commercial, large churches, local authority properties and schools.

FIGURE 1 MAP OF MATLOCK AND CHOSEN PV SITES

2.3.1 Twigg stores

Twigg Stores is one of the two sites in this study owned and operated by local business "Twigg". The Stores site is located in close proximity of the River Derwent, with a postcode of DE4 3AU.

The Twigg Stores site operates as a shop, selling a wide range of building tools and equipment, as well as hosting Twigg offices. The Stores site was selected as a priority site due to its relatively large, unobstructed roof, along with good site engagement, low District Network Operator (DNO) costs, and its energy consumption profile.

FIGURE 2 AERIAL VIEW OF THE TWIGG STORES SITE; SUITABLE ROOFING AREA OUTLINED IN WHITE

ELECTRICITY CONSUMPTION

Based on consumption data supplied by Twigg, electricity consumption at the Stores is approximately 75MWh per year. As shown in Figure 3 below, the energy consumption is relatively consistent each month, with no obvious variations for seasonality. To understand the site's annual energy consumption during normal business operations, it was decided to baseline and analyse site data before the effects of COVID-19 restrictions. Therefore, consumption data was calculated between February 2016 and January 2017 as it was the most recent complete 12-month data set pre-March 2020.

The Stores site operates five and a half days a week. Therefore, if a solar PV system was to be installed, a high percentage of the weekly solar generation could be consumed on site, behind the meter. This electricity can be sold at a higher price, therefore improving the site's business case.

Energy Modelling Assumption

To calculate the proportion of energy that will be consumed on site vs exported to the grid, we need to evaluate the site's days of operation. Twigg Stores is open five and a half days per week (5.5/7), this equates to 79%. We have therefore assumed that 79% of annual electricity generation at the Twigg Stores can be sold back to the site, and 21% is exported via the national grid.

FIGURE 3 TWIGG STORES ANNUAL ELECTRICITY CONSUMPTION

SIZING CHOICES

TABLE 4 TWIGG STORES GENERATION STATISTICS

Generation statistics	Theoretical	PV System 1	PV System 2
System size (kW)	84	55	80
Carbon saved (tCO_2e/yr)	17	9.8	16
Annual electricity generation (MWh)	71.57	46.9	68.16
Proportion of total electricity provided (%)	96	63	91
Proportion of total roof area (%)	100	66	95
System Capital Cost (£)	105000	68750	100000
Annual O&M cost (£)	512	336	488

We have outlined three different solar PV system sizes at the Twigg Stores site. Each system is constrained by an external factor, please note the descriptions below:

Theoretical: constrained by the total viable roof area available, this is the theoretical yield if the roof could be maximised with solar panels

PV System 1: constrained by the current grid export capacity available (without network upgrades). The expected PV energy output on a monthly basis was compared to consumption data for this system size. Here, peak generation nearly matches electricity consumption. This means the vast majority of electricity generated is consumed on site.

PV System 2: constrained by the potential export capacity available (with network upgrades). An increase in capacity here to 80kW is possible for an upgrade cost of £20,000. This increased capital cost was included within our analysis. Despite the increase in overall generation, the additional upfront capital cost has a detrimental effect on the project economics.

SITE RECOMMENDATION

We recommend PV System 1, covering just over 66% of entire usable roof space and a solar PV system size of 55kW. Our recommendation is based on capacity available of the local grid electricity network. Western Power Distribution (WPD) has indicated that a system size of 55kW is the maximum for this site, without having to incur system upgrade costs. WPD continued to explain that any upgrade in this section of the network would come at high capital cost to those responsible for the solar PV installation.

SITE NEXT STEPS

1. Contact solar installer for updated system pricing and installation timeline
2. Evaluate grid connection costs (if applicable)
3. Confirm business case with new figures received from solar installer
4. Engage Twigg Stores regarding PV installation, roof lease, PPA negotiation etc

2.3.2 Highfields Upper School

Highfields Upper School is one of two sites in this study that makes up the entire Highfields School. The upper school is the larger of the two school sites, located in the northeast of Matlock, with a postcode of DE4 5NA. The site was established in 1982 and houses students from year 9 upwards.

The Highfields Upper site was selected as a priority site due to its large, unobstructed roof, along with good site engagement, low DNO costs, and consumption profile.

FIGURE 4-AERIAL VIEW OF HIGHFIELDS UPPER SITE; SUITABLE ROOFING AREA OUTLINED IN WHITE

ELECTRICITY CONSUMPTION

Based on consumption data provided by Highfields Upper School, electricity consumption at the site is approximately 384MWh per year. As shown in Figure 5 below, the energy consumption varies drastically depending on both seasonality and the school's term time. During the summer months, consumption falls to its lowest throughout the year. In the winter months during term, electricity usage rises to its greatest. To understand the site's annual energy consumption during normal school operations, it was decided to baseline and analyse site data before the effects of COVID-19 restrictions. Therefore, consumption data was calculated between March 2019 and February 2020 as it was the most recent complete 12-month data set pre-March 2020.

Energy Modelling Assumption

To calculate the proportion of energy that will be consumed on site vs exported to the grid, we need to evaluate the site's days of operation. When modelling the electricity consumption at the Highfields Upper site, we have assumed 66% of annual electricity generation will be consumed on site. This is a conservative estimate accounting for the average number of school days per year, inset days, summer events and other occasions when the school may be consuming electricity. Taking this into account, 34% of generated elected is exported and sold via a secondary PPA.

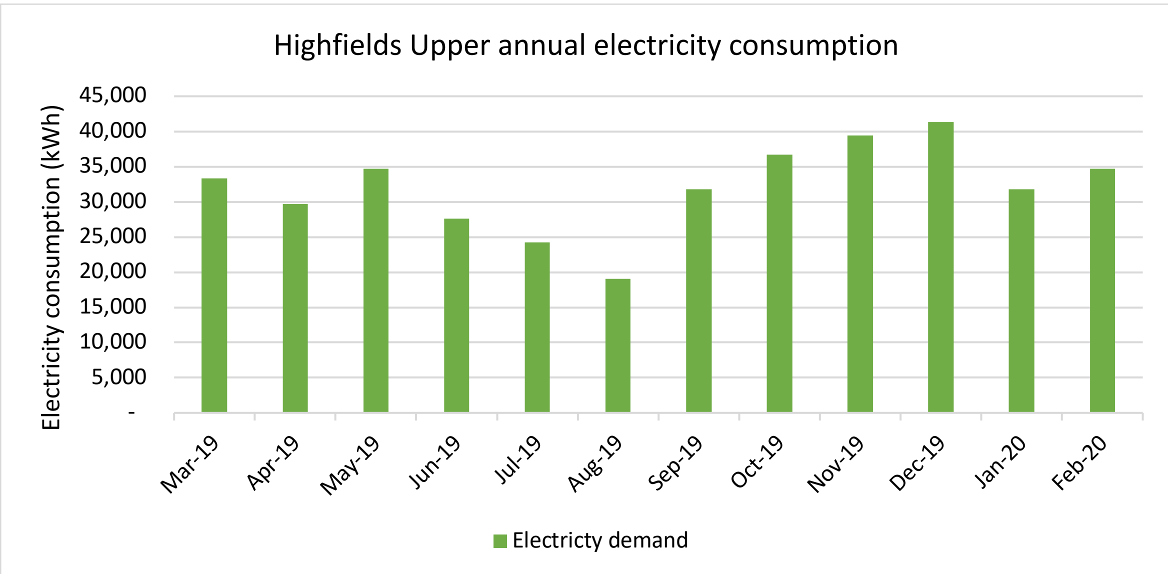


FIGURE 5-HIGHFIELDS UPPER ANNUAL ELECTRICITY CONSUMPTION

SIZING CHOICES

TABLE 5 HIGHFIELDS UPPER GENERATION STATISTICS

Generation statistics	Theoretical	PV System 1	PV System 2
System size (kW)	350	180	350
Carbon saved (tCO_2e/yr)	74	34	74
Annual electricity generation (MWh)	320.25	164.70	320.25
Proportion of total electricity provided (%)	83	43	83
Proportion of total roof area (%)	94	48	94
Initial Incremental Cost (£)	437,500	225,000	437,500
Annual O&M cost (£)	2,135	1,098	2,135

We have outlined three different solar PV system sizes at the Highfields Upper site. Each system is constrained by an external factor, please note the descriptions below:

Theoretical: constrained by the total viable roof area available, this is the theoretical yield if the roof could be maximised with solar panels

PV System 1: constrained by the monthly consumption of the site during the summer months. At 180kW, the maximum generation (in the summer months) matches the expected consumption for the school site. Meaning again that the vast majority of electricity generated is consumed on site.

PV System 2: constrained by the potential export capacity available (without network upgrades). At 350kW, the generation expected in the summer months far exceeds the expected consumption on site. A large proportion of the of generated electricity would be exported back to the grid. This electricity would be sold at a lower price leading to more challenging project economics.

A further investigation could explore the option of increasing the solar PV system size to 350kW. This investigation would need to consider a number of factors:

- Increased CAPEX and OPEX costs of increasing the system size
- Percentage of electricity consumed on site vs exported back to the grid
- Electricity sale price
- Potential electricity off-takers
- Potential use-case for battery storage technology

SITE RECOMMENDATION

We recommend PV System 1, covering just over 45% of entire usable roof space and a solar PV system size of 180kW. Our recommendation is based on monthly consumption of the Highfields Upper site. Western Power Distribution (WPD) has indicated that a system size of 180kW will not incur system upgrade costs.

SITE NEXT STEPS

1. Contact solar installer for updated system pricing and installation timeline
2. Evaluate grid connection costs (if applicable)

3. Confirm business case with new figures received from solar installer
4. Engage Highfields Upper regarding PV installation, roof lease, PPA negotiation etc
5. installation

2.4 Grid connections

Decentralised power generation assets such as solar power require a connection to the National Grid with the necessary permits that ensure the safety of the network. Factors affecting a grid connection are the strength of the local grid, the number of other connections in the pipeline, the size of the system to be connected and how much electricity would be used onsite vs exported. It is unusual for a connection to be technically impossible, but the fees levied by the distribution network operator may make the connection prohibitively expensive.

Western Power Distribution, the local Distribution Network Operator (DNO) for the Matlock region, make some of this information publicly available, including high level connection details.

In November 2021, we contacted Western Power Distribution and discussed each of the primary sites with the planner responsible for the Matlock area. Information on grid capacity in the local area was obtained and helped to inform solar PV system sizes.

More information is detailed within section 4 Planning and Permitting.

3. FINANCIAL ASSESSMENT

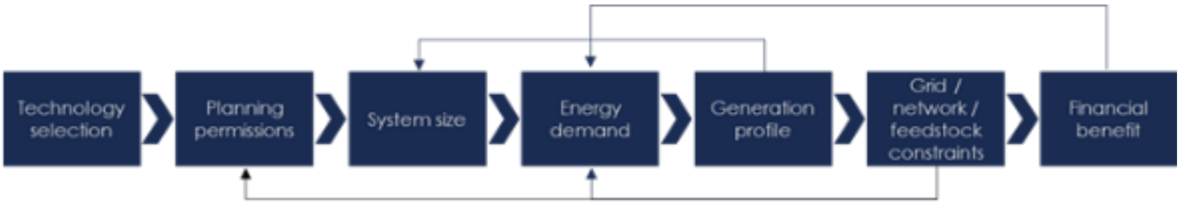
A positive business case is necessary for DDCE to install any renewable energy technology at any site. However, the financial performance of different system sizes will vary with local conditions. At this stage, we recommend progressing systems that can cover the cost of investment over the technology lifetime. Shorter paybacks are more attractive investments. DDCE can evaluate further use cases by modifying the sale price of electricity within the financial model.

As the Community will be funding the solar PV system, all capital and operational costs will need to be assessed. This will be modelled against the revenue streams over a 20-year period. DDCE will be able to negotiate the sale price of electricity, both with the site and via any third party PPA.

There may also be criteria from the project funders e.g., project payback period and return on investment. These criteria have been analysed in the following financial assessment section, where we will also identify any further constraints linked to financial performance that may exclude a technology or influence design decisions

3.1 Sizing choices and financial assessment

Methodology for financial modelling



There are multiple factors that affect sizing decisions for renewable generation systems; our approach accounts for these by iterating the technical capacity, local demand, grid capacity and business case to arrive at the optimal size based on all these factors.

All sizes of roof-mounted solar PV are considered permitted developments for the sites in scope and do not require planning permission, so sizing the systems depends on space available, grid capacity, local demand for energy and financial benefit.

3.2 Financial modelling

We have developed a scenario-based financial model for use alongside this report for Matlock Town Council. This is included as Appendix B to the report. The tool can run technical solutions for both solar PV sizing options listed below, as well as allowing Matlock Town Council to create new models for future scenarios/sites.

Table 6 Generation statistics for preferred options

Generation statistics	Twigg Stores	Highfields Upper
System size (kW)	55	180
Carbon saved (tCO_2e/yr)	9.8	34
Annual electricity generation (MWh)	46.9	164.7
Proportion of total electricity provided (%)	63	43
Proportion of total roof area (%)	66	48
Initial Incremental Cost (£)	68750	225000
Annual O&M cost (£)	336	1098

The outputs from our energy profiling model were fed into the financial model, with optionality in:

- Total capital costs (CAPEX)
- Total operation costs (OPEX)
- Total repair costs (REPEX)
- Electricity sale price (price of solar energy that will be sold via primary and secondary agreements)
- Investor Return on Investment (ROI) (the amount the DDCE wish to offer investors)
- Inflation
- Annual degradation of PV panels (this affects energy generation and therefore revenue)

This will allow Matlock Town Council and its partners to review and refine the business case for different scenarios in Matlock. The tool can accommodate for additional CAPEX, OPEX and REPEX costs. Additionally, if any grant funding is obtained, this can be incorporated into the tool to reduce the initial CAPEX cost of system.

3.3 Export / spilled electricity

As already discussed, the modelling shows that not all the electricity generated by the solar PV arrays would be consumed onsite. On an annual basis Twigg will consume around 79% of the electricity generated but the figure for Highfields Upper is only around 66%. Due to the low occupancy of the school during the summer months (when the potential for generating electricity is most optimal) and during weekends, a significant proportion of the generated electricity will be spilled to the national grid and will not be captured by the long-term guaranteed revenue of the PPA.

There are three potential routes for the spilled electricity to maximise the revenue streams for DDCE:

1) Smart Export Guarantee
The SEG is the successor to the Feed In Tariff and is a subsidy to support small scale renewable generators. It requires all licenced energy supply companies with 150,000 or more customers to provide at least one SEG tariff. Below this number, it is optional for an energy supply company to offer a tariff. Companies can set their own tariffs and most are a fixed rate for a contractual period. The tariffs offered currently range from £15/MWh to £557/MWh with the average around £35/MWh (as of January 2022). Note that SEG is not fixed for the long term.

2) Power Purchase Agreement with an energy supplier
A CEG can enter into a PPA with an energy supplier, who will purchase exported electricity from their sites. This export may be aggregated across a number of sites under one contract. The PPAs are for a fixed period (usually two years) and may be subject to a minimum threshold of exported export. Low Carbon Hub in Oxfordshire currently has two-year export PPAs in place with different energy companies. One is for £65MWh and another for £80MWh. PPA prices are subject to fluctuations in the energy market which is currently very volatile.

3) Sleeved PPA with a third party
This is an innovative way of selling the export from a rooftop solar project through a "sleeved" PPA to another consumer who may or may not be locally based. A licenced energy supply company facilitates this arrangement, which is subject to non-commodity grid costs that are born either by the producer (CEG) or the consumer. This means that to make this a viable proposition, the CEG needs to find a counterparty that is willing to absorb those additional costs in the PPA. London based CEG Energy Garden has recently developed a PPA with clothing firm Patagonia to provide electricity for its stores. The arrangement is facilitated by Younity and the PPA is aggregated across Energy Garden's multiple sites. The advantage of this over a standard PPA is that it is possible to have longer term PPAs that will be less subject to market fluctuations. This is a very new development in the marketplace therefore there is no guarantee such an arrangement can be replicated.

For all three export options, a site will need to have an export meter and a meter operator contract. An export meter will incur an installation cost and the contract will have an annual charge which will need to be factored into a project's financial model. It is important to stress that the above scenarios should not be used as the basis for a project's business case due to the short term nature of the contracts involved and the current volatility in the energy market. Assuming a lower export rate would be a prudent approach to ensure that a project is financial viable under a worst case scenario.

3.4 Financial recommendations

Based on our assessment, both the Twigg Stores and Highfields Upper sites have a payback period within the lifetime of the asset (20 years). An electricity sale price was selected to be 10% cheaper than the site's current rate to provide shared benefit.

The revenue can be divided into two main streams. Revenue stream 1 consists of electricity sold back to the site (e.g., Twigg buy the solar electricity that they consume behind the meter). Revenue stream 2 consists of any surplus electricity that will be exported via the grid. This can be sold via the Smart Export Guarantee (SEG) or via a secondary Power Purchase Agreement. Both average and high rate pricing scenarios have been modelled.

The net energy revenue is the total site revenue less the site operational costs (OPEX). This net revenue will be used to pay back the scheme's investors, whilst the surplus will be held by the CEG.

3.3.1 TWIGG STORES

As stated, both average and high rate pricing scenarios have been modelled.

Scenario 1 – Average rate SEG

TABLE 7 GENERATION STATISTICS FOR PREFERRED OPTIONS WITH AVERAGE RATE OF SEG (JAN 22)

Financial statistics	Twigg Stores PV System 1 – average rate SEG
Investment (£)	68,750
Revenue 1 Sale Price – Site PPA electricity price (£/MWh)	137
Revenue 2 Sale Price – Secondary PPA electricity price (£/MWh)	35
Cumulative Project Income – over study period (£)	117,835
Simple Payback Years (SPB)	13.7
Average Return on Investment (ROI) (%)	8
Net Present Value (NPV) - over study period (£)	-21,193
Internal Rate of Return (IRR) - over study period (%)	4.77
Study period (years)	20

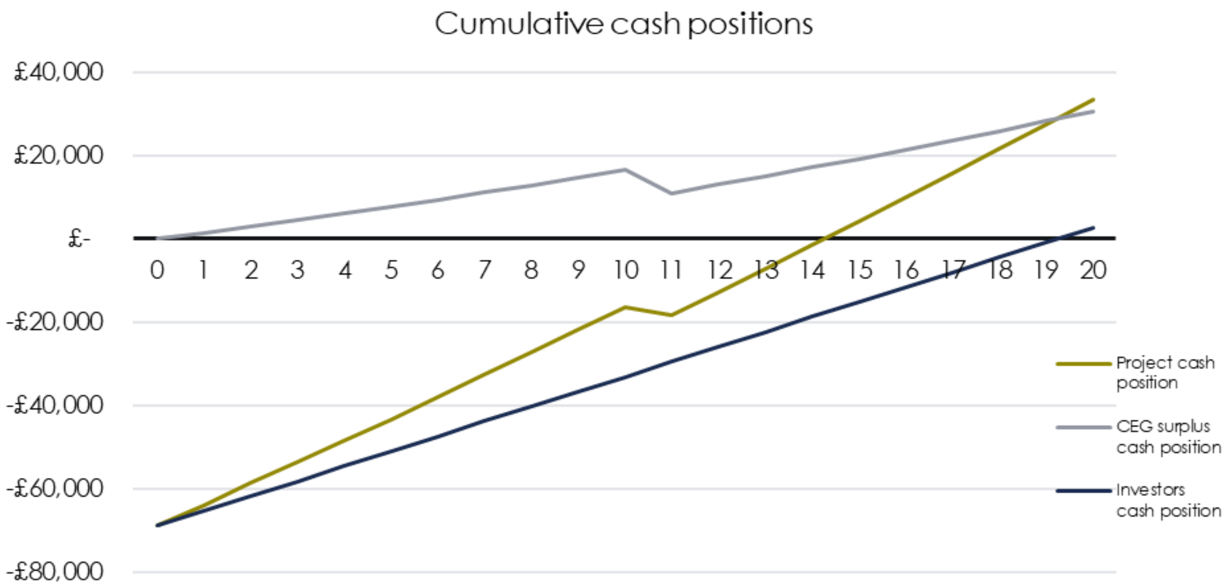


FIGURE 6: TWIGG STORES CUMULATIVE CASH POSITIONS AVERAGE RATE SEG

Scenario 2 – High rate SEG

TABLE 8 GENERATION STATISTICS FOR PREFERRED OPTIONS – HIGH RATE SEG

Financial statistics	Twigg Stores PV System 1 – high rate SEG
Investment (£)	68,750
Revenue 1 Sale Price – Site PPA electricity price (£/MWh)	137
Revenue 2 Sale Price – Secondary PPA electricity price (£/MWh)	55
Cumulative Project Income – over study period (£)	122,116
Simple Payback Years (SPB)	13.2
Average Return on Investment (ROI) (%)	8.29
Net Present Value (NPV) - over study period (£)	-19,584
Internal Rate of Return (IRR) - over study period (%)	5.21
Study period (years)	20

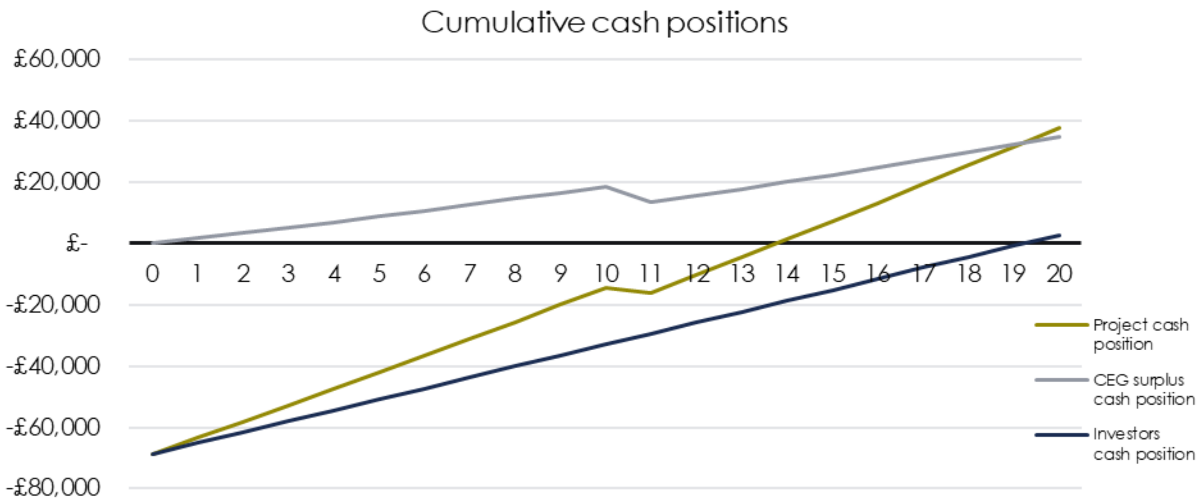


FIGURE 7 -TWIGG STORES CUMULATIVE CASH POSITIONS HIGH RATE SEG

Figure 6 and Figure 7 show the cumulative cash flow positions of the project, DDCE and the investors over the 20-year lifetime. Through modelling both scenarios, it is evident that the payback period decreases marginally when increasing the Revenue 2 Sale Price. As Twigg Stores is in operation 5.5 days per week, the majority of the electricity generated will be consumed on site, therefore sold at the Revenue 1 Sale Price.

Simple Payback (SPB) can be seen at around 13 to 14 years – where the yellow line crosses the x-axis. The financial calculations included a REPEX cost of £7,500 at year 11, when the solar PV inverters are expected to be replaced.

3.3.2 HIGHFIELDS UPPER

As above, both average and high-rate pricing scenarios are modelled.

Scenario 1 – Average-rate SEG

TABLE 9 HIGHFIELDS UPPER FINANCIAL STATISTICS – AVERAGE RATE SEG

Financial statistics	Highfields Upper PV System 1 – average rate SEG
Investment (£)	225,000
Revenue 1 Sale Price – Site PPA electricity price (£/MWh)	114
Revenue 2 Sale Price – Secondary PPA electricity price (£/MWh)	35
Cumulative Project Income – over study period (£)	312,247
Simple Payback Years (SPB)	17.2
Average Return on Investment (ROI) (%)	6.35
Net Present Value (NPV) - over study period (£)	-96,936
Internal Rate of Return (IRR) - over study period (%)	2.32
Study period (years)	20

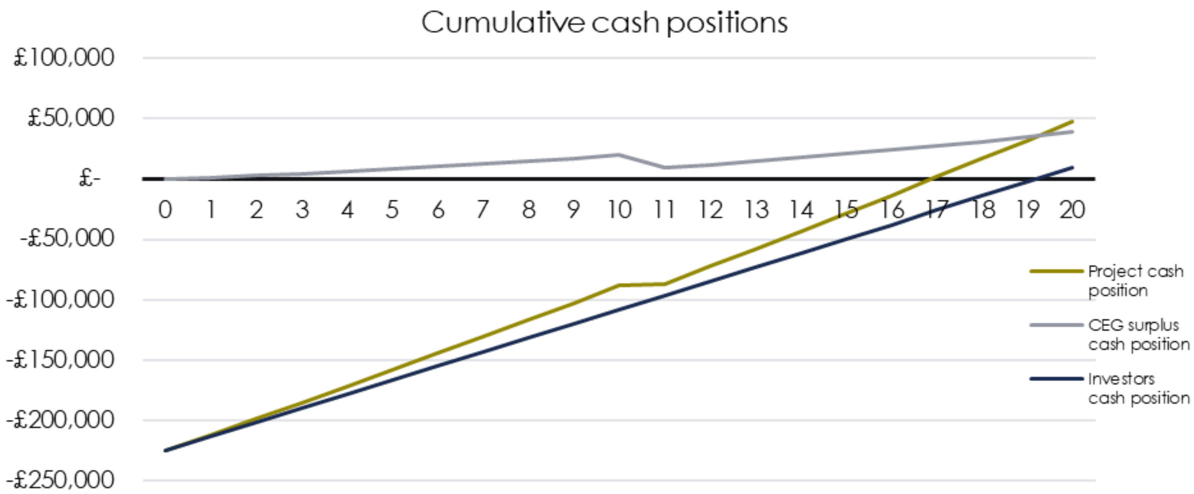


FIGURE 8 -HIGHFIELDS UPPER CUMULATIVE CASH POSITIONS AVERAGE-RATE SEG

Scenario 2 – High-rate SEG

TABLE 10 HIGHFIELDS UPPER FINANCIAL STATISTICS – HIGH RATE SEG

Financial statistics	Highfields Upper PV System 1 – high rate SEG
Investment (£)	225,000
Revenue 1 Sale Price – Site PPA electricity price (£/MWh)	114
Revenue 2 Sale Price – Secondary PPA electricity price (£/MWh)	55
Cumulative Project Income – over study period (£)	336,614
Simple Payback Years (SPB)	15.8
Average Return on Investment (ROI) (%)	6.89
Net Present Value (NPV) - over study period (£)	-87,780
Internal Rate of Return (IRR) - over study period (%)	3.17
Study period (years)	20

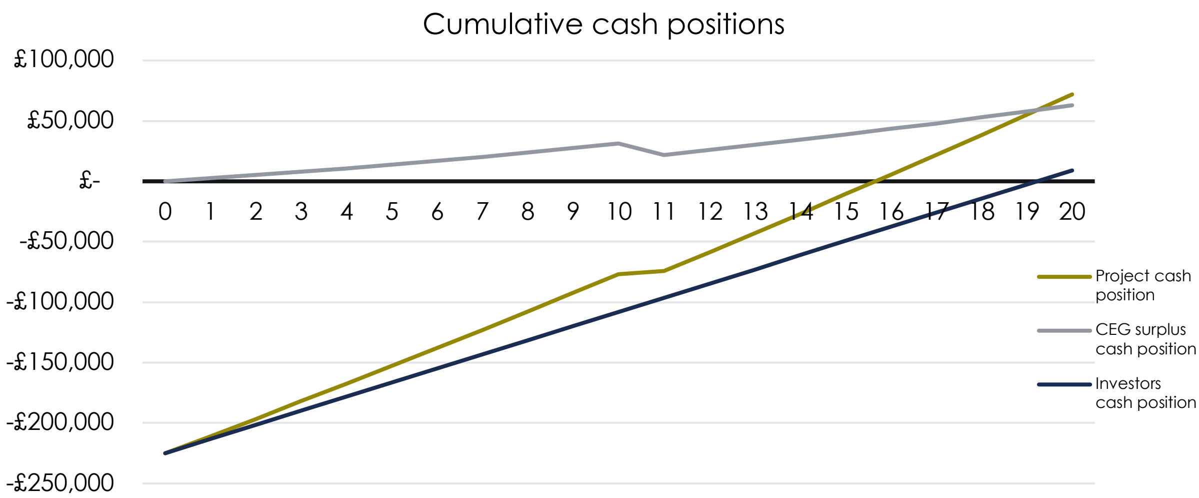


FIGURE 9 HIGHFIELDS UPPER CUMULATIVE CASH POSITIONS HIGH-RATE SEG

Figure 9shows the cumulative cash flow positions of the project, DDCE, and the investors over the 20-year lifetime. Through modelling both scenarios, it is evident that the payback period decreases greatly (around 1.5 years) when increasing the Revenue 2 Sale Price. As it is assumed Highfields Upper is in operation 66% of the year, a larger percentage of electricity is exported compared to the Twigg Stores site. If the Community Energy Group can negotiate a higher Revenue 2 Sale Price, the business case will improve, reducing the payback years.

Simple Payback (SPB) can be seen at around 15 to 16 years – where the yellow line crosses the x-axis. The financial calculations included a REPEX cost of £13,000 at year 11, when the solar PV inverters are expected to be replaced.

3.5 Distribution network operator costs

Another dependency is the cost of securing a connection to the electricity grid. The area around Matlock is fairly constrained for new generation capacity. Current modelling has assumed that the system will use the current available export capacity at each site. If the decision was taken to increase this capacity, DDCE would need to pay for this upgrade.

At the time of writing, we are seeking revised figures for increased export capacity sizing and upgrade costs. Upgrade costs can range greatly in value from thousands to hundreds of thousands of pounds. The connection to the electricity grid is a key project dependency, the DNO should be regularly engaged to understand current network constraints.

Once these revised figures have been received, the DDCE will be able to rerun the business cases, using the financial model, to understand if this increase in CAPEX and export capacity will provide more profitable financial returns.

4. PLANNING & PERMITTING

4.1 Planning

Determining whether planning permission is required is a crucial step in a feasibility project. In general, local planning authorities are supportive of renewable and low carbon development and should particularly back community-led initiatives. Hence, for proposed sites we did not identify any regulatory constraints that might restrict the installation of rooftop solar PV systems.

In November 2021 we contacted Chris Whitmore, the principal planning officer for Derbyshire Dales District Council to discuss the planning process and potential implications when installing solar PV panels on the roofs of the selected sites.

Both sites (Twigg Stores and Highfields Upper) are neither in a designated area (e.g. a conservation area) nor are listed buildings. Under the Wildlife and Countryside Act 1981 it is an offence to disturb protected species, it is therefore advised that a buildings assessment is carried out to assess the potential of any ecological disturbance and the need for any mitigation ahead of any works taking place.

The installation of solar panels to the roofs of existing buildings would therefore constitute permitted development. Provided all of the below conditions and limitations are complied with, planning permission will not be required.

- Solar panels installed on a wall or a pitched roof should project no more than 200mm from the wall surface or roof slope.
- Where panels are installed on a flat roof, the highest part of the equipment should not be more than one metre above the highest part of the roof.
- Equipment mounted on a roof must not be within one metre of the external edge of that roof.
- Equipment mounted on a wall must not be within one metre of a junction of that wall with another wall or with the roof of the building.
- If the equipment is on the roof of the building the capacity for generation of electricity across the whole of the site cannot exceed 1 megawatt.
- Equipment should be sited, so far as is practicable, to minimise the effect on the external appearance of the building and the amenity of the area.
- When no longer needed the equipment should be removed as soon as reasonably practicable.

Should DDCE not wish to observe any of the above conditions in order to maximise the microgeneration opportunities, it would need to submit a planning application.

The Local Planning Authority has expressed their support for renewable energy developments where they do not, amongst other considerations, have an adverse impact on the landscape or heritage of assets. Subject to not appearing unduly prominent, the installation of solar PV panels on the roofs of existing buildings is likely to be received favourably, should the group decide to submit a formal application.

4.2 Permitting

As previously mentioned, decentralised power generation assets, such as solar PV, require a connection to the National Grid with the necessary permits that ensure the safety of the network. Western Power Distribution (WPD) is the local Distribution Network Operator (DNO) for the Matlock area and is responsible for new and existing connection applications. WPD makes some of this information publicly available, including high level connection costs and a generation capacity map, however additional engagement was required to understand each site at a more granular level. Inquiries were made to WPD in November 2021 to understand the current export capacity and the export potential if upgrades were completed. Any infrastructure upgrade would bear an upfront capital cost which would have to be covered by DDCE.

If no upgrade is required there is no charge from WPD, unless they are required to witness test any equipment. This is not expected to be required as solar PV installers will typically use fully type tested inverters and PV panels.

Only when a formal connection application is made and accepted will any export capacity be reserved on network.

4.2.1 TWIGG STORES

There is currently a three-phase electrical supply installed at the Twigg Stores site. A three-phase supply typically allows for increased solar PV system capacity. There is currently no export capacity agreement for this site. There is approximately 55kW of export capacity available at this site. If the Twigg Steelyard was also to be selected as a potential site, this 55kW export capacity would need to be shared across the two Twigg sites – WPD has highlighted that there is existing generation on this area of the grid network. WPD has indicated a solar PV system size of 80kW could be achieved with reinforcement however this would cost between £10,000-£20,000 – around 140m of mains cable would likely have to be upgraded.

Avieco has engaged with WPD to confirm the export potential at the Twigg Stores site. Any information received post submission of this report will be circulated amongst the project group.

4.2.2 HIGHFIELDS UPPER SCHOOL

Highfields Upper School is a High Voltage (HV) metered supply. WPD has indicated that this benefits system modelling and indicated that they are able to permit higher export capacities without reinforcement. The existing agreed supply capacity (ASC) for Highfields Upper is 250kVA. There is currently no export capacity agreement for this site. As they are an HV customer and located on the main HV line, small increases are likely to be acceptable without network reinforcement. Approximately 150kW of export is likely to be accepted.

WPD has stated that an export capacity of 350kW could be available at this location. Additional modelling would be required to understand the benefits of maximising the system at this location.

4.3 Matlock grid constraints

Avieco has engaged with WPD to ask for additional information regarding the grid constraints within the Matlock area. Any information received post submission of this report will be circulated amongst the project group.

5. SITE ASSESSMENTS

As previously mentioned, eight sites were initially chosen in scope. The two most promising sites, Twigg Stores and Highfields Upper, were chosen to be investigated further. These sites were prioritised due to a number of factors, as mentioned earlier within the report. For a summary of the remaining six sites, please see Appendix A

5.1 Twigg store

FIGURE 10-SATELLITE VIEW OF TWIGG STORES

SITE INFORMATION

Twigg Stores is the second of two buildings owned and operated by Twigg in Matlock. The office also acts as a store for Twigg, selling and trading a wide range of engineering equipment to the community. The store, developed in 1934, has a postcode of DE4 3AU.

Twigg Stores sits directly across the road from the steelyard. The structure is a two-story office building with a corrugated metal roof. The external part of the roof was found to be in good condition, indicating that it would be compatible for a solar installation. There were a few extrusions that would need to be accounted for, however, these are minimal.

The southeast facing roof space is entirely pitched, and in good condition (Figure). A small, shaded area on the northeast side of the stores caused a slight concern, however having visited the structure this was deemed to be of minimal impact.

The stores site consists of two floors, the upper floor having been an addition to the structure in the 1988. The relatively recent conversion to a two-storey building ensures that there are no issues with the placement of solar PV on the roof, allowing the whole roof to be covered.

The stores site is easy to access by vehicle. Onsite parking is available at this site. There is a small building adjacent to the stores, this could pose an issue if scaffolding is used for installation, however there is also a small path that wraps the north side of the building leading directly to the roof. The gate separating the footpath and the roof are owned by Twigg, so could be used to access the roof for any installation.

FIGURE 11-TWIGG STORES' EXTERNAL ROOF

5.2 Highfields Upper School

FIGURE 12-SATELLITE VIEW OF HIGHFIELDS UPPER

SITE INFORMATION

Highfields Upper School is one of two sites that makes up Highfields school. The site is comprised of several individual buildings that together make up the school, housing students from year 9 upwards. The site was established in 1982 and has a postcode of DE4 5NA.

All buildings on at the upper school have pitched roofs, covered with concrete tiles. The majority of these face east-west, allowing for good solar PV generation throughout the day. There are also a few south facing roofs, which again would allow for good generation. Some of the roofs orient northwards or contain a number of fixtures. To optimise the site generation, these would be taken into consideration and the roofing space optimised for any solar PV system size. From a visit to the site, all the roofs appear to be in good working condition. Additionally, the upper school site has no shading issues that would affect generation.

The internal structure differed from building to building across the whole upper school site. Excluding some areas of roofing that contained lighting panels (

Figure) and other fixing, the majority of the Highfields Upper roof space is suitable for PV installation.

Figure 13 Internal view of lighting panels at Highfields Upper

Highfields upper school has a large car park on site, allowing for easy access by vehicle. The main body of the school is also not very tall allowing for easy access to this part of the building. Other, taller areas (the sports hall) may need to be accesses via scaffolding or a cherry picker, both of which will again contribute to the overall cost of the panels.

6. OPERATION AND GOVERNANCE

It has been the intention of MTC that any viable renewable energy project identified through this RCEF study would be taken forward for development by DDCE. DDCE was formed in 2020 as a constituted, unincorporated community energy group with the aim of helping local communities in the Derbyshire Dales develop community energy projects.

One of the outputs of this study is to identify the most appropriate community structure for DDCE going forward. According to the Plunkett Foundation[1], the defining features of a community enterprise are:

- Community led – the entity should be committed to identifying and meeting their community's needs.
- Inclusive – membership should be open to all members of the community.
- Democratic – the entity should be based on the principle of one member, one vote.
- Enterprising – the entity's main source of income comes from trading with and on behalf of its members.
- Not for profit – profits should be invested in the community.

The vast majority of CEGs are constituted as either a: Community Interest Company (CIC), Cooperative (Coop) or a Community Benefit Society (Bencom). The key features of these are shown in table 11.

[1] The Plunkett Foundation is a national charity that supports rural communities develop locally based solutions through the facilitation of community business models www.plunkett.co.uk

Table 11 – different types of community entity applicable to community energy groups

	BenCom	CIC	Coop
Type of entity	Industrial & Provident Society	A social enterprise with protected social mission	Industrial & Provident Society
Social Purpose	Benefit of the Community	Benefit of the Community	Benefit of its members
Changes to Purpose	FCA must approve any changes	The Regulator will only approve a change if it meets the community interest test.	FCA must approve any changes
Asset lock:	Yes, but with loopholes. Can be strengthened	Statutory	Voluntary
Constitutional document	Rules	Articles of incorporation	Rules
Dividends payable	No only interest	Yes restricted to 20% of profit	Yes equitably
Ability to raise share capital	Yes	Yes if limited by shares	Yes
Regulator/Registrar	Financial Conduct Authority (FCA)	Companies House & CIC Regulator	FCA

There are two types of CIC: one limited by guarantee (not for profit) and one limited by shares (profit). Both are subjected to an asset lock but CICs with shares issued can also distribute dividends. Distribution of dividends is also tightly regulated and subject to certain limits. The role of the asset lock is to protect any assets of the organisation for its community purpose rather than for any private or personal gain of the members.

6.1 Bencom Formation

We have worked with DDCE throughout this study to guide them through the process of becoming a formally constituted Bencom as the most appropriate form of governance structure because it:

- Operates for the benefit of the community rather than its members.
- Can raise share capital.
- Has less onerous reporting requirements compared to a CIC.

We advised DDCE to embark on the registration process in tandem with the RCEF study as this would enable the group to be in a position to apply for the funding which would be needed to take any community energy project forward. Our support has involved:

- Conducting a scoping exercise to identify potential founder members;
- Holding an event to present about the project and outline what a Bencom involves and what it means to be a founder member and director;
- Facilitating the recruitment of an apprentice from Octopus Energy who is currently available for resource for Derbyshire Dales Community Energy;
- Providing support to the group about the process of forming a Bencom.
- Linking DDCE with another CEG in the area, who are also in the process of developing an RCEF project. The two groups have discussed potential for collaboration in a number of areas such as engaging with local authorities and potentially sharing resources and experience.

Following this support, eight founding members have volunteered their services and the group is currently in the process of becoming a registered CBS.

6.2 Bencom Operation

A key feature of a CEG is the presence of a group of committed members who drive the organisation and projects forward. In common with many community projects, a CEG is volunteer led, particularly in the early phase of development. DDCE will need to ensure there is enough capacity within the organisation to help develop a project and potentially a pipeline of subsequent projects. In particular it is important to consider the relevant skills and experience required and whether these are currently present in your organisation. These could include:

- Technical / engineering
- Project management
- Financial modelling
- Fundraising
- Legal, particularly related to leases / property law
- Community engagement and outreach
- Communications / marketing

Often only a core group of members is needed to drive a project forward, although you will need wider community support and buy in, particularly for the community share raise. It is important to try to recruit a diverse range of members and volunteers to ensure that it is truly representative of your community.

7. COMMUNITY ENGAGEMENT

7.1 Project engagement

Ensuring that there is good community support for any community energy project is crucial to ensure its success and throughout this process we have endeavoured to engage with the wider community within Matlock. This is with a view to informing people about the RECF study and potential community energy projects in the town and raising awareness about the concept and benefits of community energy more generally. Laying a good foundation of community engagement and awareness at an early stage can reap dividends later when recruiting volunteers or investors to the project.

We have sought to strike a balance between providing sufficient information to enthuse and interest the community without "overselling" the potential projects, which may discourage people should the study show that they are unviable.

We undertook the following community engagement activities:

- Articles regarding the project which featured in the local media including the Matlock Mercury and the Derbyshire Times. Both of these article generated a large amount of interest;
- Using existing MTC communication routes i.e. website, newsletter, social media;
- Email communication and newsletter with a number of interest groups in the area including the Derbyshire Dales Climate Coalition and the local Community Climate Action newsletter;
- Meetings and awareness raising sessions with representatives from Twigg and the School to raise awareness of how a community energy scheme would operate. We also made sure that we were available at all stages of the study to answer any questions and address any potential concerns. This was a key part of engagement process to ensure that potential partners were fully informed which hopefully will encourage them to enter into a community energy project;
- Two scheduled presentations with local groups about the RCEF project and community energy;

In addition, throughout this process we have had ongoing, positive dialogue with representatives from the Derbyshire Dales District Council, which could be a key partner and supporter of DDCE of this and future projects in the Derbyshire Dales area.

The response from this engagement, including that involving the Bencom formation, has been very positive, with a large amount of interest shown. In addition a number of other businesses and organisations have expressed interest in becoming partner sites for potential future projects.

This has all helped generate a good level of enthusiasm and motivation, which DDCE could capitalise on if and when a community share offer is developed.

7.2 Recommended next steps

If DDCE decides to proceed with the development of rooftop solar projects at the sites identified, it should develop a community engagement plan that will ensure the local community is involved and aware of the project and kept fully informed of any developments. Further information about developing an engagement plan is shown in appendix D.

As a first step we recommend you provide as many opportunities as possible to feedback the findings of the RCEF study to the Matlock community. This could include:

- Articles in the local press
- Using existing communication routes e.g. social media, newsletters, website
- Communicating through existing stakeholders and networks in the Matlock area. A spreadsheet showing potential local stakeholders is shown in appendix E.
- An open event / workshop to present the findings to the local community and inform them of next steps.

Additionally, the insights and learnings gained as the outputs of this project should be shared with other key stakeholder groups in the wider area. These should include other community energy groups, local authorities, and national parks.

8. COMMUNITY BENEFIT

In common with the CBS model, a key feature of community energy projects the creation of a community benefit fund therefore they deliver additional positive social impacts. The fund can be used to award grants to local projects and causes that align with the CEG's objectives and priorities and can respond to the needs and challenges of the local community.

8.1 Potential areas of community benefit in Matlock

There are a number of areas where community benefit could be directed including:

1) Fuel poverty alleviation programmes
   Around 13.5% of households in Derbyshire Dales DC are classified as being in fuel poverty (slightly higher than the English average), however this varies across the County. Matlock is home to the Hurst Farm Estate which is the most deprived estate in the Derbyshire Dales, which falls within the bottom 10% of Indices of Multiple Deprivation and where the incidence of fuel poor households is much higher.
   Potential recipients of community benefit
   - The Marches Energy Agency is a charity that delivers fuel poverty and warmer homes programmes to households across the Derbyshire Dales. It offers home visits and one to one support for households struggling with fuel costs as well as community advice sessions such as roadshows and community events. There could be potential to deliver funded, targeted services in areas of Matlock identified as being more vulnerable such as funding the provision of energy cafes.
   - Rural Action Derbyshire's remit is to support and improve the quality of life for Derbyshire residents through encouraging rural communities to take action to become more sustainable and increase local control. It coordinates a number of projects where community benefit might be able to support including Feeding Derbyshire which supports a network of foodbanks across the County (including in Matlock) and a rural hardship fund which provides grants for people in difficulty in Derbyshire.
   - Friends of Hurst Farm is a group that is dedicated to meeting the needs of the residents of the Estate and encouraging community led activity. It runs a newly formed community pantry on the estate which has over 150 members. In addition, the group provides a referral service for residents to other support agencies such as Marches Energy Agency.

2) Local carbon reduction / environmental projects
   Many CEGs award grants to local environmental groups and projects that align with their objectives. For DDCE in Matlock this could include:
   - Derbyshire Wildlife Trust is currently working on a major climate change adaptation project in the Derwent Valley, which includes Matlock and its surrounding areas. This is a pioneering project that aims to reduce and

manage flood risk through rewilding measures such as woodland and peatbog creation.

- Hurst Farm Regeneration Company is a newly formed Bencom that will be responsible for maintaining and enhancing the green spaces on the Hurst Farm Estate, including a large area of adjacent woodland which they hope to turn into a public amenity which will include a forest school and woodland walkway.
- Local green spaces. Grants could be made to support and enhance biodiversity at local green spaces such as local schools, allotments, parks etc.

8.2 Approach to community benefit

There are different approaches that can be taken both in terms of how to allocate a community benefit fund and how to distribute it. One way is to assign a certain percentage of their annual turnover or a cost per MW installed capacity to community benefit (therefore is essentially an OPEX cost). Alternatively, the fund is created from surplus profit therefore is not fixed throughout the lifespan of the project. Another option is to take a contribution from both OPEX and surplus. These are variables that can be factored into the group's financial model according to Directors' preference.

It will ultimately be up to the Directors and Members of DDEC to develop its approach to the community benefit fund and to develop suitable criteria that will determine where and how to allocate funding. It is important to note that for smaller projects, such as rooftop solar schemes, the community benefit fund will be relatively small. For example, the community benefit fund arising from a solar PV scheme of 200kW may be around £1,000 per annum. However, if DDCE start to deliver a pipeline of projects, the community benefit fund would accumulate accordingly.

9. PROJECT RESOURCING

A CEG will require resources and funding at different stages for a variety of functions. These could broadly be defined as follows:

Project development resources

There are certain costs associated with project development such as legal and other professional fees and roof top surveys. It is possible to incorporate these costs into the financial model and capitalise them into a community share raise (see below). Alternatively, project development costs could be met by local grants and funding opportunities. Appendix F gives a list of potential grant providers and funding opportunities which may be relevant to DDCE to progress project development.

It is anticipated that project development and management will usually be carried out by volunteers and members. However grants could also be used to provide professional support and paid resources if required. In addition, a number of resources exist to support community energy projects including legal template documents which can help reduce the costs associated with project development.

Capital resources

The majority of community energy projects are financed through a community share raise. "Community shares" is commonly used to refer to a unique form of share capital, 'withdrawable shares', which can only be issued by co-operatives or community benefit societies registered with the FCA. Community shares exist to support a community purpose rather than create financial gain. For this reason, community share offers are not subject to the financial promotions regulations. Shares do not increase in value above the price paid for them but can reduce if the entity gets into financial difficulties. However interest may be paid on the shares according to the rate set out in the share offer document (invitation to invest). Members do not vote in accordance with the value of their share capital: instead, a 'one member: one vote' system applies. Coops UK has produced the Community Shares Handbook, which offers best practice advice and support to Coops and Bencoms in how to develop and manage a share raise.

Organisational resources

As discussed in section 6, many CEGs are reliant on volunteers for project development and delivery, particularly during the early stages of the organisation. As it grows and progresses, a group may acquire sufficient surplus to employ members of staff who may be responsible for project management and development or administrative functions. This will be influenced by the OPEX parameters included in the group's financial model. In addition, grants could potentially be used for organisational and revenue costs, although this is rare.

10. CONCLUSIONS

This study has identified two sites within Matlock that are suitable for the installation of community owned solar PV arrays. The feasibility assessment has shown that a 55kW scheme at Twigg Stores and a 180kW scheme at Highfields School Upper are possible. This is based on a number of factors including onsite electricity consumption, grid constraints, roof structure and orientation.

It is the intention of Matlock Town Council that Derbyshire Dales Community Energy will take forward these projects. We have identified a Community Benefit Society (CBS) is the most suitable structure for the group. With the support of Pure Leapfrog, the founding directors have now secured a CBS registration that became effective on 13th January 2022.

We recommend the following next steps for the group in order to progress the solar PV projects:

- Communicate the findings of the report to the wider Matlock community as detailed in section 7.2 and develop a community engagement plan. This includes the potential future host sites.
- Provide feedback to the two host sites about the findings of the study.
- Obtain at least two quotes from credible solar installers in order to arrive at a firmer capital cost.
- Undertake an exercise of the founding members of DDCE to understand the skills within the group and what capacity there is to deliver these projects. This will help identify any gaps and inform what extra support is required.
- Further investigate the funding opportunities identified in Appendix F which could be used to fund any project development costs.
- Refine the financial model to reflect the quoted capital costs plus any identified and agreed OPEX costs e.g. O&M costs, insurance costs, community benefit etc. This will help model potential PPA price which could be used as a starting point for negotiations with the sites.
- Continue to engage and collaborate with other CEGs in the region to start to build a network of groups. By sharing experience and skills it may help build community energy capacity in the area and provide impetus for more projects in the area.
- RCEF Stage 2 funding may be available to use for the above activities, particularly as DDCE is in its infancy and the group may require project development support. The possibility of making an application should be explored with the Midlands Energy Hub who will be able to advise on the suitability of the project.

APPENDIX A – ADDITIONAL SITE ASSESSMENTS

Alongside the two preferred sites in scope, we reviewed an additional six sites:

- Twigg Steelyard
- Highfields lower
- Arc leisure
- Gateway court
- Victoria court
- Denesfield court

We reviewed Twigg Steelyard and Highfields Lower in greater details, as these were primary locations prioritised prior to financial assessment. The other four sites could still be viable locations for community energy projects in the future. More research would be needed to investigate this fully.

A.1 TWIGG STEELYARD

As one of the primary sites, Twigg Steelyard was analysed and visited by the project team. Energy consumption and technical sizing analysis have been completed however the site was not preferred for the following reasons:

- Roofing structure uncertainty
    - A large portion of the steelyard roof (outlined in red) contains asbestos. Asbestos fibres are a severe health hazard, and any solar installation would require great remedial work – either asbestos is to be removed or overclad with steel. The roofing structure would also need to outlast the lifetime of the solar PV panels (around 20 years).
- Southside shading issue
    - The entire edge of the south facing steelyard roof experiences shading from the trees situated on the banks of the river. This shading would impact on the sun's coverage of the panel and therefore the solar PV generation. It is unknown whether the trees on the banks of the river are under a tree protection order however additional investigation work will need to be completed to understand this opportunity.

Figure 6 Satellite image of Twigg steelyard

SITE INFORMATION

Twigg Steelyard is a steel fabrication yard, owned and ran by Twigg. The building was constructed in the 1930s, with a postcode of DE4 3AU. The steelyard is one of two sites owned by Twigg, the second (Twigg Stores) was selected to be one of the preferred sites.

A large portion of the steelyard roof (outlined in dashed red in the figure above), contains asbestos. To overcome this issue, additional upfront costs of removing the asbestos/building a second roof above the asbestos section, would be required before any solar PV would be installed. This would greatly increase the capital cost of any PV installation.

Apart from a flat section which comprises of the office space, all the roofs are pitched. There are also numerous roof lights built into the structure. There is also some possible shading along the south side of the steelyard. During the site visit to the steelyard, the extent of the shading along the south side of the building, caused by the tall trees growing along the river, became more prominent. These trees cause a substantial portion of the south sloping section of the roof to be covered from sunlight. It is also unlikely that the trees are able to be removed due to their placement next to the river.

Figure 15 Twigg Steelyard

The internal section of the steelyard roof is depicted in Figure . Solar panels on the roof would have to be placed around the sky lights (as not to obstruct visibility within the steelyard), reducing the viable solar PV area. Furthermore, due to the spacing of the trusses, internal structural elements would again complicate placement of the solar panels.

FIGURE 16 TWIGG STEELYARD INTERNAL ROOF STRUCTURE

The steelyard is easy to access by vehicle, with onsite parking available to the east & west of the building. Direct access to the roof however is limited. For any future installation and maintenance, this would mean that direct access would need to be established either via scaffolding or a cherry picker, both of which will contribute to the overall cost of the panels.

The building has a large pitched south facing roof, which under normal circumstances would be ideal for solar generation. However, the shading alongside the south side suppresses the potential energy generation at the site. This combined with the asbestos roofing material are the main reasons why this site was not selected.

ELECTRICITY CONSUMPTION

Based on pre Covid-19 data supplied by Twigg (2016/18), electricity consumption at the steelyard is approximately 145MWh per year. As can be seen in Figure 17 below, the energy consumption appears to be relatively consistent each month, with a very slight increase in the winter months (possibly from the use of individual space heaters used by the employees).

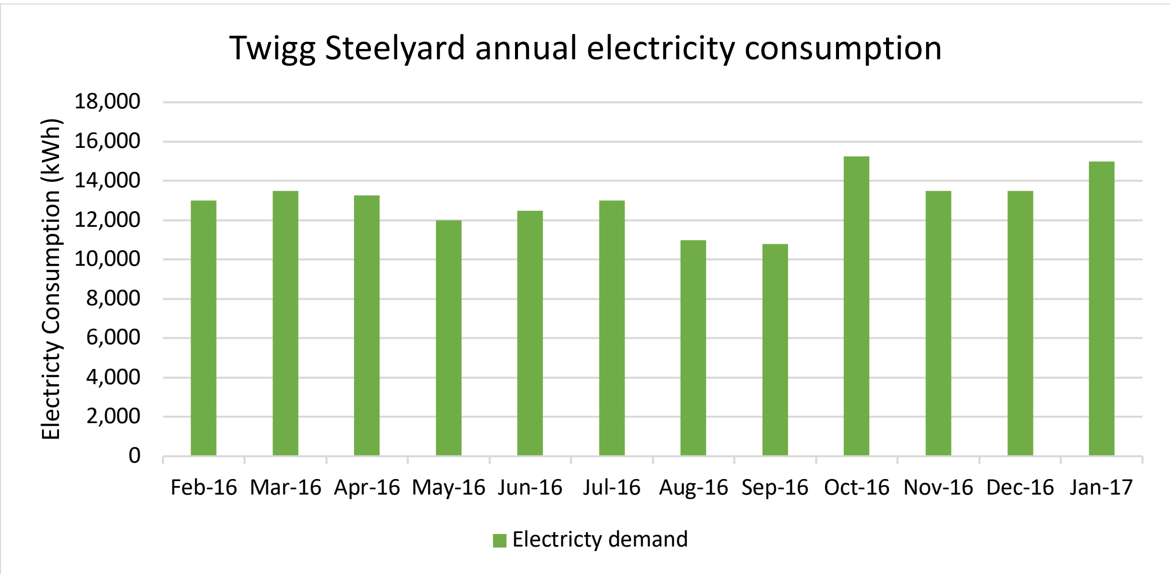


FIGURE 17 ELECTRICITY CONSUMPTION FOR TWIGG STEELYARD

SIZING CHOICES

Table 12 Solar PV sizing options for Twigg Steelyard

Generation statistics	Theoretical	PV System 1	PV System 2
System size (kW)	77	55	15
Carbon saved (tCO_2e/yr)	15	11	3
Annual electricity generation (MWh)	66.84	47.74	13.02
Proportion of total electricity provided (%)	46	33	9
Proportion of total roof area (%)	100	71	19
Initial Incremental Cost (£)	96,250	68,750	18,750
Annual O&M cost (£)	470	336	92
Simple Payback Years (SPB)	9.2	11.6	11.6
Simple Return on Investment (ROI) (%)	11	9	9
Average ROI over study period (%)	11	8	8
Net Present Value (NPV) - over study period (£)	22,619	-2,429	-662
Internal Rate of Return (IRR) - over study period (%)	13	10	10
Study period (years)	20	20	20

A.2 HIGHFIELDS LOWER

As one of the primary sites, Highfields Lower School was analysed and visited by the project team. Energy consumption and technical sizing analysis have been completed however the site was not selected for the following reasons:

- Building/roofing structure uncertainty
    - After the site visit at the Highfields Lower, it was apparent that there were greater uncertainties concerning the roofing structure and its capacity to host a solar PV system compared to the other sites. Highfields Lower consists of a flat roofing structure supported by a number of trussed beams however a full structural survey would need to be carried out before progressing this opportunity

FIGURE 18 SATELLITE IMAGE OF HIGHFIELDS LOWER

SITE INFORMATION

Highfields Lower is the second of two sites that makes up Highfields school. The site is comprised of a large central building, and a smaller building to the East. These sites housed students from year seven and eight. This site, established in 1982, underwent refurbishment in 2004. The postcode for the lower side is DE4 3DD. The lower site is located two kilometres South of the upper site.

There are two separate roofs at the Highfields lower school site all of are flat, so any panels placed on the roof would be orientated to the south to obtain the highest generation. The roof is covered with tar coating, which makes the installation of solar PV possible (as long as the solar panels don't compromise the waterproofing of the roof). The roofs are also dotted with lighting fixtures and ventilation equipment, installation of panels would have to take these into account.

Excluding a small tree covering a small section of the lower roof

FIGURE 7 INTERNAL ROOF STRUCTURE HIGHFIELDS LOWER

Figure)

there are no shading issues.

The internal roofing of the lower school site is depicted to the right. The roof is supported by a number of trussed beams. These beams are often spaced at relatively large distances, a further investigation into the structural stability of the roof would be necessary before installing PV.

In 2004 the site underwent a £1.2m refurbishment, upgrading the single glazed windows on the upper two floors.

The lower school site is easy to access by vehicle, with onsite parking available to the east side of the building. Direct access to the roof however is limited. For any future installation and maintenance, this would mean that direct access would need to be established either via scaffolding or a cherry picker, both of which will contribute to the overall cost of the panels.

ELECTRICITY CONSUMPTION

Based on consumption data provided by Highfields lower school, electricity consumption at the site is approximately 171MWh per year. As can be seen from Figure 20 below, the energy consumption varies drastically depending on both seasonality, and the schools term time. In the summer months consumption falls to a low, but not zero. During these months the school still host a number of activities on site. In the winter months, during term, electricity usage rises to a maximum as is expected. A period running from March 2019 to February 2020 was chosen to obtain a yearly consumption rate as these months most reliably give an indication of the electricity usage in the long term.

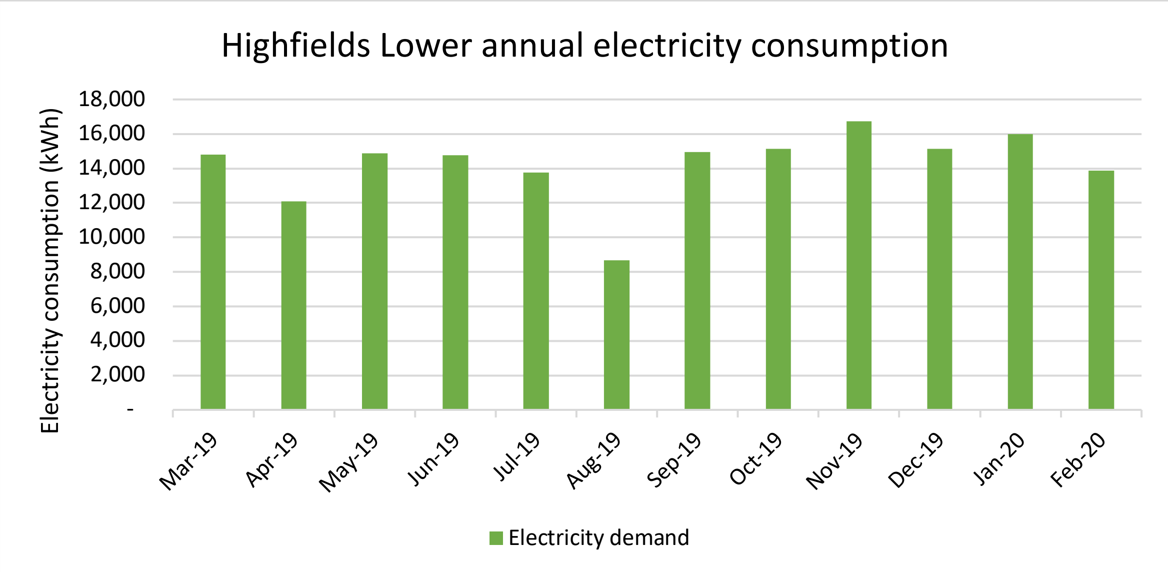


FIGURE 20 ELECTRICITY CONSUMPTION FOR HIGHFIELDS LOWER SCHOOL

SIZING CHOICES

TABLE 13 SOLAR PV SIZING OPTIONS FOR HIGHFIELDS LOWER SCHOOL

Generation statistics	Theoretical	PV System 1	PV System 2
System size (kW)	155	50	65
Carbon saved (tCO_2e/yr)	32	10	13
Annual electricity generation (MWh)	138.57	44.70	58.11
Proportion of total electricity provided (%)	81	26	34
Proportion of total roof area (%)	100	32	42
Initial Incremental Cost (£)	193,750	62,500	101,250
Annual O&M cost (£)	926	305	397

Simple Payback Years (SPB)	13.7	13.7	17
Simple Return on Investment (ROI) (%)	7	7	6
Average ROI over study period (%)	6	6	4
Net Present Value (NPV) - over study period (£)	35,926	11,589	35,066
Internal Rate of Return (IRR) - over study period (%)	7	7	7
Study period	20	20	20

A.3 ARC LEISURE

As one of the secondary sites, Arc Leisure was analysed at a high level, evaluating the potential system size available. This site was rejected due to lack of engagement within the project timescales. If required, the Community Energy Group could look to explore this opportunity in the future.

FIGURE 21 SATELLITE IMAGE OF ARC LEISURE CENTRE

SITE INFORMATION

Arc Leisure Centre is a fitness centre that includes a 25m swimming pool, a gym, studios for exercise classes and indoor cycling, as well as a children's play area, changing rooms, and more. The leisure centre is located on the West side of the town, with a postcode of DE4 3AZ. Opened in 2011, the building is currently occupied and managed by freedom leisure in partnership with Derbyshire Dales District Council.

From a desk-based study, the roof appears to be in good condition and suitable to host solar PV. It is unlikely that the roof will be subject to shading from surrounding trees and buildings. However, the age of the roof needs to be considered due to warranty conditions, as well as the surface material of the roof.

TABLE 8 AVAILABLE ROOF AREA AND GENERATION CAPACITY OF ARC LEISURE CENTRE

Potential roof area (m^2)	Potential electricity generation (MWh)
850	88

A.4 GATEWAY COURT

As one of the secondary sites, Gateway Court was analysed at a high level, evaluating the potential system size available. This site was rejected due to lack of engagement within the project timescales. If required, the Community Energy Group could look to explore this opportunity in the future.

FIGURE 22 SATELLITE IMAGE OF GATEWAY COURT

SITE INFORMATION

Gateway court is a development of four blocks of flats, comprising fifty-eight properties. The court has a postcode of DE4 3TP.

From a desk-based study, the roof appears to be in good condition and suitable to host solar PV. It is unlikely that the roof will be subject to shading from surrounding trees and buildings. However, the age of the roof needs to be considered due to warranty conditions, as well as the surface material of the roof.

TABLE 9 AVAILABLE ROOF AREA AND GENERATION CAPACITY OF GATEWAY COURT

Potential roof area (m^2)	Potential electricity generation (MWh)
1,000	108

A.5 VICTORIA COURT

As one of the secondary sites, Victoria Court was analysed at a high level, evaluating the potential system size available. This site was rejected due to lack of engagement within the project timescales. If required, the Community Energy Group could look to explore this opportunity in the future.

SITE INFORMATION

Victoria court is a retirement housing development comprised of sixty-four flats. Theo site also boasts communal areas such as a lounge, laundry room, and a garden. The court has a postcode of DE4 3QB.

From a desk-based study, the roof appears to be in good condition and suitable to host solar PV. It is unlikely that the roof will be subject to shading from surrounding trees and buildings. However, the age of the roof needs to be considered due to warranty conditions, as well as the surface material of the roof.

Table 10 Available roof area and generation capacity of Victoria Court

Potential roof area (m^2)	Potential electricity generation (MWh)
800	83

Figure 23 Satellite image of Victoria court

A.6 DENEFIELDS COURT

As one of the secondary sites, Denefields Court was analysed at a high level, evaluating the potential system size available. This site was rejected due to lack of engagement within the project timescales. If required, the Community Energy Group could look to explore this opportunity in the future.

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FIGURE 24 SATELLITE IMAGE OF DENEFIELDS COURT.

SITE INFORMATION

Denefield court is a retirement housing development which hosts fifty flats. The site also includes a communal lounge, laundry, community centre, and activity room. The postcode for the site is DE4 3EY.

From a desk-based study, the roof appears to be in good condition and suitable to host solar PV. It is unlikely that the roof will be subject to shading from surrounding trees and buildings. However, the age of the roof needs to be considered due to warranty conditions, as well as the surface material of the roof.

TABLE 17 AVAILABLE ROOF AREA AND GENERATION CAPACITY OF DENEFIELD COURT

Potential roof area (m^2)	Potential electricity generation (MWh)
900	116

APPENDIX B – FINANCIAL MODEL

Attached as a separate spreadsheet.

APPENDIX C – EV CHARGING

The effect of moving to an electric fleet at the two chosen primary sites was investigated during the study. In 2019, transport in the UK was responsible for 122MtCO2e of emissions. Electric Vehicles (EVs) provide an additional route to decarbonisation. With improved technologies the arguments for businesses to switch to an electric fleet of vehicles has never been stronger. The prospect of switching to an electric fleet is considered for Twigg Stores and Highfields Upper.

Based on our understanding of the Matlock area, there is relatively little public EV charging infrastructure in the town. As this feasibility study is primarily focused on the installation of PV systems at both the Twigg Stores and Highfields Upper sites, it was decided to model the impact of transitioning to electrical vehicles and how this would affect the site's electricity consumption, and relative carbon emissions.

First, an investigation into the sites current vehicle fleet was undertaken. The combined annual mileage of each sites fleet was then calculated and converted to kWh equivalent for an electric fleet case. This was then compared to the fossil fuel case. The electric vehicles are assumed to be only charged on-site; this means any EV charging will directly affect the electricity consumption at each site.

This electricity consumption analysis is not included within the main body of the report nor within the financial model.

TWIGG STORES

Twigg Stores owns and operates three diesel fleet vehicles on a daily basis. These include two Transit large vans for deliveries, and a smaller van for site visits, deliveries, and breakdown cover. The combined mileage of these vehicles is approximately 75,000 miles (120,700km) per annum.

Assuming these vehicles emit an equal amount of CO2/km (158.4g/km). The total tailpipe carbon emissions of these three diesel fleet vehicles are approximately 19.1tCO2e/yr.

Assuming the new electric fleet is comprised of three identical electric vehicles, with ability to travel 4.6km per kWh (Vauxhalls evaro-e), the additional annual consumption due to EV demand would be 26.2MWh/year.

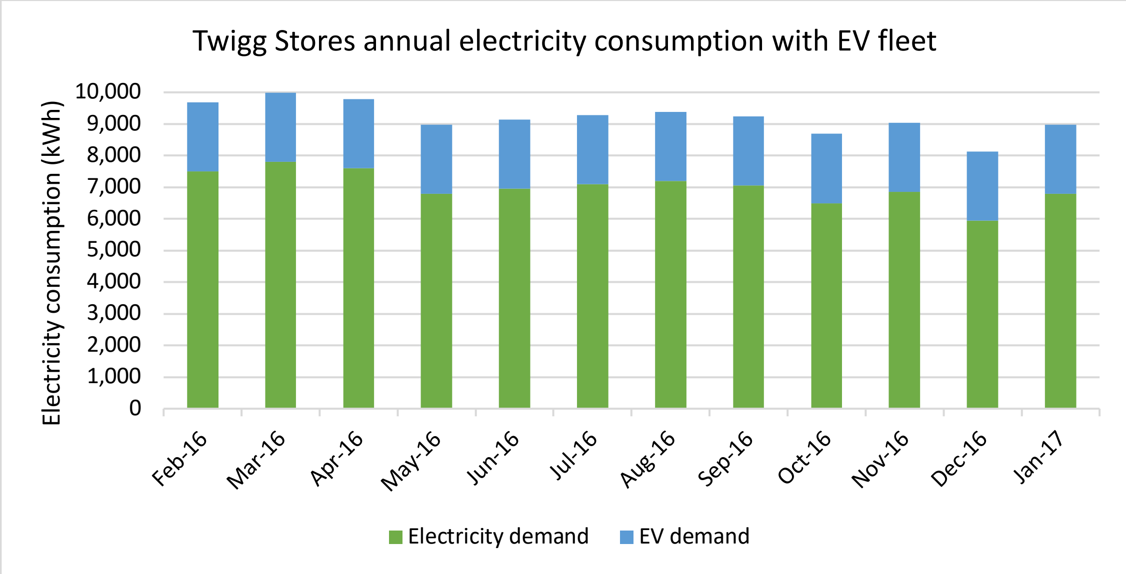

FIGURE 25-TWIGG STORES ELECTRICITY DEMAND WITH EV FLEET

As Twigg operates all year round, this can be modelled monthly. The increase in monthly consumption would be approximately 2.2MWh/month, representing an increase of between 29%-37% in monthly energy consumption

HIGHFIELDS UPPER SCHOOL

Highfields upper school operates a single school diesel minibus during the school term. This minibus periodically takes pupils on school trips around the UK. The school minibus travels approximately 5,000 miles (8,047km) in a single school year.

Assuming the minibus emits CO_2 at a slightly higher rate of 200g/km. The total tailpipe carbon emissions of the diesel minibus is approximately 1.6tCO_2e/yr.

Assuming the new electric minibus is, with the ability to travel 3.4km per kWh (LDV EV80), the additional annual consumption due to EV demand would be 2.4MWh/year.

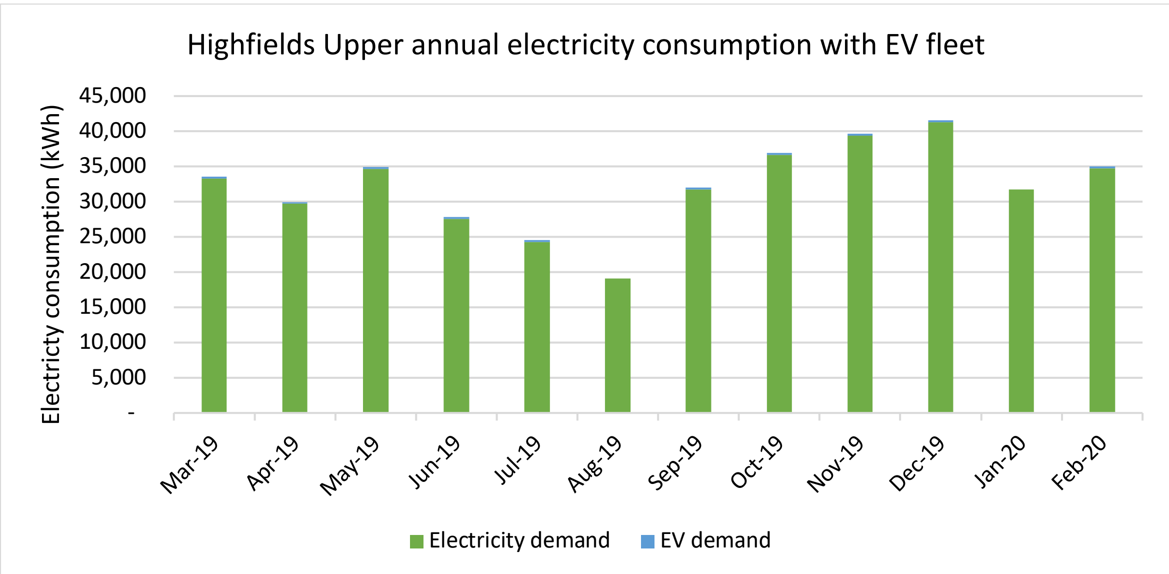

FIGURE 26-HIGHFIELDS UPPER ANNUAL ELECTRICITY DEMAND CONSUMPTION WITH EV FLEET

This vehicle is only used during term time and not during summer or winter holidays. Electric vehicle consumption has therefore been modelled across 10 months of the year (August and January have been discounted) with additional monthly consumption therefore being 0.24MWh/month, representing an increase of around 1%-2% in monthly energy consumption.

The effect on electricity consumption of transitioning to EVs would be far less for the Highfields site. Firstly, there is less overall EV electricity demand due to only one vehicle and less mileage. Secondly, the EV demand is being modelled against a much larger site electricity consumption so there is a smaller percentage increase in overall monthly energy consumption.

APPENDIX D – DEVELOPING A COMMUNITY ENGAGEMENT PLAN

One of the most important elements of a community led project is ensuring that the local community is as engaged as possible and at all stages. Community engagement should be representative and involve as many groups and stakeholders as possible from across your community. There are multiple benefits of developing a meaningful and robust community engagement process. It can:

- Provide the opportunity to learn from your community's experience about a particular issue;
- Identify potential project partners at an early stage:
- Shape a project that best meets the needs and aspirations of your community and gives the community a say in decision making;
- Ensure that there is good community buy and support, which will be essential for the success of your project;
- Recruit volunteers and supporters to your project who will be vital to ensure that the project develops and progresses;
- Help build momentum and motivation for a project. The more people have an interest in a project the more it will help move it along;
- Raise project finance through community share raises that may be required as part of your project financing strategy.

According to the National Standards for Community Engagement there are seven Standards for community engagement which have been designed to inform good practice. Referring to these standards will help guide your community engagement process and ensure it is effective as possible. The Standards are:

- Inclusion – identify and involve all the people affected by the project;
- Support – identify and support any barriers to participation;
- Planning – ensuring there's a clear purpose for engagement, including an identified timescale;
- Working together – working effectively together to achieve the aims of the engagement;
- Methods – the methods used are fit for purpose;
- Communication – communication is clear and regular;
- Impact – the impact of the engagement is regularly reviewed to inform any improvements that could be made.

At an early stage of your project you should start to develop a community engagement plan, which will help you design and deliver your community engagement process and ultimately help achieve your desired project outcomes. The plan is not set in stone and can be iterative as your project develops. As a minimum, your engagement plan should include the following:

- Project aims: You should be clear about what you want to achieve from your project: in this case community owned renewable schemes;
- Aims of engagement process: what do you want to get out of community engagement? For example recruiting volunteers, assessing appetite for community investment etc.
- Stakeholders: identify your key stakeholders through a mapping process.
- Engagement methods: consider the best approaches to engaging your community. You could use a mix of methods including: public meetings, focus groups, local media campaign, surveys, leaflets / posters etc. You could also consider the existing groups and networks within your community and use them as routes to engagement.
- Timeframes: think about how long the process will take and develop milestones to work towards. Is there a good time to consult e.g. can you piggyback off existing community events in the calendar? Consider what is realistic with the resources you have available. This is likely to change as the project progresses so your plan can be updated accordingly.
- Action plan: taking the above thinking into account, you can set out an action plan that details what you are going to do, who will do it and in what timeframe.

Your engagement plan should be reviewed and updated regularly as your project progresses to consider your changing circumstances.

APPENDIX E – STAKEHOLDER MAPPING SHEET

Attached as a separate spreadsheet

APPENDIX F – POTENTIAL SOUCES OF GRANT FUNDING

Organisation	Grant	Description	Parameters
Midlands Energy Hub	RCEF Stage 2	Business development grants to get projects investment ready.	Grants of up to £100k
Foundation Derbyshire	General Fund	This fund supports a broad range of small community and voluntary groups with a variety of different costs. As with all of the Foundation's funds the overarching purpose of each grant we make is to enhance the quality of life for people living in Derbyshire communities	Grants of up to £2,000 for capital or revenue costs
	Derbyshire Volunteer Fund	The fund has three strands: 1) Volunteer recruitment, training and retention; 2) Training for staff and committee members to enhance the community group / charities efficiency or quality of service and 3) Projects working to increase communication and networking opportunities	£2,000 capital (non-building) or revenue costs
Devonshire Group Estate	Duke of Devonshire Charitable Trust	Grant making family charity providing assistance to charitable causes and projects in areas which are local or relevant to Chatsworth, Bolton Abbey and the other Devonshire Group estates.	Grants of up to £10,000 for projects that can be delivered in a single year
Open Gate	Open Gate Trust	A small charity based in the North Midlands that supports grassroots environmental, land-based and sustainable projects to benefit local communities	Grants of between £500 - £2,500
Derbyshire Dales District Council	Local Projects Fund	A grant scheme to support community led initiatives	Grants of £900 for small capital or short term revenue expenditure