Harbury Future Energy

Electric Vehicle Charging Station Project

July 2020

Feasibility Report

Greenwatt
sustainable transport solutions

RURAL COMMUNITY ENERGY FUND

Department for Business, Energy & Industrial Strategy

ENERGY HUB

Department for Environment Food & Rural Affairs

Acknowledgements:

The Consultants wish to acknowledge the assistance and guidance provided by a number of companies and organisations in the compilation of this Feasibility Report. These include Harbury Future Energy Steering Group; Eaton Electrical; Octopus Energy; EO Charging; Eaton Green Motion; Co-Charger; Actemium; Western Power Distribution; Stratford District Council Planning Department; Stirling Council.

Consultants' Note:

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Contents

Executive Summary

Harbury Future Energy / e-Wheels ~ Community EV Charging Station

The village community of Harbury in South Warwickshire has built up an impressive record of introducing sustainable energy projects – evidenced by the Harbury Energy Initiative http://www.harburyenergy.co.uk.This has included the establishment in 2016 of a community car club using electric cars (EVs); the development of the e-Wheels initiative providing a voluntary transport service using car club EVs for members of the community; a network of solar PV and battery storage systems on several private households and community buildings; the installation of renewable technologies (solar PV panels and battery storage) on public buildings including the village hall and primary school.

The community's next ambition – to be realised through Harbury Future Energy (HFE) and e-Wheels – has been to identify the technical feasibility of providing **a community EV charging station** providing rapid and fast charging facilities in the village powered as much as possible by on-site renewable energy (wind and solar) with battery storage and mains grid back up. One direct benefit of this would be to enable the e-Wheels community EV fleet to operate on a renewable electricity supply. It will also provide a local EV charging outlet for those residents who do not have access to off-street parking, or who need a faster charge than may be possible from home, or who live in rented properties. The project sits well with the Harbury village community's mission to improve local air quality and reduce greenhouse gas emissions from transport.

A feasibility study has been prepared which examines the various technical solutions available, the level of integration of renewable power generation, the ease of grid connectivity, the operational consequences and the financial viability of providing a public access EV charging station that can service the village and surrounding Warwickshire settlements. This could provide an important community pilot for market towns and rural locations to ensure energy resilience and service provision needed for EV charging.

The Study carried out by Warwickshire low carbon consultants Greenwatt Technology and funded through the Rural Community Energy Fund covered the following sections:

- Electric vehicle charging solutions
- Local demand for EV charging
- Technology review
- Pre-planning investigation
- Grid connectivity and capacity
- Financial and operation modelling
- Community engagement

Feasibility Study - Summary of Results August 2020

1. Harbury is a large rural village in South Warwickshire, population of approximately 3,000 people and 1,400 households. The forecast growth of electric vehicles (EVs) over the next decade will require charging points in rural locations such as Harbury that do not always represent a strong commercial case for investment.

2. This feasibility study represents the commitment of a highly motivated rural community group to develop the Harbury Future Energy (HFE) project which aims to provide electric vehicle (EV) charging facilities in the village accessible to all.

3. Data related to usage and demand for fast and rapid EV charging in rural areas is sparse and deserves more attention to ensure rural communities are not disadvantaged. This raises the issues of 'social equity' and accessibility as an integral part of the transition to EVs.

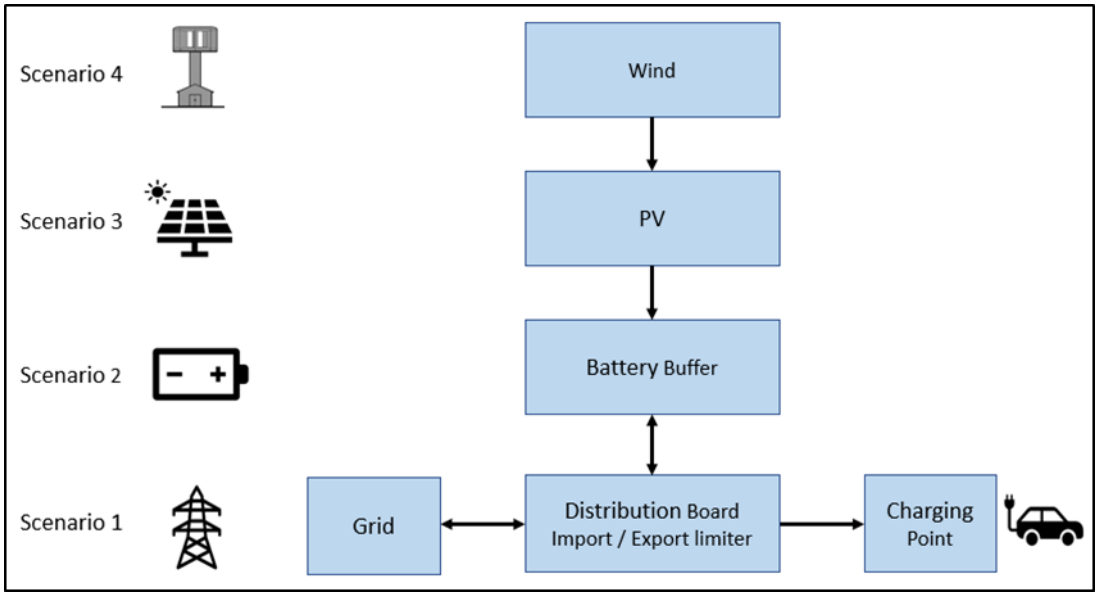
4. The proposed location for the EV charging station would be on an extension to the Harbury village hall car park, providing charging bays for six EVs of which two will service the e-Wheels fleet. The proposed layout below shows the various technical options that could be deployed:

5. A preliminary grid connection assessment by the Distribution Network Operator (Western Power Distribution) has confirmed there is sufficient capacity at the local sub-station to operate four 22kW fast chargers and one 50kW rapid charger solely from the grid. Other rural settlements are less fortunate and require alternative technical solutions to power EV charging stations e.g. battery and renewables.

6. The HFE Steering Group was keen to investigate how on-site renewable energy and battery storage technologies might contribute to a sustainable and resilient power source for EV charging.

7. An options analysis examined the sourcing of power for the EV charging station and resulted in the following scenarios:

   Scenario 1: using electricity directly from the grid
   Scenario 2: using off-peak electricity from the grid and stored onsite in a battery
   Scenario 3: using off-peak electricity from the grid plus solar energy stored in a battery
   Scenario 4: using off-peak electricity from the grid, solar and wind energy stored in battery



8. The EV charging station at Harbury could operate without renewable technology and draw power entirely from the grid using 'green' energy and off-peak tariffs from the mains grid (Scenario 1) - representing the lowest start-up cost.

9. An integrated battery would buffer supply and demand and provide the opportunity to store off-peak mains power as well as renewable electricity generated onsite. However, battery technology significantly increases the capital cost of infrastructure and could be regarded as a 'retro-fit' solution once demand increases and the cost / benefit ratio improves.

10. It is possible to install 12.6kW of solar photovoltaic panels (PV) on the village hall extension roof would provide a cost-effective but relatively small contribution to the EV charging station power demand. However, the solar energy profile is seasonal and on its own, will not necessarily match the demand profile.

11. The inclusion of a 7kW vertical axis wind turbine suitable for this village location would also provide a relatively small contribution to the EV charging station demand. This innovative turbine design brings some technical advantages over traditional systems and its annual generation profile especially in winter months provides a balance for the solar generation. As the wind turbine would add significantly to the capital cost of infrastructure, it could be regarded as a 'retro-fit' solution.

12. The study has highlighted the challenges faced by rural communities in ensuring availability of local EV charging facilities whilst mitigating the risks of high capital set up costs against initial low returns until EV ownership and local demand for EV charging increases.

13. The start-up capital costs of the HFE project including car park are high if battery storage and renewables are included. A phased and incremental approach with future proofing measures included at the outset would match EV charging demand and the availability of capital funds.

14. The potentially low and uncertain revenue forecasts from the EV charging station in the early years will require some operational cost support until user demand increases to ensure the project's long term financial viability.

15. A pre-planning enquiry including the wind turbine, car park, EV charging station, battery and power container gained the preliminary written support from Stratford District Council Planning Officers – subject to site investigations, evidence and public consultation.

16. The HFE project has the support from Stratford District Council and Warwickshire County Council who are seeking solutions to the provision of EV charging infrastructure in similar rural locations and communities. It also has the full support from Harbury Parish Council (landowners) and Harbury Village Hall Committee (hosts).

17. The HFE proposal includes wider community benefits such as an extended village hall car park and a sports field equipment store as part of the wind turbine structure. It supports the carbon reduction and clean air objectives of Harbury Energy Initiative and the community.

18. The structure of Harbury Energy Initiative / e-Wheels needs further examination to determine the organisation's level of ownership, responsibility, management and operation of the EV charging station. This might require a change of status to a Community Interest Company (CIC) – designed for social enterprises that want to use their profits for the public good.

19. The next stage of the HFE project development should aim to confirm and adjust the technical proposals outlined, refine the demand and revenue forecasts, update cost estimates, carry out investigations necessary for a detailed planning application, identify suitable capital / revenue funding sources, identify organisational structure, develop a marketing plan to increase awareness and demand, and deliver an investment ready project.

20. This feasibility study has shown that Harbury provides a good location, a committed community and a suitable development platform to demonstrate the technical feasibility, further assess the financial viability, and deploy innovative solutions to deliver the necessary EV charging infrastructure for rural communities and more isolated settlements.

1. Feasibility Study Background

1.1 Project Background

Harbury e-Wheels is a charitable company limited by guarantee established in 2015 as part of Harbury Energy Initiative (HEI) to provide a community transport service. The scheme uses two electric cars (EVs) and operates within a 15 mile radius of the village. It provides a valuable service in the absence of limited public transport for families and individuals who have special need of such a service because of their youth, age, health or disability and are prevented from reaching important and sometimes vital appointments for financial or physical reasons.

E-Wheels is staffed entirely by 24 volunteers (coordinators, drivers, board members) and works with local social agencies: surgeries and hospitals, Children's Centres, Citizens Advice, Age UK, churches and local councils. The voluntary organisation operates the service at no cost to the beneficiary or the social agency that refers them. Its purpose is to reduce rural isolation and enable local support agencies to deliver their services effectively. The community scheme combines social and environmental benefit.

To expand upon the sustainability of their voluntary service and reduce costs, Harbury e-Wheels has established the Harbury Future Energy (HFE) project. This initiative aims to provide an electric vehicle (EV) charging facility powered by green energy (solar, wind and mains grid) located in the centre of the village. The proposal will meet the current and future demands of the e-Wheels fleet and also service those residents, businesses and passing motorists needing fast and rapid EV charging. Battery storage technology provides the option to store the intermittent generation from onsite solar and wind energy sources as well as taking advantage of off-peak green energy. An export limitation system (ELS) will be installed to manage grid capacity restrictions.

A Harbury Future Energy steering group has been constituted and meets regularly to consider the opportunities and challenges of installing a village EV charging station. The HFE steering group is made up of village residents who have considerable experience across a range of technical and management sectors and have an impressive track record of raising funds and bringing energy innovation projects to Harbury for the benefit of the local community.

1.2 Summary of the feasibility study findings

A robust and accessible EV charging infrastructure will be a critical factor in the transition to electric vehicles (EVs) over the next 10-15 years – in line with the Government's declared ban on sales of petrol and diesel powered cars by 2035. The business case for commercial investment is not robust in less populated rural areas – due to the lower user demand and the increased capital costs of generation and grid balancing infrastructure. New approaches to design, finance and operation of local charging systems will be required to service the future demands of rural settlements such as Harbury to combat the risk of potential market failure.

This feasibility study reviews the various options and scenarios possible to meet the objective of Harbury Future Energy to install a public access fast and rapid EV charging station powered as much as possible by locally generated renewable electricity.

The study considers the contribution that renewable energy technologies could make. It examines the options of installing solar photovoltaic (PV) and wind turbine technologies integrated with battery storage to provide a locally-generated source of sustainable power for the EV charging station. Due to the local concerns surrounding 'conventional' wind turbine installation in this central village location, the study focuses upon an innovative vertical axis wind turbine (VAWT) and outlines the several benefits of deploying this omni-directional turbine technology.

One of the main findings of the study and modelling activity is that due to the power demands of fast and particularly of rapid EV charging and the limited space for on-site renewable energy generation, the bulk of the electricity required will still need to come from the mains electricity supply. In order to meet Harbury's sustainability credentials, mains power should utilise 'green' energy off-peak tariffs.

The integration of battery storage technology would provide a buffer between varying levels of EV charging demand and the intermittent and seasonal renewable power generation from solar and wind. Due to the capacity restrictions of the electricity distribution network servicing the village, an export limitation system will be incorporated restricting export to the grid to a maximum of 56kW. However, the on-site generation and storage system should be designed to meet demand capacity and not to export as this represents better value for money. Grid capacity is a particular feature of rural settlements and this study should provide useful information to other rural community groups with the similar ambition of providing a local EV charging facility.

A financial modelling exercise based upon four technical scenarios has been carried out. Capital costs - in particular related to the three scenarios involving local renewables and a battery - are high. This reflects the innovative technologies proposed and their integration. These require further analysis and value engineering. Due to these high capital costs, the relatively low EV user baseline and the uncertain growth in EV charging demand profile, the return on capital investment for the EV charging station is difficult to predict and will take time to build. Public and external funds will be required to avoid the risk of 'market failure' in ensuring provision of EV charging in rural settlements such as Harbury.

Gaining local approval both formally (planning authority) and informally (local community) is critical to a successful implementation of any community energy project. A detailed pre-planning enquiry report outlining the technical and spatial proposals has been prepared as part of the Stage 1 pre-engineering study. It is available as an Annex to this report and has been submitted to the local planning authority (LPA) to gain feedback and ascertain the likelihood of gaining full planning approval for measures and technologies proposed should the project proceed. Following appraisal and online discussions, the LPA has provided a written response (Appendix 14) which is generally supportive of the Harbury Future Energy ambitions and proposals outlined in this Feasibility Study. It lists the necessary planning requirements, documentation and evidence needed should a full planning application be submitted.

Community engagement is central to the successful implementation of rurally-located projects especially where the commercial case for investment in technology is not prominent. The study examined local demand through an online survey - with the positive outcome of 180 households responding - representing 15% return. It is clear that there is considerable support for the HFE EV charging station initiative, with feedback demonstrating the level of current EV ownership and future EV mobility and charging intentions. Subject to easing of Covid-19 restrictions, a community engagement event will be held during Autumn 2020 to disseminate the findings and results, to gather feedback and to confirm local intentions to proceed with the Harbury Future Energy initiative.

1.3 Harbury Future Energy – a case study

Harbury is a large village in South Warwickshire with an active community committed to low carbon and renewable energy activities https://www.harburyenergy.co.uk/. Their latest initiative 'Harbury Future Energy' is to provide a public access electric vehicle charging facility in the village to meet the growing demand from residents, local businesses and visitors. This reflects the forecast growth in electric vehicle (EV) sales and usage over the next decade and the UK Government's declared ban on new sales of petrol and diesel cars by 2035. The charging station would encourage the uptake of EVs in the village, lower fuel costs for the Harbury e-Wheels community transport EV fleet and result in a cleaner environment.

Rural settlements like Harbury often do not represent a strong commercial case for capital and infrastructure investment in power upgrades and EV charging provision due to lower population density levels. Left to market forces, there is the risk that this could lead to 'market failure' without intervention from the local community and councils.

A feasibility study funded under the Rural Communities Energy Fund (RCEF) uses scenario analysis and modelling to identify the practical and financial viability of installing EV charging infrastructure in rural settlements. The study outlines the various technical solutions possible e.g. rapid and fast charging; the likely issues to be encountered e.g. grid load restrictions; the potential of battery storage; and the opportunities to use locally generated renewable electricity i.e. solar and wind. An EV demand survey was carried out amongst residents of Harbury village which revealed strong support for a public access EV charging station. A pre-planning enquiry to the local planning authority gained positive feedback and the project also attracted the support of parish, district and county councils eager to identify solutions to rural EV charging infrastructure.

Bob Sherman, chair of Harbury e-Wheels who are coordinating the project says:

"In Harbury we are keen to play our small part in the global need to cut carbon emissions drastically. We also strive to keep our village up with developments on carbon and pollution reduction measures in urban areas. For us the transition to electric and other non-fossil fuel transport presents a special challenge that will be slow to be addressed in rural areas through official channels. Personal transport is important to rural residents and is not replaced by inadequate public transport services. Those without personal off-road parking space will find electric vehicles highly inconvenient unless there are publicly available local charging facilities. We are, therefore, really excited at the prospect of delivering such a scheme in rural Warwickshire as a possible model for other rural communities."

2. EV Drivers for Change

2.1 Electric car market statistics

The electric car market is growing[1]. The most recent set of figures[2] from the Society of Motor Manufacturers and Traders (SMMT 2020) show significant growth in EV sales (battery EVs and mild hybrid / plug in hybrids) over the last 12 months. This growth has continued in 2020 with BEVs in May proving the only fuel type to see growth in new car sales during the Covid-19 lockdown period – and sales of BEVs in the period January to May up more than 60% compared to the same period in 2019. This suggests that people are more aware of the benefits of cleaner air and low emission personal transport and intend to make a permanent move to ultra-low emission models.

Year to date

	YTD 2020	YTD 2019	% change	Mkt share -20	Mkt share -19
Diesel	95,946	282,059	-66.0%	18.9%	27.0%
Petrol	304,712	676,213	-54.9%	60.0%	64.7%
BEV	22,054	9,514	131.8%	4.3%	0.9%
PHEV	14,582	12,866	13.3%	2.9%	1.2%
HEV	29,089	40,421	-28.0%	5.7%	3.9%
MHEV diesel	17,991	7,301	146.4%	3.5%	0.7%
MHEV petrol	23,751	17,450	36.1%	4.7%	1.7%
TOTAL	**508,125**	**1,045,824**	**-51.4%**		

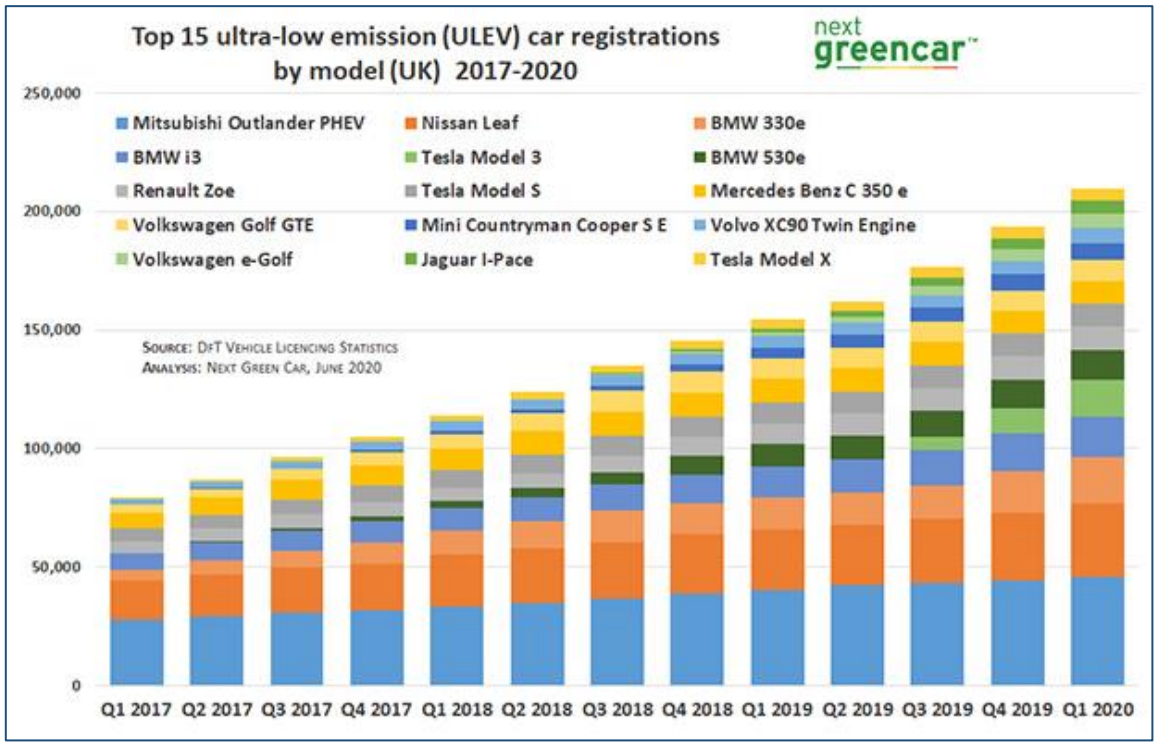
BEV - Battery Electric Vehicle; **PHEV** - Plug-in Hybrid Electric Vehicle; **HEV** - Hybrid Electric Vehicle, **MHEV** - Mild Hybrid Electric Vehicle

This data demonstrates the strength of the pure-electric car market. Where PHEVs have on average made up at least two-thirds of all plug-in cars sold since 2015 - and sometimes as much as three-quarters - since March 2019, that position has switched to EVs being the dominant powertrain type.

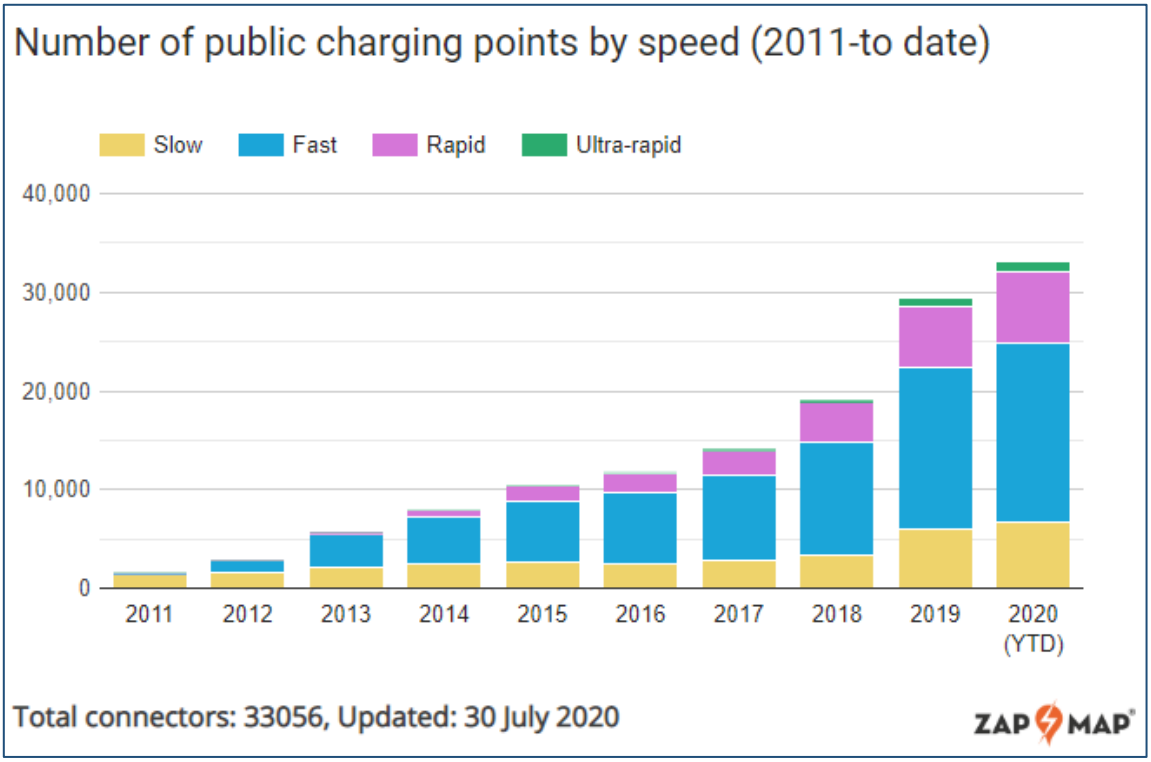
Looking forward there are clear indicators of the need to respond to the forecast growth in EV deployment. A recent report[3] from Scottish and Southern Electricity Networks (SSEN) suggested that *"electric vehicle ownership will increase from 44,000 to five million in the south of England and north of Scotland".* SSEN has committed to invest in its network infrastructure to support its forecast 10 million EVs on GB roads by 2030.

Increasing choice of electric vehicles models in the UK - Previous experience of introducing new technologies into the automotive market shows that having a broad range of models and body styles is key to ensuring strong uptake of new power-trains. With the large number of brands and classes now available, the EV market in the UK has a strong base on which to continue to grow.

[1] Adapted from Next Green Car March 2020
[2] https://www.smmt.co.uk/vehicle-data/evs-and-afvs-registrations/
[3] http://news.ssen.co.uk/news/all-articles/2020/march/ssen-publishes-electric-vehicle-strategy-with-customers-and-stakeholders-at-its-heart/



EV Charging points - The increase of EV charging points is also on an upward trend as demand grows. The graph below from ZapMap[4] shows an increase in installations across the full range of slow (3.3kW), fast (7 and 22kW AC) and rapid (50kW DC) chargers. There is an emergence since 2018 of 'ultra-rapid' (100kW – 350kW DC) representing the next generation of rapid chargers which are able to keep recharging times down despite the increased battery capacities and range of high power EVs.



[4] https://www.zap-map.com/statistics/

2.2 Government actions influencing EV uptake

Low emission vehicle grants [5]

Vehicles with CO2 emissions of less than 50g/km and can travel at least 112km (70 miles) without any emissions at all can get a grant of up to £3,000 on the price of a new vehicle.

Grants for charge point infrastructure in homes [6]

The Electric Vehicle Homecharge Scheme (EVHS) provides grant funding of up to 75% towards the cost of installing electric vehicle charge points at domestic properties across the UK (up to £350 grant from 1st April 2020)

Grants for charge point infrastructure in businesses

The Government offers businesses, organisations, charities, and local authorities financial support to have charge points installed at their premises under the Workplace Charging Scheme (WCS).The grant provides up to £350 per socket at 75% of the total cost of installation – up to a maximum of 20 sockets – to be installed on dedicated off-street parking for staff, visitor, or fleet use.

Clean air zones[7]

The Government is introducing Clean Air zones (CAZ) in Birmingham, Coventry and Leicester (delayed until after COVID 19) A Clean Air Zone is defined an area where targeted action is taken to improve air quality. It can be confined to a single road or a part of a city which vehicles can be charged or fined for entering.

Green number plates for EVs from Autumn 2020 [8]

The UK Government has confirmed that green number plates are set to be rolled out from autumn as part of a wider plan to promote low emission transport and drive a green economic recovery following the economic impacts of covid-19.

As part of the government's plans to achieve net zero emissions by 2050, drivers will be encouraged to make the switch to electric vehicles through the introduction of green number plates. The plates will make it easier for cars to be identified as zero emission vehicles, helping local authorities design and put in place new policies to incentivise people to own and drive them.

For example, drivers could benefit from local initiatives such as cheaper parking and cost-free entry into zero-emission zones where those with a green number plate will be recognised as eligible. The plates will be identifiable by a green flash on the left-hand side and will be available for zero emission vehicles only.

[5] https://www.gov.uk/plug-in-car-van-grants#:~:text=Low%2Demission%20vehicles%20eligible%20for%20a%20plug%2Din%20grant,to%20vehicle%20dealerships%20and%20manufacturers.&text=The%20maximum%20grant%20available%20for%20cars%20is%20%C2%A33%2C000.

[6] https://www.gov.uk/government/collections/government-grants-for-low-emission-vehicles

[7] https://www.birmingham.gov.uk/info/20076/pollution/1763/a_clean_air_zone_for_birmingham/2

[8] https://www.gov.uk/government/consultations/introduction-of-green-number-plates-for-ultra-low-emission-vehicles/outcome/green-number-plates-for-ultra-low-emission-vehicles-government-response

Stratford on Avon District Council Climate Action Emergency plan[9]

In February 2020, SDC councillors approved an action plan to tackle climate change with the aim of making the district carbon neutral by 2030. The 'Roadmap to 2030' was agreed by the Cabinet and follows the council's declaration of a climate emergency last summer.

Green measures within the action plan include investigating ways of making all licensed taxis electric, ultra-low or zero emission vehicles by 2030; developing a program to improve home insulation in the district; and appointing a dedicated climate change officer at the council. Other measures include holding an annual climate summit in the town, creating a district-wide tree planting scheme and helping residents to install renewable energy improvements such a solar panels through a bulk-buy scheme.

This Plan will enable the Council to be carbon-neutral by 2025 and help the district to also be carbon-neutral by 2030. In order to meet the declared climate emergency targets, it will be important to implement energy, buildings and transport solutions whilst actively addressing the need for behavioural change within the District's business, institutional and residential communities.

Note: Stratford District Council are strong supporters of the Harbury Future Energy project – evidenced by their staff inputs to this study, the waiving of pre-planning enquiry fees and their letter of support (Appendix 11). The Council has a keen interest in finding solutions for rural EV charging infrastructure provision across Stratford District.

Warwickshire County Council EV Charging Infrastructure Strategy[10]

Through this Strategy, the County Council show their commitment to the development of a county-wide charge point strategy and infrastructure that is 'fit for purpose, that represents good value for money, and responds directly to the increasing expectation and demand for a network of public access EV charge points'. Their vision statement states:

> *'Warwickshire County Council will provide the infrastructure necessary to enable residents, businesses and communities to use electric vehicles every day and for any purpose. Electric Vehicle Users will be confident that they will be able to recharge their vehicles quickly and conveniently, taking advantage of their lower cost operation and in doing so making a major contribution to air quality in the County through reduced emissions from road transport.'*

The County Council's support for initiatives such as Harbury Future Energy (Appendix 11) is reflected in the measures adopted to support the transition to EV designed to ensure accessible charging infrastructure is in place for all residents and businesses:

> *'The Council will facilitate innovation and the development of EVs and associated technologies by working with local companies and organisations to provide opportunities to test and develop technologies in local towns, rural areas and the highway network.'*

[9] https://www.stratford-herald.com/106225-district-council-agree-climate-change-action-plan.html
[10] https://apps.warwickshire.gov.uk/api/documents/WCCC-930-349

2.3 Wider vision and policy support

The UK Government has demonstrated a renewed and expanded commitment to transition to low emission vehicles – and transport electrification in particular. A Budget Statement on Rapid Charging Infrastructure was issued in July 2020[11]:

> *'Road transport is responsible for 91% of domestic transport emissions, and around a fifth of overall UK emissions. To support drivers to move away from polluting vehicles, the Budget announces investment in electric vehicle charging infrastructure, which will ensure that drivers are never more than 30 miles from a rapid charging station, provides £532 million for consumer incentives for ultra-low emission vehicles, and reduces taxes on zero emission vehicles.'*

Other useful references to the wider vision for EV charging infrastructure can be found at the following sites:

- https://www.gemserv.com/wp-content/uploads/2020/06/2020-06-18-Gemserv-Response-Improving-the-consumer-experience-of-using-Charge points.pdf
- https://www.gov.uk/government/publications/government-vision-for-the-rapid-charge point-network-in-england/government-vision-for-the-rapid-charge point-network-in-england

[11] https://www.gov.uk/government/publications/budget-2020-documents/budget-2020

3. Community Engagement

3.1 Neighbourhood Development Plan

The Harbury village community represents a highly motivated group of people determined to pioneer new technologies which improve their environment and reduce their carbon footprint. This is a feature strongly represented within the Harbury and Deppers Bridge Neighbourhood Development Plan, Regulation 16 Submission, November 2017 which stated (Section 3.12) that:

> *'The community recognises the part it has to play in mitigating climate change by supporting and encouraging efficient use of energy, reducing demand and lowering carbon emissions. The village group, Harbury Energy Initiative, has worked on an energy conservation programme in the village since 2010. Since then they have facilitated internal insulation of the library, cavity wall insulation for the rugby club, solar energy monitoring at the village hall and energy options reports for the church, school and two other community buildings. More still needs to be done.'*

3.2 Harbury Future Energy Steering Group

Four active members of the Harbury community came forward to volunteers their services to direct the HFE project and represent the various views and ambitions of the residents, businesses and organisations in and around the village. They represent considerable experience in the energy, technology, EV, marketing and fund raising sectors and have provided an excellent sounding board for the Consultants throughout the Project. They have been very active in promoting the HFE objectives using social media and played a big role in gaining a successful response to the EV demand user survey. Eight online Steering Group meetings have been held (due to Covid-19 restrictions) see Appendix 13.

3.3 Local council support

The Harbury Future Energy project has gained the support of the three relevant councils – Harbury Parish Council, Stratford on Avon District Council and Warwickshire County Council. All three councils have provided letters of support for the HFE initiative (Appendix 11) – with the District and the County Councils indicating the importance of identifying EV charging solutions for other sub-urban and rural locations within their domains to meet community expectation and demand.

3.4 Harbury Future Energy household electric vehicle survey

Under normal circumstances, the Consultants would have captured the interest and support of the local community through face-to-face awareness raising and information gathering events. However due to the lockdown restrictions created by Covid-19, this was not possible. Instead an online survey was carried out.

The main objective of this survey was to determine the likely demand for electric vehicles (EVs) from amongst the Harbury population and help determine the need for public access EV charging in the village – now and in the future. Results would also suggest the size and type of charging infrastructure needed to meet likely demand.

The online survey was hosted by Survey Monkey and circulated during May 2020 via a web link to engage the various community groups. Distribution of the survey link was through several community information outlets including:

- Village Facebook groups x 3;
- Harbury Energy Initiative and Harbury e-Wheels websites;
- Harbury Parish magazine
- Steering Group members' private WhatsApp groups.

Survey Results:

Harbury has 1,331 households (2015 Election Ward). In total, 180 online responses were received representing almost 15% of households.

A detailed analysis of survey results is included as Appendix 3. A summary of the key results from the residents who responded to the survey (n = 180) is as follows:

- Over 50% have two cars in their household.
- A total of 14 EVs and hybrids are identified in the village (7.2% of households responding). One household has two EVs.
- 51% of respondents felt they are well informed about EVs: 35% would like to know more.
- 63% indicated they will consider buying an EV in the next 5 years.
- 90% have off road parking space within their property (where a home electric charge point could be installed).
- 93% currently do not have an EV charge point at home.
- 92% thought it was a good idea for Harbury to have its own EV charging station for community, local business and visitor use.
- 50% of responders said they would use a rapid (50kW) charge point if they were going to use the community charging station with 16% indicating they would use a fast (7kW) charger.
- 14% of respondents would consider using charging overnight.

Discussion:

Whilst the % response received was good, the Consultants are aware that there is a strong likelihood that those residents replying do not necessarily represent a full cross-section of the village community. The results may more closely reflect those who have or will be making a commitment to drive electric over the next 5 years (63%). There is a case for wider dissemination and raising awareness.

Current numbers of EVs or hybrids are low at 14 representing 7% of all vehicles owned by those respondents – but clearly with a majority expecting to drive an EV within the next 5 years, this will increase the number of home charging installations significantly. But given the potential for home charging installation, how does this link with the prospect of a shared EV charging facility in the village – supported by 92% of respondents, and also the priority demand (50%) for a rapid charging facility?

With regard to the potential to charge an EV at home, estimates drawn from the 2011 Census indicate that 146 households in Harbury (approx. 10%) do not have off-street parking i.e. terraced homes, flats and maisonettes. Coupled with the fact that some residents will be renting properties, and those for whom the cost of installing a charge point (including Government grant) may still be prohibitive, this can only increase the demand for a public access charger in the village in coming years.

It should also be kept in mind that for those EVs with larger batteries e.g. Tesla; Jaguar i-Pace, home charging (3.3 or 7kW units) may not provide sufficient capacity to fully recharge in the time available which may further support the interest and potential usage of a rapid charging facility in the village.

3.5 Local dissemination

It was originally planned to disseminate the results of the survey and the findings of the Feasibility Study to the local community at an event as part of Stage 1 outputs. However public meetings have not been possible during the Covid-19 lockdown. It is the Steering Group's intention that assuming restrictions are eased further, then a presentation of findings should be delivered to a key stakeholder group and provide the opportunity to respond – ideally on a group face-to-face basis or if restrictions persist, then online. This feedback would inform Harbury e-Wheels' decision whether to progress to RCEF Stage 2 Engineering Study.

The stakeholder group would consist of the following:

- Harbury Parish Council
- Harbury Village Hall Committee
- Harbury Energy Initiative
- Stratford District Council
- Warwickshire County Council

Other groups and individuals within the community will receive a project update via Harbury Energy Initiative's usual communication channels i.e. social media. Harbury e-Wheels plan to organise a HFE Demonstration Day on in September 2020 (subject to Covid-19 restrictions) designed to promote EVs and outline the results of the Feasibility Study and the EV charging options to local residents and businesses.

4. Community Benefits

4.1 General benefits

The Harbury Future Energy community EV charging initiative was instigated by Harbury e-Wheels (part of the Harbury Energy Initiative) who are seeking an alternative parking and charging location for their small community transport fleet of two EVs. In line with other HEI initiatives, it is the intention to use locally generated renewable energy as much as possible to charge the fleet – with potential to add further EVs e.g. an electric minibus; e-cargo bikes and e-cycles.

The proposed EV charging station in a new location at the village hall car park will add value to e-Wheels and enable expansion of this valuable community transport service. E-Wheels is operated entirely using volunteer staff – either as drivers or as members of the management committee. Whilst this village volunteer driving force may expand (e-Wheels are continually looking for new drivers to expand the service), at the moment it is not envisaged that any new paid jobs will be created.

Residents in Harbury (approx. 3,000) are continually benefitting from the growing number of energy projects that have been implemented since 2010 – placing Harbury as one of the most active community energy groups in the Midlands. Many houses now support solar PV roof installations; some have integrated battery storage systems; the primary school and village hall have solar panels installed with the latter having battery storage benefitting the whole community. The local parish church is also undergoing structural improvements to reduce costs and carbon.

The EV demand survey of 180 households revealed that whilst a relatively small number (14) currently own and drive a battery EV (BEV) or plug in hybrid (PHEV), 63% (112) will consider buying an EV in the next 5 years. Whilst 90% stated that they had off-road parking, it is likely that the ability to charge at home will not be shared by everyone – especially those living in flats or rented accommodation in the village. There is also an affordability issue with the costs of home charge point installation representing a significant capital investment for some households even with the Government grant contribution. It is evident that as EV battery capacities increase to enable greater range, single-phase household power supplies will limit the speed of charging available, which suggests that access to rapid charging will be of growing importance.

Harbury e-Wheels and HEI are determined to raise awareness and educate residents into the benefits of driving electric – improving air quality, reducing noise pollution, lowering emissions. This will become a major feature of the Harbury Future Energy EV charging project going forward. Socialisation of electric driving is important – all residents should be able to benefit directly or indirectly from an expansion of EVs in and around the village. All households irrespective of their household income should have access to EVs whether new, second hand or leased – and have the opportunity to charge their EVs through a public access charging facility either overnight or in the daytime.

4.2 Other beneficiary groups

Open access EV charging facilities proposed would be accessible for visitors to Harbury e.g. B&B guests, friends and family visitors, suppliers to Harbury businesses, local sports clubs (tennis and football club) visitors and supporters.

The numbers of visitors to the village driving EVs are forecast to increase significantly over the next decade. These numbers will be influenced by external factors such as regulation e.g. clean air measures; low emission zones in town and city centres; local council climate emergency and action plans; increased choice of EVs coming into the market; Government encouragement and incentives to employers to switch to low emission fleet and staff vehicles; introduction of green number plates for EVs starting Autumn 2020; capital grants for EVs and charging points; changes in behaviour and travel modes; Government ban on new petrol and diesel vehicle sales (currently 2035).

4.3 Local objections

In spite of the awareness raising and demand survey amongst the Harbury community, and ahead of any formal planning application submission (Stage 2), there have been no objections to the proposals. Indeed the response from several quarters has been very positive. The public consultation event proposed for September 2020 should provide a good opportunity to explain the proposals and options and secure feedback and support.

5. Technology Options Analysis

5.1 Background to Harbury Energy

Harbury residents have been engaged in the deployment of renewable energy technologies since 2010 when Harbury Energy Initiative was formed. The stated aim of the organisation is:

'To identify challenges and find grants that enable us to help the residents and community building committees to cut carbon and reduce costs.'

This is reinforced by the following HEI objectives:

- To ensure that locally generated renewable energy is always a major consideration – building energy resilience and ensuring lower CO2 emissions;
- To encourage the adoption of electric vehicles (EVs) as they contribute to improved local air quality and reduced traffic noise;
- To raise awareness of emerging technologies such as battery storage and smart local grids and how they will enhance the opportunities for local grid balancing and energy resilience.

The installation of solar PV arrays on domestic and public buildings since 2010 has been impressive with an estimate of around 50 domestic PV installations in the village, as well as larger arrays on the local school (12kWp) and village hall (10kWp). The community is always looking for 'the next steps' for adoption of sustainable technologies. This is evidenced in the number of battery storage systems installed since 2017 - 11 domestic and one at the village hall - and the adoption of electric vehicles for shared use (EV car club) and community transport (e-Wheels).

The Harbury Future Energy Project represents the next step along the HEI pathway towards a low carbon future and the community's contribution to mitigating climate change in South Warwickshire. Transition to electric vehicles will only be successful if access to a reliable EV charging infrastructure is possible. This feasibility study considers the range of technical components possible and examines their suitability for installation in Harbury village.

5.2 Wind power

Onshore wind has been rather out of favour with the UK Government in recent years. However, there are signs that as part of the 'green' post-Covid recovery plans, renewable energy and in particular onshore wind power may have a resurgence. In March 2020, the Committee on Climate Change indicated that:

> *"In order to achieve the UK's legally-binding target of net-zero carbon emissions by 2050, our electricity supply will need to double as we electrify heat and transport, and power from low-carbon sources will need to quadruple."*[12]

[12] https://www.theccc.org.uk/2020/03/03/ccc-welcomes-government-re-commitment-to-onshore-wind-and-solar/

A new report from Thrive Renewables plc (July 2020)[13] suggests:

> *'Trade bodies for onshore wind, solar and hydro power are suggesting in total between them that 77GW of the required growth [of electricity demand] can be delivered by onshore renewables by 2035, which will require building 5.5GW of onshore renewable capacity annually. We estimate that could boost the UK economy by £28.9 billion.'*

At a local level, it is significant to note that the Stratford on Avon Core Strategy[14] for Strafford on Avon District includes policies relating to renewable energy. Policy CS.3 Sustainable Energy deals with renewable energy and specific policy in relation to wind turbines. The policy states that:

> *'Proposals for wind energy development will be supported where the impacts are, or can be, made acceptable, unless material considerations indicate otherwise.'*

Wind energy is not new to Harbury – evidenced by the now disused Harbury Windmill (still intact as a building more than 200 years after its construction) and the nearby Chesterton Windmill shown below:

The suitability of sites for capturing wind energy usually depends upon the availability of a steady wind speed. According to the NOABL wind speed database, the Harbury site has an average wind speed of around 5.3 metres per second at 10m height – which is applicable to many small scale wind turbines. Both the original Harbury and Chesteron windmills shown above operated at a suitable height to pick up in particular the south westerly winds coming up from the Avon valley and Cotswolds.

The feasibility study set out to establish the practicality and viability of installing a wind turbine on the village sports fields and in the vicinity of the EV charging station location. A number of technical options have been considered – with a comparison of vertical axis (VAWT) and horizontal axis (HAWT) turbines (Section 6 below). The Harbury Future Energy project is conscious of the merits and issues with both systems in this location – and these were illustrated within the Pre-Planning Enquiry document submitted to the local planning authority in June 2020 (presented as a separate Annex to this Study).

The Consultants were asked specifically to review the merits of installing a VAWT as this was considered to provide the most suitable option for the Harbury sports field. Keen to identify British manufacturers, an innovative West Midlands-based turbine design company McCamley Ltd was invited to provide specifications and a cost proposal (Appendix 7) in which the company outlined the benefits of their turbine.

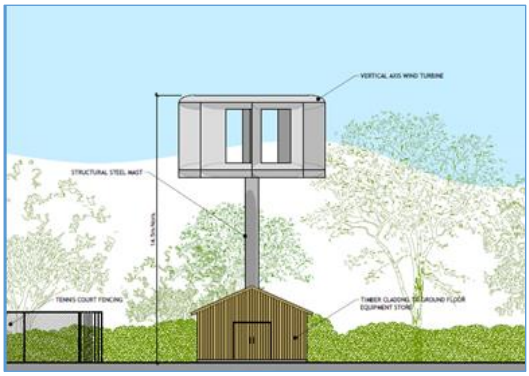
[13] https://www.thriverenewables.co.uk/media/2196/delivering-a-green-recovery-with-uk-renewable-power-final.pdf
[14] https://www.stratford.gov.uk/templates/server/document-relay.cfm?doc=173518&name=SDC%20CORE%20STRATEGY%202011%202031%20July%202016.pdf

Power rating comparisons:

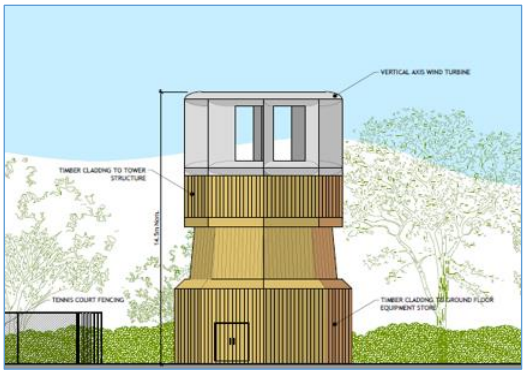
The Consultants were asked to compare and contrast other potential solutions in terms of energy generated with the preferred McCamley options. **Note:** Due to the location the Harbury Future Energy Steering Group decided to include only the McCamley VAWT in the pre-planning enquiry to gauge the planning authority's response to this innovative wind power solution for Harbury.

a) **McCamley (UK) 7kW vertical axis wind turbine (VAWT)** – this vertical axis technology designed and manufactured in the West Midlands is designed to 'capture' wind energy in locations which do not receive 'steady' air streams i.e. it can generate power in more turbulent air conditions i.e. in proximity to buildings. Prototype models of the McCamley are operating at Keele University, on the Vauxhall Tower in London and in Bulgaria. A similar 7kW turbine installation at Aston University is currently going through planning stages (July 2020). Harbury e-Wheels is keen to test this turbine technology in the rural setting of Harbury village.

The McCamley VAWT can be mounted in several structural formats – roof mounted (not suitable for Harbury), mast mounted or tower mounted (illustrated below). Whichever structure is adopted, it is important to ensure a minimum height of the turbine of 10m – the height used as a minimum by the NOABL[15] national wind speed database. **Note:** McCamley advises that their VAWT is 'omni-directional' due to its rotor-stator design and therefore less influenced by prevailing wind direction or high winds.



McCamley VAWT mast mounted



McCamley VAWT tower mounted

Analysis of potential energy generated per annum by the 7kW McCamley is included in Section 6.

b) **Antaris (Germany) 7.5kW horizontal axis wind turbine[16]** – this design mounted on a 12m mast offers similar energy outputs per annum as the McCamley VAWT but has different operational characteristics to the VAWT system as outlined above. This turbine design would produce 'flicker' from rotating blades and would require a working wind speed of 2.5m/sec to start up. However, Section 6 demonstrates that the likely installed capital cost of this type of turbine will be lower than the VAWT proposed.

[15] Numerical Objective Analysis Boundary Layer

[16] https://www.braun-windturbinen.com/products/antaris-small-wind-turbines/antaris-7-5-kw/

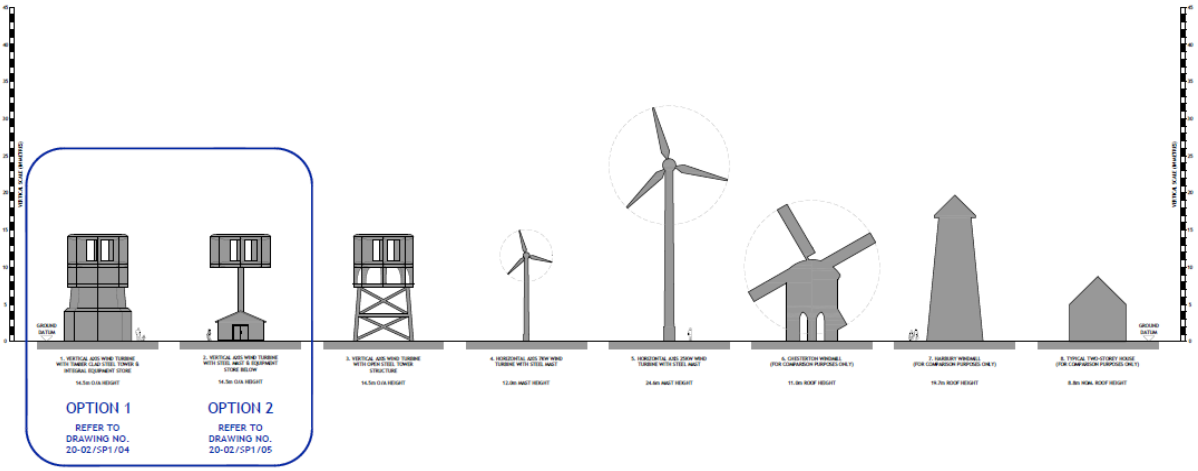
c) EO Cycle (Canada) 25kW horizontal axis wind turbine [17]

This company provide medium size wind turbines from 25kW upwards with a market aimed at farms and rural locations. The company recently erected a 25kW turbine on a farm in Shropshire – suggesting that in the right place, onshore wind power is still an acceptable option to some councils and communities. The 'wind swept area' of the blades on such a unit means a significant increase in generated power which makes it attractive as a means of powering medium to heavy demand e.g. a rapid EV charging station. However, at a mast height of 24m the location of this turbine design at Harbury playing fields is unlikely to gain local and planning approval – meaning that it would need to be located further away from the proposed location i.e. out of scope of this study. It also incurs a much higher initial capital cost – compensated however by the much higher energy generation levels.

EO Cycle 25kW installed 2019 at Sandy Lane Farm, Shropshire

Structure and height comparisons

As part of the pre-planning enquiry it was appropriate to present the differing structures and heights of the turbines compared:



5.3 Solar photovoltaics (PV)

Solar PV is the obvious first consideration with regard to renewable technologies. It presents a low maintenance solution providing solar power for 25 years or more. The business / investment case for solar power has reduced significantly since the Feed in Tariffs were removed in March 2019. The viability and return on investment on solar projects now relies upon maximising usage of the solar power resulting in energy savings. Given the intermittent and seasonal nature of solar radiation, battery storage becomes a vital part of the Harbury system.

The Study considered a number of possible options to enable solar power to contribute to the proposed electric vehicle charging facility:

[17] https://eocycle.com/our-wind-turbines/

a) **Village hall extension roof -** In 2015, a 10kW array was installed to reduce energy bills and take advantage of the Feed in Tariff (now closed to new applications). This was followed by the installation of an 18kW battery storage unit in 2018 to maximise the benefits of on-site power generation.

The village hall was extended in 2016 which provides an additional south-facing roof area suitable for solar PV installation. Site estimates (to be confirmed on technical site visit) show the potential for a 12.6kWp system with the capability to generate approximately 11,000kWh of solar electricity per annum. A structural roof load was commissioned as part of this study which has confirmed the suitability of the hall extension roof to carry the additional solar panels (Appendix 4). **Note**: As with all solar power systems, the solar electricity generation is seasonal and therefore will not necessarily match the EV charging demand profile.

Adding a further 10kWp array onto the original village hall roof below the existing solar PV array was rejected by the Village Hall Committee on the grounds that the roof structure was not designed to carry the overload of additional solar panels, and previous damage to the concrete tiles (over 50 years old) discourages further loading and activity.

Being a lower capital cost than the wind turbine options, this form of renewable electricity generation produces a much lower cost of energy than wind power. It is however very seasonal – and the generation pattern does not suit the all-year-round demand for EV charging. The mix with wind power therefore provides a more balanced renewable electricity generation profile throughout the year.

b) **Solar car port** – one option which is growing in popularity especially in car park locations is the installation of solar car ports which provide space for solar PV roofs as well as shading for parked vehicles. Details of a 10kWp solar canopy were kindly supplied by West Midland specialist installer Solisco Ltd. However this option requires not only the additional capital but also ideally a south facing solar roof aspect – which does not fit in with the proposed EV charging station and car park design. As such, this option is not included within the feasibility modelling.

c) **Ground mounted solar** – given the space available on the sports and playing field area, this may seem an obvious solution. However this option has been rejected due to the risk of vandalism and health and safety in this public area.

5.4 EV charging station

Given the main objective of the Harbury Future Energy project is to provide a public access EV charging facility in the village, the selection of appropriate hardware and software solutions is critical. Maximising the potential of local renewable energy generation might be seen as a secondary consideration as the EV charging station could operate solely with off-peak mains grid power. The DNO Western Power Distribution (WPD) has informed the study that the proposed Harbury project could be connected enabling the fast and rapid charging demand to be met either directly from the grid[18] or through a combination of grid power with battery storage and renewable generation as long any export of surplus power is restricted to 56kW. WPD's budget costs for connection are in Appendix 15.

EV charging technology is being continually developed as the need for charging infrastructure grows alongside EV user demand. Section 6 of this feasibility study has considered the likely level of charge demand now and over the next few years from the Harbury community. Whereas there is a growing amount of evidence and data related to future user demand in cities and larger urban settlements, there are very few case studies that support rural EV provision. ChargePlace Scotland[19] and Stirling Council have provided very helpful data related to the provision of fast and rapid charging provision for rural settlements. The study has also benefitted from data from a Swiss rural EV case study supplied by Eaton Electric (Section 6).

The ambition of Harbury Future Energy is to provide both fast i.e. 3-6 hr and rapid 0.5–1 hour full charge facilities in the village. The demand for rapid 'opportunity' or 'top up' charging has been reinforced by the local demand survey – where >50% of responders indicated that they would use this facility. Rather less (14%) indicated a demand for fast or overnight charging – reflecting the capacity amongst most of the responders to install 'off-street' home chargers. This might also suggest some reluctance amongst residents to park and charge their EV away from their home overnight – even given that CCTV and lighting are proposed within the project.

The demand for rapid charging is reflected in other studies such as ChargePlace Scotland. This brings power capacity issues and challenges to more rural locations such as Harbury where grid upgrade becomes an expensive solution. However, as evidenced within this study, integrated battery 'buffer' storage coupled with export limitation technology provides a solution.

5.4.1 Matching charger capacity to demand

The proposal takes a view on the current and likely future EV charging demand over the next 5 years – firstly by the installation of four fast 22kW AC chargers via a 3-phase supply. Whilst many of the current EV models cannot maximise 22kW charge supply, there are exceptions e.g. Renault Zoe. This situation is changing and newer EV models will enable faster charging than the standard 7kW chargers. The additional cost of installing 22kW as against 7kW charge points is marginal.

The installation of a 50kW DC rapid charger would meet the increasing demands of larger battery EVs – and those residents and local businesses needing a quick top-up i.e. 'opportunity charging'. It would also meet the demands of passing EV traffic – at the same time encouraging visitors to the village and its amenities. This is in line with findings from ChargeScotland that rapid charging will be the preferred choice of many EV drivers going forward – a view reinforced in the Harbury residents demand survey.

[18] Western Power Distribution import limited to 145kVA
[19] https://chargeplacescotland.org/

5.4.2 Fast Charging

'Fast' charging usually refers to either 7kW charging (AC single phase) or 22kW (AC three phase). These systems are suited to home, work or public charging locations where EVs are parked for longer periods i.e. >2 hours and can usually use the existing mains power supplied to the charging site.

As indicated above, the power that can be supplied to EVs via fast and rapid charging varies depends upon the electric vehicle model. In 2020, relatively few vehicles e.g. Renault Zoe and the Audi e-Tron are able to maximise a 22kW charge. However, a growing number of vehicles can now charge at 11kW and this trend of increased 'on board' charging capacity is likely to continue. By installing higher power fast chargers at Harbury i.e. 22kW at only modest additional costs this will 'future proof' the charging facility and provide the best user experience. It should be noted that both 7kW and 22kW chargers are rated at 32A, the difference being that the 22kW has a 3-phase rather than single phase AC supply.

5.4.3 Rapid Charging

Most EVs have the capacity to be charged using direct current (DC) power – usually 50kW – which enables a 'rapid' recharge either from empty or as top-up. Nissan indicates the following charge times using rapid and fast chargers for their 40kWh Nissan Leaf[20]

Rapid 50kW DC	Fast 22kW AC	Fast 7kW AC	Slow 3kW
40 mins 0-80% charge	6 hrs 0-100%	6 hrs 0-100%	14 hrs 0-100%

Note: EVs can only charge up to 80% full from a rapid charger in order to protect the battery and maximise efficiency whereas on a fast or slow AC charger this will provide a 100% charge refill.

EVs with larger batteries e.g. Jaguar i-Pace[21] (90kWh) require longer charging time (unless using 'superchargers' up to 150kW). It is useful to compare the 50kW charging time for these EVs below with the Nissan Leaf above:

Rapid 100kW DC	Rapid 50kW DC	Fast 22kW AC	Fast 7kW AC	Slow 3kW
45 mins 0-80%	1.5hrs 0-80% charge	13 hrs 0-100%	13 hrs 0-100%	30 hrs 0-100%

Whilst most recharging is not from empty and therefore charging times will be reduced, nevertheless the use of home chargers (usually 7kW) may not suit all EV drivers - and provides some justification for 50kW+ rapid charging outlets.

Note: The data tables above re-iterate that neither the Nissan Leaf nor the Jaguar i-Pace can gain faster charging benefit currently from accessing the 22kW AC 3-phase charging point. The 40kWh Leaf takes 6 hours using a 7kW charger and the same time on a 22kW charger due to the restricted on-board charger power @ 6.6kW. This situation is likely to change as more on-board charging flexibility is introduced into newer EV models. For example, the Audi e-Tron can charge at 22kW AC and up to 150kW DC. Other models also have greater on-board charging capacity e.g. the Vauxhall Corsa-e (11kW AC / 100kW DC) and Tesla Model 3 (11kW AC / 145kW DC)

[20] https://www.zap-map.com/charge-points/nissan-leaf-charging-guide/
[21] https://www.zap-map.com/charge-points/jaguar-i-pace-charging-guide/

The main issues related to the installation of a rapid charger in Harbury are:

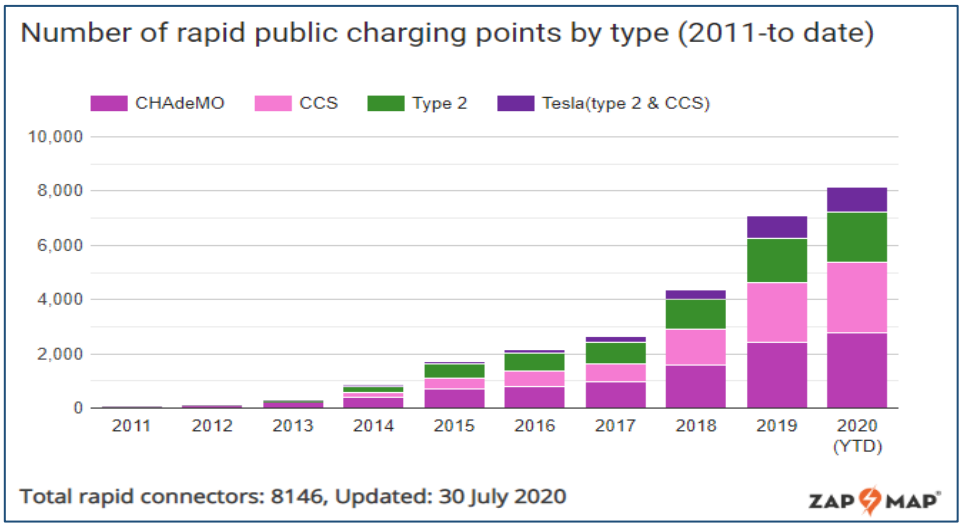
i. **Power capacity** – Western Power Distribution has confirmed that the existing mains network has the capacity to enable a rapid charge direct from the grid (see 'Power Connection' section below). The inclusion of battery storage, renewables and export limitation represents a solution for rural settlements such as Harbury and avoids expensive network upgrade. Such costs of main grid upgrade are usually prohibitive to the viability of community projects.

ii. **Cost** – DC rapid chargers are significantly more expensive than the slower AC charge points with installed prices ranging from £20k - £40k[22] compared to £2k - £3k for a 7kW-22kW AC charge point. As part of the feasibility study and with acknowledgment of their assistance, cost estimates and system solutions have been kindly provided by EO Charging Ltd (Appendix 8) and Eaton Green Motion[23] (Appendix 9) for the Harbury EV charging station proposal. **Note:** These are estimates only and have been used to support the financial modelling of the project (Section 6). Equipment and installation costs will be subject to detailed proposals based upon confirmed specifications should the project proceed.

5.4.4 EV charging socket standards

There are a number of different plug and socket standards in use today and different vehicles adopt different standards. Most vehicles use either Type 1 or Type 2 connectors for fast charging – using charging cables supplied with the EV. Holster-type CCS or CHAdeMO connectors are used for rapid charging. The range of options of charging socket standards has been influenced by EV manufacturers. This is seen as a limiting and confusing factor in the market roll-out of infrastructure – but there is evidence of standardisation in major global markets e.g. CCS is becoming the standard in Europe.

The graph below indicates the growth of the various EV charge point connectors:



Note: Tesla have their own proprietary connector standard but every vehicle is supplied with a Type 2 lead to enable use of public charging infrastructure. They can also use CCS or CHAdeMO with the appropriate adaptor. The Tesla Model 3 can use CCS without an adaptor.

[22] https://energysavingtrust.org.uk/sites/default/files/reports/6390%20EST%20A4%20Chargepoints%20guide_v10b.pdf
[23] https://www.current-news.co.uk/news/eaton-partners-with-green-motion-to-help-integrate-ev-chargers-into-buildings

Note: The 2021 Nissan Ariya, which will likely supersede the LEAF and is expected to launch in the US and Europe next year, will use the CCS standard[24]. This is a strong indicator of the expected dominance in Europe for CCS connected chargers in future years.

For Harbury, the selection of connectors will be advised by potential installer operators to ensure that the charging station meets the current and future needs of all EV drivers.

5.4.5 EV charging payment options

EV chargers for public use need to incorporate a secure means of payment. Typically, this is done via a subscription service, RFID card or smartphone app – and this is outlined in more detail in Section 7 below. A few charge point operators offer contactless payment by credit/debit card or smartphone payment such as Apple Pay. It should be noted that, due to the proliferation of different apps and subscriptions that EV drivers are required to adopt, the UK Government is pushing for all public charging facilities to accept contactless payments and it is recommended this be included to future-proof the infrastructure and for the speed, ease and simplicity it offers users. This will encourage wider adoption of electric vehicles as it removes a perceived barrier presented by the complexity of payment.

Different charge point operators calculate their charges in different ways and there is currently no consistency in the way prices are expressed. Some of the variants include £ per charge; £ per specified time period (for example, £xx per 30 minutes, or per hour) bundled in as part of a general parking charge; or on p/kWh basis. The UK Government are seeking to eliminate the confusion this causes by mandating a standard method of expressing prices. This is likely to be in p/kWh as this relates most closely to the way traditional fuels are charged for.

A broad recommendation is that the charging infrastructure incorporates a means of displaying pricing that can accommodate this expected legislation. This can help encourage wider adoption of electric vehicles as it removes a perceived barrier presented by the complexity of payment.

5.4.6 Security issues

The chargers at Harbury Village Hall will be publicly accessible and located in an area that is likely to be hidden from general view of pedestrians and passing traffic and will not be highly populated overnight. It is recommended therefore that a suitably robust solution be selected to minimise the chances of equipment damage from vandalism and the associated danger to life that may arise from any such damage. This will be coupled with on-site security measures such as lighting and CCTV – both of which could be linked to the charging station power network.

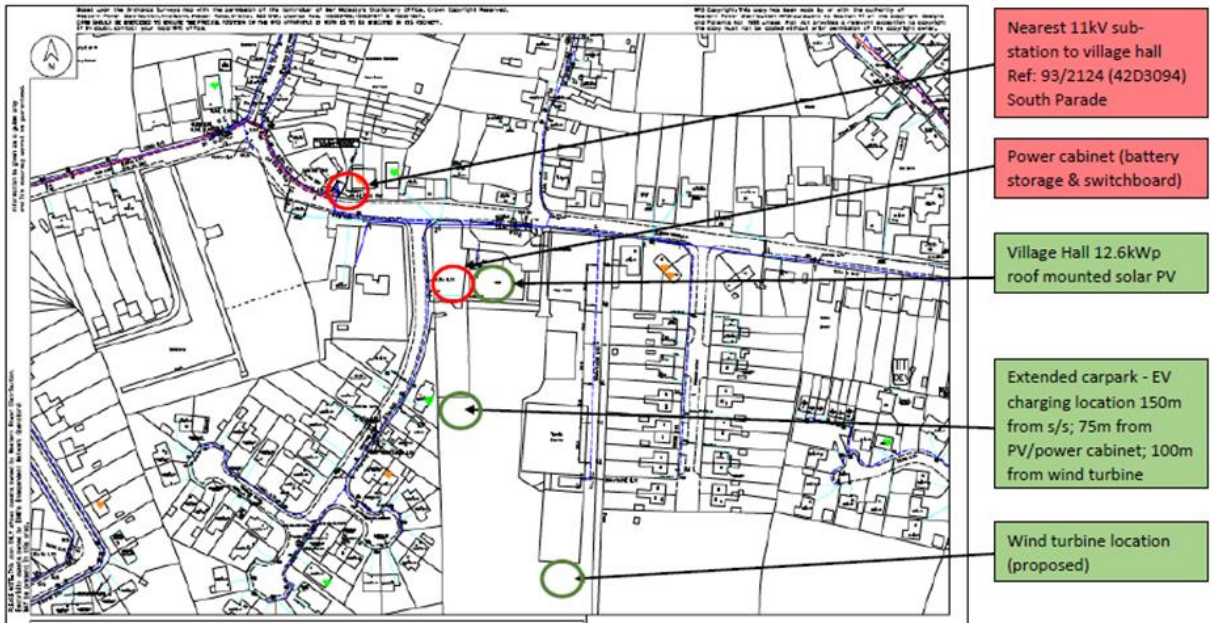
5.5 Grid connectivity

Any renewable energy generation, battery storage or EV charge point demand linked to the mains grid network requires the approval of the Distribution Network Operator – in Harbury's case this is Western Power Distribution (WPD). There are often restrictions imposed on applications (under G99 load and G100 storage legislation) which can result in either a limitation to the power infrastructure proposed (import and export) and/or expensive network upgrade costs. This is particularly the case in rural locations where the existing power supply capacity is often much lower than in urban areas due to less demand for power from homes and businesses.

[24] https://www.greencarreports.com/news/1128891_nissan-s-move-to-ccs-fast-charging-makes-chademo-a-legacy-standard

The local power diagram below shows that the nearest sub-station to the proposed mains connection point for the EV charging station at Harbury Village Hall is approximately 100m distance (South Parade). WPD's EV map[25] shows that there is 'capacity available' at this sub-station. A preliminary enquiry response from WPD indicates that all the Harbury scenarios are technically feasible (Appendix 15). WPD propose a connection to the existing low voltage supply (LV) at the Constance Road / South Parade intersection and a new cable laid in the pavement to the car park entrance and across to a cabinet (Scenario 1) or power container (Scenarios 2, 3, 4). Subject to Stage 2 funding, the engineering study will submit detailed G99 and G100 connection applications to WPD to confirm the import and export loads permitted and the necessary costs (uncontested and contestable) for grid upgrade works.

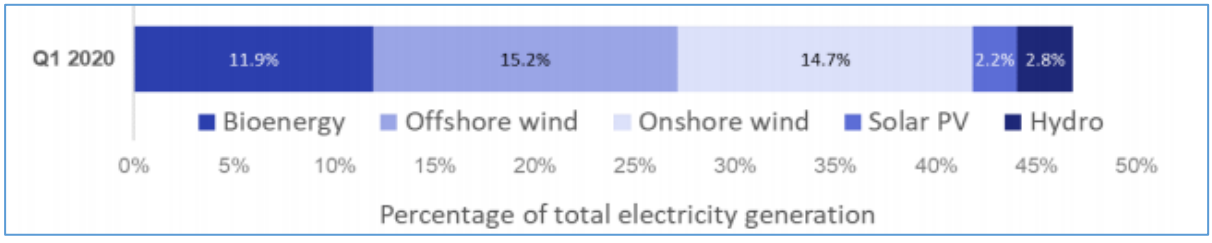
Substation name	South Parade Harbury Harby
Substation number	932124
Capacity	Capacity Available



A detailed single line diagram (SLD) to show the power layout for the proposed Harbury EV charging facility is included as Appendix 6.

5.6 Battery storage

The graph below shows the increasing importance and share of the UK electricity market coming from renewables[26]. The ability of the UK to balance intermittent supply with growing demand will depend upon the ability to store large amounts of power either centrally or locally.



[25] https://www.westernpower.co.uk/ev-capacity-map-application
[26] BEIS Renewable Electricity UK Q1 2020

With the advance in battery technology in recent years, the potential of installing batteries as part of power infrastructure schemes is now a realistic and increasingly viable option, especially applicable to weaker rural networks and where both renewable generation and demand profiles are intermittent.

In the Harbury system, a battery would serve as a 'local buffer' power supply – able to capture and store renewable power generated locally e.g. solar and wind, when not being used by the EV charging station, and also able to store 'off-peak' electricity from the grid. The Single Line Diagram (SLD) (Appendix 7) prepared for the preliminary G99 and G100 applications shows the schematic layout of the system being proposed. The Consultants wish to acknowledge the support provided by Western Power Distribution, Eaton Electric and Actemium Ltd in developing the system layout.

5.6.1 Modes of battery operation

Harbury e-Wheels wishes to install a public access EV charging facility for community use – consisting of 4 x 22kW AC fast EV chargers and 1 x 50kW DC rapid charger and subject to grid connection approvals. The system proposed could be supported by a 12.6kWp solar PV system and possibly a 7kW wind turbine (subject to local planning approval) with integrated battery storage.

As a relatively large village (1400 households) Harbury has a steadily growing number of EV owners and is in close proximity to a major road (Fosse Way) so passing trade as well as local use of the EV charging station is anticipated. A battery energy storage system is proposed not only to balance out the intermittent renewable energy generated on site but also to enable the storage of 'off peak' electricity purchased at lower tariff rates.

The battery will provide several services:

- Act as a buffer to deliver a higher power level than that available from the grid when vehicles are charging. (Mode of Operation: Peak Shaving)
- Store energy from the solar PV and wind generators and deliver it upon demand to maximise the amount of renewable energy used for charging. (Mode of Operation: Maximise Auto Consumption)
- Reduce carbon intensity of electricity used for charging by maximising the amount of on-site renewable energy generated and by using off-peak electricity when the carbon intensity of grid electricity is typically lower. **Note:** This does not apply if 100% green electricity is purchased. (Mode of Operation: Shifting Time of Use)
- Reduce imported energy costs by setting a charge profile to take advantage of low overnight tariff rates. (Mode of Operation: Arbitrage)
- Reduce system stress on the local distribution network by minimising demand at times of peak system use. This typically occurs in the late afternoon / early evening period (16:00-19:00) when many people may be considering charging. (Mode of Operation: Peak Shaving & Shifting Time of Use)

5.6.2 Matching battery with EV charging infrastructure

Whilst there is some information available from other similar rural locations which can be considered e.g. ChargePlace Scotland, it is difficult to predict the initial demand for public EV charging in Harbury. In order to minimise the initial investment for the EV charging infrastructure, it is recommended that a modular approach to the supporting battery energy storage system be adopted. This will allow a relatively small system to be installed in Phase 1 with the ability to increase power and capacity as EV charging demand grows.

The main low voltage (LV) switchgear should be rated at the maximum expected power after expansion and designed to facilitate the connection of additional power modules. This will have a relatively small impact on initial cost but will make it much easier to expand in future. The size of the battery system housing ('power container') should be designed to allow the installation of at least some additional storage capacity. To prevent needless oversizing, a second power container could be added in future should yet more capacity be required.

It is recommended that a system with an Application Controller with the ability to implement a range of Modes of Operation (as listed above) and to adapt to changing needs be selected. The addition of a communications module allows such changes to be implemented remotely and facilitates future firmware upgrades, allows changing of system setpoints as actual usage patterns become available and allows remote diagnostics to be performed. The use of 'dashboards' to view, display and analyse system data on a single platform will actually save cost of physical site visits that may otherwise be required for firmware upgrades etc.

5.6.3 Battery supporting security and lighting

Most battery energy storage systems are wired in parallel to the grid and this is likely to be the case at Harbury here. However, because the xStorage Compact solution proposed by Eaton (Appendix 9) is based on a technology development of one of their standard UPS platforms, it retains the full UPS functionality. This means it has a dedicated battery-supported UPS output. With a critical power distribution board added and connected to this output, this would ensure an uninterrupted, no-break seamless power support is maintained to critical security systems such as the CCTV, lighting and communication systems, so these loads continue to function with no interruption during a power outage. It could also support an intruder alarm system in the village hall if necessary which may add further security and peace of mind to residents.

Acknowledgement: *This specifications for the battery storage part of the feasibility study has been considerably informed through the support of Richard Molloy (Eaton Electric).*

6. Technology Projections and Modelling

6.1 Summary

Results from the technical modelling for this study indicate that:

a. **EV Charging direct from the grid**. As Western Power Distribution (WPD) has confirmed that the proposed EV charging demand (fast and rapid) would be permitted within the existing local power network infrastructure, it will be possible to install a charging station connected direct to the grid without battery or renewable technologies. This would offer significant capital cost savings over alternative options and provides a practical first phase opportunity for Harbury. However, with no ability for storage, this would increase operational costs with no opportunity to utilise off-peak tariffs. The analysis has explored alternative technical scenarios to explore other grid balancing opportunities and assess the variations in cost.

b. **Using Green Electricity**. To ensure maximum low carbon credentials for Harbury Future Energy, electricity drawn from the grid will be required to be REGO-certified 'green energy'[27].

c. **A battery buffer to store off-peak electricity and local renewable generation.** With the inclusion of a buffer battery in the system it will be possible to store lower price off-peak electricity for delivery to the charging station and reduce costs. The case for this improves as demand grows. The buffer battery would also be needed to "couple" the energy produced by local renewables to the demands of the EV charging station. Technical advice received suggest initially an 80kW/100kWh battery should be installed - expandable as charging demand grows through installing a modular battery system design.

d. **The power contribution from on-site renewable generation will be limited.** The total capacity for solar and wind power generation represents about 5% of the overall energy available at the site when off-peak grid capacity is taken into account. Whilst local renewables could contribute a significant portion of the energy to the initial low baseline demand forecast, as demand grows most of the electricity required by the charging station will be drawn from the grid. Renewable energy yields are estimated as approximately 11,800 kWh per annum from a 12.6 kWp PV system mounted on the village hall roof and 9,300 kWh per annum for a 7kW McCamley vertical axis wind turbine (VAWT) located south of the tennis courts.

e. **Factors constraining renewable energy generation**. Renewable generation at the site is constrained by the size of those systems that can be practically installed and the local wind energy potential. The potential to install larger renewable energy generation systems in the local area e.g. on a local farm could be explored.

f. **Grid balancing solution.** The proposed technical design incorporating grid supply, battery and local renewables could be used as an exemplar for other rural sites which will have greater constraints (import and export) from the grid connection.

[27] Renewable Energy Guarantees Origin - https://www.ofgem.gov.uk/environmental-programmes/rego

g. **E-Wheels vehicles charging – a community benefit.** The Harbury EV charging station will be designed to provide parking and free charging for e-Wheel's two electric community transport vehicles. It is estimated that the EV charging station will provide approximately 6,000 kWh of charge per annum for e-Wheels – saving approximately £1,000 per annum.

h. **Public demand forecast for charging at rural locations such as Harbury is very uncertain and will be initially light.** Data from ChargePlace Scotland (with thanks to Stirling Council) and information from Eaton Green Motion suggest that current demand for the use of EV charging stations in similar rural situations is light.

i. **Rapid charging will be of increasing importance.** The ChargePlace Scotland data also points to an increasing demand for 'opportunity' charging at public chargers e.g. where the EV driver only wants sufficient charge to complete a journey. The higher frequency of use of rapid chargers reflects behavioural demand. This demand for rapid charging is expected to grow with the transition towards EVs and especially for high range models with larger batteries - but this study has taken a cautious approach and used a baseline demand scenario initially.

Important Note: Certainty of Performance and Demand estimates

This feasibility study represents an early pre-engineering situation review and technical assessment of options. Given the lack of evidence and case study related to EV charging stations in rural locations – and due to the requirement to consider innovative technologies and their integration at Harbury - there is a significant degree of uncertainty in the forecasting of EV charging station demand and the potential for renewable electricity supply.

At this stage it has been challenging to derive demand forecasts for the public use of the EV charger. We are grateful to ChargePlace Scotland and Eaton Green Motion for sharing some rural demand data from their networks. This shows quite a significant variability in use between charging points and over time and is discussed further in the section on demand forecasting. Given the key role that demand will play in the business case for the Harbury EV charging station we feel it prudent at this stage to assign a significant margin of uncertainty to the demand forecast figures used in the modelling. The detailed business case would need to demonstrate an ability to manage this type of variability as noted above.

6.2 Technical design

6.2.1 Design Objectives

The brief from the Harbury Project Steering Group for this Stage 1 pre-engineering feasibility study has a number of key elements and ambitions:

- To install a community owned and managed electric car (EV) charging facility in the centre of Harbury to meet the current and future needs of the local community.
- To maximise the contribution of locally generated renewable energy using solar panels and an innovative vertical axis wind turbine.
- To provide public fast (7 or 22 kW) and rapid (50 kW) charging facilities - as well as overnight charging facilities for the exclusive use of e-Wheels. It is anticipated that e-Wheels fleet charging will be funded by income generated from the Harbury Future Energy (HFE) project.
- To provide an income (if possible) to support Harbury e-Wheels operations.

- The final scheme must be acceptable for planning approval.
- The project must work within the constraints of the mains grid connection both in terms of import and export.

6.2.2 Technical Review Approach

In reviewing the technical feasibility of the project the consultants adopted the following approach:

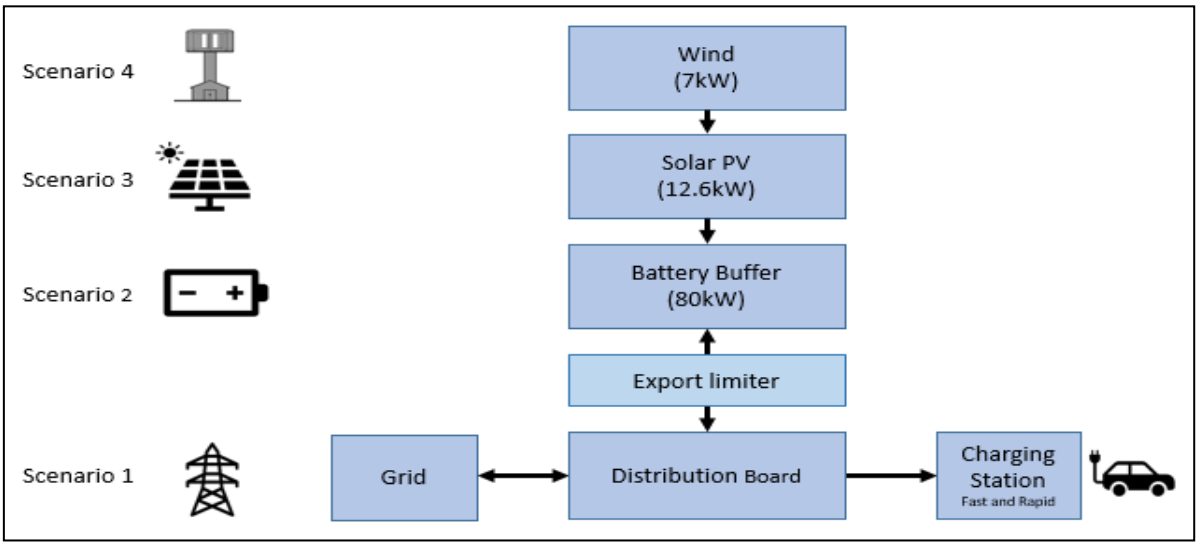
1. A technical design was developed in consultation with partner organisations
2. The technical design was broken down into 4 scenarios starting with a direct grid connection operating the EV charging station and moving to battery storage and the installation of onsite solar and wind renewable energy as EV charging demand increases.
3. A data base of the technical performance of the various components was created taking account of renewable energy availability and grid import/export restrictions at the site.
4. A rural EV charging station performance data was collected for similar sites. **Note:** due to the current lack of rural EV charging stations in the UK, this data set is limited.
5. A baseline line potential demand forecast for the Harbury EV Charging Station was created using the rural EV charging station data set available.
6. An annual model of the possible performance of the Harbury EV Charging Station was built to review the ability of the technical design to support the baseline demand forecast.
7. A diurnal (by hour) model for 4 seasonal points (mid-summer, mid-winter, 2 equinoxes) was built to review the interplay of demand, renewable availability and battery energy storage.

6.2.3 Overall Design

The objective of the Harbury project is to provide charging and parking for e-Wheels electric vehicles and for use by local residents. It is also expected that visitors and passing traffic will use the facility for opportunity charging to complete journeys. Currently Harbury e-Wheels vehicles use a charging point behind the village library – but there is an intention to relocate the EV parking and charging facility.

This review will show that the capacity of renewable electricity generation at the playing field site is limited - and that significant use of grid electricity will be required to meet the growing demand for rapid and fast EV charging beyond the capacity of the renewable generation.

The block diagram below summarises the overall design as described in Section 5 above:



Key elements of the proposed design are:

1) Charging point station: 4 x 22kW AC chargers (fast) and 1 x 50kW DC charger (rapid)
2) Battery store: 80kW/100 kWh
3) PV system: 12.6 kWp
4) Vertical Axis Wind Turbine: 7 kW

An Export Limitation System will be installed restricting any onsite export back to the grid to 56kW.

Import from the grid connection is limited to 145 kVA which is approximately the capacity of the proposed charging station gross of system inefficiency.

The Harbury residents' survey showed a clear preference for the installation of a rapid 'opportunity' charger. Historical data from ChargePlace Scotland and from Eaton Green Motion [28] for rural systems support this preference and show an emerging pattern of opportunity charging.

6.2.4 Technical scenarios

In addition to the full equipment configuration described above as 'the maximum scenario 4', three reduced technical scenarios were examined – which would allow the objective of the project to be introduced and delivered in phases and at lower initial capital costs. There are summarised as follows:

Scenario	Coverage
1	This uses green energy direct from the grid to support fast and rapid EV charging but with no battery nor renewable electricity generation installed.
2	As Scenario 1 but with the inclusion of an onsite battery storage system used to store off peak grid electricity for use in the EV charging station.
3	As Scenario 2 with the installation of a 12.6kWp solar PV array on the village hall roof. The output would be stored in the battery for use in the EV charging station.
4	As Scenario 3 with the installation of a 7kW vertical axis wind turbine. The output would be stored in the battery for use in the EV charging station.

	Technical scenarios inclusion list			
Item	**1**	**2**	**3**	**4**
Car park extension	Yes	Yes	Yes	Yes
Charging station	Fast and Rapid	Fast and Rapid	Fast and rapid	Fast and rapid
Grid connection import capability	Yes (138kW load)	Yes (138kW load)	Yes (138kW load)	Yes (138 kW load)
Battery unit	No	Yes	Yes	Yes
Solar PV	No	No	Yes (12.6 kWp)	Yes (12.6 kWp)
Wind (McCamley VAWT)	No	No	No	Yes (7 kW)
Grid connection export potential and DNO (WPD) limit	0kW	100kW (restricted to 56kW	110kW (restricted to 56kW)	120kW (restricted to 56kW)

[28] Spreadsheets kindly supplied by ChargePlace Scotland and GreenMotion

Note: The grid connection import load is the total of the nominal power capacity of the EV charging equipment to be connected i.e. 4 x 22kW and 1 x 50kW chargers. Grid export is the total of battery and renewables generation equipment.

The Distribution Network Operator (DNO) Western Power Distribution has confirmed that the import limit from the substation to the Harbury site will be 145kVA. This means that Scenario 1 is expected to meet the capacity demands of the charging station direct from the grid. Scenarios 2, 3 and 4 provide the benefit of storing grid off-peak electricity and local renewable energy for use in the charging station. This will reduce the operational cost of electricity purchased but at the expense of increased capital cost to the project. The case for Scenarios 2, 3 and 4 will grow as use of the charging station rises. Scenarios 2, 3, and 4 also offer an opportunity for Harbury to demonstrate and manage technical solutions applicable to other rural EV charging projects experiencing grid constraint issues.

Part of the project brief was to explore the contribution that on-site renewable electricity generation (solar and wind) could make to service a community based EV charging project. **Therefore the majority of the technical and financial analysis has focussed on the maximum scenario i.e. Scenario 4.**

6.3 Demand forecasts

6.3.1 Summary

A key to building the technical and financial case for the project is to understand the potential demand from EV users in the village and others e.g. passing EV traffic. The proposal is that access to the chargers for Harbury e-Wheels cars will be provided free of charge as the community support element of the project. Public access to the EV chargers will provide the revenue stream for the project.

To represent demand, the study considers forecasts in three areas:

1. E-Wheels usage of 2 x 22kW chargers
2. Public use of 2 x 22kW chargers
3. Public use of a 50kW rapid charger

6.3.2 E-Wheels demand forecast

Harbury e-Wheels will park and charge in two reserved parking bays. E-Wheels operate two EVs that have a joint mileage of approximately 18,000 miles[29] i.e. 9,000 mile per year each. It is assumed that the cars have an average 140 mile range on a 40 kWh battery and battery charging efficiency is at 85%. The current e-Wheels charging demand is estimated at 6,100 kWh per annum. As this is based on historical mileage there is more certainty for this figure. Any growth in charging demand will depend on higher use of vehicles and if more EVs are acquired to service the community transport scheme.

6.3.3 Public demand forecast

The survey of Harbury residents (Appendix 4) gives a useful view on intentions regarding the charging station and shows a clear preference for a rapid charging facility. This preference is reflected in data gathered from ChargePlace Scotland and from Eaton Green Motion which shows the actual performance of EV chargers in rural settings. This evidence should be regarded as a useful indicator of usage preference although it is difficult to draw too strong a prediction on how this might apply to the Harbury EV charging station.

[29] Spreadsheet of historical vehicle mileages provided by e-Wheels

6.3.3.1 ChargePlace Scotland data

The ChargePlace Scotland data [30]gives usage data for their charging network across Scotland covering 31 councils and 405 charge points. The 2018 data showed that on average rapid chargers were used four times more often than fast chargers. Each visit drew on average of 10 kWh of charge per visit.

The table below shows across the ChargePlace Scotland network the minimum, average and maximum annual usage of chargers.

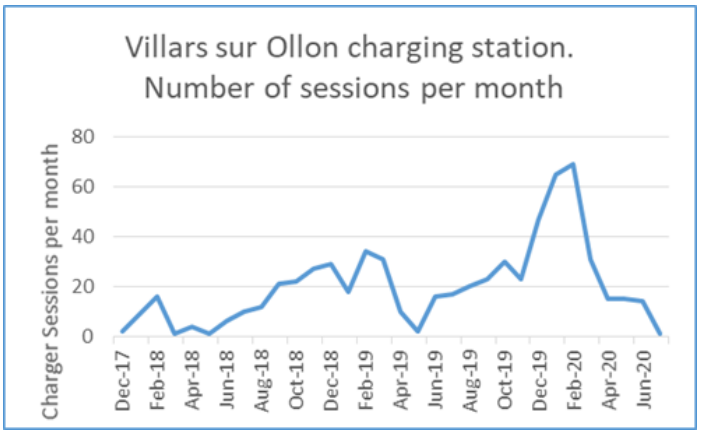
ChargePlace Scotland EV Charge Point Usage for 2018			
Charger Type	Minimum (kWh per annum)	Average (kWh per annum)	Maximum (kWh per annum)
Fast	0	3,500	8,400
Rapid	1,500	15,000	35,000

Note: The average figures above will be used for a baseline forecast for the demand at the Harbury Charging Station, although it is suggested that a wide margin of uncertainty is attached to their use until the demand behaviour at the Harbury site is better understood.

6.3.3.2 Villars sur Ollon (Switzerland) EV Charger Experience

Eaton Green Motion [31] kindly provided data for 2018-20 on the performance of a 22kW charging station located in Villars sur Ollon - a Swiss village (population of 8000 residents i.e. double the size of Harbury). This study shows an average of 20 visits per month and an EV charge of 21kWh per visit. Interestingly, the rate of visit is lower than ChargePlace Scotland but the charge is higher at each visit. Total power consumption in 2019 in Villars was 5,500 kWh although usage dropped in the summer for an unexplained reason. This figure is much lower than average rapid charger consumption reported by ChargePlace Scotland and suggests the need for caution in estimating a base line consumption figure for Harbury village.

The graph below plots the number of visits to the chargers each month in Villars shows a pattern of rising demand with considerable variability. It would be necessary to understand the history of the village charging station to explain the drop in use in Jun 2019 and the peak in Feb 2020 but this illustrate that unforeseen events can affect the patterns of use at any site, including Harbury.



[30] Source: ChargePlace Scotland LA (charger) Analysis 2018/2017

[31] Source: Eaton Electric – case study AC Rural charge station consumption.

6.3.4 Harbury Village EV Charging Station Demand Baseline Estimate

The availability of EV charge station performance data in rural areas similar to Harbury is very limited and forecasts are therefore difficult to estimate. The monthly usage pattern shown in the Swiss case study shows there will be considerable variability month by month but an overall rising trend in usage.

On the basis of the information that has been shared with the Consultants from ChargePlace Scotland it was decided to adopt the average usage data shown above for the base line demand forecast.

Note: this is subject to a significant level of uncertainty in applying the data in a different setting. The figures below were used for the baseline demand forecast for the Harbury Charging Station:

Harbury EV Charging Station Baseline Demand Forecast		
Charger Type	**Average (kWh per annum)**	
Public Fast (7-22kW)	7,000	Significant margin of uncertainty
Public Rapid (7-22kW)	15,000	Significant margin of uncertainty
e-Wheels Fast (7-22kW)[32]	6,100	Based on 2019 consumption
Total	**28,100**	

Note: It is assumed that two fast chargers will be available for public use and the other two fast chargers reserved for the exclusive use of Harbury e-Wheels.

6.4 Renewable energy technical review

This section summarises the results of the review of the performance of the renewable energy solutions outlined above.

6.4.1 Local Renewable Energy

The Steering Group set as a requirement the inclusion of local renewable energy systems in the design – although the study has revealed subsequently that the that the EV charging station could function without local renewables or buffer battery to deliver the power capacity needed for rapid charging.

Two renewable electricity systems are included in the scenarios 3 and 4 as discussed above:

- A 12.6 kWp solar PV system could be mounted on the village hall extension roof. This adds to the current 10kW array but would be an entirely separate system.

- A 7kW wind turbine could be installed at the south end of the tennis courts (The Consultants were requested to review an innovative vertical axis wind turbine (VAWT) manufactured by West Midlands based McCamley Ltd. **Note:** A review of alternative horizontal wind turbine technologies (HAWT) has also been included below as a comparison of cost, size and energy generation capacity, although there is understood to be strong local and planning resistance to the installation of this design. Performance data for other HAWT wind turbine systems was kindly provided by the several suppliers contributing to this feasibility study (see Appendices).

[32] E-Wheels demand is based on historical data and has less uncertainty assuming 2019 patterns of usage continue.

6.4.2 Wind turbine design comparisons

The McCamley VAWT was selected by the HFE Steering Group as an operation example based upon its innovative design and a number of merits and advantages to the site and locality (Appendix 7). However, it is acknowledged that this turbine is relatively untested in the type of environment that Harbury presents. The HFE Steering Group determined that although a horizontal axis turbine (HAWT) would not be a popular option in the village – and indeed may not meet planning approval conditions - they still required information related to the more conventional and widely installed HAWTs to provide a comparison in terms of costs and capacity. Two HAWT models were selected - one rated at 7.5kW i.e. similar capacity to the VAWT proposed, and a second larger / taller turbine rated at 25kW. Both these devices can be classed as 'mature' technologies and have a wide user base in North America and Europe.

Wind Turbines comparative data				
Wind turbine	**Rating**	**Budget Estimate Capital cost ex VAT**	**Estimated Yield, MWh per annum**	**Estimated Cost of Energy p/kWh**
McCamley VAWT, mast mounted (preferred option)	7kW	£58,500	9	41.5
McCamley VAWT, tower mounted	7kW	£73,500	9	49.5
EO Cycle HAWT	25kW	£142,800	101	9.3
Braun Windturbine Antaris HAWT	7.5kW	£27,100	11	21.4

Note: capital cost includes the turbine, mounting, delivery, installation and cabling estimates.

6.5 Environmental impact of renewable energy installations

Some information has been collected on environmental impacts and will be referred to in the presentation of the scheme to residents. This will also need to be more formally reviewed if the HFE project moved to a full planning application. Environmental impact assessments attributable to wind, solar and battery storage components of the HFE project will include:

- Noise disturbance
- Light disturbance
- Visual flicker from wind turbines
- Radar flicker from wind turbines
- Threat to wild life

6.6 Annual performance analysis of renewables

The overall annual generation estimates for on-site renewable electricity generation give a good indication of the contribution to balancing the demand from the EV charging station. However there will be diurnal and seasonal variation in renewable energy generation. Variation in solar energy through the day and the seasons is largely predictable but wind energy will be subject to greater variation and in general is higher in the winter. At any point in time the local renewable energy generation could range from close to zero to a maximum in the high single figures (kW).

Power demand from the EV Charging Station will be much higher than local renewable energy generation and will require the support of the battery buffer and grid connection.

The following table summarises the annual energy supply and demand estimate for the project. We have included using off-peak (7 hours per day[33]) 'green' grid electricity. The maximum DNO import capacity of 145kVA is assumed.

Estimated Maximum Annual Electricity Availability		
Supply Estimate	**Average (kWh per annum)**	**Source**
Solar PV 12 kWp system	11,800	Greenwatt SAP based models
Wind McCamley 7.5 kW VAWT	9,300	McCamley supplied power curve using NOABL average wind speed of 5.3 m/s at 10m height
Subtotal renewables	**21,100**	
Maximum Off peak green grid electricity accessible	370,500	365 days x 7 off-peak hrs x 145 kVA grid import capacity (WPD). Octopus off-peak period
Total supply available (theoretical)	**391,600**	

Notes:

1. The wind energy estimate is subject to uncertainty as it is based on the national NOABL wind speed data for the site[34]. Should the project proceed, a more detailed assessment of the wind resource at the Harbury site will be needed.

2. Local renewables represent approximately 5% of the energy available at the site. At low levels of demand, local renewables could make a significant contribution to the EV charging energy delivered but at a significant capital cost. As demand grows most of the energy delivered will need to come from the grid as 'off-peak green electricity'.

3. The table above shows on an annual basis that the baseline demand forecast could be met mostly by the on-site renewable energy systems if these were to be installed (Scenario 4). Alternatively this baseline demand could be met solely from the grid. As demand grows most of the electricity would need to be supplied from the grid and there is significant capacity for this given the Western Power statement on the 145kVa import limit (Appendix 15).

6.7 Discussion

The technical design presented for this stage of the feasibility study has the potential to support the objective of providing an EV charging station connected to local renewable energy sources. The design needs to be developed further if a second stage of the project is undertaken. This is to ensure a better understanding of the performance of the individual and combined components. A mechanical and electrical evaluation was not undertaken at this stage and this will need to be covered in Stage 2 to ensure the safety and robustness of the design. Foundations for the wind turbine were excluded from the costing pending ground investigations and will be specified during the next stage of the project.

[33] Other energy suppliers could offer longer off peak times.

[34] https://www.rensmart.com/Information/NOABLModel

Developing a demand forecast is important in evaluating the business case. The baseline forecast using historical data from ChargePlace Scotland has a high degree of uncertainty and any technical solution for energy supply and to support the financial case would need to take this uncertainty into account. A preference for rapid opportunity charging at public rural EV charging stations has been illustrated[35].

At this stage of the analysis, the central point of the renewables yield forecast for solar PV and wind of around 21,000kWh per annum is roughly comparable to the baseline demand forecast for the EV charging station of 28,000kWh per annum. However the financial review shows this baseline low demand is not viable due to initial capital cost and usage would need to grow. At this point further electricity would need to be drawn from the grid specially to balance out the supply and demand fluctuations throughout the year.

The limit to local renewable generation at the site is the result of the limited space available on the village hall roof for solar PV and the physical size of wind turbine that would be acceptable at the site. Larger capacity solar and wind systems in the vicinity of Harbury village e.g. on a local farm and not under the same space restrictions could be an option to explore further.

The HFE Steering Group's preferred option to investigate for wind power generation is the McCamley vertical axis turbine. This innovative design has several advantages that would make it suitable for installation on the Harbury playing fields. The study and pre-planning enquiry considered two mounting options for the McCamley - a tower structure and a mast – the latter being the preferred option based on cost and visual impact grounds. However, it was felt important to show a comparison of energy production and costs between the McCamley VAWT and other more 'traditional' horizontal axis wind turbines. Information is provided therefore for a 7kW HAWT which would give a similar yield to the McCamley but at a lower cost (10MWh per annum) and a larger 'farm size' 25kW HAWT which would yield 100MWh per annum. Both have a lower cost of energy but were considered unacceptable for installation at the Harbury playing field site due to the proximity to housing and likely turbulent wind flows.

A mains grid connection supplying green electricity will be required. Western Power has confirmed that the HFE project will be able to import all the electricity direct from the grid at the outset to run the four fast and one rapid chargers together (i.e. max 145 kVA). This 'preliminary approval' came late in the feasibility study and was a significant change from the previous information received from the DNO which indicated a lower on-site import restriction for the EV charging station (as there is with many rural locations). This means that a direct connection of the charging station to the grid with no buffer battery or renewables is possible. This presents a lower capital and operational cost option for the project as discussed in Section 7 of this Report.

A battery could be added to the system to take advantage of off-peak electricity tariffs for use during the day and to facilitate the installation of local renewables. Western Power Distribution has placed a 56kW export limit on this system which will require an Export Limitation System to be installed either as part of the main switch board or as part of the battery system (Scenarios 2, 3 and 4). However, it will be more important to balance the battery capacity with demand i.e. a modular battery rather than installing a higher capacity with the intention of exporting power back to the grid for revenue generation.

[35] Harbury resident survey and data from Eaton Green Motion

7. Financial Projections and Modelling

7.1 Summary

Results from the financial modelling for the study indicate that:

1) **Rural EV charging station projects are financially challenging**. From the information gathered, modelling and discussions with other rural charging projects it was considered that the Harbury EV Charging Station project would share similar characteristics to other rural EV projects i.e. high costs and uncertain revenues. Modelling calculations illustrate the risk of trying to address 'market failure' especially in the EV transition years – and raises the need for early stage rural infrastructure funding to ensure EV charging access is available for rural communities and settlements.

2) **Capital costs (CAPEX) for the technical scenarios range from budget estimates of £85,000 to £300,000.** The lower estimate for Scenario 1 would cover the costs of a direct connection to the grid which would actually support the proposed charging station facility i.e. four fast and one rapid charger. Adding a battery to store off-peak electricity and provide on-site renewable energy storage improves the flexibility and resilience for rural situations – but could add significantly to the cost of the Harbury project up to a budget estimate of around £300,000.

3) **Choice of the charging station price points and payment model is challenging.** A number of sources were reviewed including a What Car[36] survey, ChargeMyStreet[37], ChargePlace Scotland and other public charger networks. For the purposes of modelling the financial feasibility a simple price point in the middle of the range of prices was chosen. The operational model for Harbury Future Energy is likely to include both pay-as-you-go rates and a local resident membership scheme as used by ChargeMyStreet and ChargePlace Scotland.

4) **Baseline revenues are forecast to be light and are uncertain**. The revenues from the baseline demand forecast are light and forecast to be in the region of £5,000 per annum but this comes with a high margin of uncertainty as it was based on historical demand data from other settings.

5) **Phased implementation as a solution to high capital cost and revenue uncertainty**. A possible solution to high capital and operational costs with uncertain revenue is to phase the implementation of the scheme in line with increased demand over the next few years – and available capital funds. The Harbury EV Charging Station could operate with just a grid connection (Scenario 1) which offers a lower cost start point.

6) **Harbury Future Energy as a rural demonstrator project**. Many small towns, villages and rural settlements will face the issues of 'market failure' in the provision of EV charging facilities. Harbury with its central location, vibrant energy community and size could provide an ideal testbed and demonstrator for other rural communities and councils to benefit from.

[36] https://www.whatcar.com/news/electric-vehicle-charging-%E2%80%93-what-does-it-really-cost/n16833

[37] https://www.chargemystreet.co.uk/charge

Important Note: Certainty of Demand estimates

As with the technical assessment and the assumptions made to enable scenario development and systems modelling, there is a significant degree of uncertainty in the estimates for capital and operational costs. The Consultants have engaged with a number of potential suppliers and operators who have kindly provided pre-quotation budget estimates based on the early specifications but subject to final requirements and site visits (not possible during this study period due to Covid-19 restrictions). If the HFE project proceeds to RCEF Stage 2, there will be a need for the specification of the equipment to be refined and finalised as further technical and engineering assessments are carried out. Formal quotations will be sought from suppliers following Invitation to Tender and other procurement processes.

Costs and assumptions are analysed in detail in Appendix 2. These figures will be subject to variation for the reasons given above. The Consultants have identified the scope, source and level of certainty for the various cost item estimates. Any decisions taken concerning the business case at this stage need to take into account that budget estimates have been presented in good faith but may be subject to change when costs are formalised in quotations.

7.2 Approach to the financial review

In reviewing the financial feasibility of the project the consultants adopted the following approach:

1. A dataset of capital and operational costs for the various components of the project was created from budget estimates provided by partner organisations and suppliers. Where possible the full cost estimates of activities required to implement and run the project in all 4 scenarios were included. We have identified where cost estimates were not available - for example foundation works costs.
2. Usage pricing was surveyed for rural EV charging stations in general and local chargers in the South Warwickshire area. From this dataset price points for modelling were established but note that this will be subject to change and further business review.
3. Electricity purchase costs were surveyed and a price for use in the model was set. This will be subject to change if the project goes to its next stage of tendering.
4. Using the baseline demand forecast a revenue forecast was created but it should be noted that this has a significant range of uncertainty.
5. A capital and annual operational estimated cost model was created for each of the 4 scenarios including estimates of purchase cost for grid electricity in each case.
6. Estimated cost of energy for the renewable energy options was calculated using both a simple formula and discounting (described below).
7. A project lifetime (20 year) cash flow model was created to explore Return on Investment (ROI), payback and the need for capital and operational subsidy.

7.3 Cost of business electricity

A key aspect of the business case is the purchase price of grid electricity. There appears to be significant movement and flexibility in terms of tariffs offered by energy supply companies as they move towards meeting the requirements for increasing electricity demand particularly from the growth of EVs and heat pumps – with an increasing need for grid balancing solutions.

BEIS data for 1st quarter 2020 [38] show average electricity prices for small to very small businesses were in the range 15.52 to 17.34 p/kWh. However energy supply companies are offering prices lower than those in the survey and it is possible to find flat rates for REGO certified 'green electricity' at approximately 13p kWh plus standing charges. Companies also offer bi- or tri-band rates [39] which could be used to advantage in developing the Harbury business model.

7.2.1 Electricity price used for this study

Based upon advice from Octopus Energy (whose contribution to this feasibility study is acknowledged), the following tariff was used for the financial modelling exercise:

- Flat rate: 13p kWh
- Two band: 9.82 off peak (00:00 to 07:00) and 13.98p (07:00 to 00:00)
- Standing charge: 78.43p per day / £286 per annum

Should the HFE project proceed to a next stage of development, then a process of competitive tendering will be undertaken to select a suitable energy supply company partner prepared to work with Harbury e-Wheels and develop a payment scheme which meets viability objectives.

7.4 Price for EV charging

7.4.1 Summary

The choice of price points and payment methods for the EV charging service in Harbury is complex. It is likely to include a number of different methods while supporting the objective of ease of access to all and the ability for payment methods to roam from one EV charging facility to another.

It is important to support both pay-as-you-go charging for opportunity users and a subscription method for more regular users. The former method usually carries a cost premium. Subscribers use a card or app and a prearranged payment method to access the charger. ChargePlace Scotland and ChargeMyStreet provide examples of membership schemes and charge rates.

7.4.2 Setting Tariffs

An important task for the body running the charging station will be to set a price for its usage to ensure the project is sustainable. The consultants reviewed a number of sources for guidance on a price point to use for the feasibility study modelling but we recognised that this needs to be reviewed again at a later stage of the project when more information is available. These prices we found varied significantly reflecting a wide range of factors for example location, type of charge, competition, market conditions:

- A survey by What Car [40]shows EV charging costs for fast charging ranging between 0p - 21p per kWh and for rapid charging between 24p-36p per kWh.
- Some pay-as-you-go charge rates have been depressed as a result of reduced demand caused by COVID19. BP Chargemaster were quoting 12p/kWh for fast and 15p/kWh for rapid charging in Warwickshire during June 2020.

[38] Source: DBEIS 2020 Energy Prices Non Domestic Prices. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/895159/table_341.xlsx

[39] See the Octopus illustrative rates.

[40] Source: https://www.whatcar.com/news/electric-vehicle-charging-%E2%80%93-what-does-it-really-cost/n16833

- Co Charging [41] are recommending 'hosted' EV charging rates in the range 14p to 28p/kWh.
- ChargeMyStreet show a pay-as-you-go tariff of 35p/kWh or a monthly membership of £20-30 with limits on the amount of free charging provided.

A "pay-as-you-go price" was used for modelling revenues in this feasibility study and the mid-point (21p kWh for fast and 29p kWh for rapid charging) of the What Car survey figures were adopted for this:

What Car EV Charging Prices Survey		
Charger Type	**Average Price**	**Price Range**
Fast	21p kWh	21p -21p per kWh
Rapid	29p kWh	24p - 36p kWh

Clearly there is a range of EV charging tariffs and Harbury Future Energy will need to take a decision on the levels of tariffs to charge – in association with charge point operators. This decision will impact upon revenues received from the EV charging station.

7.5 Revenue estimates

Revenue for the project will be derived from the public use of the EV charging point with payments made either at the time of use or via a subscription or a mixture of both.

The Harbury revenue estimate has been modelled using the baseline forecast and price points discussed above. Note the considerable uncertainty and scope for variation in these forecasts.

Revenue estimate using the Baseline Demand Forecast			
	p/kwh (2)	**Baseline demand (1) kWh per annum**	**Estimated revenue £ per annum**
Public Fast (22kW)	0.21	7,000	£1,470
Public Rapid (50kW)	0.29	15,000	£4,350
Total Public revenue(4)		**22,000**	**£5,820**
			e-Wheels donation (3)
e-Wheels Fast (22kW)	0.21	6,100	£1,280

Notes:

1. See above for the basis of the Baseline demand forecast: there is a wide margin of uncertainty.
2. See above for the basis of the price point choice: there is scope for wide variability in pricing.
3. This row shows the project's donation to e-Wheels.
4. The revenue is gross of any costs which will include Operation and Maintenance, insurance, organisation costs, loan repayments and purchase of mains grid electricity.
5. The ability to generate a break-even price is dependent on the quantity of EV charging 'sold'. Until the Harbury EV charging station builds up a strong user demand pattern and is able to reduce the cost of fixed overheads, a revenue subsidy or grant may be needed.

[41] In conversation with the founder of Co-Charging www.co-charger.com

7.6 Project capital and operational cost estimates

The table below summarises the cost estimates for the major components of the project under capital expenditure (CAPEX) and operational expenditure (OPEX). Details of the breakdown of each of the cost estimates can be found in Appendix 2. Note that the majority of costs provided by the suppliers are budget estimates and not formal quotations. The cost estimates given here can be expected to change once formal quotations are provided. All costs are ex VAT and rounded to the nearest £100.

Estimated CAPEX and OPEX for the Major Components							
Ref	**Component**	**CAPEX**	**Foundations & groundworks**	**Sports Equipment Store (Note 5)**	**OPEX per annum or one-off as indicated**	**Annual Generation Capability per annum**	**Estimated Cost of Energy p/kWh (Note 1)**
1	PV on village hall 12.6kWp	£13,900	n/a	n/a	£1,500 (one off)	11,900 kWh per annum	6.5
2a	Option 2 – 7kW VAWT mast mounted with equipment store	£58,500	Not known	£12,000	£900 per annum plus £1,500 (one off)	9,300 kWh per annum	41.5
	Alternative wind options:						
2b	Option 1 – 7kW VAWT on timber clad steel frame with equipment store	£73,500	Not known	£17,000	£900 per annum plus £1,500 (one off)	9,300 kWh per annum	49.6
2c	EO 25 HAWT, 25 kW	£142,800	Covered by main cost	£12,000	£1,500 per annum plus £1,500 (one off)	101,000 kWh per annum	9.3
2d	Wind Braun HAWT 7.5kW	£27,100	Not known	£12,000	£1,500 (one off)	10,500 kWh per annum	21.4
	Other components:						
3	Charging Station(4 x 22kW fast; 1 x 50kW Rapid)	£42,400	Included with installation		£720 per annum		
4	Battery store	£89,000	Not known		£1,600 per annum		
5	Grid connection	£22,000					
6	Car park extension	£20,000					
7	Other Items CAPEX (Note 2)	£69,100	Scenario 4 (Note 4)				
8	Other Items OPEX (Note 3)	n/a	Scenario 4		£7,810 per annum		

Notes to CAPEX / OPEX Table above:

Note 1: The cost of energy (giving p/kWh fixed for 20 years) has been derived using a formula provided by McCamley Ltd as follows:

$$\frac{\text{Capital Cost + Installation Cost + O\&M/Annum x 20}}{\text{Estimated Annual Yield /Annum x 20}}$$

IRENA[42] and other bodies use a discounting method to calculate cost of energy which tends to result in higher figures. The formula above used in the Harbury modelling is sufficient to make comparison between the renewable options for this project but caution will be needed if comparison is made to wider benchmarks as a different formula may have been used.

Note 2: Other CAPEX items includes a 15% of CAPEX as project management and professional fees provision. This assumes that a project manager and appropriate experts will need to be engaged if the project proceeds. There is also some provision for contingency at 5% of CAPEX.

Note 3: Other OPEX includes:

- Equipment insurance
- Business insurance
- Electricity purchase costs and standing charges
- Outsourced operational costs (to be determined)

Note 4: Technical scenario 4 consists of the charging station, essential infrastructure, buffer battery store, 12.6 kWp solar PV system installed on the village hall, and a 7 kW wind turbine.

Note 5: Budget estimates for the sports equipment store were provided as a range. For the purpose of developing the overall cost estimate a mid-point of that range has been use.

General note: The modelling has assumed that the charging station operation will be outsourced and there will be no direct staff costs. It is further assumed that the community body overseeing the service e.g. e-Wheels will be staffed by volunteers.

Electricity purchase cost forecasts are also included. This is variable depending on how much demand exceeds renewable availability. The estimate was calculated using the baseline demand forecast.

7.7 Analysis of capital costs of selected scenarios

As noted above although the Consultants have concentrated on evaluating the full technical requirements as requested from the Harbury Future Energy Steering Group, it has become evident that this raises the likelihood – and therefore viability risk - of high capital cost and low revenues. Many other projects of this type especially in even less commercial locations than Harbury will have similar issues and need to seek capital funding to address potential market failure.

[42] https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf

One approach within the control of the Harbury Future Energy Group is to phase and/or reduce the capital equipment deployed in the project – and hence reduce the capital costs.

To illustrate how this could work the four technical scenarios described in Section 6 above are again outlined below and used:

Scenario	Coverage
1	This uses green energy direct from the grid to support fast and rapid EV charging but with no battery nor renewable electricity generation installed.
2	As Scenario 1 but with the inclusion of an onsite battery storage system used to store off peak grid electricity for use in the EV charging station.
3	As Scenario 2 with the installation of a 12.6kWp solar PV array on the village hall roof. The output would be stored in the battery for use in the EV charging station.
4	As Scenario 3 with the installation of a 7kW vertical axis wind turbine. The output would be stored in the battery for use in the EV charging station.

The CAPEX of each scenario is estimated in the table below. Most of the costs are budget estimates and could change when formal quotations are obtained. All figures exclude VAT and are rounded to the nearest £100.

CAPEX budget estimates for four scenarios ex VAT				
Item	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Grid connection	£22,000	£22,000	£22,000	£22,000
Car park extension	£20,000	£20,000	£20,000	£20,000
EV station with fast and rapid charger capacity	£42,400	£42,400	£42,400	£42,400
Battery buffer	£0	£89,000	£89,000	£89,000
Solar PV array	£0	£0	£13,900	£13,900
McCamley 7kW VAWT on mast	£0	£0	£0	£58,500
Total Equipment	**£62,400**	**£151,400**	**£165,300**	**£223,800**
Sport equipment store	£0	£0	£0	£12,000
Other Costs (Note 1)	£21,800	£42,900	£45,700	£69,100
TOTAL CAPEX	**£84,200**	**£194,300**	**£211,000**	**£304,900**

Note 1: Other costs include professional fees and contingency and are estimated at 20% of the equipment cost. Therefore 'Other costs' will rise pro-rata in each scenario.

7.8 Operational cost of the four scenarios

The table below shows the estimated OPEX as applied to the four technical scenarios. Figures have been rounded to the nearest £100. **Note**: these figures are budget estimates and carry a degree of uncertainty. They will be subject to change when formal quotations are obtained.

BUDGET ESTIMATE OPERATIONAL COSTS OF THE TECHNICAL SCENARIOS per annum ex VAT				
Item	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Grid connection	£0	£0	£0	£0
Car park extension	£0	£0	£0	£0
EV station with fast and rapid charger capacity	£700	£700	£700	£700
Battery buffer unit	£0	£1,600	£1,600	£1,600
Solar PV	£0	£0	£100	£100
Wind McCamley VAWT	£0	£0	£0	£900
Total Equipment	**£700**	**£2,300**	**£2,400**	**£3,300**
Other Costs	£4,900	£5,300	£4,300	£4,500
TOTAL OPEX	**£5,600**	**£7,600**	**£6,700**	**£7,800**

7.9 Discussion - cash flow and pay back projections

Using the revenue forecasts and cost estimates described above, an analysis of 'pay back' and Return on Investment (ROI) was carried out for the proposed 20-year life of the project. The consultants reviewed this for the 4 technical scenarios selected. The results confirm the experience of other rural EV charger projects in that it is difficult to create a standalone business case for them especially in the early years as the transition to EVs continues. All such projects require significant start-up capital and early phase revenue support. If left solely to market forces, these returns are unlikely to attract commercial operators and investors and without funding support will lead to 'market failure'.

The high capital cost evidenced in this feasibility study is caused by the need for a range of technical solutions to address the issue of grid weakness found in many rural settings[43] . However it must be highlighted that the local grid supply to Harbury could provide the charging station needs in 'power terms' directly – but ignores the flexibility that a battery and off-peak tariffs could offer. Rural EV charging infrastructure could be regarded as a 'public infrastructure' issue requiring solutions and capital investment beyond the remit of individual development projects. Involvement of the local community provides the opportunity for partnership working to deliver local solutions.

The UK is still at very early stages of EV adoption - the market for which will be enhanced with the provision of a reliable national charging network. In this immature market it is reasonable to provide financial support for projects to demonstrate system integration, solve grid supply and infrastructure issues and develop business models to suit a wider range of user situations. Specifically with regard to the Harbury Future Energy EV charging initiative, this provides an opportunity for the project to be an exemplar of how different technologies and solutions might be integrated and implemented in the provision of what may become an essential transport and local energy resilience service.

[43] It is noted that in Harbury's case the grid can provide sufficient capacity for the EV charging station but not utilising off-peak electricity. The analysis carried out will still have value in other rural settings.

A further issue will be the inclusion and integration of new and emerging energy generation and storage technologies which are on the journey to market deployment but still have relatively high capital costs until scalability impacts upon unit prices. Funding could be sought specifically to raise the Technology Readiness Levels (TRL) of such innovative products such as the vertical axis wind turbine suggested for the Harbury project.

However, in the circumstances of limited capital start-up funding, a phased approach to technology implementation may be the answer. This feasibility study explored the capital and operational costs of phasing the project delivery. In Harbury's case the EV Charging Station could be implemented solely with a green electricity grid connection and this provides a means to initiate and deliver the first phase of the Harbury Future Energy project with less 'start up' cost.

The operational business case for Harbury as with other similar rural schemes relies on income from the sale of EV charging services either directly or via a membership. With the rapidly emerging EV sector, it is very difficult to forecast usage of the EV charging station and this has been noted elsewhere. The historical data analysed in the feasibility study shows a pattern of average low use especially in the early years post installation. The data also shows a preference amongst EV users for rapid public access charging facilities although patterns of usage fluctuate widely over time. More usage data is needed to support the significant additional capital cost of rapid charging infrastructure. The business model applied to Harbury must be able to cope with this variability and uncertainty or more likely, be supported through development and innovation funding until more robust patterns of use can be established.

8. Site, location and layout

8.1 Site selection

Harbury e-Wheels considered several potential sites in the village for locating the proposed EV charging station. For various reasons e.g. land ownership, accessibility, the village hall car park and playing fields became the obvious choice.

The land is owned by the Harbury Parish Council who have given their support to the project concept on the basis that they wish to promote clean transport modes and also support the e-Wheels service going forward. The Parish Council is also keen to extend the public car parking provision and ensure that an EV charging station will not reduce the number of car parking bays available. They have also considered that the erection of a wind turbine offers the opportunity to incorporate a much needed storage area for goalposts and sports field equipment

The Harbury Village Hall Trustees own the village hall which is connected to the mains electricity supply. The connection to the mains grid for import and export will be subject to a formal application in Stage 2 to Western Power Distribution (DNO) under G99 regulations and also a G100 application to enable the inclusion of the proposed battery storage. A preliminary investigation by WPD has confirmed that the 'maximum scenario' would be possible for the Harbury EV charging station (solar, wind, battery storage and EV chargers rapid and fast) as long as an Export Limitation System is installed restricting export to 56kW (Appendix 15).

The Trustees have given approval for installing a solar PV array on the roof for the purposes of powering the charging station. A roof load survey has confirmed its suitability for additional solar panel array.

The playing field site is flat land and has a south west aspect which suits both the solar PV proposed for the village hall roof and also the wind turbine. It is on the southern edge of the village with residential properties on the west border and village allotments on the east. Local residents are aware of the project concept through local social media – and further details will be disseminated following the feedback from the pre-planning enquiry and a public consultation will form part of any subsequent planning submission stage.

The feasibility study has revealed no environmental restrictions on the playing field area but it is understood that some archaeological investigations will be required as part of a formal planning submission.

Management of the proposed EV charging station will be via an operation and maintenance agreement between Harbury e-Wheels, the EV charge point operator selected and the Parish Council who are the landowners. Further details can be found in Section 10 Operation and Governance.

8.2 Main site layout plan – Harbury Playing Field

The image below (courtesy Google Maps) defines the location of the various components considered as suitable for the Harbury Future Energy EV charging project. The layout reflects the 'maximum' scenario i.e. with renewables and battery storage included:

The layout has gone through several iterations before arriving at the scheme shown – which has been submitted as a pre-planning enquiry to the local planning authority, and also as a preliminary grid application enquiry to Western Power Distribution (DNO). The final layout has been developed following the preliminary responses from both authorities.

Note: On the image above, the red lines indicate main grid connection cables, and the yellow lines indicate service cables to and from the main power container.

8.3 Solar PV system – village hall extension roof

The village hall extension was completed in 2015 and provides a south facing roof area with the capacity for adding a further 40 solar panels which will contribute around 11,000kWh (11MWh) to the EV charging station per annum. The roof location is adjacent to the proposed location of the power container as shown below enabling an easy DC power transfer to the battery storage unit.

8.4 Power container

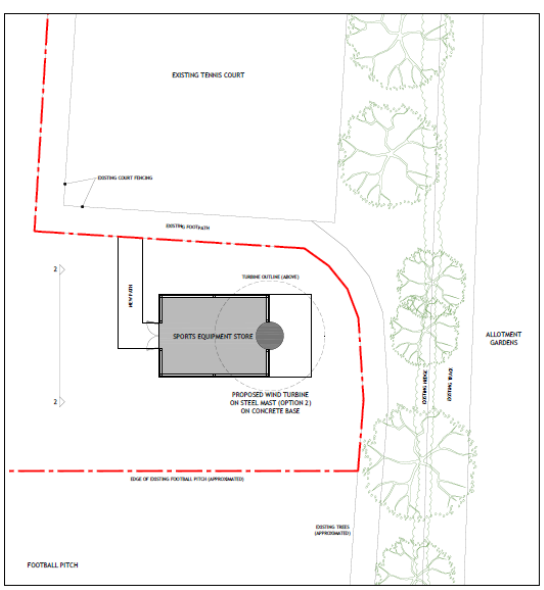
A central air-conditioned timber-clad power container will be required for Scenarios 2, 3 and 4 to house the main grid connection switches, the export limiter, the distribution board, control panels and the battery storage units. Its location adjacent to the village hall (west side) has been selected for the following reasons:

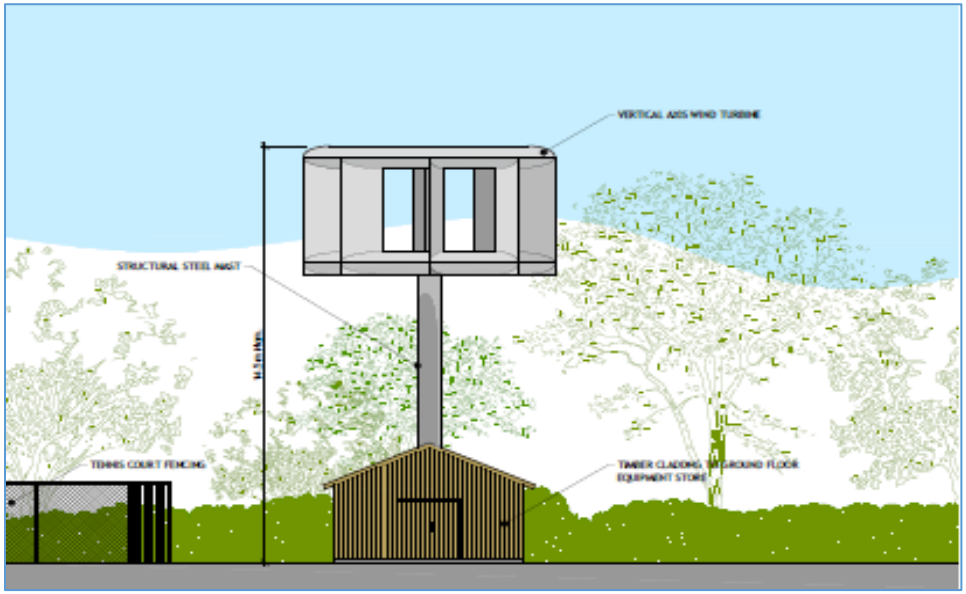
a) Proximity - to the grid connection some 35m away at the intersect between South Parade and Constance Drive – and also the proposed solar PV system on the adjacent village hall roof.
b) Appearance – as part of the village hall footprint it does not present a stand-alone structure.

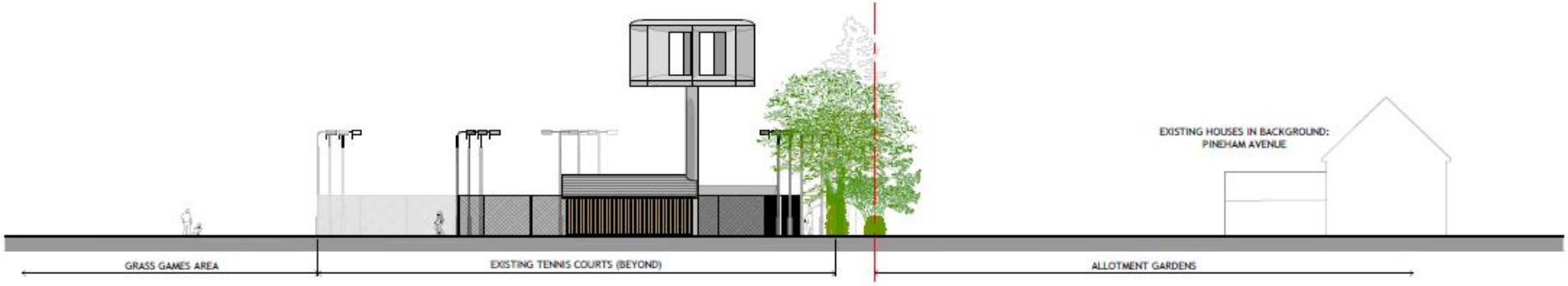
Note: Should battery technology not be installed in the first instance, a smaller mains cabinet will be installed on the site – which can be transferred to a power container as part of a subsequent retro-fit.

8.5 Wind turbine

The site selected as the most appropriate to the playing fields site and neighbouring properties was south of the tennis courts. This enables access to the prevailing air stream from the south west even though the McCamley VAWT is considered 'omni-directional'. It is also sited adjacent to the allotment gardens to the east boundary of the playing field which is bounded by trees (below the 10m height of the turbine base. As this location is some 150m away from the power container, battery and consumer board this location will incur higher capital cost of cabling and groundworks.

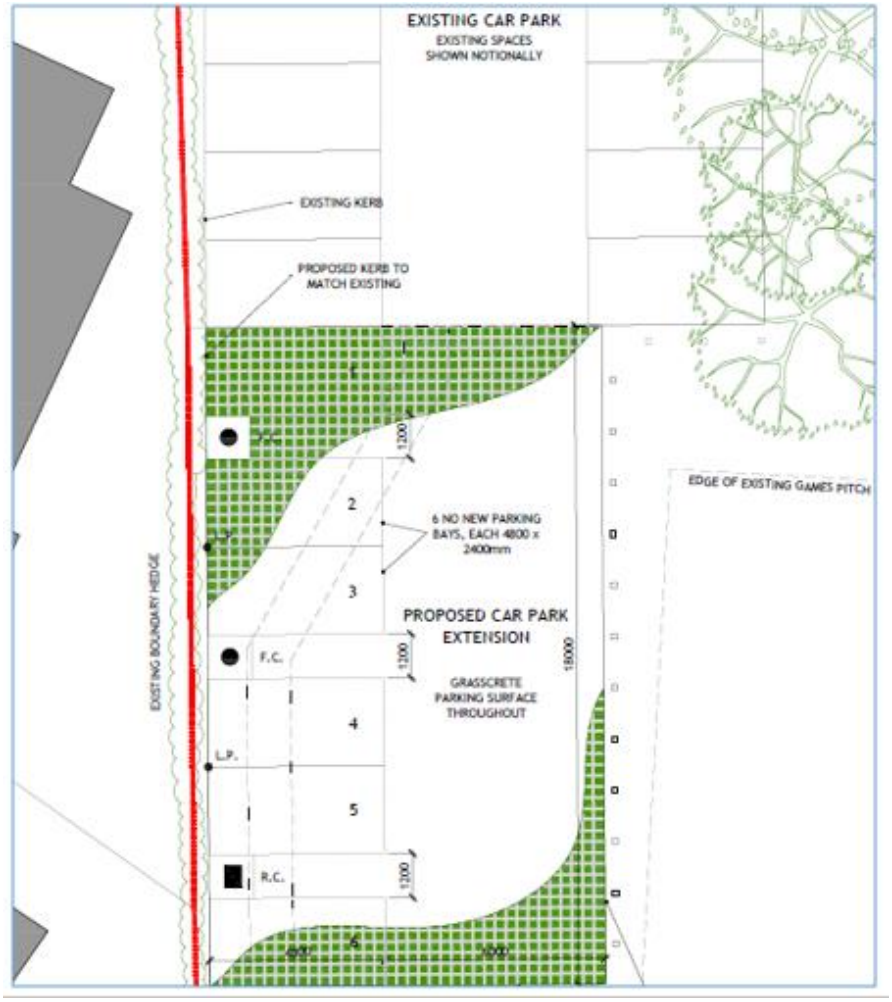






SECTION B-B: PARTIAL SITE SECTION THROUGH PROPOSED WIND TURBINE SITE (OPTION 2) - FROM SOUTH

8.6 Harbury Village Hall Car Park and proposed EV charging station location



The location of the EV charging station has been influenced by the Parish Council's wish to:

a) ensure through a car park extension that the capacity of the existing car park is not affected;
b) ensure that congestion on the main car park is avoided;
c) ensure that the car park extension does not encroach onto the existing junior soccer pitch

As such the proposal (approved in principle by the local planning officer) is to build a car park extension to house the EV charging station – adding six bays to the overall capacity. Note: the pre-planning enquiry response has requested a slight extension of each bay to 5m which can be accommodated in the design. The car park extension borders a local residence so attention will be paid to ensure no additional disturbance results i.e. visual, lighting, noise.

The use of 'grasscrete' is proposed to improve drainage and lower the visual impact of the car park extension. This has been included within the car park works estimate kindly provided by local civil engineering contractor RJ Hartwell (Appendix 10).

9. Planning and Permitting

9.1 Local planning authority discussion

A pre-planning application enquiry has been prepared and submitted to the local planning authority Stratford District Council (SDC) to ascertain the LPA's views on the proposed developments of Harbury Future Energy. This is provided as an Annex to this report. A planning specialist and architect have worked as part of the Greenwatt feasibility team and ensured close liaison throughout. The feedback from SDC in the form of a Pre-Application Report is attached as Appendix 14.

9.2 Summary of pre-application enquiry

Local and National Planning Policy Review

Several key strategy documents have been taken into consideration:

Local Development Plan

The relevant adopted Development Plan includes:

- Stratford on Avon District Core Strategy July 2016
- Harbury and Deppers Bridge Neighbourhood Plan November 2018

In addition there is guidance in the Development Requirements outlined in the Supplementary Planning Documents (SPD).

The Stratford Core Strategy includes policies relating to renewable energy. Policy CS.3 Sustainable Energy deals with renewable energy and specific policy in relation to wind turbines. The policy states that:

> *'Proposals for wind energy development will be supported where the impacts are, or can be, made acceptable, unless material considerations indicate otherwise.'*

This policy is subject to a number of criteria covering landscape/visual, heritage, traffic, biodiversity, amenity and other impacts. The policy also refers to the need for pre-application discussions with the local community, key consultees and the Council. Policy CS.9 which cover Design and Distinctiveness is also relevant. Policy CS 26 covers transport and communications. This provides support for the provision of EV charging points. It also sets out the Council's policy on Parking Standards. Policy CS.7 covers the protection and enhancement of Green Infrastructure.

The Harbury and Deppers Bridge Neighbourhood Plan provides support for sustainable development and includes Policy H.14 on Sustainable Design and Energy Efficiency. There are no specific policies on this type of development. The Village Hall playing fields are identified as a Local Green Space in Policy H.07.

National Planning Policy

The National Planning Policy Framework (Feb 2019) (NPPF) sets out the Government's national planning policy. The NPPF is generally supportive of proposals to transition to a low carbon economy and of renewable energy. Paragraph 152 states:

> *152. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.*

However in relation to onshore wind turbines footnote 49 states:

> *49 Except for applications for the repowering of existing wind turbines, a proposed wind energy development involving one or more turbines should not be considered acceptable unless it is in an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing.*

9.3 Key planning issues

9.3.1 Car Park Extension

The main issues regarding the car park which need to be considered are:

- Residential amenity of adjacent properties on Constance Drive.
- Highway considerations and parking standards
- Security and safety
- Relationship to adjacent boundary hedge

The Applicant and the Harbury Parish Council (landowner) note the Planning Officer's verbal and written comments on the above considerations.

9.3.2 Solar PV

The solar PV on the village hall roof has been confirmed as permitted development and no planning issues are envisaged with this part of the development.

9.3.3 Wind Turbine Development

In terms of the wind turbine the main planning issues to be considered are:

- Principle of wind turbine development in Stratford District
- Landscape and visual impacts
- Amenity of nearby properties/allotments
- Community consultation

The National Planning Policy Framework (NPPF) is supportive of community led initiatives. However, the NPPF is currently not supportive of further onshore wind turbine development unless it is identified within a Local Development Plan and has local community backing. As evidenced above, Stratford District Council's Core Strategy Policy CS.3 appears generally supportive of wind turbine development subject to meeting a number of criteria.

Given the above national and local policy position the Harbury Future Energy has sought the views from the District Council on the principle of wind turbine installation in this location.

It is acknowledged that the proposed vertical axis wind turbine (VAWT) mounted on a 10m mast would represent a significant structure within the village and therefore an assessment of its landscape and visual impacts will be required as part of a full planning application. At this pre-planning stage Planning Officer comments were invited on the preferred location and options put forward for the wind turbine.

The proposed location for the turbine is close to the eastern boundary of the playing field site beyond which are allotments and rear gardens of dwellings on Pineham Avenue. The Planning Officer was invited to comment upon any potential impacts on the amenity of these neighbouring uses, in particular whether further assessment of overshadowing may be required.

9.3.4 Power Container

The potential planning issues with the power container include:

- Visual appearance
- Noise from air conditioning unit (approx. 65 decibels at the unit)
- Potential impact on nearby trees protected under Tree Preservation Orders as pruning may be required

The siting and suggested cladding of the power container are designed to mitigate these issues. Further confirmation of air conditioning unit noise would be provided as part of the planning application.

9.3.5 Power Cable Connections

It is not envisaged that there will be any potential impacts resulting from cabling works provided - subject to avoiding impacts on trees within the site. However, an archaeological survey may well be required as part of a full planning application.

In addition any cabling works required to connect the Western Power sub-station would be outside of the planning application and would be installed by Western Power using their own Permitted Development rights as DNO.

9.4 Pre-planning application enquiry – summary of council response

The response received from Stratford District Council is included as Appendix 14. This comprises a review of the planning history of the site, relevant Development Plan policy and other guidance, details of relevant contacts and an assessment of the proposal in relation to all the main planning issues.

The response confirms that a planning application is required for the development with the exception of the rooftop solar PV panels.

A summary of the Planning Officer's assessment of the proposal is included overleaf.

9.4.1 Principle of Development

The response confirms that both the Stratford Core Strategy and Harbury and Deppers Bridge Neighbourhood Plan are supportive of sustainable development initiatives and provision of renewable energy and low carbon travel. The proposal to install an electric vehicle charging bay powered by renewable energy is therefore in line with the general thrust of local planning policy.

The Council has confirmed there is general policy support for Solar PV and in any event the proposed rooftop PV on the Village Hall would be Permitted Development not requiring a planning application.

In relation to the wind turbine, the Development Plan policy is supportive subject to assessment against a number of detailed criteria. The response provides further comment on these criteria. The turbine is considered to fall within the definition of a small turbine and Harbury is not a village considered to be particularly sensitive to this type of development based on the Renewable Energy Landscape Sensitivity Study.

A range of supporting information would be required with the application to demonstrate that there are no adverse effects on the Landscape and Visual amenity, ecology, highways during construction, radar, noise and vibration on local residents.

The proposal is considered to be in accordance with local planning policy and therefore could be supported in principle. The key consideration of the application will be the impacts of the proposed wind turbine and whether they are, or can be made acceptable. Further information would need to be provided to determine this at the application stage.

9.4.2 Design and Impact on Landscape

The design and visual impact of the proposed car park and power container was considered to be acceptable.

The enquiry presented two options for the wind turbine structure. The Council expressed a preference for Option 2 based on the turbine being supported by a mast. This was felt to be more visually lightweight. The Council also commented that further consideration should be given to see if the bulk of the turbine structure (as opposed to the mast) could be reduced to limit its impact.

A Landscape and Visual Appraisal (LVIA) would be needed to allow the Council to assess the impacts of the structure on the landscape. Additional tree planting was also recommended along the eastern boundary.

9.4.3 Residential Amenity

The Council will require further assessment of the impact of car park lighting and noise from the power container and wind turbine on nearby residents.

9.4.4 Highways

As discussed during the virtual meeting between the Consultants, Harbury Steering Group and the Council, the current proposed parking spaces do not meet the Council's standards and should be larger (2.5m x 5.5m) as they are bounded at one end by an existing hedgerow. However the Council has commented that if the existing overgrown hedgerow can be cut back to provide suitable clearance then a 5m bay length is acceptable. This avoids conflict with the adjacent sports pitch.

9.4.5 Trees

The site is close to existing trees including some covered by Tree Preservation Orders (TPOs). The Council will therefore require a tree survey which should include an impact assessment of the development proposals on the trees, tree protection plan, arboriculture method statement and possible mitigation proposals.

9.4.6 Archaeology

The Council have advised that the northern part is within an area of medium archaeological sensitivity. Due to the need for buried underground cables the application would need to be accompanied by an archaeological assessment to assess any impact on archaeology.

9.4.7 Ecology and Wildlife

The response states that an Ecological Assessment would be required with the application

9.4.8 Requirements to validate a future application

The Council have set out all of the documents and plans that they would require to be submitted with a future application. These are set out in detail in Appendix 2.

9.5 Environmental impact assessment and permitting

The project falls below the applicable thresholds and criteria for Environmental Impact Assessment as set out in The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended).

Environment Agency

No environmental permitting requirement is envisaged as the Harbury Future Energy project will not affect anything over which the EA have jurisdiction.

10. Operation and Governance

10.1 Introduction

This feasibility study for an Electric Car charging station in Harbury powered by local renewable energy has been initiated by Harbury e-Wheels. Harbury e-Wheels is a community transport service initiated in 2015 by Harbury Energy Initiative, a low carbon group for the village of Harbury, in association with All Saints Church Harbury. It provides free transport to people referred by local social agencies, such as food banks, surgeries, child centres and others, in order for them to reach important appointments that would otherwise prove financially or physically difficult for them.

Transport is provided by a group of 15 volunteer drivers, all DBS checked and all having signed a confidentiality policy agreement. The cars used for the transport are electric cars used exclusively by Harbury e-Wheels and supplied by Electric Zoo Ltd (Coventry). The service, therefore, not only aims to meet local need but does so in a clean, green way.

10.2 Legal entity

Harbury e-Wheels is the legal entity that will be used to manage the delivery of the project. It is a registered charitable company limited by guarantee (Registered Charity No: 1188537; Charitable Company No: 12369097). The EV charging station and associated renewable energy systems will be owned by a new legal entity described below and part of the Stage 2 project will be to establish that new legal entity.

Harbury e-Wheels will commission the project to establish the EV charging station and renewable energy systems. The management and operation of the scheme is yet to be determined (Stage 2) in association with EV charge station operator proposals.

10.3 Raising funds

The proposal for an EV charging station combining rapid (50kW DC) and fast (22kW AC) charging points is capital intensive (as shown in Section 6 above) – and its deployment as a pilot project will require significant funding through a combination of community energy grants e.g. Next Generation; Landfill Community Fund, local developer contributions (via Section 106 or Community Infrastructure Levy (CIL) and potentially community investment. There will also be a case for seeking innovation funding during Stage 2 aimed at reducing the capital costs of such technology to assist with market penetration.

The potentially low and uncertain early year revenue from the EV charging station would also require some operational cost support to ensure the project's viability until the revenue stream from the facility is established. Such levels of public investment will be needed if the 'market failure' of lack of private investment in rural EV charging infrastructure is to be avoided.

Harbury Energy Initiative has an impressive track record of raising funds and grants to support a number of low carbon energy and transport initiatives that benefit the local community of Harbury and surrounding settlements. A summary of the village community organisation fund raising since

2012 is shown below – with further detail included as Appendix 12. This provides evidence of successful grant application and project delivery within the Harbury community.

Organisation	Funds raised
Harbury Energy Initiative	£88,667
Harbury e-Wheels	£67,900
Harbury Village Hall	£529,796
Total raised 2012 – 2020	**£686,363**

10.4 Distribution of income

The EV charging station being proposed represents an enterprise which will generate both costs and revenues. This 'enterprise' carries significant risks in terms of financial viability especially in the early years following installation. Usage of the EV charge points in Harbury is expected to be low – but will gradually increase in line with the projected adoption of EVs over the next 5 years. One of the original objectives was that any profits generated from the EV charge station revenues would be used to support the e-Wheels service – which has an approximate running cost of c£15k per annum. In the early stages and dependent upon the usage profile, this may not be possible as the operational costs are likely to exceed the revenues. However, as a minimum, the Harbury e-Wheels community transport service would benefit financially from free EV charging at the point of use.

10.5 Community investment

This community investment model operating for renewable energy projects such as solar, wind and hydro are well established – with 84,000 engaged community members across England, Wales and Northern Ireland, who form part of 228 community energy organisations[44].

There is evidence of growing interest in expanding such community engagement and investment to fund the installation of public EV charging infrastructure. Community Energy England in their 'State of the Sector' 2018 report[45] refers to the existence of 20 community-owned EV charging points and 5 community-owned EVs in 2017 – of which Harbury EV Club was one. Since then it is highly likely that community owned EV schemes have expanded – although these appear to be largely for urban schemes.

One example of community involvement in EV charging schemes is Brighton Energy Cooperative (BEC is a Community Benefit Society) which is engaged in a 'Next Generation' pilot project[46] trialling electric vehicle charge points connected to their community-owned solar PV arrays. The pilot will measure EV charging usage to discover whether such community investment will provide sufficient additional income to make community owned solar PV viable post Feed in Tariff (FIT). BEC are keen to draw together a network of community-led initiatives including Harbury and establish a community of interest group to share ideas, challenges and lessons learnt.

[44] https://communityenergyengland.org/pages/state-of-the-sector-report-2018/
[45] https://communityenergyengland.org/news/state-of-sector-report-2020
[46] https://brightonenergy.org.uk/electric-vehicle-charge-points/

The Energy Savings Trust[47] suggest that community energy group members who contribute towards the costs of installing EV charging infrastructure might have sole or preferential use of charge points that they have helped to fund. Potentially, the EV charging station could service Harbury community members who pay an annual membership which gives them preferential rates for using the EV charging station. Non-members using the charging station would pay a more commercial rate.

In this way, community funded EV charging points [especially those connected to community renewable energy systems] can provide real benefit to a local area, as it keeps a far greater proportion of revenue within the community and the local economy. These funds can then be reinvested in additional EV charging points in line with expanding demand. However in the early years community investors will need to realise that a positive return on investment in a low use location like Harbury may be delayed until the number of EV drivers using the facility increases. As such, the local investment might be regarded as 'philanthropic investment'?

However EST also highlights why community EV charging schemes are not yet common practice:

> *'Electricity provided by community-funded charge points, when the community groups or co-operatives have previously invested in renewable energy generation, is likely to be 100% renewable and possibly cheaper than usual – as it goes straight from their solar panels or wind turbines to the charging points. So why isn't there more investment in community-owned EV charging points already?*
>
> *The main barrier is likely to be a lack of short-term demand. As these groups invest based on the requirements of their members, it is unlikely they would invest in electric vehicle charging until a significant number are using electric vehicles. It can also be tricky to secure locations for the charging points.*
>
> *In these cases, local authorities have a key role to play in creating opportunities for community groups to access suitable locations. For local authorities looking to expand their EV infrastructure network, supporting local groups to install and manage public charging points reduces the demands on their own finances, while also benefiting local communities. A potential win-win situation.'*

10.6 Managing a community investment EV charging scheme

Whilst Harbury e-Wheels and Harbury Energy Initiative demonstrate significant experience and commitment of their members, they are not a community energy investment organisation and are therefore not engaged in distribution of profits generated through energy projects. This is unlike other community groups in the locality such as Community Energy Warwickshire[48] (CEW) and Heart of England Community Energy[49] (HoECE).

[47] https://energysavingtrust.org.uk/blog/local-energy-and-community-groups-can-support-expansion-electric-vehicle-infrastructure

[48] http://www.cew.coop/

[49] https://www.hecommunityenergy.org/

Intermediary organisations such as Communities for Renewables[50] (CfR) already step in to support community energy groups through the provision of professional and financial skills needed to ensure community investment schemes in renewable energy are well managed, sustainable and profitable.

Most of the EV charge point operators and increasingly some of the energy are recognising the potential demand for EV charging infrastructure in non-urban areas. **Note:** This aspect of the Harbury Future Energy feasibility study has received advice and support from EO Charging and Octopus Energy for Business. Clearly the business model in these lower population density locations is more difficult to justify commercially – but operators working in partnership with community groups and local councils keen to encourage low emission transport represents a way forward.

In the Road to Zero strategy[51], published in July 2018, the Government has stated its ambition:

> *'To encourage and leverage private sector investment to build and operate a thriving, self-sustaining public network'.*

The Energy Savings Trust in a recent EV infrastructure procurement report[52] aimed at local councils suggested that with the right policy framework and more EVs on the road, the Government expects the market to deliver the public infrastructure needed in the long-term. However it is worthy of note and relevant to the Harbury Future Energy initiative that 'the Government will monitor gaps in provision and assess the need for direct central government support in areas of market failure'.

As with other community services, it may well become part of the responsibility and capital programmes of local councils to step in and address these market failures especially in less densely populated areas where user demand and profit from the charging station is likely to be low especially in the EV transitional years. Councils play a leading role in providing access for all and maintaining social equity. The transition to driving electric must be accessible and affordable for all.

The EV charging station and renewable energy systems carry particular service requirements that will need to be delivered by the operating body:

1) It must always be available (with minimum down time) and actively managed.
2) It must be safe and secure
3) The pricing of the charging station needs to be comparable (or better) with other EV charging services in the area. This may need dynamic management to avoid 'stranded asset' risk.

10.7 Operation models

Finding or designing the most suitable operation model for a rurally located EV charging station with locally attached renewable energy systems like in Harbury will be a main factor in the success of delivering an EV charging infrastructure accessible and affordable for all. Without this, EV charging will be for those fortunate to have access to a home charger or for whom the costs of public access rapid charging are not prohibitive. The need to ensure community engagement with and ownership of the project is important.

[50] http://www.cfrcic.co.uk/
[51] https://www.gov.uk/government/publications/reducing-emissions-from-road-transport-road-to-zero-strategy
[52] 'Procuring electric vehicle charging infrastructure as a local authority' Report Sept 2019

10.7.1 'Own & Operate' model.

This is where a community group or a council as 'host' are able to fund the capital costs of installation of an EV charging station – and will use a standard procurement system issuing Invitation to Tender to supplier / operators. Hosts can source capital funds from external grant providers such as Landfill Community Fund; Community Infrastructure Levy (CIL) from developer contributions; Office for Low Emission Vehicles (OLEV). Once procured the host will own the charging station, and have control of all revenue gained from charge point users – paying a monthly or annual fee to the supplier installer for a Service Level Agreement for maintenance and operation.

This model puts the host in full control of the system. However this requires not only suitable capital funds but also carries the associated risks and responsibilities – something that many councils and community grants may be ill-equipped to manage and would prefer to leave with the professional operators of EV charging stations.

10.7.2 Private operator model.

The direct alternative to EV charging infrastructure owned and managed by the host organisation is to hand over the total operation to the private sector 'operators' who use their own funds to install the charge points and provide 'back office' software and logistics to handle the payments and manage revenue. This transfer of costs, risks and liabilities from the host to the private sector allows a network infrastructure to be developed, and ensures that hardware and software upgrades are made in line with changing EV technologies. An agreement to transfer a percentage of the income from the EV charging is usually offered as part of the operational agreement between operator and host to provide a limited income stream.

In this private sector model, commercial operators are clearly interested in EV charging sites where there is strong user interest and able to generate healthy income streams. Whereas these are found either in city centres or large towns, at transport hubs or at shopping centres with large car parking facilities, there is less commercial interest in investing in sites where likely usage is low or uncertain. This is the situation in more isolated rural locations such as Harbury.

10.7.3 Concessional framework model.

This is a hybrid system where the operational costs and risks are shared, in part or completely, with a charge point supplier / operator. Private operators will still need to ensure a healthy income stream is possible – but the source of this income may be in the form of a service provision rather than as a direct share of charging income. Successful schemes mean that the capital and operational risks for the hosts are reduced – and the host retains ownership of the system. However, revenue generation is reduced or sacrificed completely in order to ensure a local EV charging service is provided in a 'less commercial' location. The risk is that neither party takes full responsibility especially if the scheme is tax-payer funded – leading to a service that does not meet EV user expectations.

The Energy Savings Trust provides a helpful summary of EV infrastructure procurement approaches taken by local authorities which includes concessional frameworks[53]

[53] 'Procuring electric vehicle charging infrastructure as a local authority' ~ Energy Savings Trust December 2019

10.7.4 Community investment model

The amount and power of community energy investment schemes has been documented earlier. With low interest rates on savings, members of the community are increasingly seeking local capital projects which if properly established and managed, can provide an attractive return on their investment. This system operates very successfully on solar parks – but it must be added that such investments have been de-risked to a large extent by the level of guaranteed and rime-bound subsidies via the now discontinued Feed in Tariff (FIT) or Renewable Obligations Certificates (ROCs).

Attention is now turning to investable projects which are based around integrated renewable energy generation, onsite storage and local usage of power – the emphasis being that income can be generated through savings of the costs of grid supplied heat and power. In essence, community investors respond to share offers with forecast returns on medium to long term infrastructure projects and schemes that can show either a robust business case, demonstrate a strong local need – or both!

Community investors gain much more than the financial return on shares – they may gain from cheaper services e.g. EV charging, enjoy 'touching and feeling' their investment infrastructure, and feel that they are investing ethically in their local environment and community.

Community groups can decide to manage investment schemes themselves as a community benefit society e.g. Community Energy Warwickshire[54] and Charge my Street (see below) or alternatively work with intermediary Community Interest Companies (CICs) such as Communities for Renewables (CfRCIC)[55] which helps communities to set up local energy enterprises and works with them to develop, finance and manage their own renewable energy generation.

Community investment EV charging models operating in partnership with local councils to ensure accessible charging infrastructure for all in more rural and suburban locations may be a model to pursue (Stage 2). Both Stratford District Council and Warwickshire County Council have expressed their interest and provided their support to the Harbury Future Energy feasibility study and this is a model which requires further development. The case for such an investment partnership will be heavily influenced by the high level of capital investment in these more isolated locations and the uncertain revenue streams from usage especially in the early years. Considerations such as social equity, accessibility for all, and philanthropic investment will also influence decisions.

10.8 Alternative community charging solutions

10.8.1 Co Charger[56] is a platform that enables the sharing of home charge points within a local community. Operating through an App, this service provides affordable and convenient local EV charging for those who cannot charge a vehicle at home. This could be because the EV driver is living in rented property or does not have off-street parking – estimated by Co Charger as around 40% of the national driving population. This community model is based upon the principle of 'collaboration over competition'. Co Charger is affiliated with the 'Co Cars' family based in Exeter which also includes 'Co Bikes' and 'Co Delivery'. Together, their focus is upon providing a shared, community-driven, zero-emissions future.

[54] http://www.cew.coop/
[55] http://www.cfrcic.co.uk/
[56] https://co-charger.com/about-us/

10.8.2 Charge my Street[57] is a community benefit society that installs and operates community charge points across the North of England, raising capital through community shares. The Society's aim is to drive EV adoption by giving everyone access to a charge point within a 5 minute walk of their homes. Charge my Street has already successfully demonstrated that community investment can provide charge points and stimulate demand for EVs in areas without off-street parking by installing charge points at two locations in Lancaster, and in two Cumbrian villages.

Charge My Street plans to install around 200 new charge points in the north of England by March 2021. It is part of a government-funded programme to install more charge points in areas where people don't tend to have their own driveway, and in rural areas that commercial charge point providers might not reach. Based on a 'host and user' model, it provides a means of attracting more people to hosts' premises e.g. a local shop or pub, whilst servicing the community.

The aim of the project is to ensure that the cost of installation and operation is as little as possible – and in many cases, there will be no cost at all to charge point hosts. The community partnership will pay for as much of the capital installation costs as possible, with Charge my Street's total contribution depending on the number of charge points the host wishes to install, and any upgrades to the grid or changes to parking bays required. Hosts are requested to promote Charge my Street's periodic Share Offers.

10.9 Succession planning

Harbury Energy Initiative and e-Wheels are both voluntary organisations and therefore unlikely to have sufficient resource themselves fund or manage the EV charging station and renewable energy systems over the project life of 20 years. Therefore whilst the assets should be held by the community e.g. via a Community Investment Company, an operational agreement between stakeholders will be required. This could include local councils, charge point operators, energy suppliers and the Harbury community organisations themselves.

[57] https://www.chargemystreet.co.uk/

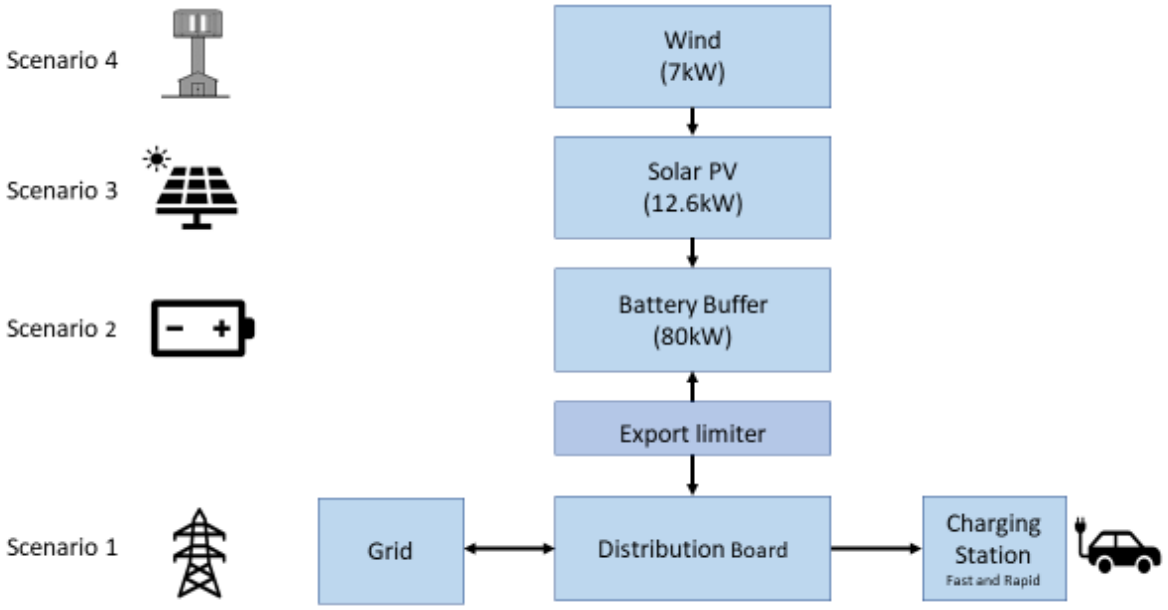
11. Scheduling

11.1 Activity schedule

Should the Harbury Future Energy Project proceed to the next stage of its development, Harbury e-Wheels would apply to the Rural Community Energy Fund for Stage 2 funding in October 2020. A draft activity schedule is attached as Appendix 5. As a prospective start date will be subject to further grant assistance and souring of match funding, the schedule has a month by month allocation rather than actual dates.

11.2 A programme of incremental delivery

Whereas the modelling for this study has been based upon delivering the maximum – and preferred – scenario, the high capital cost and uncertain early year's usage and revenue may require a form of incremental delivery. Where the project is delivered in stages this would also allow adjustments as the emerging demand develops and which would influence the business case develops. To illustrate this, the four technical scenarios discussed above can be broken down as follows:



Scenario	Coverage
1	This uses green energy direct from the grid to support fast and rapid EV charging but with no battery nor renewable electricity generation installed.
2	As Scenario 1 but with the inclusion of an onsite battery storage system used to store off peak grid electricity for use in the EV charging station.
3	As Scenario 2 with the installation of a 12.6kWp solar PV array on the village hall roof. The output would be stored in the battery for use in the EV charging station.
4	As Scenario 3 with the installation of a 7kW vertical axis wind turbine. The output would be stored in the battery for use in the EV charging station.

12. Summary of Results

1. Harbury is a large rural village in South Warwickshire, population of approximately 3,000 people and 1,400 households. The forecast growth of electric vehicles (EVs) over the next decade will require charging points in rural locations such as Harbury that do not always represent a strong commercial case for investment.

2. This feasibility study represents the commitment of a highly motivated rural community group to develop the Harbury Future Energy (HFE) project which aims to provide electric vehicle (EV) charging facilities in the village accessible to all.

3. Data related to usage and demand for fast and rapid EV charging in rural areas is sparse and deserves more attention to ensure rural communities are not disadvantaged. This raises the issues of 'social equity' and accessibility as an integral part of EV transition.

4. The proposed location for the EV charging station would be on an extension to the Harbury village hall car park, providing charging bays for six EVs of which two will service the e-Wheels fleet.

5. A preliminary grid connection assessment by the Distribution Network Operator (Western Power Distribution) has confirmed there is sufficient capacity at the local sub-station to operate four 22kW fast chargers and one 50kW rapid charger solely from the grid. Other rural settlements are less fortunate and require alternative technical solutions to power EV charging stations e.g. battery and renewables.

6. The HFE Steering Group was keen to investigate how on-site renewable energy and battery storage technologies might contribute to a sustainable and resilient power source for EV charging.

7. An options analysis examined the sourcing of power for the EV charging station and resulted in the following scenarios:
   Scenario 1: using electricity directly from the grid
   Scenario 2: using off-peak electricity from the grid and stored onsite in a battery
   Scenario 3: using off-peak electricity from the grid plus solar energy stored in a battery
   Scenario 4: using off-peak electricity from the grid, solar, wind energy stored in battery

8. The EV charging station at Harbury could operate without renewable technology and draw power entirely from the grid using 'green' energy and off-peak tariffs from the mains grid (Scenario 1) - representing the lowest start-up cost.

9. An integrated battery would buffer supply and demand and provide the opportunity to store off-peak mains power as well as renewable electricity generated onsite. However, battery technology significantly increases the capital cost of infrastructure and could be regarded as a 'retro-fit' solution once demand increases and the cost / benefit ratio improves.

10. It is possible to install 12.6kW of solar photovoltaic panels (PV) on the village hall extension roof would provide a cost-effective but relatively small contribution to the EV charging station power demand. However, the solar energy profile is seasonal and on its own, will not necessarily match the demand profile.

11. The inclusion of a 7kW vertical axis wind turbine suitable for this village location would also provide a relatively small contribution to the EV charging station demand. This innovative turbine design brings some technical advantages over traditional systems and its annual generation profile especially in winter months provides a balance for the solar generation. As the wind turbine would add significantly to the capital cost of infrastructure, it could be regarded as a 'retro-fit' solution.

12. The study has highlighted the challenges faced by rural communities in ensuring availability of local EV charging facilities whilst mitigating the risks of high capital set up costs against initial low returns until EV ownership and local demand for EV charging increases.

13. The start-up capital costs of the HFE project including car park are high if battery storage and renewables are included. A phased and incremental approach with future proofing measures included at the outset would match EV charging demand and the availability of capital funds.

14. The potentially low and uncertain revenue forecasts from the EV charging station in the early years will require some operational cost support until user demand increases to ensure the project's long term financial viability.

15. A pre-planning enquiry including the wind turbine, car park, EV charging station, battery and power container gained the preliminary written support from Stratford District Council Planning Officers – subject to site investigations, evidence and public consultation.

16. The HFE project has the support from Stratford District Council and Warwickshire County Council who are seeking solutions to the provision of EV charging infrastructure in similar rural locations and communities. It also has the full support from Harbury Parish Council (landowners) and Harbury Village Hall Committee (hosts).

17. The HFE proposal includes wider community benefits such as an extended village hall car park and a sports field equipment store as part of the wind turbine structure. It supports the carbon reduction and clean air objectives of Harbury Energy Initiative and the community.

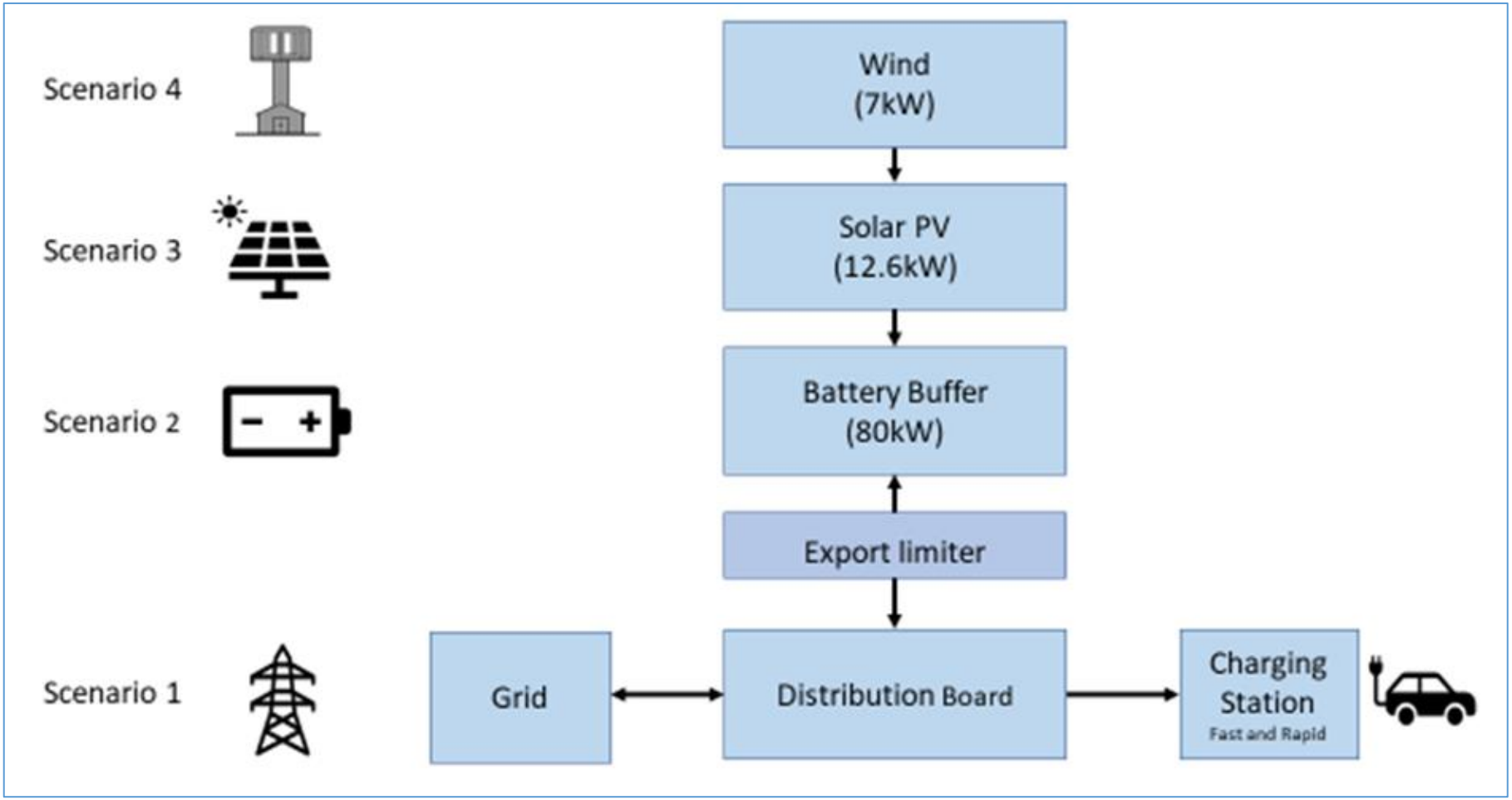
18. The structure of Harbury Energy Initiative / e-Wheels needs further examination to determine the organisation's level of ownership, responsibility, management and operation of the EV charging station. This might require a change of status to a Community Interest Company (CIC) – designed for social enterprises that want to use their profits for the public good.

19. The next stage of the HFE project development should aim to confirm and adjust the technical proposals outlined, refine the demand and revenue forecasts, update cost estimates, carry out investigations necessary for a detailed planning application, identify suitable capital / revenue funding sources, identify organisational structure, develop a marketing plan to increase awareness and demand, and deliver an investment ready project.

20. This feasibility study has shown that Harbury provides a good location, a committed community and a suitable development platform to demonstrate the technical feasibility, further assess the financial viability, and deploy innovative solutions to deliver the necessary EV charging infrastructure for rural communities and more isolated settlements.

APPENDICES

Appendix 1: Harbury EV Charging System - Incremental Model



Appendix 2: Cost Analysis

Note: All costs shown here are ex VAT. Most figures are budget estimates and could be subject to change once formal quotations are received.

The Study analyses costs for four levels of technical scenario as described in Section 6. This section shows the breakdown of individual components which may be included in some or all of the 4 scenarios put forward.

Appx 2.1 Solar PV Option

Item	Cost Estimate	Covering	Source	Certainty
Village hall - 40 roof mounted 315w PV panels, 12.6kWpeak	£12,900	Supply and install	CAMLEC Ltd estimate dated 6/6/2020	Fixed quote valid for 30 days from receipt. After then use as a budget guide price.
Cabling to battery store	£1,000	Ground work and cabling	Greenwatt	Budget estimate
Installation	£0	Covered by the main installation quote	n/a	n/a
TOTAL CAPEX Estimate	**£13,900**			
O&M	£0 per annum	No maintenance costs expected	Greenwatt	Prior project experience
Renovation provision	£1,500 (one off)	1 inverter replacement during life of project (usually after 10 years)	Greenwatt	Prior project experience
TOTAL O&M	**£1,500 (one off)**			

Solar Yield Estimate

Item	Yield Estimate	Covering	Source	Certainty
Power generation estimate at site	11,850 kWh / annum	Estimated annual yield for roof mounted 12.6 kWp solar array.	Greenwatt - PV yield calculation tool using SAP metrics (PVGIS)	Greenwatt estimation tool
Yield degradation provision (annual)	Year 1 - 2% Year 2 onwards 0.54% pa	Accounts for reduction in yield due to wear and degradation in equipment over project life.	Q-Cell specification sheet	Q-cell warranty sheet

Appx 2.2 Wind Renewable – VAWT 7kW McCamley Ltd (UK) Capital and Operational Cost Estimates (all ex VAT)

Item	Cost Estimate	Covering	Source	Certainty
CAPITAL COSTS ESTIMATE				
McCamley 7kW VAWT turbine supplied to site with inverter	£43,500	7kW McCamley VAWT, inverter, connection to power container. Manufacture and delivery of the turbine to Harbury Playing Field. No installation costs nor support structure costs included.	Budget proposal received from McCamley dated 31/3/20	McCamley budget proposal
McCamley VAWT mounting, foundation and storage options				
Mounting Option 1 – VAWT mounted on a clad steel frame tower with integral sports storage structure				
Steel frame tower for mounting the turbine.	£25,000	10m steel frame tower.	McCamley Email from Philip Mayer 15/6/20	McCamley budget proposal
Cladding for steel tower for use as a sports equipment store	£14,000 - £20,000 (mid-point £17,000)	Timber cladding for steel tower to enabling use as a secure storage space for sports field equipment. To include power and lighting, fitting, ladders, security etc. Timber clad area = 260 m2 @ between £55/m2 - £80/m2 installed	https://www.self-build.co.uk/timber-cladding-what-will-it-cost/ Estimate confirmed as 'reasonable' by McCamley in email on 13/7/2020.	Subject to commercial quotes. Self-Build website suggests quality range for cedar cladding at between £20 and £40 / m2 and approx. £35-40 /m2 for fitting.
Foundation for steel tower	Not known	Concrete and steel reinforcement foundation for mounting steel tower. Includes excavation, concrete and spoil removal.	Unable to estimate until a detailed engineering study is carried out. Foundations are project and site specific and requires design by a structural engineer – as per email from McCamley 23/6/20.	Not included as part of Phase 1 study

Item	Cost Estimate	Covering	Source	Certainty
Mounting Option 2 (Preferred) – VAWT mounted on a steel mast with additional freestanding sports storage structure				
Steel mast for mounting the turbine	£10,000	10m mast	McCamley – email from Philip Mayer 15/6/20.	McCamley budget proposal
Sports equipment store	£10,000-£14,000 (mid-point £12,000)	To include free standing wooden structure with security, lighting and internal fit out. Includes concrete slab base	Warwick Buildings website lists double garage structure 8m x 5.5m for £8,750. Cost estimate expanded to include fitting and slab foundation. Estimate confirmed as 'reasonable' by McCamley in email on 13/7/2020.	Warwick Buildings Website price listing for buildings http://www.warwickbuildings.co.uk/garages-workshops Greenwatt budget estimate for fittings
Mast foundation	Not known	Concrete and steel reinforcement foundation for mounting steel mast. Should include excavation, concrete and spoil removal.	Unable to estimate until a detailed engineering study is carried out. Foundations are project and site specific and requires design by a structural engineer – as per email from McCamley 23/6/20.	Not included as part of Phase 1 study
Other installation costs applied to Mounting Options 1 and 2:				
Delivery	£0	Covered by the McCamley budget proposal above.	McCamley – budget proposal received from McCamley	McCamley budget proposal dated 31/3/2020
Installation	£5,000		McCamley – included in the main VAWT budget proposal	McCamley budget proposal dated 31/3/2020
Cabling and ground work	£0	150m buried 3-phase cable for 7kW connection between the VAWT and the grid connection/ battery container near the village hall.	McCamley – supplied as part of the main equipment budget proposal as per email 23/6/20	McCamley budget proposal
O&M	£870 pa	O&M Cost (£/year) @ 2% of capital cost. Just for the VAWT.	McCamley Budget proposal	McCamley budget proposal 26/5/20

Item	Cost Estimate	Covering	Source	Certainty
Renovation provision	£0 pa + £1500 one off	Covers parts replacement after 2 year warranty expired. Assumes only 1 inverter replacement after 10 years @£1500 but no other refurbishments.	Greenwatt estimate - confirmed as 'reasonable' by McCamley in email on 13/7/2020.	Greenwatt budget estimate
TOTAL O&M	**£870 pa + (£1500 one off)**			

McCamley VAWT Capital Cost Estimate Summary

Item	Equipment, mounting, installation excluding cladding and storage area	Foundations	Sports Equipment Storage Structure
Option 1 VAWT tower mounted	**£73,500**	Not known	£14,000 - £20,000 estimate for tower timber cladding with basement store
Option 2 VAWT mast mounted	**£58,500**	Not known	£10,000 - £14,000 estimate for stand-alone timber store

McCamley VAWT Yield Estimate

Item	Yield Estimate	Covering	Source	Certainty
Power generation estimate at site	9,330 kWh / annum	Average estimated annual generation at 10m tower/mast height	McCamley and NOABL. NOABL wind speed figure for the site at 10m of 5.3m/s. Power curve provided by McCamley in their budget proposal	McCamley budget proposal dated 31/3/20
Yield reduction provision	0% pa	Covers any reduction in yield due to wear and degradation in equipment over project life.	McCamley – Email from Philip Mayer dated 19/6/20, states no annual yield reduction is expected.	Statement by McCamley

Notes:

1) Confirmation received from McCamley on 13/7/2020 via email confirming "budget figures for Options 1 and 2 are good enough for this stage of the process".

2) As a result of the pre-planning enquiry and subsequent discussions, the HFE Steering Group decided to make Option 2 – the mast mounted turbine – their preferred option which would go forward to any next stage of development.

Appx 2.3 Wind Renewable – HAWT 25 kW EO Cycle (Canada)

Item	Cost Estimate	Covering	Source	Certainty
EO25 HAWT, 25kW	£140,000	25 kW turbine on 23.5m mast. Guide price from EO Cycle for a turnkey project which would include planning, installation, commissioning, 2 years maintenance	EO Cycle Email dated 26/5/2020.	Rough guide price supplied by EO Cycle not a formal quote
Steel mast for mounting the turbine	£0	23.5m mast included in the turbine price	n/a	n/a
Sports equipment store	£10,000 - £14,000 (mid-point £12,000)	To include free standing wooden structure with security, lighting and internal fit-out. Includes concrete slab base. Same structure as specified for the McCamley VAWT with mast.	Warwick Buildings website lists double garage structure 8m x 5.5m for £8,750. Cost estimate expanded to include fitting and slab foundation.	Warwick Buildings Website price listing for buildings http://www.warwickbuildings.co.uk/garages-workshops Greenwatt budget estimate for fixtures and fittings
Foundations	Included in EO Cycle estimate	Includes excavation, concrete and spoil removal.	n/a	n/a
Delivery	Included in estimate	Delivery to site	n/a	n/a
Installation	Included in estimate	Covered by main guide price	n/a	n/a
Cabling and ground work	£2,800	150m buried 3 phase cable for 25kW connection between the turbine site and the grid connection/ battery container near the village hall	Estimate from an M&E consultant for 7kW cable for smaller wind turbine. Estimate increased by 50% to cover heavier duty cable.	Rough guide price sourced by Greenwatt
TOTAL CAPEX	**£142,800 plus £10,000 - £14,000 (equipment store)**			

Item	Cost Estimate	Covering	Source	Certainty
Operation & Maintenance	£1,500 per annum	Approx. 1% of equipment cost	EO Cycle Email with project cost illustration received 29 May 2020	Rough guide price supplied by EO Cycle not a formal quote.
Renovation provision	£1500 (one off)	Budget estimate includes 2 years maintenance. Assumes only 1 inverter replacement after 10 years @£1500 but no other refurbishments.	EO Cycle & Greenwatt Email from EO Cycle date 26/5/2020 and Greenwatt estimate for inverter replacement.	Rough guide price supplied by EO Cycle not a formal quote. Greenwatt budget estimate for inverter
TOTAL O&M	**£1,500 per annum + £1,500 (one off)**			

EO Cycle 25kW HAWT Yield Estimate

Item	Yield Estimate	Covering	Source	Certainty
Power generation estimate at site	101,000 kWh / annum	Average estimated annual generation at 25m mast height at the Harbury site.	EO Cycle. Budget illustration received 29/5/ 2020	Rough guide price supplied by EO Cycle not a formal quote.
Yield reduction provision	0% pa	Covers any reduction in yield due to wear and degradation in equipment over project life.	EO Cycle Email dated 29/5/2020 confirms that the yield estimate is net of any performance degradation.	EO Cycle statement

Appx 2.4 Wind Renewable – HAWT 7.5 kW – Braun (Germany)

Item	Cost Estimate	Covering	Source	Certainty
Antaris HAWT, 7.5kW on 12m mast / pole	16,600 Euros £15,100 (20/7/20)	7.5kW Antaris turbine and inverter. "complete Grid connected system Grid controlling ENS and Turbine controlling, incl. Smart!wind 7.5 3-phases Grid Inverter; Heating Rod 6.0 kW Dump load 6.5 kW Rotor diameter 5.30 m, slip rings"	Braun Published list price (Note. 1) for turbine, note prices in Euros converted to £ sterling July 2020	Published list prices Braun
Steel mast for mounting the turbine	4,500 Euros £4,100 (20/7/20)	12m pole , includes tilting mechanism	Braun Published list price (Note. 2) for mast, note prices in Euros converted to £ sterling July 2020	Published list prices Braun
Sports equipment store	£10,000 - £14,000 (mid-point £12,000)	To include free standing wooden structure with security, lighting and internal fit out. Includes concrete slab base. Same structure as specified for the McCamley VAWT with mast.	Warwick Buildings website lists double garage structure 8m x 5.5m for £8,750. Cost estimate expanded to include fitting and slab foundation.	Warwick Buildings Website price listing for buildings http://www.warwickbuildings.co.uk/garages-workshops Greenwatt budget estimate for fittings
Mast foundation	Not known	Concrete and steel reinforcement foundation for mounting steel mast. Should include excavation, concrete and spoil removal.	Unable to estimate until a detailed engineering study is carried out. Foundations are project and site specific and requires design by a structural engineer.	Not included as part of Phase 1 study
Delivery	£1000	Shipping from Germany and delivery to site (approx. 850km). Turbine weight 225kg + pole and other items.	Greenwatt Rough guide estimate of £1/km transport	Greenwatt budget estimate

Item	Cost Estimate	Covering	Source	Certainty
Installation	£5,000	Installation at the site. This would need to be done by a local installer.	Use the McCamley installation estimate as a guide price.	Greenwatt budget estimate
Cabling and ground work	£1,900	150m buried 3 phase cable for 7kw connection between the VAWT and the grid connection/ battery container near the village hall	Estimate from an M&E consultant	Greenwatt sourced budget estimate
TOTAL CAPEX	**£27,100 plus** £10,000 - £14,000 (mid-point £12,000) for equipment store	Includes sport storage		
OPEX				
Maintenance	£0 per annum	Covers maintenance activity after the 2 year warranty period.	Braun Email dated 4/5/2020 says there are not maintenance costs apart from one adjustment.	Braun statement
Renovation provision	£1500 (one off)	Inverter replacement	Greenwatt	Greenwatt budget estimate
TOTAL OPEX	**£0 per annum + £1500(one off)**			

Notes:

1) Turbine list source: Pricelist englisch 01.08.2018 GH.pdf

2) Pole price list source: Pricelist Pole 01.01.2019 Dealer.pdf

Braun Wind 7.5kW HAWT Yield Estimate

Item	Yield Estimate	Covering	Source	Certainty
Power generation estimate at site	10,500 kWh / annum	Average estimated annual generation at 10m mast height at the Harbury site using NOABL average site wind speed of 5.3 m/s.	Braun Power curve taken from brochure {reference in appendix} estimate 1.2kW at 5.3 m/s. Note 1 Email received 4/6/2020.	Estimated yield taken from power curve in brochure.
Yield reduction provision	0% pa	Covers any reduction in yield due to wear and degradation in equipment over project life.	Assume no yield reduction	Assumption

Notes:

1) Source of power curve: Broschuere-EN_web_Stand_05-2020.pdf

Appx 2.5 EV Charging Station

Option 1 would apply to the Minimum Technical Scenario and Option 2 to the Medium and Maximum Technical Scenarios.

Item	Cost Estimate	Covering	Source	Certainty
4x 22 kw AC and 1 x 50 kw DC	£41,400	4x 22 kW AC chargers and 1x 50 kW DC charger	EO Charging, budget estimate received 22/7/20	Budget estimate
Foundations	£0	Assume in car park cost		
Delivery	£0	Included in the quote above		
Installation	£0	Included in the quote above		
Cabling and ground work	£1,000	Cabling to battery container at village hall, assume 80m @ £12.33/m	Greenwatt Sourced from M&E consultant	Budget estimate
TOTAL CAPEX	**£42,400**	4x 22 kW AC chargers and 1x 50 kW DC charger		
O&M				
Maintenance	£720 per annum	Charger management and billing	GreenMotion budget estimate 4 x £120 per annum per fast charger and £240 per annum per rapid. Email received 1/7/20	Budget estimate
Monitoring and data collection	£0	Monitor and data collection included in maintenance	Included in the maintenance estimate	
Renovation provision	£0	Equipment replacement during the lifetime of the project	No evidence of renovation costs at this stage	
TOTAL O&M	£720 per annum			

Appx 2.6 Battery Store

Item	Cost Estimate	Covering	Source	Certainty
100 kwh battery store and	£78,000	80kW 100kWh storage system based on 2 off xStorage Compact systems including comms module: £58K. Containerisation, including internal fit-out, thermal management, G99 & G100 control: £20K	Eaton Power Email received 17/6/ 2020	Eaton budget estimate
Foundations	Not known	Concrete and steel reinforcement foundation. Should include excavation, concrete and spoil removal.	Unable to estimate until a detailed engineering study is carried out. Foundations are project and site specific and requires design by a structural engineer.	Not included as part of Phase 1 study
Delivery	£0	Believed to be covered by the above figure		
Installation	£10,000	On-site installation including testing & commissioning	Eaton Power Email received 17/6/2020	Eaton budget estimate
Cabling and ground work	£1,000	Groundwork and cable connection to the charge points	Greenwatt	Budget estimate
TOTAL CAPEX	**£89,000**			
O&M				
Maintenance	£1,600 per annum	Covers maintenance and support of equipment.	Greenwatt Budget estimate using approx. 2% of the equipment cost. Subject to review by supplier in a formal quote.	Budget estimate
Refurbishment				
Total O&M	**£1,600 per annum**			

Appx 2.7 Grid Connection

Item	Cost Estimate	Covering	Source	Certainty
Grid connection	£22,000	Connection covers supply to 4x22 kW and 1x 50 kW also feed in from renewables. 145kva import / 56 kw export. Contains contested £8000 and uncontested work £6000. Cable route is down foot path £8000.	Western Power budget estimate dated 7/8/20.	Budget estimate
TOTAL CAPEX	**£22,000**			
O&M				
Total O&M	**£0 pa**	No provision made at this stage		

Appx 2.8 - Car Park Extension

Item	Cost Estimate	Covering	Source	Certainty
Car Park extension	£20,000	6 new parking bays, grasscrete, kerbing, signage, lighting as per drawing	R J Hartwell Ltd	Budget estimate received 21/7/20

Appx 2.9 - Other Project and Operating Costs

Other project and operational cost estimate for each of the technical scenario are dependent on the equipment installed and the capital cost of that equipment.

	Technical Scenario Cost Estimates						
Item	**Scenario 1, CAPEX £62k**	**Scenario 2, CAPEX £151k**	**Scenario 3, CAPEX £165k**	**Scenario 4, CAPEX £236k**	**Covering**	**Source**	**Certainty**
Project Costs **CAPEX**							
Contingency	£3,120	£7,570	£8,265	£11,790	Assume 5% of capital cost of equipment as shown in the column headings	Greenwatt Budget estimate	Budget estimate
Planning fees	£9,300	£12,600	£12,600	£21,950	Preparation of application; planning fee.	Budget estimate from Greenwatt planning consultant	Budget estimate
Professional Fees	£9,360	£22,710	£24,795	£35,370	Covers project management and professional fees including ground surveys and searches. Assume 15% of project costs as shown in the column headings.	Greenwatt Budget estimate	Budget estimate
Total project costs	**£21,780**	**£42,880**	**£45,660**	**£69,110**			
Operating Costs **OPEX per annum**							
Operating service	Not known	Not known	Not known	Not known	Operation of the service by another organisation	Not budgeted for at this stage of the study as the operating model is uncertain.	

	Technical Scenario Cost Estimates						
Item	**Scenario 1, CAPEX £62k**	**Scenario 2, CAPEX £151k**	**Scenario 3, CAPEX £165k**	**Scenario 4, CAPEX £236k**	**Covering**	**Source**	**Certainty**
Infrastructure insurance	£926	£2,247	£2,454	£3,500	Budget estimate was received for Scenario 4. This was reduced proportionally by the CAPEX for the other two scenarios. Covers public liability, fire, theft, damage. Note product liability is covered by the suppliers.	Greenwatt: Sourced from insurance broker	Budget estimate
Business insurance	Not known	Not known	Not known	Not known	Personnel insurance, operational insurance	Not budgeted for at this stage of the study as the operating model is uncertain	
Staff costs	£0	£0	£0	£0	It is expected that this will be operated as a service – with a combination of inclusion within operator agreement and volunteer time.		
Electricity purchase	£3,940	£3,050	£1,880	£970	Assumes scenario 1 buys at 13p, other scenarios buy off peak at 9.82 p (Octopus quotes) with a standing charge of £286 per annum added in each case.	Greenwatt modelling	Modelling forecast high uncertainty
Total operating costs per annum	£5,586	£7,617	£6,729	£7,810			

Note: Electricity purchase cost is variable depending upon charge point usage and renewable energy available.

Appx 2.10 - Summary of CAPEX and OPEX estimates for equipment

This Table shown below provides a summary of the CAPEX and OPEX for the equipment costs. Alternative wind power options are shown for completeness. This cost summary is based upon Scenario 4 which incorporates:

1. 4x 22 kW and 1x 50 kW charging station
2. 80kW/100 kWh battery store
3. Grid connection
4. 12.6 kWp PV
5. 7 kW VAWT

Other configurations of equipment analysed below comprise the other technical scenarios.

CAPEX and OPEX budget estimates for the major equipment components (Figures rounded to the nearest £100)							
	Item	**CAPEX**	**Foundations**	**Sports equipment Store**	**OPEX** per annum or one off as indicated	**Annual Generation Estimate**	**Estimated Cost of Energy p/kWh**
1	PV on village hall, 12.6 kWp	£13,900	n/a	n/a	£1,500 (one off)	11,850 kWh per annum	6.5
2	Option 2 (preferred) – 7kW VAWT on mast with equipment store	£58,500	Not known	£10,000 - £14,000	£900 per annum plus £1,500 (one off)	9,300kWh per annum	41.5
	Alternative wind options:						
2a	Option 1 – 7kW VAWT on timber clad steel frame with equipment store	£73,500	Not known	£14,000 - £20,000	£900 per annum plus £1,500 (one off)	9,300kWh per annum	49.6
2b	EO 25 HAWT, 25 kW	£142,800	Covered by main cost	£10,000 - £14,000	£1,500 per annum plus £1,500 (one off)	101,000kWh per annum	9.3
2c	Wind Braun HAWT, 7.5 kW	£27,100	Not known	£10,000 - £14,000	£1,500 (one off)	10,500kWh per annum	21.4
3a	Charging station, fast and rapid chargers	£42,400			£720 per annum		
	Other components:						
4	Battery store	£89,000			£1,600 per annum		
5	Grid connection	£22,000					
6	Car park extension	£20,000					

Appx 2.11 - Summary of CAPEX and OPEX budget estimates for the four technical scenarios

This section summarises the CAPEX and OPEX for the four technical scenarios described in Section 6. Figures are rounded to the nearest £100. As noted earlier these figures are budget estimates and subject to update in formal quotations.

BUDGET ESTIMATE CAPEX COSTS OF THE 4 TECHNICAL SCENARIOS				
Item	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Grid connection	£22,000	£22,000	£22,000	£22,000
Car park extension	£20,000	£20,000	£20,000	£20,000
EV station with fast and rapid charger capacity	£42,400	£42,400	£42,400	£42,400
Battery buffer	n/a	£89,000	£89,000	£89,000
PV	n/a	n/a	£13,900	£13,900
Wind McCamley 7kW VAWT on mast	n/a	n/a	n/a	£58,500
Total Equipment	£62,400	£151,400	£165,300	£223,800
Sport equipment store	n/a	n/a	n/a	£12,000
Other Costs	£21,800	£42,900	£45,700	£69,100
TOTAL CAPEX	**£84,200**	**£194,300**	**£211,000**	**£304,900**

Note: Other costs include contingency, professional fees and project management.

BUDGET ESTIMATE OPEX OF THE 4 TECHNICAL SCENARIOS per Annum				
Item	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**
Grid connection	£0	£0	£0	£0
Car park extension	£0	£0	£0	£0
EV station with fast and rapid charger capacity	£700	£700	£700	£700
Battery buffer unit	n/a	£1,600	£1,600	£1,600
Solar PV	n/a	n/a	£100	£100
Wind McCamley VAWT	n/a	n/a	n/a	£900
Total Equipment	£700	£2,300	£2,400	£3,300
Other OPEX	£4,900	£5,300	£4,300	£4,500
TOTAL OPEX	**£5,600**	**£7,600**	**£6,700**	**£7,800**

Note: Other OPEX includes insurance and electricity purchase costs.

Appendix 3: Harbury EV Demand Survey Results

Online Residents Survey May 2020

Introduction ~ Will you need an Electric Vehicle Charging Point in Harbury?

The UK Government has stated that there will be a ban on selling new petrol, diesel or hybrid cars in the UK from 2035 at the latest.

In preparation for the uptake of Electric Vehicles by residents and businesses in the village, Harbury e-Wheels has applied successfully for a grant from the Rural Community Energy Fund to investigate the practicalities and viability of installing a community Electric Vehicle charging station in Harbury.

Harbury e-Wheels needs the help of all residents and local businesses to determine the likely demand for Electric Vehicles and therefore the need for public access Electric Vehicle charging – now and in the future.

Please respond to this online survey and add comments in the spaces provided. Please complete this survey by 30th May 2020

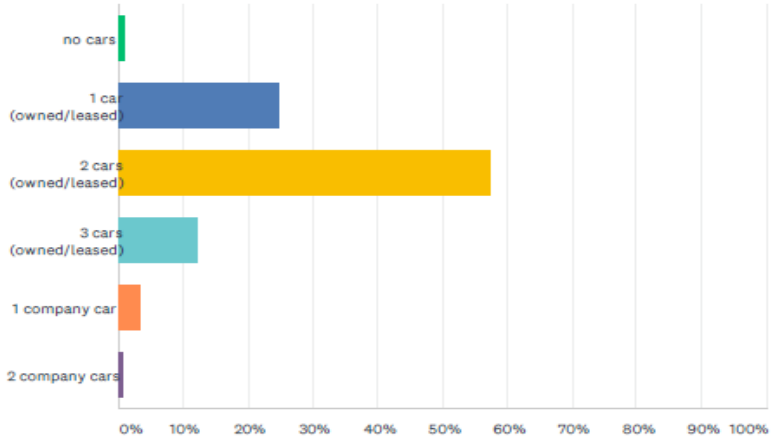
Thank you for your cooperation.

Bob Sherman - Chairman, Harbury e-Wheels

Philip Mayer - Project Director, Harbury Future Energy

Q1 Does your household own / lease a car or have a company car(s)?

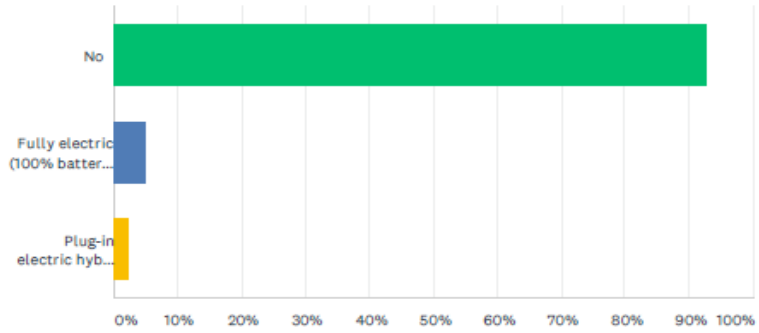
Answered: 180 Skipped: 0



ANSWER CHOICES	RESPONSES	
no cars	1.11%	2
1 car (owned/leased)	25.00%	45
2 cars (owned/leased)	57.22%	103
3 cars (owned/leased)	12.22%	22
1 company car	3.33%	6
2 company cars	0.56%	1
TOTAL		180

Q2 Are any of your cars a fully electric or plug-in hybrid cars?

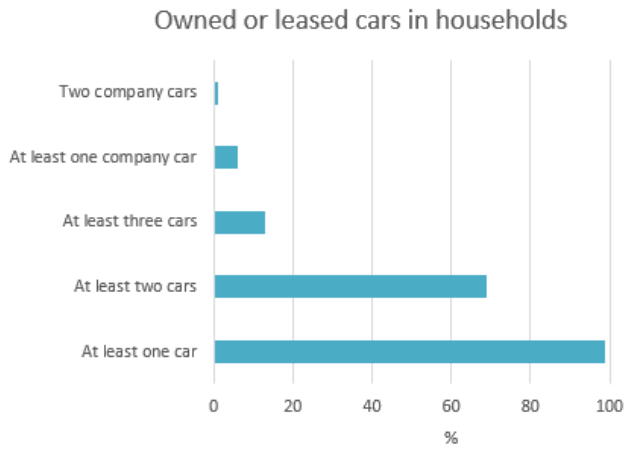
Answered: 180 Skipped: 0



ANSWER CHOICES	RESPONSES	
No	92.78%	167
Fully electric (100% battery powered)	5.00%	9
Plug-in electric hybrid (petrol + battery)	2.22%	4
TOTAL		180

Q3 Please list make and model of all your cars - own/leased cars and company cars

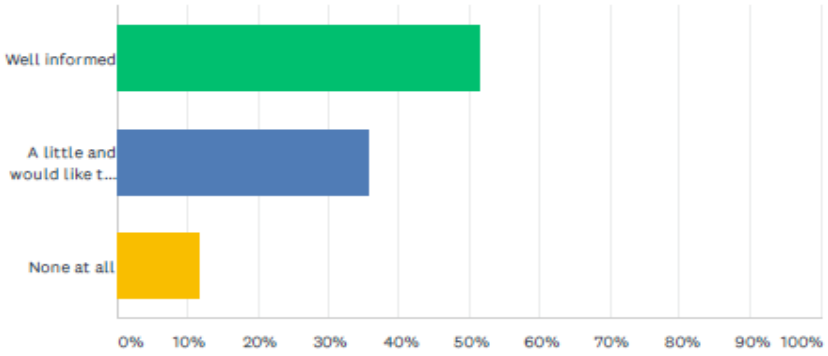
Answered: 179 Skipped: 1



Owned / leased or company cars	Responses	%
At least one car	178	99.44
At least two cars	123	68.72
At least three cars	24	13.41
At least one company car	10	5.59
Two company cars	2	1.12

Q4 How much do you know about electric vehicles?

Answered: 179 Skipped: 1

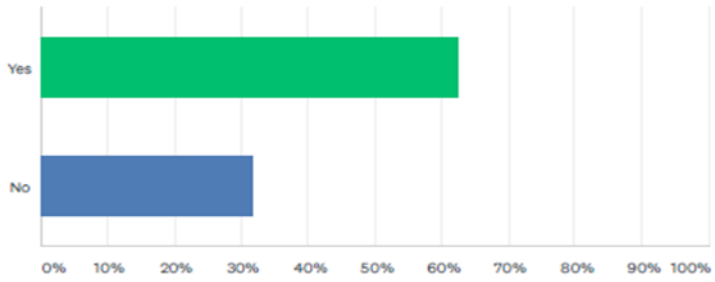


ANSWER CHOICES	RESPONSES	
Well informed	51.40%	92
A little and would like to know more	35.75%	64
None at all	11.73%	21
TOTAL		179

#	ANY COMMENTS
1	I know enough
2	Well reasonably well informed
3	Have basic knowledge but not in any great detail
4	Just given back a company 330e
5	Tesla are definate leaders - But good other EV's are starting to arrive.
6	Distance to travel before recharging is far too small.
7	They're too quiet
8	Work in the automotive sector designing electric cars
9	Not viable now or in the foreseeable

Q5 Are you considering buying/leasing an electric vehicle in the next 5 years?

Answered: 179 Skipped: 1

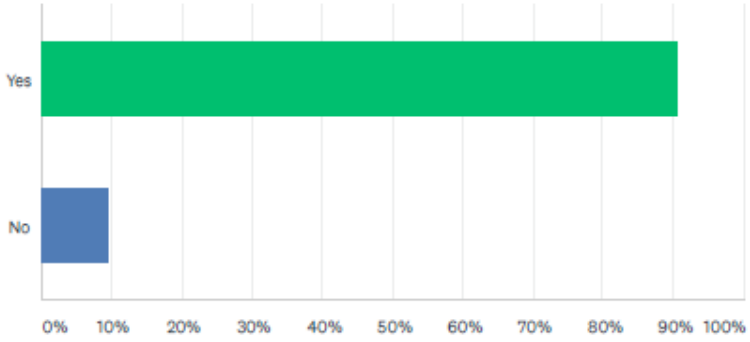


ANSWER CHOICES	RESPONSES	
Yes	62.57%	112
No	31.84%	57
TOTAL		179

#	ANY COMMENTS?
1	Current range restrictions on electric vehicles are holding me back.
2	Would like to go electric for one car
3	It will replace our smaller car which is already 6 years old. Timescale to replace: 1-2 years, subject to prices.
4	Would love to but too expensive at the moment
5	Maybe if the price wasn't ridiculous
6	Only a hybrid
7	Possibly but current car quite new
8	Would definitely use one in the village.
9	Possibly
10	Not financially in situation to do so
11	Considering only.
12	Much depends on price/cost of ownership and the real range in both summer and hard winter (heavy battery use)use.
13	Haven't thought about what we might purchase next
14	Too expensive and too few charging points
15	Dependent on cost effectiveness over alternatives
16	A small one to replace my existing one which is now 8 years old
17	Price dependent
18	Already got it
19	Possibly price is an issue
20	I would seriously consider buying if there is one available that will take a wheelchair, assistance dog and passengers and had the range we need
21	Not sure
22	They will have to give greater range before I say yes. No idea how expensive they will be to run
23	Unless either or both cars need replacement in the next 5 years - but no change planned at present
24	Limited range and lack of quick charging being the issue currently
25	at 77 i hope this car will last many years
26	Possibly
27	Like the reassurance of petrol backup.
28	I'd only ever consider electric - And do my best to explain to everyone, why it's the only choice.
29	I would buy one now, but they are still too expensive. That will change.
30	I intended to buy an electric car last autumn but need the village club to grant access to a charging point near our garage, which we currently do not have. They were unable to enter into a discussion and so I had to put the plan on hold.
31	Current one will suffice within that time frame.
32	Depends on price.
33	I need a car to tow a caravan and electric vehicles are not yet able to
34	I am in my eighties now. By 2035 I will be 96. I will only buy an electric car if necessary.

Q6 Do you have an 'off-road' parking space within your property so a charge point for an electric car could be provided at home?

Answered: 179 Skipped: 1

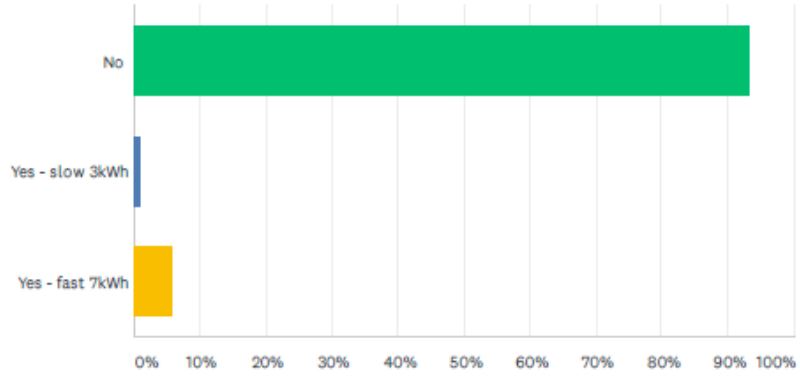


ANSWER CHOICES	RESPONSES	
Yes	90.50%	162
No	9.50%	17
TOTAL		179

#	ANY COMMENTS?
1	M
2	We already have a charging point installed.
3	Park on road, so would need access to one.
4	We have a car charging point in our driveway
5	Also have holiday flat without likelihood of charge point.
6	Yes, Already have a driveway and garage with EV charging.
7	This is contingent upon the village club granting a right of way across a portion of their car park.
8	There should be no difficulty in providing a charge point, two if necessary.
9	I have solar panels on the Garage Roof, so should be able to connect easily.
10	Have a charge point already
11	We could install charge point in garage
12	8 houses in Church Terrace are without off road parking

Q7 Do you presently have an electric vehicle charge point at home?

Answered: 180 Skipped: 0

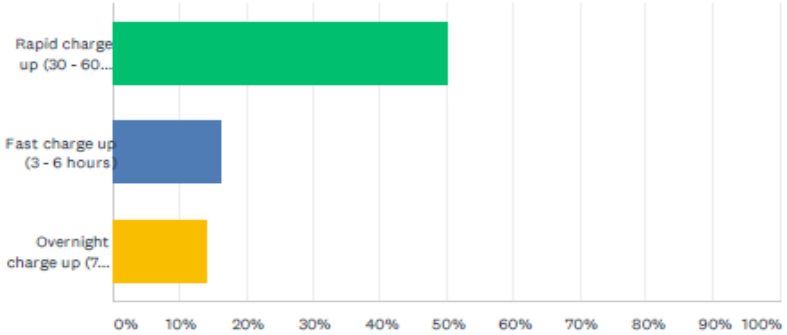


ANSWER CHOICES	RESPONSES	
No	93.33%	168
Yes - slow 3kWh	1.11%	2
Yes - fast 7kWh	5.56%	10

#	ANY COMMENTS?
1	... but we do have an outside 13amp socket that we could use.
2	Will probably install a 2nd at some point
3	Upgrading to 7 kWh shortly
4	All powered on 100% Solar too - Tesla Batteries.
5	I will fit one or two when absolutely necessary.

Q8 Electric vehicles can charge at different speeds. If you think you might use the Harbury Community EV charging station, which charging speed are you most likely to use? NB charging period depends upon EV battery size.

Answered: 165 Skipped: 15



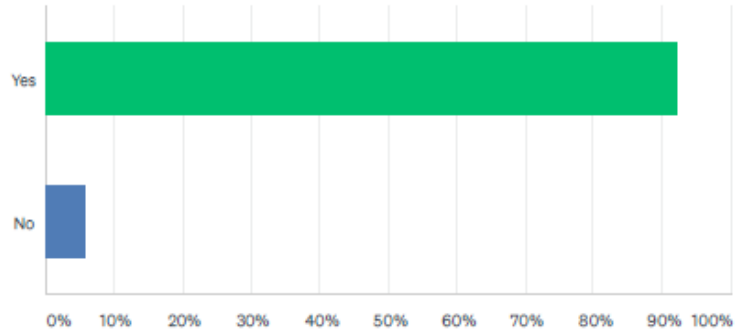
ANSWER CHOICES	RESPONSES	
Rapid charge up (30 - 60 mins)	50.30%	83
Fast charge up (3 - 6 hours)	16.36%	27
Overnight charge up (7 to 10 hours)	13.94%	23
TOTAL		165

#	ANY COMMENTS?
1	Unlikely to use it.
2	Don't know
3	The Fosse garage for petrol
4	Would buy fuel for a hybrid
5	If this is a community facility with multiple users I guess a rapid charge pint would be most suitable.
6	Can't answer this question
7	None at present
8	Would aim to overnight charge at home and top-up, if needed, at charging station.
9	charge at home
10	Unlikely to use Community charge point, would charge at home
11	I would actually need both the overnight and the rapid in reality,I think
12	??
13	Only sensible solution anywhere. Tesco making a BIG mistake installing (free) 7kW points
14	we would use a charger at home if this was applicable
15	Can't answer this as I have no idea
16	N/A
17	For family & friends visiting
18	I want to say none as I have a charge point already.
19	Would not be required
20	Being able to park overnight and forget is most likely
21	I would prefer my own charge point
22	no
23	Retired, no work travel, and so overnight charging suits us.
24	Don't know - might vary
25	Rapid is for service stations and forecourts. It's very expenive to fit. Lots of slower overnight charging is way more practical for a village.
26	Difficult to say ....
27	Obviously depends on make/ model of car bought but rapid would be my preference
28	No idea
29	Given I have one at home the only use I'd have for a public charger would be a fast charge [30-60mins] if I wanted to extend the range I did in one day with return to village.
30	Not applicable
31	No idea
32	N/A as could charge at home
33	If I had an electric car I would have my own charge point or points.
34	Charging speed/capability would be a consideration when choosing vehicle.
35	Would only need this facility if it proved impossible to charge at home.

36	Don't think we would use it. Would have our own installed
37	But unlikely to use as can easily install charge points at home, using power from our solar panels
38	Would not use
39	Would only use of own charge out of action
40	I wont be using it
41	Are they universal. No!
42	I would imagine a shared community charge point would serve more users if the time required was shortest possible.
43	Not interested
44	And possibly fast charge
45	Unlikely to use it if have charge point at home
46	Fast charge would be adequate for us and probably cheaper but rapid charging would be more convenient

Q9 Do you think it is a good idea for Harbury village to have its own electric vehicle charge point for the community and visitor use?

Answered: 179 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	92.18%	165
No	5.59%	10
TOTAL		179

#	ANY COMMENTS?
1	As a community we should make provision for the future we wish to see.
2	So long as it is in an appropriate place - like the village hall car park, not at the back of the library blocking the driveway or in the centre or the village occupying valuable parking space
3	The queue would be a mile long!
4	Don't know
5	I think in future years this will become most useful for people who don't have off road parking at their property.
6	Not sure
7	It will become expected in not so many years.
8	Not sure it is particularly viable. I am involved with helping a local authority to develop EV charging facilities. Harbury is not an obvious priority site.
9	There are many houses in Harbury that do not have off street parking therefore a number of electric vehicle charging points would be required.
10	Depends, it would be wasted if the majority of residents have the ability to have their own charger at home
11	Need more than one! Think 10 or so DC 50kW
12	Yes or No. Not much scope for nuance
13	For all that don't have off road parking
14	Don't think it would be suffiently used
15	Experience as an EWheels driver was impressive - esp Nissan Leaf.
16	Good for Harbury, not sure there would be many external customers.
17	It needs multiple points. There's nothing worse than relying on a charger, only to find its in use.
18	my main concern with an all electric would the 'range anxiety' so having more charging points, not only here but everywhere, removes that barrier.
19	Highly desirable
20	Cannot comment until there is a uniform plug in system.
21	All settlements will need them. Best to get them early.
22	I would have thought that this would be necessary with so much street parking.
23	Much too early, won't be needed for many years.
24	Of course. We are pioneers and supporters of local sustainability.
25	One charging point will not be enough
26	With the right measures to ensure not only used by locals & sufficient capacity for growing market
27	More than one charge point is required
28	The nearest public charge point is likely to be 3 miles away in Southam or 6 miles away in Leamington Spa

Q10 Please add further comments or suggestions

Answered: 70 Skipped: 110

#	RESPONSES
1	I am currently considering changing my car and purchasing a self charging hybrid. I would like to go fully electric but there are certain factors which may prevent me from doing so 1) Purchase Price 2) I frequently tow a heavy trailer and am concerned that an electric car would have sufficient power to do this. 3) Keeping the car charged, particularly when I am on holiday based on a camp site.
2	The electric charge point will, I feel, have to have a capacity for minimum two cars at a time, or will not provide sufficient flexibility and convenience for potential users.
3	The purchase price of these vehicles are prohibitive
4	Great idea
5	Purchase of electric car (new or secondhand) depends on affordability.
6	Interested to know more
7	What happens when your your battery runs flat miles from anywhere?
8	Ease of charging would make the idea of owning an electric car more likely
9	Moving towards electric cars is an absolute must and if I could afford to change my car I would definitely look at electric options
10	Only reason we don't have electric or hybrid cars now is because we can't charge them as no private parking space to have one.
11	None
12	Well done for being proactive, thanks
13	Can the charge point be better positioned than where the two E-wheels are located to help with access to the scout hut/white school car park.
14	I am seriously considering buying an electric vehicle sooner rather than later. The only thing stopping me doing it now is that there is nothing wrong with my current car so it feels wasteful to just get rid of it.
15	The price of electric cars will have to come down before I could afford to buy one
16	Would like to buy EV as soon as affordable, but also wonder if something even greener will soon materialize .
17	I think the use will grow but cost is going to be a big issue especially as present economic climate is now so unsettled
18	Would be interested in subsidised installations of outside power points at houses - ones that only use renewable and non-nuclear energy.
19	This would be a great facility for Harbury, especially for central village locations
20	This seems to be the future so think Harbury should be prepared for residents and visitors with electric vehicles.
21	no further comments
22	We will all have to consider electric vehicles in the not too distant future.
23	The lack of off road parking, is the only reason I have not got an electric car. If these facilities were available I'd buy one
24	Following on from above, I'd struggle to see the viability of a community charge point when EV car owners are likely to have home charging.
25	None
26	As an amenity in the village it would be a plus point
27	If we have an electric car we would want our own charging point at our house, for ease, but the more accessible they are for everyone, the better.

28	I am from Ladbroke and have been in contact with MP Jeremy Wright about charge points. Today 50 different companies offer 50 different charge accounts. It's chaos. We need standard open public connect-charge-credit card pay not closed system with RFID or Apps. Please write to MP to push this through DfT.
29	I am no longer a resident in this area but visit fairly frequently.
30	Glad to support survey and project
31	We are relatively low mileage users and tend to run our cars until they need replacement, so our plans are vague, but will definitely be looking at electric. On this basis, have answered questions as best we can
32	A great suggestion. If more public charging points were available we would be more inclined to use our electric car for longer distances.
33	Great for visitors and those without off street parking. Get several if you can.
34	Great idea
35	None
36	The challenge is, people like to set and forget, so ideally you would need enough spaces and charge connectors for lots to park and leave. Speed of charge then becomes less important.
37	I am ready, in principle, to replace both our vehicles with an electric vehicle, but until the range is greater they are not convenient enough for us yet. I would like the manufacturers to be more honest on battery life, and have a good plan for how they are recycled.
38	I USED A HYBRID CAR IN USA FOR SIX YEARS. I HAVE ALSO VOIYED BERLIN IN PAST TWO YEARS AND AM IM[RESSED BY THE GERMAN PREPAREDNESS FOR ELECTRICAL CARS
39	One charging point for the whole village and visitors seems a little impractical
40	We think this is a good idea and look forward to further updates.
41	Should also consider inductive charging
42	I am thinking of changing my vehicle this year
43	This has to be the foreseeable future. If anything, the last few weeks have taught us that the future can be unpredictable. There are other sources of energy - fuel cells, hydrogen - and too much investment in electric cars could be short-sighted.
44	Happy to see how things develop
45	The village should be installing more green energy producing systems e.g. wind, solar hot water, PV, regardless of its use.
46	Brilliant forward thinking idea. I thoroughly aplaud it. I think the best way is to have 8 Slower night chargers installed, maybe in the village hall car park. With credit card swipe payments, and only charge a little above the actual cost of the elctricity. It will be a few £'s for a full nights charge and people will be OK with that. It doesnt need to be a complete loss leader! Happy to advise more, I know a lot about EV's. I went EV 5+ years ago. Street light charging is a fantastic way forward too. Andrew Oliver andrew@oliverfamily.net.
47	Don't put charging points in the entrance's of car parks.
48	We would be really pleased to add any support we can to this project.
49	Still need a lot of info.
50	It will be asbolutely essential for mobility in future to have a readily acccesible charging point in Harbury.
51	I am not the oldest member in Harbury. So much now depends on the speed at which the change to electric cars takes place. As I have already said, I am in my eighties now.
52	Should also consider inductive charging
53	it would be good to have charging points but people would probably complain about how much

	it would cost them and how far you can go on one charge
54	Another great initiative from HEI & EWheels. Well done all
55	Well done, keep up leading the way.
56	Harbury has an outstanding track record of improving community buildings to high sustainability standards. We are committed to reducing carbon emissions and our previous improvements are outstanding.
57	There needs to be some incentive from the government to encourage people to get rid of their diesel and petrol cars. We have seen how much better our air is during this lockdown and I feel we would all want this to continue.
58	How would you avoid a car being left at a community charger all day - and therefore not allowing other users access to the charging point.
59	Great project
60	.
61	Excellent resource
62	Please make this step into the future
63	I live in a flat with communal parking. I quite often cant get parked in my own road so as much as i would like an electric car it isn't possible unless parking possibility are changed.
64	we need to contribute towards improving the charging infrastructure to make electric cars viable
65	The electric grid could not cope with charging cars and boiling kettles.
66	Will a substation upgrade be reqyas understand high energy demand of fast chargers to be available when no wind sun
67	There are many properties in Harbury without off-road parking there is therefore a need for a number of charging points.
68	Not interested in purchasing an electric car
69	Although I will install a charge point at home when I get an electric car, I believe it is essential for the village to have charging point(s) for those who do not have the luxury of being able to install a charge point at their property.
70	Excellent to be considering accessible charging

Appendix 4: Solar PV Roof Structural Survey

02/07/2020 / 20:11 — 5 Vicarage Lane, Harbury — 952A load/1

Loading			imposed (KN/m²)	dead (KN/m²)	UDL imposed (KN/m)	UDL dead (KN/m)	total UDL combined (KN/m)
Check of Roof Structure over Original Hall							
Rafters							
Roof							
Pitch(°)		22.50	0.75				
weight of tiles(Kg/m²)		51.20		0.54			
spacing of rafters (mm)		400.00					
size of rafters (w x d (mm))	60 x	225.00					
weight of rafters (KN/m²)				0.18			
battens and felt		0.03		0.03			
Wt of PV cells (kg)		23.00					
h x w of cell (m)	2 x	1.10					
load from cell				0.11			
Total load on Rafter (KN/m²)			0.75	0.87			
width to be supported		0.40					
load on rafters					0.30	0.35	0.65
Purlin							
width to be supported (m)		2.60					
UDL (KN/m)					1.95	2.25	4.20
Check of Roof Structure over Extended Section of Hall							
Rafters							
Roof							
Pitch(°)		22.50	0.75				
weight of tiles(Kg/m²)		51.20		0.54			
spacing of rafters (mm)		400.00					
size of rafters (w x d (mm))	50 x	175.00					
weight of rafters (KN/m²)				0.12			
battens and felt		0.03		0.03			
Wt of PV cells (kg)		23.00					
h x w of cell	2	1.10					
load from cell				0.11			
Total load on Rafter (KN/m²)			0.75	0.80			
width to be supported		0.40					
load on rafters					0.30	0.32	0.62
Purlin							
width to be supported (m)		3.70					
UDL (KN/m)					2.78	2.97	5.74

Peter D Bonas Building Consultant
3, Heber Drive, Harbury, Warwickshire CV33 9NA
Tel. (01926) 612632 E-mail peterdbonas@btinternet.com

Calculations by .....
P.D.Bonas B.Sc., C.Eng., M.I.C.E.

02/07/2020 20:04 Harbury Village Hall - Check on Increase Loading from PV Cells 952A UDL(timber)/1

Check of Roof over Original Section of Hall

load (KN./m)	0.65
span of member	4.30
permissible deflection (mm)	17.20
permissible bending stress (N/mm^2)	6.00
E (N/mm^2)	8200.00
minimum I value cm^4	2051.56
maximum bending moment(KN.m)	1.50
width of timber(mm)	75.00
min depth of timber	148.62
actual depth of timber	225.00
I value of section(cm^4)	7119.14
maximum bending stress(N/mm^2) =	2.37
permissible max bending stress (N/mm2)	6.00
permissible deflection(mm) =	17.20
actual deflection (mm) =	4.96

Rafters are satisfactory to support increased load from PV cells

Chech on Purlins

load (KN./m)	4.20
span of member	2.50
permissible deflection (mm)	10.00
permissible bending stress (N/mm^2)	6.00
E (N/mm^2)	5200.00
minimum I value cm^4	4108.14
maximum bending moment(KN.m)	3.28
width of timber(mm)	90.00
min depth of timber	176.28
actual depth of timber	215.00
I value of section(cm^4)	7453.78
maximum bending stress(N/mm^2) =	4.73
permissible max bending stress (N/mm2)	6.00
permissible deflection(mm) =	10.00
actual deflection (mm) =	5.51

Therefore Purlins are satisfactory

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Calculations by .....
P. D. Bones B.Sc., C.Eng., M.I.C.E.

02/07/2020 20:03 Harbury Village Hall - Check on Increased Loading from PV Cells 952A UDL/1

Steel Purlin over extended Section of Hall

load (KN./m)	5.74
span of member	5.50
permissible deflection (mm)	16.50
minimum I value cm^4	1973.78
maximum bending moment(KN.m)	21.70

actual steel size

203 x 133 x 30 Universal Beam

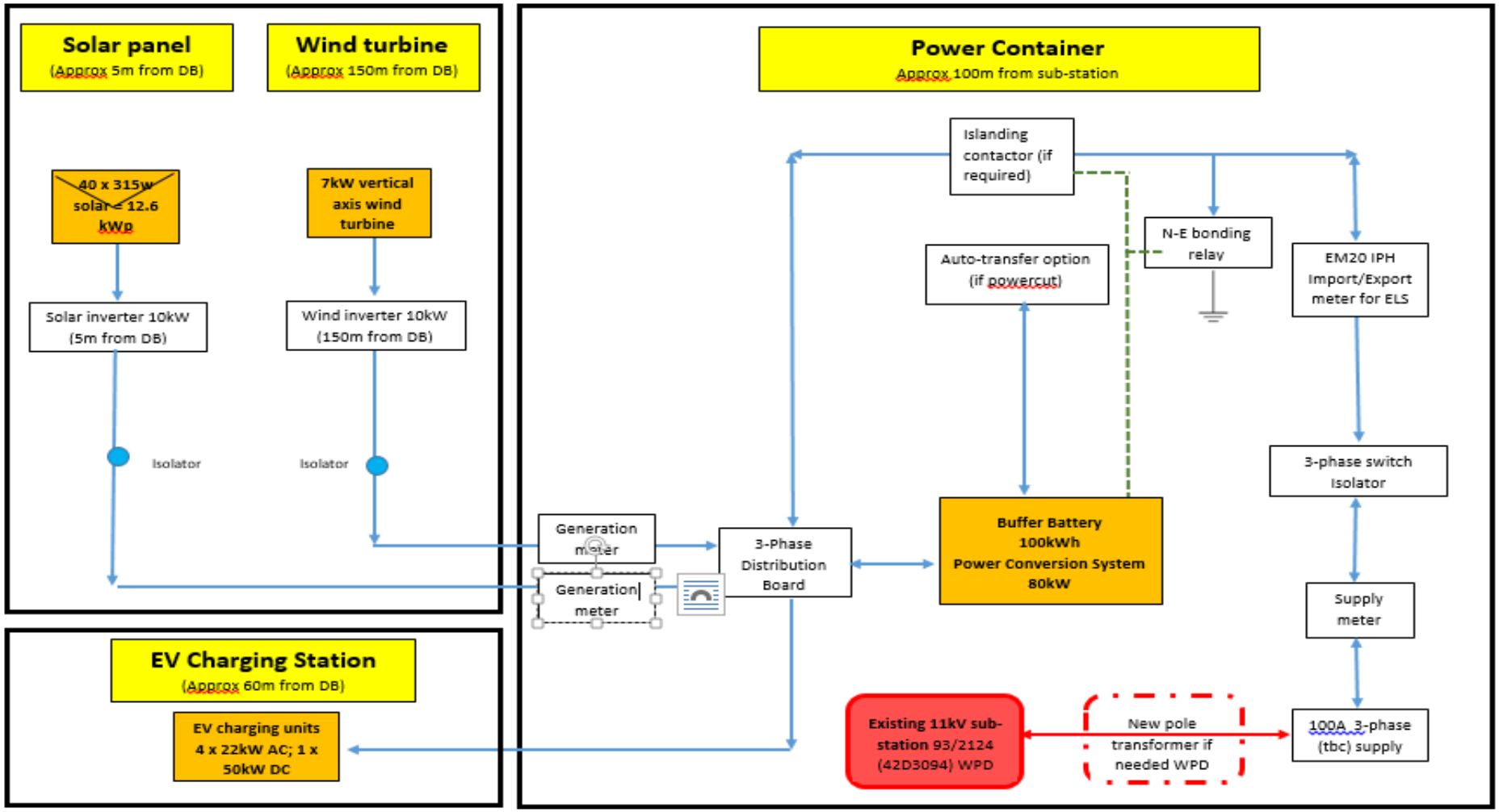
$I(cm^4)$ =	2896.00		
actual deflection (mm) =	5.62		
maximum bending stress(N/mm^2) =	77.49		
l (m)=	5.50		
r_y (cm) =	3.17	l/r_y =	173.50
D (mm) =	206.8		
T (mm) =	9.6	D/T =	21.54
permissible bending stress (N/mm^2) =	87		

Therefore Steel Purlin is adequate to support increased load

Appendix 5: Project activity schedule proposed

HARBURY FUTURE ENERGY COMMUNITY EV CHARGING STATION Proposed Activity Schedule Stage 2				Month										
				Stage 1	Stage 2 by month (8 month delivery period)								Contingency 2 months	
Area	**Ref**	**Activity**	**Period / status**	Stage 1	1	2	3	4	5	6	7	8	9	10
Work already completed or in hand	HFE1	Scenario analysis	completed											
	HFE2	Technical and financial modelling	completed											
	HFE3	Pre-planning enquiry (SDC)	submitted											
	HFE4	Village hall structural roof load assessment	completed											
	HFE5	Vibration and noise assessment for wind turbine	in hand											
	HFE6	Cost estimates - battery, chargepoints, car park	completed											
	HFE7	Conservation area check	in hand											
Permits & Approvals	HFE8	Ecology study - hedges, trees, wildlife study	4 weeks											
	HFE9	Landscape visual impact study	3 weeks											
	HFE10	Archaeological survey (sports field)	3 weeks											
	HFE11	Ground surveys - wind turbine site, car park	4 weeks											
	HFE12	M&E site assessment - power and lighting	4 weeks											
	HFE13	Noise assessment - power container and wind turbine	2 weeks											
	HFE14	Traffic impact study for Highways approval (WCC)	2 weeks											
Design Cost & Tender	HFE15	System design process and finalisation	12 weeks											
	HFE16	Planning drawings / documentation process	4 weeks											
	HFE17	Cost process and finalisation	8 weeks											
	HFE18	Development of Funding Plan	4 weeks											
	HFE19	Funding secured period	16 weeks											
	HFE20	Design of Invitiation to Tender and procurement documents	2 weeks											
	HFE21	Preparation of tender contracts	4 weeks											
Planning & permits	HFE22	WPD connection (G99) and storage (G100) application	8 weeks											
	HFE23	Planning application documentation process	8-12 weeks											
	HFE24	Planning application process to decision	8-12 weeks											
Promotion & Public Consultation	HFE25	Stakeholder Engagement Event (Councils, key groups)	in process											
	HFE26	Harbury EV Demonstration Day (residents and businesses)	2 weeks											
	HFE27	Online dissemination (social media) campaign	ongoing											
	HFE28	Press releases	quarterly											
Project Management	HFE29	Monthly Steering Group meetings and reports	monthly											
	HFE30	Mid-term evaluation	1 week											
	HFE31	Final Stage 2 'investment ready' Report	4 weeks											

Appendix 6: Single Line Diagram



Appendix 7: McCamley Wind Turbine proposal

31st March 2020

Mike Woollacott
Greenwatt Technology
Roseleigh,
Oversley Green
Alcester
Warwickshire B49 6PG

Dear Mike & Ruth,

BUDGET PROPOSAL FOR MCT07 WIND TURBINE – RCEF PROJECT HARBURY

Further to our discussions over the past few weeks we have pleasure in submitting this budget proposal to supply a 7kW Vertical Axis Wind Turbine to the playing field area in Harbury, Warwickshire.

The information contained in this proposal relates to the MCT07 Vertical Axis Wind Turbine. All values outlined are for guidance only.

It is envisaged the Turbine will be sited on either the eastern or western boundary of the playing field mounted on a 10m tower, clad in material acceptable to the local Planning Authority, and public consultation. The tower can be used for storage of playing field equipment.

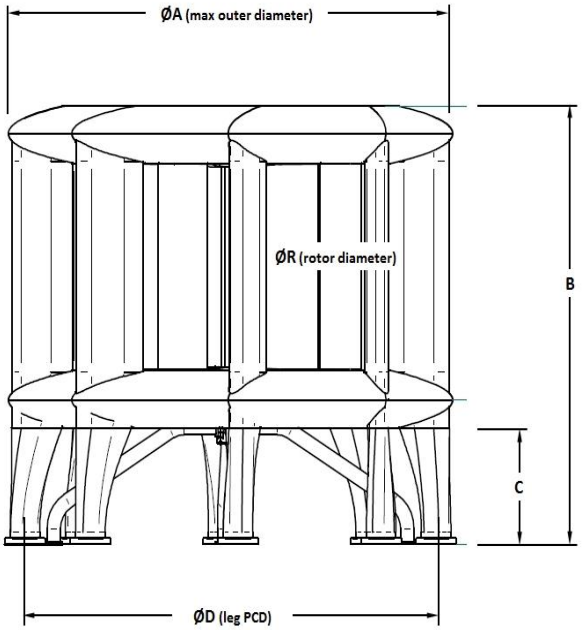
Details and cost of the storage tower and foundations will be subject to further consideration at the appropriate time, following public consultation and planning approval.

It is envisaged that the turbine will be integrated with:

- appropriate electric vehicle charge points (possibly 2 slow charge and 2 rapid charge)
- solar photovoltaic cells
- a 3 Phase grid connection
- battery storage.

These items, supplied by others, are not included in this budget proposal.

TURBINE BASIC DIMENSIONS



dim	McT07 (m)
ø A	8.00
B	6.68
C	2.23
ø D	7.47
ø R	5.13
blade span	3.18
blade chord	1.03

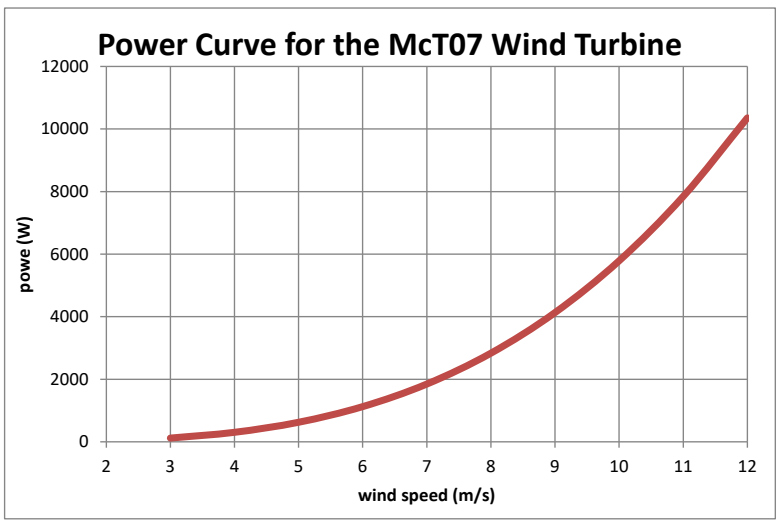
TURBINE POWER & ANNUAL YIELD CURVES

Given below are the estimated power curve and annual yield curve for the MCT07 with tabulated values used to make the curves.

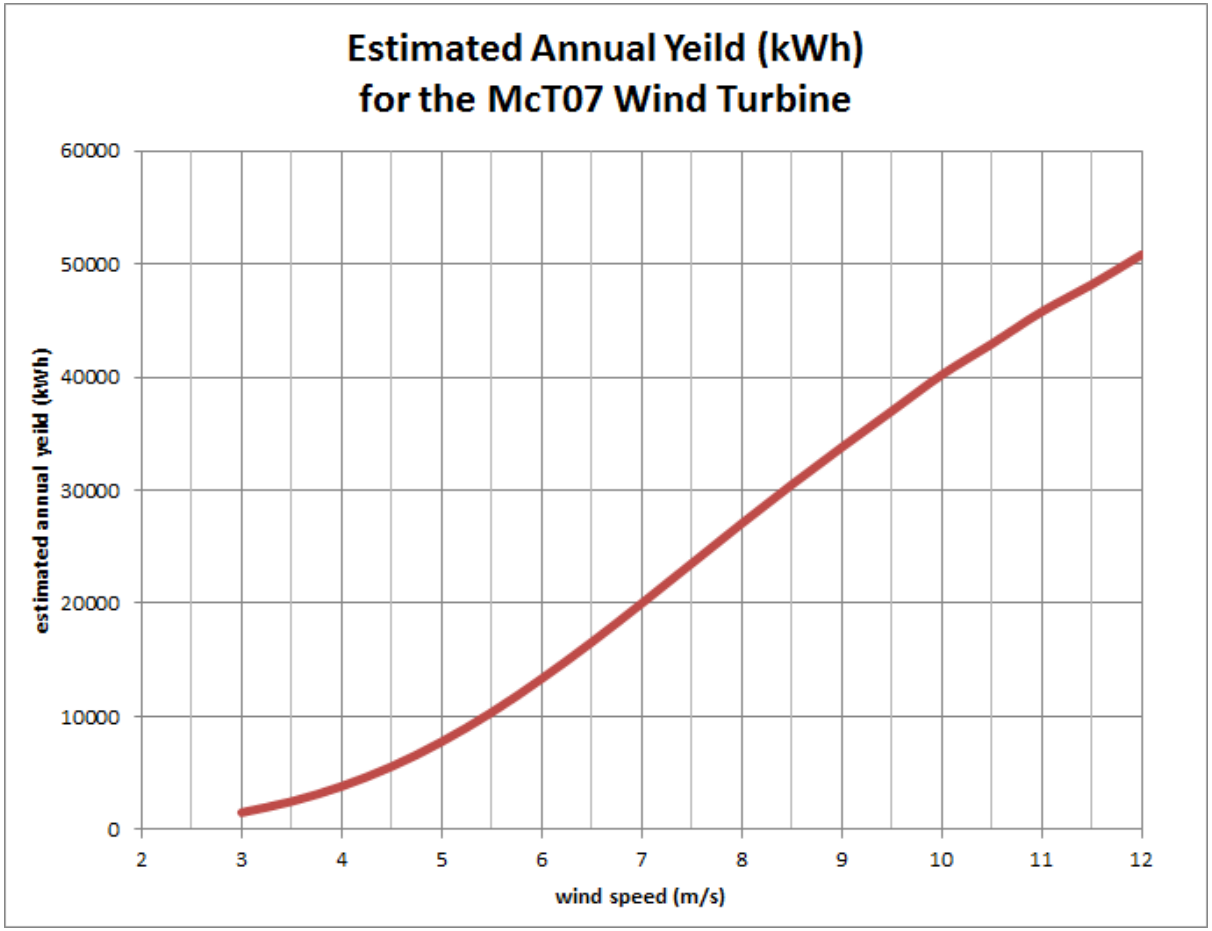
Current design philosophy is to limit the maximum power of the wind turbine such that it occurs at a wind speed of 12 m/s. This enables the electrics, electronics and control systems to be sized for a realistic wind regime. If a much higher average wind speed is expected, then this setting can be changed but this would also impact the above-mentioned systems.

Both the power curve and the associated annual yield figures are considered to be conservative so through the life of the turbine it is likely that the values will increase.

For sizing the electrical interface a maximum turbine power has been set at 15kW. The initial max rated power for the MCT07 upon installation is estimated to be 7kW at a wind speed of 11m/s. Note that it is standard practise to give the rated power of a wind turbine of this size at a wind speed of 11m/s.



McT07	
wind speed (m/s)	power (W)
3	120
4	304
5	626
6	1125
7	1847
8	2834
9	4131
10	5786
11	7844
12	10353



McT07	
average wind speed (m/s)	Estimated Annual Yield (kWh)
3	1,514
3.5	2,491
4	3,829
4.5	5,579
5	7,766
5.5	10,369
6	13,343
6.5	16,567
7	20,001
7.5	23,535
8	27,060
8.5	30,491
9	33,791
9.5	36,994
10	40,209
10.5	42,929
11	45,788
11.5	48,192
12	50,835

BUDGET QUOTATION

Manufacture and Delivery of the turbine to Harbury Playing Field, Warwickshire.

£43,500.00

Payment Terms for Manufacture and Delivery:

- 50% of the contract sum with order
- 45% of the contract sum ex-factory (ready for shipment)
- 2.5% of the contract sum on completion of erection and commissioning
- 2.5% of the contract sum retention for 6 months following commissioning

Erection, Commissioning and integration with related elements of the project:

- To be agreed following Public Consultation and Planning Consent

VAT at the prevailing rate is due on the stage payments invoiced in accordance with the payment terms detailed above.

Terms and Conditions of Sale or Purchase to be agreed.

WARRANTY – 2 Years from commissioning

EXCLUSIONS

The following exclusions apply:

- Planning Permission and Building Regulations Approval
- The tower and related items, supplied by others, for the complete public Electric Vehicle (EV) charge point project
- Ducts from the turbine to the EV charge points and associated batteries.

CONCLUSION

Harbury's community has unrivalled potential to promote environmental innovation in a rural area for public EV charge points and showcase sustainable living in the UK. McCamley welcomes the opportunity to be involved in this exciting endeavour. As such; this proposal is given in good faith and in the hope that this showcase project will gain wide acceptance as we challenge the issues related to climate change.

Kind Regards,

Philip Mayer

Chairman

McCamley has developed and proved a unique Vertical Axis Wind Turbine (VAWT) technology that has numerous advantages over other VAWTs and Horizontal Axis Wind turbines (HAWTs). McCamley's Vertical Axis Wind Turbine is:

- **Self-starting** – starts in a zephyr of wind without the need for energy input from the electricity grid or battery
- **Omni-directional** - capable of full operation in gusting and turbulent wind conditions
- **Self-feathering** – the turbine has no shut down speed so will continue to operate in storm conditions
- **Bird and bat friendly** – does not kill wildlife
- **Vibration free and virtually silent** – less than ambient wind noise
- **Structurally redundant** - resulting in a fail-safe design and with rotating parts encased in a stator operational safety is also enhanced
- **Radar benign** – will be seen by radar as a fixed item such as a tall building
- **Suitable for urban environments** – retrofit, or new-build integration
- **Improves air quality** - when coated with photocatalytic hydrophobic material will absorb toxic gases from road transport and provide cleaner air
- **Genuine "off grid" solution** - needs no electrical supply to start
- **Very efficient** –operates close to the theoretical maximum efficiency (circa 59%), which compares with 44-47% for the best-known efficiency from very large HAWTs
- **Hybrid Potential** – with the application of solar PV film or paint to the sun-facing surfaces of the turbine, academic study indicates potentially c30% more power output
- **Scalable** – from 6kW to 100kW and potentially to 500kW

A potentially significant employment driver for regional manufacturing, sales work force, installation and ongoing maintenance and has the potential to change the world for people not well served with electrical power and telecommunication/internet connectivity through inadequate infrastructure.

McCamley Power Ltd
Cedar Court 221, Hagley Road, Hayley Green, Halesowen,
West Midlands B63 1ED
www.mccamleypower.com

Appendix 8: EO Charging Proposal

Ryan Spillane
Head of Partnerships
EO Charging

m: +44 (0) 7956 474432
p: +44 (0) 333 77 20383
w: www.eocharging.com
t: @eocharging

Mike Woollacott
Greenwatt Technology Ltd
Harbury e-Wheels

22nd July 2020

Harbury EV charging station proposal

Please find our outline proposal for the Harbury EV charging station project based upon drawings and information supplied.

Installation infrastructure:

- 1 x Feeder Pillar + Plinth (Location TBC)
- 1 x 50kW EV Charger Pad
- 2 x Dual 22kW EV Charger Pads
- Trenching work for DNO and Chargers
- TT Earthing System

Hardware included from EO:

- 4 x 22 Genius Chargers
- 1 x 50kW Charger (Solution TBC)
- 1 x Hub
- 3 x 200a CT's
- 1 x GSM Router
- 2 x Posts
- 6 x bump stops
- Backoffice fees etc

Hardware, Software and Accessories				
Item	**Summary**	**Unit Price**	**Quantity**	**Price**
Charging Units	EO Genius 22kW Charging Station (with DCL)	£ 750.00	4	£ 3,000.00
EO Hub	EO Hub Intelligent Operating System	£ 400.00	2	£ 800.00
DC Charger 50kW	DC Charger - 50kW	£ 17,000.00	1	£ 17,000.00
Accessories	CT Clamps (for load management)	£ 29.55	3	£ 88.65
Accessories	Stainless Steel Mounting Posts (Double)	£ 254.00	2	£ 508.00
Accessories	GSM Router and Booster Aerial	£ 600.00	1	£ 600.00
Accessories	Parking Blocks / Wheel Stops (to protect chargers)	£ 78.00	6	£ 468.00
Accessories	Instructional signage	£ 195.00	1	£ 195.00
Software	EO Cloud Access - 3 years	£ 1,500.00	1	£ 1,500.00
Installation	Turnkey delivery and installation	£ 16,500.00	1	£ 16,500.00
Commissioning	Support on system design, comms testing, EO Cloud training, customer sign-off	£ 500.00	1	£ 500.00
Delivery	Delivery costs	£ 50.00	1	£ 250.00
			Total excl VAT	**£ 41,409.65**
			Total incl VAT	£ 49,691.58

Please note these are indicative costs only with drawings provided but should be good enough to get the project moving forward. It does not include or accommodate for any equipment for EV or battery storage at this time.

Best regards,

Ryan Spillane - Head of Commercial Sales, EO Charging

Appendix 9: Eaton Green Motion Proposal

Eaton
252 Bath Road | Slough | SL1 4DX | United Kingdom
tel: +44 (0)1753 608 700 | **mob:** +44 (0)7803 740125
email: richardmolloy@eaton.com | **web:** www.eaton.com/uk

Harbury Future Energy EV Charging Project ~ proposed solution.

Battery Energy Storage System: The Eaton xStorage Compact system addresses all the considerations noted above. Each xStorage Compact system has a power rating of 40kW so two will have a combined power output of 80kW. Each rack houses the PCS (Power Conversion System) and a single string of 5 lithium ion batteries. Note: New batteries are proposed; second life batteries would make the system much larger and carry only a 5-year warranty instead of a 10 year warranty on new batteries. Each battery has a nominal nameplate rating of 10kWh which provides 50kWh per rack and 100kWh (nominal) in total for both racks. Up to two additional racks can be connected for future expansion which would provide a power rating of 80kW with 300kWh (nominal) of storage capacity.

A modified standard shipping container will be suitably robust as a 'power container' for the intended location. A 20' container will provide sufficient space for two xStorage Compact racks plus the one or two further battery racks required for future expansion to 200 or 300kWh. If further power and capacity is required a third PCS with an additional rack of batteries could also be installed in future which would increase the system rating to 120kW 450kWh.

Note: The potential maximum charge power that could be demanded at any one time is 4 x 22kW (fast chargers) + 40kW (rapid charger) = 128kW. Whilst it is very unlikely that this would ever be reached since it would require 5 vehicles to be simultaneously charging and each vehicle to have the capability to charge at the maximum rate, it is perfectly possible that power demand could exceed the available 80 kW. In this case it will be necessary to ensure that the charging infrastructure has the capability to perform load balancing and management e.g. EV charging priority.

Fast Chargers: The Eaton Green Motion Network Two technology solution addresses all the considerations noted above and is recommended for this application. Each charger includes 2 x 22kW outlets so 2 Network Two units will provide the 4 fast charge points required.

Rapid Charger: The Eaton Green Motion RangeXT 40/160 technology solution addresses all the considerations noted above and is recommended for this application. This charger can be configured with a DC power rating of between 40kW and 160kW in 20kW increments. Initially we propose a 40kW charger.

Outline budget pricing (all prices ex VAT and subject to site visits and specification confirmation)

1. **Battery Energy Storage (Eaton Power):**
   Containerised battery energy storage system, initially including 2 x Eaton xStorage Compact rated 40kW 50kWh (nominal) each with the facility to expand capacity in 100kWh stages up to a total of 300kWh. The 20' 'power' container will be insulated, lined and fitted out to include the main LV switchgear, circuit protection and controls and G99 grid protection relay. Thermal management will be integrated to ensure temperature limits for the batteries are not breached. There will be space for up to an additional 40kW/150kWh of storage should further future expansion be required.

Eaton xStorage Compact, 2 @ £28K each	£56,000
Containerisation, including internal fit-out, a/c, controls, delivery etc.	£20,000
Installation, testing & commissioning, excludes civil works	£ 8,000
G99 / G100 testing	£ 2,000
Total:	**£86,000**

2. EV Chargers (Eaton Power / Green Motion) (all prices ex VAT and subject to site visits and specification confirmation)

Fast Chargers: The Green Motion NETWORK TWO is a charging station for public use. Thanks to its sturdy construction and anti-graffiti coating, it is weatherproof and vandal-resistant. This station allows you to charge two vehicles (cars or motorcycles) simultaneously and can be equipped with any socket type available on the market, making it the ideal solution for any public facility. As well as its charging capabilities, the Network Two has a system for identification and payment via RFID, app, SMS, car park tickets and contactless credit and debit cards. Lastly, the Network Two can be managed remotely, which makes it particularly suitable for entities wanting to operate their charging network centrally.

Rapid Charger: The RANGEXT40/160 is the high-speed DC station of the Green Motion public range. Available from 40kW to 160kW (possibility of increasing the power per module of 20kW), the station is equipped with CCS and CHAdeMO sockets. Alternatively, a version of the station including both socket formats on each side is available.

Green Motion Network Two	2 @ £10,500 each	£21,000
Green Motion RangeXT40kW	1 @ £24,000 each	£24,000
Installation, testing & commissioning	(est. only subject to site visit)	£ 8,000
Total:		**£53,000**

Appendix 10: RJ Hartwell Car Park Works Proposal

RJHartwell Ltd

21 July 2020

ATI Projects Ltd
Roseleigh House
Oversley Green
Alcester
Warwickshire
B49 6PG

For the attention of Mike Woollacott

Dear Mike,

Re: Harbury Village Hall, S Parade, Harbury, Leamington Spa CV33 9JE
Quote Re: 1256

We thank you for your valued enquiry and have pleasure in submitting our BUDGET quotation for the car park extension works at the above as per your drawings. The scheme is to consist of approximately 195.00m² of car park extension consisting of an assumed specification of 200mm type 3 porous sub-base, 50mm sand blinding, Bodpave 85 and a 20mm decorative gravel all subject to approval/confirmation once planning has been secured and we would offer to complete these works:

For the sum of £19,976.24 plus VAT

We hope that the above meets with your approval and await your further instructions. If we can be of any further assistance, please do not hesitate to contact us.

Yours Faithfully

K Mitchell

Kevin Mitchell
For and on behalf of R J Hartwell Ltd

Fencing
Commercial, Security, Hoarding, Sports, Agricultural, Equestrian, Domestic.

Line Marking
Multi Storey Car Parks, Playgrounds, Highways, Car Parks, Bespoke Logos, Tennis Courts, Warehousing, Airports.

Ground Works
Site Clearance, Demolition, Earth Works, Drives, Drainage, Footings, Hard Landscaping, Surfacing, Street works Registered.

R J Hartwell Ltd, 4 White Cottages, Billesley, Alcester, Warwickshire B49 6NE
Telephone: 01789 766505 website: www.rjhartwell.co.uk email: info@rjhartwell.co.uk
Company Registration: 05914734
VAT No: 807377612

Appendix 11: Letters of Support

Harbury Parish Council

Mr R Sherman
Harbury e-Wheels
8 Church Terrace
Harbury
Leamington Spa
CV33 9HL

17 September 2019

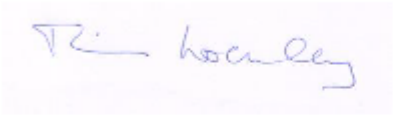
Dear Bob,

I am very pleased to confirm the strong in principle support of Harbury Parish Council to your application to the RCEF.

The parish council has an enduring record of encouraging energy efficiency in the village, including support for the solar panels that have been installed at the village hall, and financial support for the e-Wheels project over several years. There is a clear appetite for eco-friendly policies in the village and the e-Wheels project has provided a vital village service for a number of years.

I wish you all good fortune in this application.

Yours sincerely,



Prof Tim Lockley
Chairman, Harbury Parish Council.

LOCAL COUNCIL AWARD SCHEME FOUNDATION

Harbury Parish Council
2 Bull Ring Business Centre
Church Terrace
Harbury
Leamington Spa,
CV33 9HL
Email: clerk@harbury-pc.gov.uk
Tel: 01926 614646

Warwickshire County Council

PO Box 9, Shire Hall
Warwick
CV34 4RR
www.warwickshire.gov.uk
markryder@warwickshire.gov.uk

23rd June 2020

Dear Mike

Re: Harbury EV Charging facility

Thank you for your recent email which outlines the aspirations for an EV charging station in Harbury. Warwickshire County Council is fully supportive of the initiative, particularly given the innovative and semi-rural nature of the project.

As you are aware, the County Council is currently working towards the installation of wider public charging facilities across Warwickshire. However, this is initially in the County's larger towns/market towns and therefore the deployment of improved public charging facilities in Harbury would provide further diversity in the location of publicly available charge points. At a strategic level we are looking how we can further accelerate a more comprehensive network of EV charging points, including a range of charging speeds and locations. This project, therefore, could provide a useful pilot for innovative local charging hubs in rural /semi-rural locations.

I look forward to hearing from you and please get in touch if the County Council can assist with the development of the project in any way.

Yours sincerely,

Victoria Mumford
Principal Transport Planner
Transport & Highways
Communities

Working for Warwickshire

Supporting letter from Tony Perks, Stratford District Council

Bob Sherman,
Chairman, Harbury e-Wheels

24th March 2020

Dear Bob,

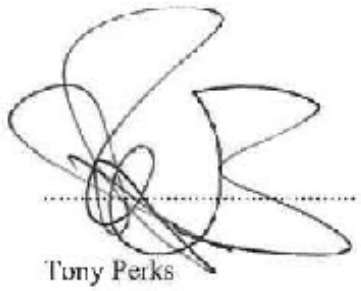
Harbury Future Energy ~ community EV charging station

Thank you for your email and apologies for my delay in responding. Your idea of a community electric vehicle charging hub is an interesting one, it has the potential to be a blueprint for providing charging in rural locations where residents do not have access to off road parking and your incorporation of renewable energy into the hub is also very innovative.

I am very happy to lend my support to the development of this idea as I think it addresses a key issue and has the potential to be more widely deployed.

If I can be of any further assistance to you please let me know.

Kind regards



Tony Perks Deputy Chief Executive

Switchboard +44 (0)1789 267575, Direct +44 (0)1789 260620

email tony.perks@stratford-dc.gov.uk,web www.stratford.gov.uk

Emails of Support – Office for Low Emission Vehicles

Office for Low Emission Vehicles

Part of Department for Transport and Department for Business, Energy & Industrial Strategy

17th July 2020

Hi Mike,

Thanks for reaching out and sending the attached. Apologies for the delaying in responding – it's been pretty hectic.

I'll forward this onto Aaron, who heads up the energy and charge point teams in OLEV – as a reminder of this work. I know the rural charging challenge is something that he is thinking about.

Separately, colleagues in OLEV and a wider Environmental Strategy team are increasingly working on themes of 'shared mobility', which includes consideration of what is needed to support the uptake of electric car clubs. I'll also pass the attached onto them, and suggest they get in touch should they want to know more. I watched the YouTube video linked in the attached, and it felt the car club was very community led – as oppose to a commercial operator like Zip car, that you might find in cities. Perhaps that's a point I'll flag to them.

Happy to stay in touch going forward.

Many thanks,
Ed

Edward Nelson | Head of Local Delivery | Office for Low Emission Vehicles (OLEV) | Edward.Nelson@DfT.gov.uk | 07977 421115

Office for Low Emission Vehicles

Part of Department for Transport and Department for Business, Energy & Industrial Strategy

12th May 2020

Hi Mike,

Thanks for sharing this – what a fabulous project! Very best luck with the study and please do share the results.

Aaron

Aaron Berry | Deputy Head, Office for Low Emission Vehicles (energy and infrastructure), Department for Transport
1/32 | 07500 573527 |

Appendix 12: Harbury Fund Raising 2012 - 2020

Harbury Village Fund Raising Track Record 2012 - 2020				
Organisation	**Year**	**Grant donor**	**Grant amount (£)**	**Purpose**
Harbury Energy Initiative (HEI)	2012 - 2019	LEAF	45,000	To promote government Green Deal. Used for internal wall insulation of library, PV generation monitor for Village hall PV to display to public, Energy options reports for 3 community buildings, EPCs for a historic range of buildings in the village, public awareness raising event.
		e-on Energy Action Fund	2,000	Roof and wall insulation of the Harbury RFC clubhouse
		Carplus DCCE fund	18,000	set up an electric car club in collaboration with E-Car Club
		Big60Million	1,000	Start up funding for Harbury e-Wheels
		Heart of England Community Foundation	960	Start up funding for Harbury e-Wheels
		Heart of England Community Foundation	2,000	LED lighting in school completed with match funding from Warwickshire County Council
		Postcode Local Trust	15,495	Energy Store for Harbury Village Hall
		Carbon Trust	1,300	Contribution to capital cost of 12kWp solar PV for school roof
		Heart of England Community Foundation	1,400	Contribution to capital cost of 12kWp solar PV for school roof. Also helped to secure £12,000 loan @0% interest from Salix Fund.
		Heart of England Community Foundation	1512	LED lighting for the Scout Hut.
Sub-total			88,667	
Harbury e-Wheels (HeW)	2016 - 2018	Coventry Diocese Together for the Community	2,000	Start up costs for e-Wheels
		Harbury Parish Council	2,000	Running costs
		Harbury Parish Council	1,500	Running costs
		Southam Town Council	1,000	Running costs

Organisation	Year	Grant donor	Grant amount (£)	Purpose
Harbury e-Wheels (HeW)	2018 - 2020	Poors Allotment Charity closing fund	500	
		Harbury Parish Council	1,500	Running costs
		Bishop's Itchington Parish Council	500	Running costs
		Heart of England Community Energy	5,400	Running costs, spread over 3 years at £1,800 per year
		RCEF	40,000	Feasibility study for HFE
		WI Harbury	750	Running costs
		WPH Charitable Trust	500	Running costs
		HS2 CEF	10,000	2 years running costs
		Coop Helping Hearts	250	Running costs
		Warwickshire County Councillor's Fund	500	Running costs
		Ecclesiatical 12 Days of Giving	1,000	Running costs
		Let's Talk Ageing	500	Website upgrade
Sub-total			**67,900**	
Harbury Village Hall	2012 - 2020	Buy a Brick Local Appeal	75,000	Changing room extension
		WREN	15,000	Kitchen
		The Big Lottery	10,000	PV Panels
		Veolia	88,546	Extension
		Biffa	50,000	Extension
		Section 106	52,000	Heating/Lighting
		Bob Stevens SDC	2,000	Heating/Lighting
		PO Lottery	15,500	Batteries
		Section 106	30,000	General refurb
		HS2	75,000	Porch
		Biffa	66,250	Porch
Sub-total			**499,296**	
Grand Total			**655,863**	

SUMMARY

Organisation	Funds raised
Harbury Energy Initiative	£88,667
Harbury e-Wheels	£67,900
Harbury Village Hall	£499,296
Total raised 2012 - 2020	**£655,863**

Appendix 13: HFE Steering Group meeting minutes

Harbury e-Wheels RCEF Feasibility Study

Skype Meeting 01 - Wednesday 18th March

Key notes and actions

Attendees:

HFE Steering Group - Bob Sherman e-Wheels Chair (BS), Philip Meyer Project Director (PM), Hugh Tottle (HT), Peter Walshe (PW).

Greenwatt Technology - Bernard Perkins (BP), Tim Perkins (TP), Mike Woollacott (MW), Ruth Woollacott (RW)

1. **Key points from introductions**
   a. Harbury E-Wheels needs to be self-sustaining and needs to aim for income generation of £15k/year – this project should aim to contribute to this.
   b. Vision is to have 4 EV charging points/bays of which two will be for Harbury E-Wheels slow charging (3.3kW) and two fast charging points (7kW or 22kW 3-phase) for public charging .
   c. Study to identify suitable 'back office' payment options for the public charging system.
   d. Important that all technical developments need to be sustainable.

2. **The Project Brief and Activity Schedule**
   These were circulated in advance of the meeting and can be used to assess project progress and also to introduce the project to suppliers / community members or others engaged in the project. The summary (v1) is a draft - comments welcome and to MW.

3. **Section A: Technical (MW lead)**
   a. Options analysis – wind, solar, storage, EV charging – under way (MW)
   b. Electric vehicle charging infrastructure and payment options (including car port, MW in initial discussions with Solisco)
   c. Grid connectivity, energy capacity and substation options (MW liaising with Western Power and Actemium, Coventry)
   d. Structural preliminary assessment – needs specification of 7kW turbine (PM to MW)
   e. Option analysis to take account of emerging technologies to future proof the development e.g. Vehicle-to-Grid charging; acknowledge extended range of EVs and hybrids coming into the market.
   f. Council Support – Warwickshire County Council (WCC - David Ayton Hill) will support project as part of the roll out of EV charging in rural communities. Presently none of the WCC planned charge points are in rural areas.
   g. Council support - Stratford District Council (Tony Perks - Deputy Chief Executive) has offered support for the project and has asked Robert Weeks (Head of Planning) to support / guide the project. Study will engage with SDC through a formal pre-planning application to get a good steer before full planning and the associated costs are started.

4. **Section B: System Operation and Modelling (BP lead)**
    a. Study will develop scenario modelling to match EV charging demand with electricity generation and include buffer storage to enable a balanced supply.
    b. Annual wind speed potential for the site will be profiled using national database.
    c. Solar photovoltaic options both at the turbine and as a solar car port will be examined as a back-up / top up to wind power.
    d. Financial scenarios and modelling will include capital cost estimates, running and maintenance costs, lifecycle costs.
    e. Investment and ownership options, comparisons and case studies (e.g. community investment scheme).
    f. EV charge payment options and study of preferential tariffs e.g. Octopus Energy
5. **Section C – Location and Planning (BP lead)**
    a. Early confirmation of preferred location of VAWT, battery storage and EV charging station – MW and BP to arrange early site visit.
    b. Pre-planning advice preparation to be coordinated. TP and Greenwatt architect Andy Mann to liaise with SDC.
    c. Car park capacity - Parish Council (contact – Tim Lockley, Chairman) considering extension to car park as now too small for Hall events. Important to coordinate plans with EV charging bays. Will car park extension be a separate planning application by PC?
6. **Section D – Local Demand (RW lead)**
    a. Local demand study. Combination of desk based research, socio economic data, previous Harbury transport studies (if any?), national transport studies, and EV uptake.
    b. Community ownership critical - caution not to engage too early except for EV demand indicators. PW offered support to RW for market research and promotion. Parish Council has offered assistance with public awareness – with likely presentation in July.
    c. Images – it would be helpful to have a visualization of what the structures in the proposed location, particularly important for the public consultation. RW to advise upon use and costs of photomontage and computer generated imagery.
    d. Base of wind turbine the battery storage unit would need to hold power inverter and battery storage – but could also include a secure store for football equipment storage as part of the structure. This would gain additional community support for the development. Study to identify nature of base structure e.g. block/brick/timber
    e. Structural design – potential for public artwork to soften the turbine installation and gain local community acceptability?
7. **Section E – Project Management (MW lead)**
    a. A Risk and Issues Log will be kept throughout the project and updated regularly with mitigations indicated. Quality assurance process also to be included.
    b. Security - Parish Council are planning to install 24-hour camera surveillance in the car park which could cover the EV charge point location. PM/BS to check on this.
    c. Scaling up potential, funding options i.e. RCEF Stage 2. PM advised a meeting with Midlands Energy Hub / RCEF (Ruth Mulvany) to gain her input and support. MW to make contact with Ruth (subject to Covid19 situation).
    d. Harbury e-Wheels (BS) is required to send a monthly report to RCEF (first week of every month). Greenwatt will provide a first report to Harbury e-Wheels before end of March and then subsequent month ends (as shown on Activity Schedule)
8. **Next meeting** – (Skype or at Harbury) - April date tbc.

Harbury Future Energy RCEF Feasibility Study
Meeting 02 (via Skype) Notes
Thursday 16th April 10.30 – 12.00

HFE Steering Group - Bob Sherman e-Wheels Chair (BS), Philip Meyer Project Director (PM), Hugh Tottle (HT), Peter Walshe (PW).

Greenwatt - Bernard Perkins (BP), Tim Perkins (TP), Mike Woollacott (MW), Ruth Woollacott (RW)

Papers circulated in advance:

- Scenarios summary
- Location plans
- Demand survey – Survey Monkey link

1. **Project Update**
2. **Scenario Analysis (MW)**

The different scenarios were provided as an attachment with the agenda. Discussion around scenarios together with some of the decision making behind them. Agreed that the priority objective of the project is to provide a system that combines fast and rapid EV charging powered by renewables (in the main) with integrated storage and with connection to the electric grid.

There will be primarily three scenarios;

- Maximum (EV rapid and fast charging stations powered by wind/solar plus battery storage and grid back up.)
- Medium (EV fast charging + solar OR wind with battery storage and grid back up)
- Minimum (EV fast charging and green energy (no renewables or battery buffer)

A site map with options for potential locations for the electric vehicle charge points, photovoltaic panels and 7kW wind turbine (VAWT) was discussed.

Comments from the discussion;

- Essential to have a rapid charger for residents' daytime charging and for 'passing' EV users.
- Residents may prefer not to leave cars charging overnight in the car park for risk of damage and security issues. CCTV should protect e-Wheels EVs and others.
- Car park is locked overnight allowing exit only.

- Western Power's initial reaction to connecting a 50KW charger was 'unlikely' - however this should be seen as a constraint and not a veto – and subject to technical solutions review.
- Village hall roof on 'new' extension has space available for additional PV array (up to 10kWp subject to site visit) and provides optimum aspect for solar. Permission / agreement with Parish Council required. (PM to discuss with PC Chairman)
- Any solar canopy needs to have southerly aspect to maximise solar radiation. Only option for this would be to install to south of car park.
- Options 1 (west of village hall) and 4 (east of village hall) rejected due to protection order on trees and access / disabled parking priority.
- Option 2 (north end of car park) is preferred option – but suggestion that charging bays are installed on east side of car park for easier access for EVs. This option also closer to sub-station on South Parade (100m away) and also to village hall roof PV array (if permitted).
- Option 3 – (south end of car park) – closer to wind turbine but further from sub-station (150m). More security issues and also junior football pitch will have to be moved.
- Discussion on additional option behind village hall east of trees – but would present issue of access for events – and would require new car parking surface, planning permission etc.
- There would likely be objections from the Parish Council if four parking bays were dedicated to EV charging as the present car park is already too small. The Parish Council is presently considering extending the present car park – and this should form part of e-Wheels discussion with PC.
- No interest in ground mounted solar due to high risk vandalism/damage to the panels.

3. Project Client Requirements (BP)

Key issues were identified and clarified as follows:

3a. Projects

- Project revenues
- Breakdown of the present annual costs for e-Wheels is approx.;
- £80/month for EV electricity (charged at the domestic rate by Library)
- £3,000 / annum insurance
- £790 / month lease costs for the two vehicles

MUST: Provide an annual revenue contribution of £15,000 towards Harbury e-Wheel's running costs. However with the changing situation e-Wheels could find alternative revenue contributions, so changed to SHOULD provide a contribution (unspecified and tbc). (Agreed)

Project life span
SHOULD: The solution should be capable of running for 10 years to take account of parts lifetime and replacement e.g. inverters. (Agreed)

i. Financial viability

MUST: The solution must be financially viable for the life span of the project. Note: This will depend upon grants (capital and revenue) support – as it is unlikely to be viable on its own as a commercial enterprise. (Agreed)

3b. Stakeholders

Local Community

MUST: The development must be acceptable to a majority of the local population with consideration including usage by EV owners; visual acceptability by local residents. (Agreed – and include public information event)

3c. Development

i. Reliability and Maintenance

MUST: The solution must offer industry standard levels of reliability and maintenance costs (Agreed)

ii. Safety

MUST: The development must be safe and not a source of danger to users or the general public either from structures or operations (Agreed)

MUST: Be designed and constructed in conformance with Health and Safety in Design Regulations (Agreed)

iii. Security

MUST: The site should be no more prone to risk of vandalism and theft than other areas of Harbury and must not attract antisocial behaviour. Following discussion it could be assumed security would be provided by others and that at present the Council was proposing a CCTV system to reduce local vandalism in this area. At present the car park is closed (one way barrier) at night which may have to change with the new EV charging infrastructure?

4. Harbury EV Demand Study (RW)

- A link to the proposed draft community survey was sent out to the Committee members with the agenda. SG members were requested to complete the draft survey to test the collation system.
- Circulation of the questionnaire through the community to optimize the number of responses was discussed and the Steering Group agreed to promote it through Harbury News; three village face book groups; Harbury Energy Initiative website; Harbury e-Wheels website; through community groups (e.g. Scouts, WI) and via SG members private WhatsApp groups. (BS to lead on this supported by PW.)
- The introduction to the survey would be updated to include the issue of climate change, changing government legislation and the proposed deadline for the sale of petrol and diesel vehicles.

- The final version would be ready for circulation next week and will close at the end of May allowing time for as many of the households to complete the survey as possible.
- Coventry University Business School (Business in Society) have assisted in EV user evaluation studies previously and are interested in assisting. Agreed that RW could send invitation to join.

5. Technical stakeholders – grid; VAWT; PV; battery; solar canopy (MW)

MW reported strong liaison and co-operation with various stakeholders including;

Octopus Energy; EO Charging; Western Power Distribution; Solisco (solar canopy); Actemium (energy connections); McCamley

6. Project Risks and Issues (BP)

A risk and Issues log is being maintained, some of the key items include;

- Understanding Western Power's connection constraints
- Risks and issues related to COVID 19 virus and the limitation of community engagement and consultation, direct meetings, and technical site meetings by Greenwatt and technical advisers

7. Meeting and reporting schedule (MW)

- End of month report will be sent through to Bob for submission to RCEF by Friday 24th April
- Next online Committee meeting will be on Zoom on 14th May 10.00am

8. AOB and next meeting

Tim confirmed good relationship with Stratford District Council planning officer and introduced to the new officer who will be taking over shortly.

Harbury Future Energy RCEF Feasibility Study

Meeting 03 minutes Thursday 14th May 09.30 – 11.00

Papers circulated in advance:

- Site location maps latest (MW v10)
- Planning issues grid (TP)
- Harbury demand survey – interim report (12.5.20)
- Renewable energy – discussion paper (BP)

Present:

Bob Sherman, Peter Walshe, Philip Mayer, Mike Woollacott, Bernard Perkins, Tim Perkins, Ruth Woollacott

Apologies: Hugh Tottle

Minutes:

1. Project Update - summary (MW)

Project is going well and we are all working from our own home office(s) during this COVID 19 lockdown. We have had some delay in getting gird connection data back from Actemium as their staff have been furloughed but they should be back in the office next week. Planning visits have also been delayed but now Mike and Ruth plan to make an 'isolation' visit to take a video and measurements for the pre-planning submission.

2. Technology locations – solar PV; wind turbine; EV charging station; battery (MW)

Solar PV - The village hall with the south facing roof presents the best location for solar PV with opportunity for up to 20kWp of new panels to join the existing 9.9kW system. PM has discussed the option of putting additional PV on the village hall with the Chairman of the Village Hall Committee (Andy Rutherford) and subject to a structural survey does not anticipate any problems. Note: The village hall is owned by the Trustees and not the Parish Council (who own the land). PM is one of the Trustees.

It was agreed to organize a quote for a structural survey of the roof and source a cost estimate. PM advised that Peter Bones, a structural engineer who lives in Harbury could be approached for a structural survey quote.

Action: MW to supply PM with potential layout and loading weights.

Action: PM to request quote from Peter Bones.

Action: MW to source an estimate for 10 or 20kWp systems from Absolute Solar who have installed local farm PV systems.

Solar PV Inverter location options:

Further technical advice will inform as to whether there will be a need to invert the solar power from DC to AC supply. It may be better to run the whole system on a DC micro-grid and the Steering Group will be kept informed. Should a DC:AC inverter be required then it could be located:

- inside the roof space of the village hall
- outside the hall in a weatherproof wall mounted structure
- together with batteries in a containerised 'power room' on the car park as part of the EV charging station

Security: The Parish Council is proposing installing 2 x 24hour cameras in the village hall car park - one focusing on the back (south) of the village hall and the other facing down the car park.

EV charging stations: Discussion on options. Review of 'Option 1' (close to the village hall) and 'Option 2' (south end of the existing car park) on the map circulated. Option 1 would be closest to the solar PV energy source, is closer to the Western Power electric substation and is potentially more secure e.g. overnight charging. The Parish Council are proposing an additional 6 or 12 new car parking spaces in the south end of the carpark on a 'grasscrete' base as there is presently shortage of car parking spaces at peak times. The PC has indicated a preference for Option 2. It was agreed that the Study should model both locations and identify costs and issues associated with each location.

EV solar car port: It was agreed we would no longer continue with the car port solar canopy but would refer to it in the final report together with the identified costs.

Planning Issues: TP advised that planning permission will be required for the additional car parking spaces. However, planning permission is not required for the solar PV if installed on the village hall roof.

MW indicated that 2D drawings would be produced to illustrate the wind turbine as part of the pre-planning advice process. As Stratford District Council planning department will not undertake site visits for the next few weeks (Covid-19) they will also require visual images and a 360 degree video.

Action: MW to liaise with Andy Mann (AM - project architect) to arrange an onsite visit to capture these images

Wind Turbine - the proposed location is south of the tennis courts. Sketches produced by AM illustrated the proposed wind turbine structure with the McCamley 7kW vertical axis wind turbine (VAWT). The minimum height for the structure will be approx. 16.68m high i.e. a 10m platform with the wind turbine on top. The height of the support platform was identified in the McCamley data to optimize the wind speed and for Health and Safety reasons. The proposed platform structure could have a double use i.e. to carry the turbine and provide secure storage of sports equipment. The proposed height was compared to other windmills and buildings in the area (Harbury All saints Parish church tower (15m), Harbury Mill Tower (21m) and Chesterton Windmill (11m). There have been no objections to date (BS) where the project has been outlined in articles / social media but potentially HFE could expect objections once the size and design of the structure became public. The importance of local 'buy in' was vital and there will be a need for a robust public awareness campaign once plans have been finalised.

> **Action:** MW, AM and TP will draw up 2-D sketches to illustrate the turbine in its location and with comparisons for planning. It was agreed that information being gathered should not be placed in the public domain until approved by the HFE Steering Group.

Wind power - The capital cost of a 7kWp turbine unit supplied to site by McCamley Ltd is c£43,500 + VAT. The additional capital cost of support tower / building is to be confirmed and is subject to design – but a current estimate being used by BP in his modelling is £50k. BP indicated that would suggest an estimated cost of renewable electricity generated at around £1.00p/kWh. PM suggested that this was inaccurate and required further analysis.

> **Action:** PM to check on costs per kWh electricity generated and liaise with BP to make any necessary adjustments.

BP indicated that the average wind speed for the proposed site is 5.3M/sec at 10m height - data taken from the NOABL Wind Speed Database (Numerical Objective Analysis of Boundary Layer). We need to use the NOABL data which provides the annual wind data as we would not be able to collate this ourselves for the site within the project timescale. Using this data allows us to estimate the turbine would produce an annual yield of 10MWh, which is similar to that generated by a 10kWp PV system proposed for the village hall roof.

BP also reiterated the importance of verifying the return on capital investment which should include purchase of the turbine, support structure works, groundworks and maintenance over a 20 year generation period. The analysis will compare and contrast the vertical axis and horizontal axis turbines.

External partnerships and stakeholders:

Western Power Distribution (WPD – the DNO) have indicated that enabling connection for a rapid (50kW) charging station is highly unlikely from the existing local sub-station. MW indicated the prospect of engaging with Independent DNOs (IDNO) who have more flexibility to operate with smart local networks and off-grid hybrid systems.

Octopus Energy is in discussion with Greenwatt and have expressed a strong interest in the HFE project as rural energy infrastructure and integration is important to their future policy. They have

indicated that Harbury's unique profile may provide pilot and demonstration opportunities which could provide community benefits beyond the EV facility. For example, the installation of a large battery buffer system could provide a store for renewable energy and off peak power from the grid for use not only for the EV charging station but also by the wider community at lower tariff. Discussion continues with Octopus Energy to understand the pricing, the economics and competition for electricity and options around these. Four key Octopus Energy staff have been nominated to support the project – including Zoisa Walton, Octopus EV's CEO and who lives herself lives in a rural location and clearly understands the issues facing communities like Harbury.

Office for Low Emission Vehicles (OLEV) part of the Department of Transport (DfT) has responded positively to the HFE summary sheet circulated by MW recently – and have asked to be kept informed.

Other companies that have indicated interest and support:

- EO charging
- Eaton / Green Motion
- Siemens
- Actemium

3. System Modelling (BP)

Renewable energy production from PV and wind balance out over the year. PVs have peak generation during the day and over the summer: wind is more even during the day and higher during the winter months. (Performance data circulated in the Renewable Energy discussion paper). Work will continue to identify how much battery buffer capacity will be required to allow 50kW rapid EV charging. The objective would be to buy cheap green electricity as 'off-peak' i.e. during nighttime to top up the batteries. The support from Octopus Energy will be critical here.

4. Harbury EV Demand Study (RW)

RW reported that to date (12.5.2020) there have been 122 people responding to the online survey – which will close at the end of May so still time to encourage more households to respond. There appeared to be less people responding from homes without off-road charging facilities? To date, 11 EVs have been identified (8 fully electric cars; 3 plug in electric hybrids) which is approximately in line with expectations. (Interim summary of responses has been circulated).

5. Planning update (TP)

A document outlining the infrastructure requiring planning and the likely issues related to each was circulated. If there are any further questions these can be forwarded to TP and MW.

6. AOB and next meeting

The project monthly report will be prepared by 22 May and forwarded to BS for the RCEF May report.

The next meeting is planned for **Thursday 18th June 9.30 – 11.00am by Zoom**.

Harbury Future Energy RCEF Feasibility Study

Steering Group Meeting 04 (via Zoom)

Thursday 18th June 09.30 – 11.00

Present:

Bob Sherman, Peter Walshe, Philip Mayer, Hugh Tottle, Mike Woollacott, Bernard Perkins, Tim Perkins, Ruth Woollacott

Papers circulated in advance:

- Site Layout v16 (MW)
- Car park layout v3 (MW)
- Solar PV layout v3 (MW)
- Planning issues grid updated (TP)
- Demand survey – executive summary (RW)
- Updated publicity 1-pager (MW)

Minutes

1. **Project Progress summary (MW)**
   Good progress to date. The plan is to have the draft feasibility report by the end of June for the Steering Group to view and comment. The Final Report is on track to be completed by the end of July.

2. **Harbury EV Demand Study (RW)**

   A summary of the demand survey was circulated with the agenda. The survey provides a baseline of the situation in Harbury at this point in time and a reflection of resident viewpoints.

   A risk of limited demand for charging as many respondents indicated they could charge from home. However several supported the opportunity for overnight charging as a public access facility (over and above the need for o/n charging for e-Wheels EVs). Survey results could be skewed toward those with households with off-street parking. It would be useful to identify the number of households who do not have off-street parking nor have space to install a charge point e.g. flats, terrace houses in Harbury. Also the numbers of people renting properties who are unlikely to invest in home installations.

There are many external developments which may influence interest, demand and requirement for EVs and charging stations over the next few years. (e.g. clean air measures; low emission zones in town / city centres; County Council and District Council implementation of Climate Action Plans; increased choice of EVs coming into the market; employer encouragement/ incentives to drive electric; introduction of green number plates for EVs; increased awareness of EV options and accessibility; changes in behaviour and travel modes; Government ban on new petrol and diesel vehicle sales (currently 2035).

3. Planning enquiry update (TP)

The HFE feasibility study is addressing the following factors;

- technical options and models
- cost and viability
- planning issues

A detailed pre planning enquiry report is being prepared to include;

- a statement explaining the project and the proposed infrastructure
- a section identifying and addressing the likely planning issues
- drawings of the proposed layout and illustrations of the proposed wind turbines

Power container: the power connection from the substation will be under 'permitted development' and is the responsibility of the DNO – Western Power. The suggested size of the container to hold batteries, switch gear and inverters will be approx. 6 m by 2.44m. There will be a need for air conditioning – there are planning guidelines / standards relating to noise levels near residential properties.

Discussion was had about the most appropriate location for the power container taking into account H&S, low level noise from the internal air conditioning unit in the container, distance from nearby residential properties and the likely acceptance of the container location by residents and Harbury Parish Council.

Steering Group members confirmed that the most acceptable location for the container was adjacent to the west of the village hall near the new changing rooms with the benefits being;

- visual impact / size would be reduced
- away from residential properties re noise levels
- away from the football pitch re H&S
- practical access for the power requirements and proximity to the WPD sub-station

It was noted that this location would be subject to formal agreement with the Village Hall Committee and the landowner, Harbury Parish Council. It was agreed that once drawings were amended Steering Group members would discuss with the respective committees and feedback to the Consultants.

Lighting: Lighting points (LP) were identified on the plan for the car park extension and will be part of the planning application as they are near a residential area. Full details of the lighting are not required at pre-planning stage: however discussions with planners would identify suitable lighting options both for EV charge point users and also for security camera visibility. Lighting should of course make minimal impact on nearby residential properties.

Solar PV: this is regarded as **'**permitted development' and not requiring planning approval; however it will be included in the planning enquiry for information.

Wind Turbine: there are slightly conflicting national and local policy issues relating to wind turbines:

- the Government introduced a ban on onshore wind turbines in a 2015 policy which effectively stopped onshore wind turbine development;
- Stratford District Council's policy is more open and in principle will support wind developments if there are minimal negative impacts which do not override the benefits of sustainable energy;
- A recent case study in Shropshire for a 25kW horizontal axis turbine was approved by councilors even though planning officers followed national policy and recommended refusal.

Discussion followed on the specific issues related to the Harbury wind turbine proposal:

- Proposed location on the sports field is not an isolated location but a public place with homes nearby;
- Government policy is supportive of local community energy schemes;
- A successful project will depend upon the level of local objection highlighting the importance of good presentation and communication;
- A pre-planning enquiry will inform HFE as to what the planners think and how they will interpret the different policy statements.

A silhouette sketch illustrating the comparative sizes of different wind turbines and local windmills was provided:

- McCamley VAWT on steel mast (ht 14.5m)
- McCamley VAWT on timber clad tower (ht 16.7m)
- 25KW Horizontal axis wind turbine (ht 24.6m)
- 7KW Horizontal axis wind turbine (ht 12.0m)
- Chesterton Windmill (ht 11.0m)
- Harbury Windmill (ht 19.7m)

These sketches illustrated the relative heights and volume of the various structures and the likelihood of acceptance – locally and through planning. After some discussion three key questions emerged:

a. Should the wind turbine option be included in the pre-planning as it may have a negative impact on Harbury E-Wheels? SG decision – yes.
b. Does the whole EV charging scheme fail if the wind turbine is not included? TP response – No.

c. Which of the wind turbine schemes should be 'promoted' as favoured options? SG decision – McCamley 7kW on mast (with storage building at base) and on tower.

BP indicated that all calculations show that to meet the energy demand from slow / fast / rapid charging the majority of the power will need to come from the gird. A buffer battery will enable storage of surplus renewable energy and off-peak tariff 'green energy' from the grid supply.

The anticipated 7kW from wind and 12kW from solar provides only a contribution. The energy production from PV and from wind complement each other with regards to energy production through the day and over the year. There is limited space onsite at Harbury for more renewables. EV charging proposals are possible even if the wind turbine is not approved. Technology is now available to optimize the use of grid and battery storage.

The Steering Group acknowledged the section drawings which illustrated the local site for the turbine and the village hall, using the height of the local trees. The planning enquiry would also include the design of the McCamley VAWT on a mast (which reduces the height of the turbine by 2.37m) and include a storage 'room' at the base for sports equipment.

Planning status: Pre planning applications are not automatically published but any requests for information are given out – so the pre planning application is not confidential. During this COVID-19 period instead of a meeting with the planners (likely to be two officers), there is a Zoom call and it would be good to have a representative of the Steering Group on the call. Philip Mayer nominated to join the call with the SDC planners and Greenwatt.

4. System Modelling latest (BP)

It was agreed it would be worth having a specific meeting to discuss the modelling options which will go into the final report. The modelling options and business case will include;

- supply and cost of energy sources
- matching supply with demand
- revenue streams and viability review
- system operation and 'back office' options

5. Draft Feasibility Report

Draft feasibility report to be presented to the Steering Group – Thursday 2nd July 10.00 (Ruth Mulvany RCEF invited)

6. AOB and next meeting

Business modelling Zoom meeting led by Bernard - **Thursday 25th June 10.00 – 11.00**
Draft feasibility report presentation Zoom – **Thursday 2nd July 10.00 – 11.30**

Harbury Future Energy RCEF Feasibility Study

Meeting 05 (via Zoom)

Thursday 2nd July 10.00 – 11.30

AGENDA

1. Welcome from Harbury e-Wheels – Bob Sherman Chairman (5 mins)
2. Rural Community Energy Fund – Ruth Mulvany Midlands Energy Hub (10 mins)
3. Background to project, aims, objectives, outputs – Mike Woollacott (10 mins using PPT)
4. Technical aspects and locations – Mike Woollacott (20 mins PPT)
5. Scenarios and System Modelling technical and financial – Bernard Perkins (20 mins PPT)
6. Feasibility Study activities July / August – Mike Woollacott (5 mins)
7. Discussion led by Philip Mayer, Project Director (20 mins)
8. Closing remarks and next Steering Group meeting date – Bob Sherman.

Invited:

Ruth Mulvany, RCEF Project Coordinator, Midlands Energy Hub

Bob Sherman, Harbury e-Wheels Chair and Steering Group member

Philip Mayer, Project Director and Steering Group member

Hugh Tottle, Steering Group member

Peter Walshe, Steering Group member

Bernard Perkins, Greenwatt Technology

Ruth Woollacott, Greenwatt Technology

Tim Perkins (optional), Greenwatt Technology

Meeting minutes note: The format of this meeting was to present via PowerPoint a mid-term progress report – and as such, no meeting minutes or actions points were considered necessary.

Harbury Future Energy RCEF Feasibility Study

Steering Group Meeting 06 (via Zoom)

Thursday 23rd July 2020 09.30 – 11.00

Present:

Midlands Energy Hub – Michael Gallagher, Ruth Mulvany

Harbury Steering Group - Bob Sherman, Peter Walshe, Philip Mayer, Hugh Tottle

Greenwatt Technology - Bernard Perkins, Tim Perkins, Ruth Woollacott, Mike Woollacott

Notes from Meeting

1. **Introductions (BS)**
   Bob Sherman welcomes MG and RM to the meeting and thanked them for their support to date. MG thanked the Harbury team for regular updates and congratulated the Harbury team on progress made in 'challenging times'.

2. **Project Progress summary (MW)**
   MW reported that things were on track to deliver the final draft of the Feasibility Study on schedule by the end of July. This would enable the Steering Group to examine the Study in detail in August and request any adjustments. It would be used as a basis for a Stage 2 funding application to RCEF (see Item 8 below).

   Following a reminder of the Harbury Future Energy objectives, MW summarized the main activities and outputs achieved since the last SG meeting. The pre-planning enquiry had been submitted and a Zoom meeting with SDC Planning had taken place on 22nd July – with written response expected w/b 27th July. Estimates for the various equipment and capital works have been provided from a range of potential suppliers which has enabled real cost evidence to be used in the modelling.

   MW highlighted that a couple of areas were still 'work in progress' i.e. submission of G99/G100 application to Western Power; listing of possible capital funding sources; and the role and level of involvement of e-Wheels and HEI in the EV charging station. On this latter point, MW reported that a Zoom meeting with Brighton Energy Coop was planned for 29th July; and further guidance was expected from Communities for Renewables.

MG asked about the evidence to support the rapid EV charging option – given the capital cost and energy demand. He advised that the Report should build the case as this would be a critical consideration should the project proceed to Stage 2. MW reported the Study has looked at national (Scotland) and international (Switzerland) evidence for demand for rapid chargers in rural areas. Also the evidence of local aspiration for the rapid charger based on the demand survey (>50% respondents) – and its potential importance on several fronts i.e. those living in rented accommodation or without off-street charging requiring quicker recharge; and those buying / leasing EVs with larger batteries e.g. Tesla, Audi e-Tron, Jaguar i-Pace for whom fast charging would not meet demand requirements in all situations. Passing traffic e.g. Fosse Way would only be interested in using a rapid charging facility.

3. Pre-planning enquiry – verbal feedback (PM and TP)

PM reported a very positive online discussion with Louise Casey (LC), Planning Officer at SDC who would be submitting a detailed written response w/b 27th July. In summary:

- **Car park**
  - LC indicated that SDC now required extended car park bays of 5.5m x 2.5m (rather than the 4.8m x 2.5m submitted). TP would check whether this still fitted within the car park layout and would not protrude onto the junior football pitch.
  - Request for a lighting assessment in relation to new lighting proposed.
  - Planning proposal must demonstrate no damage to the boundary hedge
- **EV Charging station** – no issues raised
- **Solar PV** – no issues raised
- **Power container** – two areas needing technical assessment:
  - Nearby trees (under TPO)
  - Noise levels emitting from the container aircon system.
- **Wind turbine:**
  - LC indicated that SDC supported wind turbines 'in principle' but approval dependent upon a range of factors such as amenity, character, noise, visual impact etc.
  - There is a shared preference in the planning team for the mast mounted VAWT as more 'visually lightweight' than the tower structure.
  - Planning application would benefit from a visual landscape study to show the 360° impact of the turbine proposals.
  - Planning application would require evidence of noise, flicker and vibration levels.
  - Suggestion to consider additional tree planting on east boundary to mask the turbine structure.
- **Groundworks** – It seems that the northern part of the playing fields lies in an archaeological sensitive area – and a full study would be required ahead of any groundworks.
- **Community** – SDC very supportive of community led initiatives which have the support of local residents and businesses.

4. Main conclusions (BP)

BP summarized the technology options for HFE and the option and benefits of an incremental delivery programme for the EV charging facility. This will depend upon available capital, evidence of increasing EV user demand and approvals from SDC Planning and Western Power distribution. It will be important to 'future proof' the installation however to enable expansion to match growing demand over the next 10 years e.g. space for added battery storage; cabling and ducting for additional charging infrastructure.

BP presented the following headlines resulting from the scenario analysis and modelling activity:

- Forecast demand - baseline use and revenue will be initially light - but anticipated to grow in line with forecast uptake of EVs.
- Renewable generation matches baseline demand reasonably - however, renewable energy generation will be intermittent - diurnal, seasonal and weather conditions.
- EV charging station requires a balancing battery to store renewable energy surplus and also off-peak grid supply to meet [power] demand.
- Capital costs are high (estimated at £290,000 +/- 30%) - therefore capital innovation grant required along with local authority support.
- Operating costs are higher than the forecast of early revenue from the charging station – the project would likely need a revenue grant to subsidize early years.

5. RCEF publicity and promotion

RM explained that projects such as HFE would be used as case studies for other community groups to access. BEIS funding criteria requires project dissemination. Midlands Energy Hub (MEH) acknowledges that data and costs included in Stage 1 feasibility studies are not appropriate for public circulation – but MEH will expect a short project case study with contact references as part of the Feasibility Study. MW explained that the Study would also have an Executive Summary which would be suitable for community sharing.

6. Harbury dissemination (BS)

BS indicated that the case study and Executive Summary would also be useful for local dissemination via usual social media and websites used by e-Wheels, HEI and the Parish Council. MW noted that SDC and WCC might also require such materials and be able to assist with dissemination. It will be important to demonstrate possible solutions for other rural situations in the District and County.

BS reported Steering Group discussions had been discussing an awareness event – with a main focus on main local stakeholder groups e.g. councils, village organisations etc. However this could be extended to a wider public audience and also bring in the developing Warwickshire Low Carbon Network – a group of rural energy groups with shared interests. The event could invite operators and suppliers who have contributed to the Feasibility Study as well as Electric Zoo who supply the e-Wheels fleet. A date for such an event would depend upon Covid-19 restrictions but perhaps September or October – and in time to provide support and feedback for a subsequent application for RCEF Stage 2 funding.

MW asked who would have responsibility for the event – as Stage 1 delivery will have been completed and budget expended. Costs would be expended e.g. in producing display boards, refreshments, village hall hire etc. SG members to meet and discuss in more detail. MW to supply SG with contact details of companies that have contributed to the Feasibility Study.

7. RCEF Stage 2 prospects

MG outlined the process for Stage 2 applications under RCEF. Projects would need to demonstrate technical practicality, financial viability and strong community support. Bids would also need to identify the potential sources of funding (capital and revenue) including grants.

The Stage 2 grant would support the further development of the Business and Delivery Plan – and should lead to the project being 'investment ready' at the end of Stage 2 (including planning approval). Much of the Stage 2 budget would therefore be for professional fees, legal, planning and survey costs. No capital costs are included. MG supported the work to date for Harbury Future Energy and encouraged a Stage 2 application – ideally by mid-October (tbc)

8. AOB and next meeting

There was no further business. BS thanked all for their participation.

Harbury Future Energy RCEF Feasibility Study

Steering Group Meeting 08 (via Zoom)

Wednesday 12th August 10.40 – 12.30

Present:

Bob Sherman, Peter Walshe, Philip Mayer, Hugh Tottle
Bernard Perkins, Tim Perkins, Mike Woollacott, Ruth Woollacott,

Notes of Meeting

The Steering Group had received a full copy of the draft Final Report in advance of the meeting.

1. **SDC Planning** – TP summarized the written response from SDC Planning Officer and highlighted the following points:
   - Bay length in car park – 5m would be acceptable as long as the hedge was trimmed, which would mean no encroachment onto the junior soccer pitch
   - Power container -= location fine but there would be a noise assessment of air conditioner required
   - Tree survey required to confirm no damage risk to trees under TPO
   - An archaeological survey (desk-based) would be required for north end of site prior to any earthworks
   - An assessment of traffic access and disturbance would be required particularly related to wind turbine construction

2. **Western Power Distribution:** A formal letter with a budget estimate from WPD confirms that HFE would be able to draw all the power requirements for four fast and one rapid charge point directly from the grid as there is a good power supply into Harbury village and from the nearby sub-station. Note: this is unlike the situation in many other rural locations. Prior to this assessment WPD had indicated that there may be grid restrictions limiting the supply capacity required for the EV charging station.

3. **Minimum scenario** – because all the power can be drawn directly from the grid the minimum scenario (Option 1) will now be adjusted to installing 4 x 22kW charge points and 1 x 50kW rapid charge point. Modelling is based on the Octopus flat rate 13p/kW at any time of day or night.

4. **Demand:** Baseline EV charging use data is based on experiences from ChargeScotland and the village of Ollons in Switzerland both of which indicate low use of public access charge points in

rural locations. Both studies also show a clear preference for rapid charging. The demand for charging in Harbury is uncertain and likely to be low initially but should increase over the next 5 and 10 years.

5. **Budget figures:** These are presently expressed with 30% buffer either way to illustrate the uncertainty of cost estimates due to lack of site visits from suppliers or confirmed specifications. Following discussion the Steering Group advised that the cost estimates were for budget purposes only and therefore only 'mid' budget prices should be shown in the Study reflecting the detailed work carried out and written estimates. An explanation in the text should still be included to illustrate caution and the need for a contingency element.

6. **Supply and demand profile**: It is critical to match demand and supply and plan for an incremental development of the EV charging station. With EV charging power able to be supplied directly from the grid, further consideration is needed as to the timing and benefits of introducing capital intensive battery storage and renewable components (solar and wind) in light of the initial low demand and revenue stream.

7. **Sources of electricity for EV charging - Options**: Following the response from Western Power, and the grid capacity to supply power for 4 x 22kW AC and 1 x 50kW DC charge points, the Steering Group requested an additional Option 2 to be added:

   Option 1: rapid and fast charging using electricity directly from the grid
   Option 2: rapid and fast charging using off-peak electricity from the grid and stored onsite in a battery
   Option 3: rapid and fast charging using off-peak electricity from the grid plus solar energy stored in a battery
   Option 4: rapid and fast charging using off-peak electricity from the grid plus solar and wind energy stored in a battery

8. **Revenue:** The proposal does not currently show a strong commercial case in what will be initially a low EV charging demand in Harbury but there may be other reasons to continue with the HFE project e.g. social equity and affordability; testbed and demonstrator for other rural community energy groups; future energy resilience. There will be a need to subsidise the capital costs as a pilot project through public sector investment, innovation funding and grants. Other similar initiatives e.g. Brighton Community Energy are in the same position.

9. **Business case:** It is difficult to demonstrate a robust business case when demand forecast for Harbury is so uncertain. Going forward it will be important to:
   - drive down capital and operational costs
   - identify the optimum pricing policy options
   - identify capital and revenue grants
   - develop a marketing strategy to build local demand
   - start small and build incrementally to match increase in demand

10. **Executive summary**: This was requested by the Steering Group to contain main conclusions and be a summary document for circulation. MW informed that the Main Study followed the template supplied and required by Midlands Energy Hub.

11. **Public consultation event:** Planned for Saturday 26th September (same date and school location as the local market). Three CAD drawings will be presented on A1 foam back board plus a further board showing a diagram of the 4 options being considered. Each board would cost £20 if printed by PSW (Redditch). BS to confirm funds for this. Three Councils (HPC, SDC, WCC) will be invited to the event plus the local MP Jeremy Wright. SDC Planning Officer would also be invited. Commercial companies would not be asked to take part in this initial event.

12. **Stage 2 RCEF bid**: Key issues which need to be discussed / addressed;
    - Organisational Plan - clarify organisation structure of HFE (e-Wheels; HEI; CiC etc) and confirm stakeholders and partnerships needed to progress the project;
    - Financial Plan - identify the operation and payment model for EV charging / grid energy;
    - Marketing Plan - develop a marketing strategy to raise the profile for EV charging and build demand;
    - Funding Plan - identify capital and revenue funding options;
    - Community Investment Plan – consider the options for community investment

13. **Final Report**: The draft will be amended in light of this meeting's discussions and completed next week, along with an Executive Summary. PM thanked the Greenwatt team on behalf of the Steering Group for their hard work in delivering the Feasibility Study on schedule in spite of the Covid-19 restrictions. MW reciprocated thanking the Steering Group for their excellent cooperation and support throughout.

Appendix 14: Planning Enquiry Response SDC

Note: A full pre-planning enquiry document was prepared and submitted which has been forwarded to Harbury e-Wheels as a separate Annex to avoid duplication with this main Feasibility Report.

Mr Tim Perkins
Greenwatt Technology
Roseleigh House
Oversley Green Alcester
B49 6PG

Pre Application Report

Application No	**PREAPP/00093/20**

Location	Village Hall And Playing Field South Parade Harbury
Proposal	Proposed Electric Vehicle Charging Station.

Application Type		
Received	30 June 2020	
Map Ref	(E) 437313	(N)259761
UPRN	010023583888	
Site History	00007003	

Receiving Officer	Jonathan Verrier
Parish Ward	HARBURY Harbury
Ward Members	Councillor J Harris

Applicant Name and Address	Agent Name and Address
Mr Bob Sherman 8 Church Terrace Harbury CV33 9HL	Mr Tim Perkins Roseleigh Oversley Green Alcester B49 6PG

Case Officer: Louise Casey

Date Valid: 30 June 2020

Meeting Date (if applicable): 22 July 2020

Response Date: 03 August 2020

Site History Search for UPRN 010023583888

00/03220/TEL	Telecommunications mast and equipment cabinet.	07/12/2000
78/00358/FUL	STORAGE AREA FOR VILLAGE HALL EQUIPMENT	19/07/1978
83/00139/FUL	ALTERATION TO EXISTING PITCHED AND FLAT ROOFS TO FORM NEW PITCHED ROOFS.	15/06/1983
88/01975/FUL	EXTENSION AND IMPROVEMENT OF CAR PARK.	18/01/1989
08/02240/FUL	Alterations and extension to village hall to: extend hall, construct stage with storage over, replace changing facilities, replace toilets, including wheelchair accessible toilets, enlarge entrance lobby, provide parish office and two lettable offices	07/11/2008
09/00086/FUL	Alterations and extensions to village hall to extend hall. Construct stage with semi-basement under. Replace changing facilities. Replace toilets including wheelchair accessible toilets. Enlarge entrance lobby. Provide Parish Office and two lettable offices.	12/03/2009
11/01163/FUL	Alterations and extensions to extend the existing village hall relocating sports changing rooms and forming a new entrance and meeting room.	05/07/2011
12/00336/TPO	- T1 : Horse Chestnut - Fell - T3 : Horse Chestnut - Remove dead wood, prune back from cables - T4 : Sweet Chestnut - Remove dead wood, lift crown footpath side to 3 metres above ground level - T5 : Sweet Chestnut - Remove dead wood and balance crown - T6, T7, T8 : Sweet Chestnut - Remove dead wood	09/05/2012
12/01788/FUL	Alterations and extensions to village hall to create new changing rooms and a performance/stage area	25/09/2012
19/00581/FUL	Re-configure the main entrance, including the provision of additional storage space together with enlarging the entrance steps with the provision of an access ramp with balustrading.	08/07/2019

96/01579/FUL	RECREATION GROUND SOUTH PARADE - ERECTION OF 2.1M HIGH PROTECTIVE CHAIN LINK FENCE TO NETBALL COURT SURFACE	28/01/1997
99/00205/FUL	Extension of existing netball court to provide a multi-use all weather surface area. Provision of floodlighting to one tennis court and multi-use area. Erection of Clubhouse.	06/05/1999
05/01549/FUL	Extend provision of floodlighting to a second tennis court by erection of 3 x 6metre high lighting columns.	14/07/2005
08/00429/FUL	Proposed BMX track	11/04/2008
08/02903/FUL	Extend provision of floodlighting to a third court (dual purpose, netball and tennis court) by erection of 6 x 6 metre high lighting columns.	30/01/2009

Does the proposal require a planning application?

Yes

Site Constraints

- Air Safeguarding - Consult: Gatwick
- Mineral Safeguarding Area
- Trees covered by TPO: Ref No: TPO/042/030/G1, Location: Harbury, Legal Doc: 651
- Medium sensitivity Archaeology

Relevant Core Strategy Policies

Any application made for this proposal will be considered against the policy guidance contained in the National Planning Policy Framework (NPPF) and policies within the Stratford-on-Avon District Core Strategy 2011-2031.

The Core Strategy 2011-2031 was formally adopted by Stratford-on-Avon District Council on 11th July 2016. The Core Strategy and its associated documents are available on the Council's website at: https://www.stratford.gov.uk/planning-regeneration/core-strategy.cfm.

The following policies of the Development Plan are of particular relevance to this proposal:

- Sustainable Development (CS.1)

- Climate Change/Sustainable Construction (CS.2)
- Sustainable Energy (CS.3)
- Landscape (CS.5)
- Natural Environment (CS.6)
- Historic Environment (CS.8)
- Design and Distinctiveness (CS.9)
- Transport and Communications (CS.26)
- Countryside and Villages (AS.10)

Relevant Neighbourhood Plan Policies

Stratford-on-Avon District Council resolved that the Harbury and Deppers Bridge Neighbourhood Development Plan was 'made' on 17 December 2018. It is now formally part of the District Council's development plan and will be used to assist in making decisions on planning applications within the plan area.

The following policies of the Neighbourhood Plan are of particular relevance to this proposal:

- Protecting and Enhancing Local Green Spaces (H.07)
- Landscape Design Principles (H.10)
- Sustainable Design and Energy Efficiency (H.14)

Relevant Supplementary Planning Guidance/Documents

- Development Requirements SPD
- Site Allocations Plan (draft – adoption expected summer 2022)

Any other relevant guidance/documents e.g. Parish Plan, HNS or VDS

The majority of the supplementary planning guidance and other documents referred to, including Parish Plans, Housing Needs Surveys and Village Design Statements can also be accessed through the Council's website at https://www.stratford.gov.uk/planning-regeneration/planning-policy.cfm

However, some of the older documents, particularly the Village Design Statements, are only available in hard copy not electronically. You should contact our Customer Service Centre for help accessing these documents. Village Design Statements, Parish Plans and Housing Needs Surveys should also be available through your Parish or Town Council.

Relevant National Guidance and/or Circulars

- National Planning Policy Framework ('The Framework')
- National Planning Practice Guidance (NPPG)
- Circular 06/05: Biodiversity and Geological Conservation
- Human Rights Act 1998
- Natural Environment and Rural Communities (NERC) Act 2006
- The Conservation of Habitats and Species Regulations 2010
- Localism Act 2011

EIA development?	Yes	No	x	**Significant Trees?**	Yes	x	No
If Yes, will a screening opinion be needed? Yes/No				If yes, a tree survey will be required with your application.			

Consultations

Parish Council
Mrs Alison Biddle – Clerk to
Harbury Parish Council
clerk@harbury-pc.gov.uk

Ward Member
Councillor J Harris
jacqui.harris@stratford-dc.gov.uk

SDC Building Regulations
martin.bennett@stratford-dc.gov.uk or iain.wyatt@stratford-dc.gov.uk

SDC Environmental Health
envhealth@stratford-dc.gov.uk

WCC Ecological Services
David Lowe
Warwickshire County
Council PO Box 43, Barrack
Street Warwick, CV34 4SX
planningecology@warwickshire.gov.uk

WCC Local Highway Authority
P.O.Box 43
Barrack Street, Shire Hall
Warwick, CV34 4SX
highwayconsultation@warwickshire.gov.uk

WCC Rights Of Way Elaine Bettger PO Box 43

Barrack Street Warwick CV34 4SX

elainebettger@warwickshire.gov.uk

WCC Fire and Rescue Service
Water Department
Rachael Dimbleby
Bedworth Fire
StationPark Road
Bedworth CV12 8LB
FR-Water_department@warwickshire.gov.uk

Western Power Distribution (West Midlands) Plc
Avonbank Feeder Road Bristol
BS2 0TB

Severn Trent Water
Asset Protection Waste Water
Leicester Water Centre, Gorse Hill
Anstey LE7 7GU
Planning.APEast@severntrent.co.uk

Environment Agency
swwmplanning@environment-agency.gov.uk

You are advised to contact Warwickshire County Council directly in relation to pre-application advice relating to ecological, archaeological, highways and infrastructure (S106 – Infrastructure Manager) matters, if the consultee has been identified above.

Not contacting key consultees before making a formal planning application could result in a decision on the application being significantly delayed and/or makes it more likely that officers would have to make a recommendation of refusal.

Officer assessment of proposal

Principle of development:

The Council is required to make a decision in line with the Development Plan, unless material considerations indicate otherwise (Section 38(6) PCPA 2004 and Section 70(2) TCPA 1990). The National Planning Policy Framework (NPPF) is a key material planning consideration.

Policy H.14 of the NDP provides support for sustainable development initiatives and encourages the adoption of sustainability measures promoted through the Harbury Energy Initiative and the Parish Council. It is understood that E-Wheels has been established by the Harbury Energy Initiative and that the Parish Council are supportive of the proposal.

Policy CS.3 of the Core Strategy sets out the District's objective to reduce its greenhouse gas emissions in order to contribute to the national target for reduction. This is through a range of measures such as the location and design of development, provision of renewable and low carbon energy schemes, and promoting opportunities for low carbon travel.

Proposals will be determined with regard to the Council's Renewable Energy Landscape Sensitivity Study. This will be used to assess the capacity and sensitivity of the landscape to accommodate such schemes.

The proposal to install an electric vehicle charging bay is therefore in line with the general thrust of Policy CS.3. It is acknowledged that as much power as possible is to be supplied by renewable energy sources with the development proposing the installation of both solar panels on the roof of the village hall and a wind turbine.

Part B of the policy states that proposals for solar energy will be supported where the impacts are, or can be, made acceptable, unless material considerations indicate otherwise. In regards to solar development, the

following issues relevant to this proposal are of particular local significance in the District:

- Impact on the openness and character of the landscape and on visual amenity.
- Impact on the character of the historic landscape.
- Impacts of trees and other vegetation which may cause overshadowing, making allowance for their future growth.
- Impact on and opportunities to enhance biodiversity.
- Impact of direct and reflected lighting (including glare) on the amenity of occupied affected buildings or land on light pollution, on aviation and on biodiversity (particularly bats).

Notwithstanding the above, having considered the submitted information, I would concur that it appears the proposed solar panels to be installed on the roof of the Village Hall would be permitted development under Part 14, Class J. As the solar equipment would fall under Class J (b) i.e. microgeneration solar PV equipment, it would not be subject to an application for Prior Approval.

Part D of the Policy states that proposals for wind energy development will be supported where the impacts are, or can be, made acceptable, unless material considerations indicate otherwise. In regards to wind energy development, the application would be assessed against the following issues which are of particular local significance in the District:

- Impact of the scheme on landscape character and visual amenity. Careful consideration should be given to the likely significant effects of the wind turbine(s) on the visual amenity and landscape character, both individually and cumulatively, taking into account similar developments and permitted proposals within the District and within adjoining local authority areas.
- Impact of the scheme on the significance of a heritage asset, whether designated or non- designated, including the impact of the proposal on views important to its setting or function.
- Impact on the natural environment, including biodiversity, habitats and species of international, national and local importance.
- Impact of traffic generation on the local highway network during construction, operational and decommissioning stages.
- Impact on air traffic operations, radar and air navigational installations.
- Impact on users, businesses and residents of the local area and visitors, including generation of emissions, noise and visual impact, shadow flicker and safety.

Policy CS.3 therefore supports the principle of a wind turbine, however, this would be subject to meeting the criteria set out above.

It is understood that the wind turbine is proposed to be located south of the existing tennis courts and would be 14.5m tall. The turbine would be a vertical axis wind turbine (VAWT) as oppose to a more conventional horizontal axis wind turbine (HAWT) as this is considered to be the better option due to the site constraints. The submission puts forward two design options for the turbine which were discussed during the virtual meeting.

I have consulted the Council's Renewable Energy Landscape Sensitivity Study and can confirm that the application site does not fall within the main identified areas of constraint across the District.

Outside of these identified areas there is some capacity for 'occasional wind turbines spaced to avoid cumulative impact'. The size of turbines is recommended generally to be small and either single or in small clusters to avoid adverse effects on the topography, landscape pattern and settlements. The proposal puts forward a single wind turbine and I would consider the proposed height to meet the definition of a small turbine.

The application site falls within the 'Feldon Lias Farmlands' Landscape Character Type (no.13). Capacity for wind turbines in this area is set at level 2 – Landscape character type with occasional wind turbines in it and/or intervisible in another landscape character area(s). Reference is made to Harbury Conservation Area (along with other Conservation Area's) which would be sensitive to wind energy development. However, Harbury village itself is not identified as a settlement which would have a particular increased sensitivity to this type of development.

As discussed during the virtual meeting, I would request a Landscape and Visual Impact Appraisal (LVIA) to be carried out which is proportionate to the level of development proposed. The appraisal should take into account key viewpoints in addition to similar developments and permitted proposals within the District and within adjoining local authority areas. This will help to better understand the impact of the scheme on landscape character and visual amenity.

The proposed wind turbine would be situated some 200m from the southern edge of the Conservation Area. Having verbally discussed the proposed wind turbine with the Conservation Officer, they considered that the wind turbine would not be seen in juxtaposition to the Conservation Area and therefore was of the view that harm will not be caused to the Heritage Asset.

Though it is noted that the proposed VAWT is bat and bird friendly, an Ecological Assessment will be required in order to demonstrate that the impact on biodiversity will be acceptable.

It is advised that contact is made with Warwickshire County Council Highways Authority in order to determine whether the scale of the turbine works would require a separate assessment to be carried out regarding the impact of traffic generation on the local highway network during construction, operational and decommissioning stages. The local Highway Authority would be consulted on any forthcoming application.

It is acknowledged that the submitted information indicates the VAWT to be radar benign. It is however expected that sufficient and robust information to demonstrate this is submitted as part of any forthcoming application in order to ascertain the turbine's impact on air traffic operations, radar and air navigational installations.

The final consideration should be in regard to the impact of the wind turbine on users, businesses and residents of the local area and visitors. I note from the submitted information that it is claimed that the VAWT is 'vibration free' and 'virtually silent' and I recall from the virtual meeting that it does not produce shadow flicker as the rotor is fixed inside the frame. Given the

proximity of the development to neighbouring residential built form, it is crucial that sufficient and robust evidence is put forward to demonstrate these claims so that the Council can be confident on the impacts of the development in this regard and conduct an accurate and informed assessment. Having spoken with the Environmental Health Officer, a noise assessment will be necessary and will need to show that the development can meet 35Db up to 10m/s and the BWEA standard thereafter.

To conclude, the proposal is considered to be in accordance with the general thrust of Policy CS.3 and therefore could be supported in principle. However, the key consideration of the application will be the impacts of the proposed wind turbine and whether they are, or can be made acceptable. At this stage, I am not satisfied that I have sufficient information to determine this.

Detailed comments:

Design and Impact on the landscape

Policy CS.9 of the Core Strategy seeks to ensure that all forms of development will improve the quality of the public realm and enhance the sense of place, reflecting the character and distinctiveness of the locality. Proposals are required to be sensitive to the setting, existing built form, neighbouring uses, landscape character and topography of the site and locality.

Policy CS.5 aims to maintain the landscape character and quality of the District by ensuring that development takes place in a manner that minimises and mitigates its impact and, where possible, incorporates measures to enhance the landscape.

Car Park Extension and Power Container

The ultimate outcome of parking design is that it does not dominate the public realm or inconvenience pedestrians, cyclists and other vehicles. From a visual amenity perspective, the siting and layout of the proposed parking area is considered acceptable, appearing as a continuation of the existing parking area and tucked away behind existing built form. The use of grasscrete for the surfacing would also help mitigate the area of grass lost to the parking bays. Though the charging units will be functional in appearance, I am satisfied that their presence would not cause harm to the nearby surroundings.

The power container would be sited adjacent to the western wall of the village hall. I am mindful that views of the structure would be visible from Constance Drive to the west, however, the setting of the structure against the backdrop of existing built form as oppose to within an open area would help to reduce the visual prominence of the container. Moreover, I would consider the use of timber cladding to help improve the aesthetics of the container.

Wind Turbine

The siting of the wind turbine is on the edge of a rural settlement set against a backdrop of mature planting. It would be visible when entering the village from the south from Bush Heath Lane and Bush Heath Road and would also be visible from nearby residential streets as well as the public right of way which runs adjacent to the eastern site boundary.

The submission documentation sets out two design options for the wind turbine. Option 1 is for a timber clad supporting steel structure with an overall diameter of 8m. Option 2 is for a turbine mounted on a mast with a timber clad equipment store below. Both turbines would stand at 14.5m in height. Since submission, a further amendment to option 2 has been received featuring a narrower steel mast on which the turbine would be mounted.

In regard to the visual impact of the wind turbine, it is considered that option 2 would be the preferred design given that it appears more visually lightweight. Nevertheless, I would still consider the bulk and massing of the turbine (rather than the mast) to see it appear as a dominating structure, particularly when compared to the more conventional style HAWT. If there is scope to reduce the bulk of the turbine further I would strongly advise this in order to help reduce the visual impact of the development.

Taking into account the size and location of the turbine, the structure is likely to have an impact on the surrounding landscape character. However, at this stage I am not satisfied that I have enough information to assess the overall level of harm which would arise. As referenced in the above principle section, a LVIA should be carried out in order to assess the impacts of the structure on the wider landscape.

It was apparent on my site visit that the eastern boundary of the application site adjacent to the proposed location of the wind turbine is lined by a number of mature trees. Nevertheless, there are gaps within this tree belt which afford views towards the application site from the public right of way that follows the eastern boundary through the allotments. As such, additional tree planting along the eastern boundary (subject to it not interfering with the functionality of the wind turbine) is advised to help mitigate its visual impact.

It is encouraged that the proposals would be accompanied by a full and comprehensive landscaping scheme. A list of native species for planting can be found within Part N of the Development Requirements SPD available at:

https://www.stratford.gov.uk/doc/207802/name/PART%20N%20Biodiversity%20and%20Green%20 Infrastructure.pdf

I would recommend that, where possible, the proposal adheres to this guidance.

Residential Amenity

Policy CS.9 of the Core Strategy states that proposals should protect occupants of new and neighbouring buildings from unacceptable levels of noise, contamination and pollution, loss of daylight and privacy, and adverse surroundings.

The submitted information indicates that two new lighting columns are to be installed within the car park extension. Careful consideration should be given to ensure that this does not result in light pollution, adversely affect residential amenity and character of the settlement/landscape. This however needs to be balanced with consideration of the needs of elderly/disabled users of the car park. Any forthcoming application would need to be supported by a lighting scheme and assessment and you are also advised to contact Warwickshire County Council's Street Lighting team using the link below for more information:

WCC Street lighting services
http://www.warwickshire.gov.uk/streetlightingstandards

Information detailing noise levels for the power container will be required in order to assess the impacts on nearby residential properties.

The principle section already covers the need for sufficient and robust information to be submitted in order to demonstrate that the impacts of the wind turbine would be acceptable on the nearby allotments and residential properties. In terms of the potential for overshadowing from this structure, I would consider it to be sited at a sufficient distance from the houses in Pineham Avenue not to cause undue harm in this regard.

Highways Matters

Policy CS.26 of the Core Strategy states that, amongst other matters, new development proposals should encourage a greater use of sustainable forms of transport and improving the safety of all road users. This is also consistent with Paragraph 110 of the NPPF.

Warwickshire County Council as Local Highways Authority will be consulted on any subsequent planning application and their advice should be sought prior to the submission of an application.
You may also wish to undertake a separate pre-application enquiry with the Local Highway Authority to obtain more detailed comments in relation to highways matters.

As discussed during the virtual meeting the current proposed parking spaces do not meet the parking bay sizes set out within part O of the SPD. I note that the proposed layout would see the spaces bound at one end by the existing hedgerow. In this instance, the guidance states that the spaces should be 2.5m x 5.5m, the length has been increased due to the existence of the hedgerow. In order to meet these standards, the length of the bay (currently proposed at 4.8m) would need to be increased by 0.7m, however, I am mindful that this introduces potential conflict with the alignment of the existing sports playing pitch. If the hedgerow can be cut back to provide a suitable clearance at the end of the bay so that it would not be restrained on this side, I would consider 5m for the length to be acceptable. Consideration should however be given to the impact that this would have on the nearby neighbouring dwelling, the amenity of which should not be compromised.

Trees

As per the wording of Policy CS.5, proposals that will have an impact on woodlands, hedges and trees should incorporate measures to protect their contribution to landscape character, public amenity and biodiversity. The loss of those trees which are of high public amenity value will be resisted.

The trees to the north and west of the village hall are subject to Tree Preservation Order's (TPO) and I note that there are a number of mature trees in close proximity to the location of the wind turbine. The application will therefore need to be supported by a tree survey which should include an impact assessment of the development proposals on the trees, tree protection plan, arboricultural method statement and possible mitigation proposals. Any pruning works identified to be required to the TPO trees will need to be applied for under a separate application for tree works.

Archaeology

Policy CS.8 of the Core Strategy 2011-2031 states that where proposals will affect a heritage asset, applicants will be required to undertake and provide an assessment of the significance of the asset using a proportionate level of detail relating to the likely impact the proposal will have on the asset's historic interest. Proposals which would lead to substantial harm or total loss of significance of designated heritage assets will only be permitted where substantial public benefits outweigh that harm or loss.

The northern part of the application site is situated in an area identified as having a 'medium' archaeological sensitivity. The location of the wind turbine would fall outside of this area and therefore would be considered unlikely to impact on archaeology, nevertheless, I am mindful that the associated buried cables are to be routed through the identified area for archaeological potential and therefore it is advised that any future application should be accompanied by an appropriate desk-based assessment and, if necessary, a field evaluation, carried out by a member/organisation registered by the Chartered Institute for Archaeologists (CIFA).

Ecology and Wildlife

Policy CS.6 'Natural Environment seeks to ensure that developments have a minimal impact on biodiversity and, where possible, secure an enhancement to habitats. In addition, the Natural Environment and Rural Communities (NERC) Act 2006 seeks to ensure that no protected species are not harmed by development.

Given the nature of the proposal, any forthcoming application would need to be supported by an ecological assessment. This information would be consulted with the Warwickshire County Council (WCC) Ecology Team. The Ecology Team will closely analyse any submitted evidence and provide a formal response and recommendation. If you wish to further discuss the submission of an ecological survey/report(s), I would recommended contacting the WCC Ecology Team who will be able to provide further information on the aforementioned application.

The two new lighting columns will also have the potential to affect natural habitats and their species. Warwickshire County Council's Ecology Services can be contacted using the link below:

WCC Ecology Services
https://www.warwickshire.gov.uk
/planningecology

CIL

Except for applications for Outline planning consent, all planning applications must now be accompanied by the 'Planning Application Additional Information Requirement Form', available at the following link:
http://www.planningportal.gov.uk/uploads/1app/forms/cil_questions.pdf

Guidance on completing this form is available at the following link:
http://www.planningportal.gov.uk/uploads/1app/cil_guidance.pdf

Requirements to validate a future application – including likely application fee

The council needs you to provide several documents to be able to process your application. The documents you will need to submit with your application are listed below, which identifies the national and local requirements that apply to your proposal. If you or your agent omits any of these documents, your application is likely to be delayed.

We would advise all applicants to give serious consideration to using an agent to aid the swift progress of their application. However, if you wish to submit the application yourself, without using an agent, we would draw your attention to the need to provide plans and supporting information of sufficient quality to meet the validation criteria.

- Planning application fee of £462 per 0.1 hectare for plant or machinery
- Planning application form (including serving notice to County Highways and any other landowner accordingly)
- Community Infrastructure Levy (CIL) form
- Design and Access Statement
- Planning Statement
- Desk-based archaeological assessment and, if necessary, a field evaluation. The assessment and/or field evaluation must be carried out by a member/organisation registered by the Chartered Institute for Archaeologists (CIFA).
- Tree survey/ Arboricultural Impact Assessment and Arboricultural Method Statement
- Ecological Assessment
- Noise Assessments
- Landscape & Visual Impact Appraisal (LVIA)
- Site Location Plan (red line to include all land needed for the visibility splay)
- Block/Site Plan
- Proposed Plans and Elevations
- Landscaping Details (hard & soft)
- Lighting schemes and assessments
- Details of parking and manoeuvring areas
- Details of visibility splays
- Details of materials

Community Involvement

Stratford District Council wishes to involve local communities affected by development as early in the process as possible, leading to higher quality developments and to better decision-making processes. We would ask that, as a potential developer, you engage with the local community as soon as possible, and certainly well before you have finalised your proposals.

You should always consider discussing your proposals with the neighbours immediately adjoining the site. We would also suggest that you make contact with your Parish or Town Council and your local Ward Councillors.

Disclaimer

Our ability to provide a high quality service is very dependent on the quality of documents submitted to us and the quality of the merits of the proposal. We rely on applicants and agents to provide us with comprehensive documents, commensurate with the scale/complexity of the proposal to enable us to work with you.

The advice given by Council Officers in response to pre-application enquiries does not bind the Council's decision-making or constitute a formal decision by the Council as Local Planning Authority. We will, however, give you the best advice possible based on the information that you provide, and with regard to relevant circumstances at the time. Any views or opinions expressed are given in good faith and to the best of our ability without prejudice to the formal consideration of any planning application following statutory public consultation.

The written advice provided will be considered by the Council as a material consideration in the determination of a future related planning application, subject to the proviso that circumstances and information may change or come to light that may alter that position. In this regard the weight given to pre-application advice will decline over time.

Please be advised that delays between obtaining pre-application advice and the formal submission of a related planning application may lead to the pre-application advice becoming outdated, especially if new planning policies/guidance are adopted, new case laws are formed, or the surrounding context changes.

Confidentiality

As a matter of course, requests for pre-application advice will not automatically be treated on a confidential basis. The Environmental Information Regulations 2004 require us to make recorded information available to members of the public, if requested. Pre-application advice may only be treated as confidential if you have specified in your submission clear demonstrable issues of commercial sensitivity or other specified reasons why this information may not be disclosed, and a public interest test may also be applied.

Appendix 15: Western Power Preliminary Response

WESTERN POWER DISTRIBUTION
Serving the Midlands, South West and Wales

Budget Estimate

Greenwatt Technology
Roseleigh House
Old Stratford Road
Oversley Green
Alcester
Warwickshire
B49 6PG

Western Power Distribution
Hammonds Way
Hinckley
Leicestershire
LE10 3EQ

Telephone: 01455 232 222
Email:
btrueman@westernpower.co.uk

Our ref
3723858

Date
Friday, 07 August 2020

Dear Mr Woollacott,

Budget Estimate for electricity connection works by Western Power Distribution East Midlands plc ("WPD") for a new connection for EV chargers and potential PV, wind turbine and battery storage at Harbury Village Hall Playing Fields, South parade, Harbury, Leamington Spa, CV33 9JE.

Thank you for your recent enquiry. I am pleased to provide an indication of WPD's likely costs to carry out the connection works for you ("the Budget Estimate").

Our estimate for this work is based upon the information you have provided and is shown below.

Estimated Connection Charge		
	Contestable works	£6,000.00
	Non-Contestable works	£8,000.00
	VAT at 20 %	£2,800.00
	Total	**£16,800.00**
	Additional costs if footpath route taken	**+ £8,000.00 ex VAT**

Non-Contestable works are those works that only WPD can undertake. It is possible for you to get someone else to quote for the contestable part of the works. For further information please visit our website: https://westernpower.co.uk/Connections/Competition-in-Connections.aspx

Your supply will have the following electrical characteristics

Voltage	**230 / 400**
Phase	**Three Phase**
Agreed Import Capacity	**Max 145kVA**
Agreed Export Capacity	**Max 56kW**

Please note that the proposed works and estimated connection charge is for **guidance purposes** only and has been derived from a desk-top design exercise. It is non-binding and subject, in particular, to any legal permission, wayleaves and any other consents being successfully obtained. It is based on present day prices. It does not include the cost of any necessary on-site civil works, which should be provided by you at your expense.

Enclosures

Please also find enclosed:

- Our summary document entitled “Your Budget Estimate explained - A guide outlining your options for obtaining an offer to connect to WPD’s Distribution System”
- A drawing showing the indicative point of connection (POC) of the new assets to our existing distribution system, in relation to the proposed development. 3723858
- Design Brief detailing works required

Competition in Connections

The Budget Estimate is based upon WPD undertaking both the contestable and non-contestable connection works. You are able to seek competitive prices for some or all of the contestable elements.

You have the option to appoint an independent Connection Provider (ICP) or Independent distribution network operator (IDNO) to carry out some of the connection works, referred to as the Contestable Connection Works. Any connection works that can only be undertaken by WPD are referred to as Non-contestable Connection Works. See our enclosed Budget Estimate guide for more information.

Proposed Connection Works

Our estimate of the connection charge is for providing the following works:
See design brief and plan

Please note that these proposals are based upon a desk top provisional investigation and no site visit or detailed study has been carried out.

The estimate does not include costs for any reinforcement or diversionary work that may be required, or for any environmental, earthing, or stability studies which may also be necessary, although these are generally only required for larger capacity connections.

Progression to Connection Offer stage

This Budget Estimate is not a legally binding contract, but sets out the amount we reasonably estimate we would require you to pay for the connection works under a formal Connection offer.

If you would like us to undertake a more detailed analysis, including an assessment of any network reinforcement required we can provide a formal Connection Offer. Further information regarding how to apply is provided in our enclosed summary guide.

Upon receipt of your application we will carry out detailed network studies to finalise the design of the connection works (and any associated reinforcement works), and provide a Connection Offer detailing the works required, the associated costs, timescales, payment terms and conditions for the connection.

If you have any queries regarding this Budget Estimate please do not hesitate to contact me via the contact details at the top of this letter.

Yours sincerely,

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