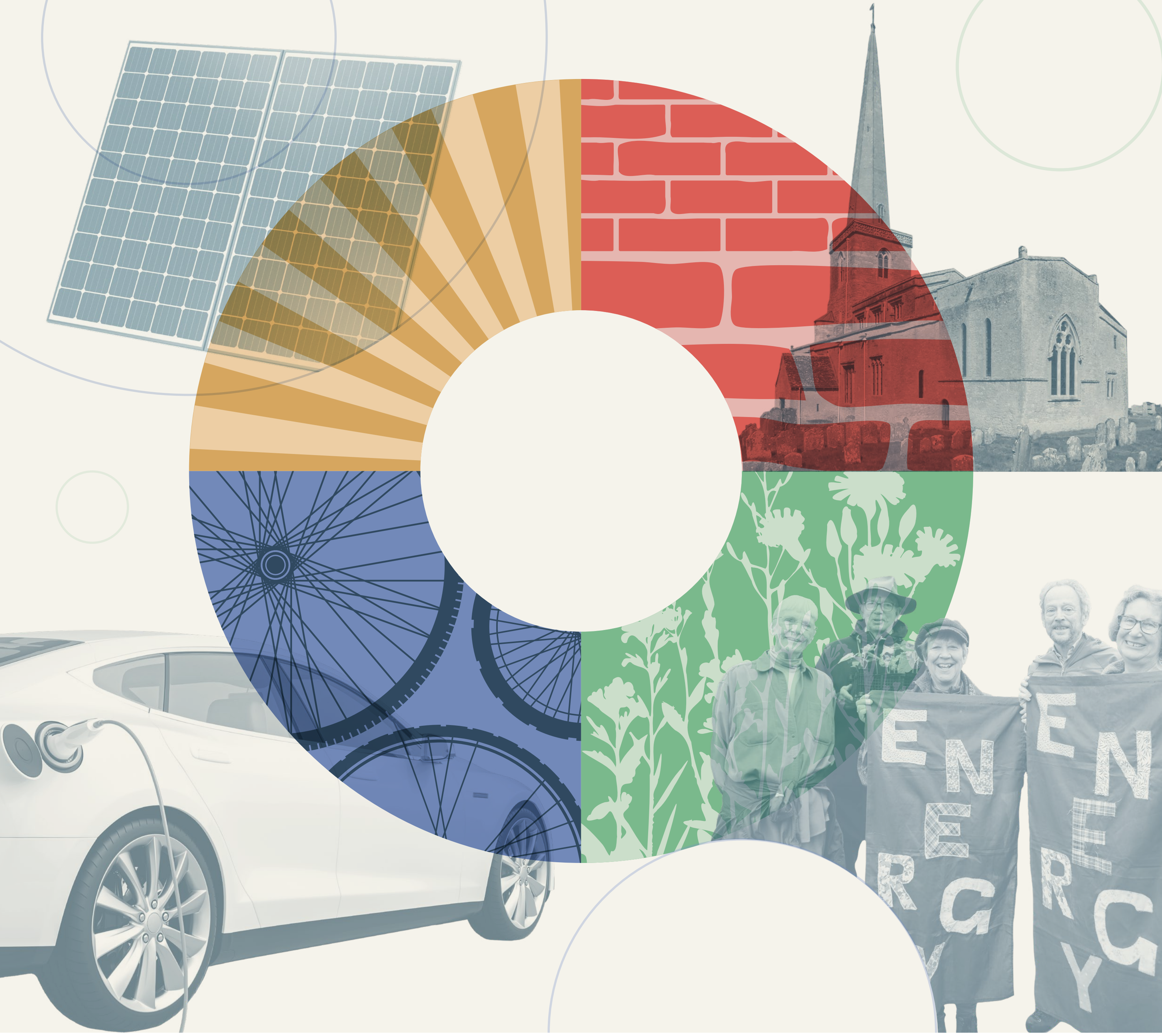
Community Action Plan for Zero-Carbon Energy

CAPZero | Leading the Way



low carbon hub

LEO Local Energy Oxfordshire

green TEA Transition Eynsham Area (TEA)

Cassington
Eynsham
Farmoor in Cumnor
Freeland

Hanborough
North Leigh
South Leigh
Stanton Harcourt & Sutton

The Eynsham (Cuckoo Lane) Primary Substation Area includes all or parts of the parishes of:

Cassington
Eynsham
Freeland
Farmoor in Cumnor
Hanborough
North Leigh
South Leigh
Stanton Harcourt & Sutton

Image 1: Map of Eynsham (Cuckoo Lane) Primary Substation Area

Foreword

The transition to a clean energy system involves more than just changing the fuels we use. It involves changing where and when energy is produced and used. Local generation, a shift to low-carbon electricity and increased efficiency of energy use are the way forward. The era of big power stations and centralised control is coming to an end, with implications for everyone.

In 2021, I was fortunate to be part of the team commissioned by Oxfordshire's local authorities to think through the implications for Oxfordshire of the UK net-zero emissions target. Our report on 'Pathways to a Zero-Carbon Oxfordshire' (PaZCO) set out the challenge at a county level and I am pleased that our local Councils are now using it at their planning level. It is, of course, a huge challenge.

As we wrote the report, it became increasingly obvious that, even within a relatively small county, there is huge diversity that needs to be taken into account. In rurality, access to public transport, plans for housing and economic development, grid infrastructure and renewable resources, every area is different. So balancing the electricity grid will pose different challenges in different places. This means that delivering the vision of a zero-carbon county requires energy planning at a more granular, genuinely local level than ever before.

Ideally, we need a well-resourced system of local area energy planning that brings together land use and energy planning, all with extensive consultation to ensure plans have public support. Sadly, to date, central Government has not been persuaded to set up such a process. So we may have to wait for a comprehensive approach.

But national inaction has not deterred the community in the Eynsham area. This 'Community Action Plan for Zero-Carbon Energy' is a ground-breaking effort. With the exception of some remote islands, it's the first attempt of which I am aware, to set out what a zero-carbon society might look like at a local level. More importantly it includes a plan of action for delivery.

I'm sure that the plan will create debate and, in a democracy, that's entirely healthy. But just having that debate is a huge step forward. In the PaZCO report, we named our most ambitious pathway "Oxfordshire Leading the Way". With this plan, the Eynsham area truly is leading the way.

Foreward by Professor Nick Eyre, Professor of Energy and Climate Policy, and Senior Research Fellow in Energy, at the Environmental Change Institute. He is Director of the Centre for Research into Energy Demand Solutions and is a Co-Director of the Oxford Martin Programme on Integrating Renewable Energy.

This report is dedicated to Nicky Chambers whose commitment to sustainability, community and nature knew no bounds.

Energy language explained

Voltage (measured in volts, V)

The easiest way to think about voltage is thinking of electricity as if it were water, and the voltage measures the pressure of the current.

The higher the voltage level, the faster the flow and the more deadly it is to human beings. We let the current flow at higher pressures when it is away from human beings and we want to transmit it for longer distances because the losses that happen during transmission are smaller at high voltages than at low voltages. For this reason, the transmission network which criss-crosses the country operates at voltages as high as 400kV (400,000V). But for safe and convenient use in our homes, electricity is supplied at 230V, so as the electricity lines get closer to the customer the voltage is "stepped down" as the electricity lines get closer to the customer. This is done using transformers located at substations in the transmission (high voltage, long distance) or distribution (lower voltage, local networks). Some large industrial customers use electricity supplied at an intermediate voltage.

Power and Energy

A watt (W) is the unit of electrical power. 1,000W=1kW.

Electricity is paid for according to the amount of energy used, that can be calculated by multiplying the number of kW your appliance uses by the number of hours for which it is operated. This gives you the number of kilowatt hours (kWh) of energy; these are the units we see on our electricity bills.

- A MWh (Megawatt hour) = 1,000 kWh
- A GWh (Gigawatt hour) = 1,000 MWh

When talking about electricity demand, we use peak power (Wp, kWp, MWp, etc.) to describe the maximum amount of power that will ever flow through a given part of the network. This is important because it determines how much electrical power this part of the network needs to be designed to carry.

Units of peak power are also used to describe the maximum amount of power generated by, for example, a solar farm. This also has implications for the design of the local network and makes it possible to predict the total amount of energy expected to be generated over a year. During the year, the amount of electrical power generated by a solar farm varies from zero (during the hours of darkness) up to the peak power. The total annual energy generation from a solar farm is calculated by multiplying the peak power (MWp) by the amount of solar energy (irradiance) that falls at a particular latitude.

Tonne of CO_2 Equivalent (tCO_2e)

There are gases other than CO_2 that contribute to global warming.

To understand the overall effect resulting from other types of gases present in the atmosphere, the mass of these gases can be converted into an equivalent mass of carbon dioxide; tonnes of CO_2 equivalent (tCO_2e).

Who produced this plan

This plan was developed by the Eynsham Smart and Fair Futures project funded by the Low Carbon Hub as part of Project LEO (www.project-leo.co.uk). The steering group was chaired by Green TEA, included representation from West Oxfordshire District Council, Eynsham Parish Council and South Leigh Parish Council. The project benefited from expert independent advice given by Graham Oakes.

Technical work was provided by the Energy Systems Catapult (ESC) using their Local Area Energy Planning toolkit. Oxford University and Urbanomy provided technical input in estimating energy demand for the new development at Salt Cross.

Contents

Image 2: Eynsham village square, credit GreenTEA

Our mission

Our mission is to achieve a zero-carbon energy system in the Eynsham (Cuckoo Lane) Primary Substation Area before 2050 through long-term stewardship in a way that benefits and motivates current and future residents and provides a model to inspire wider action.

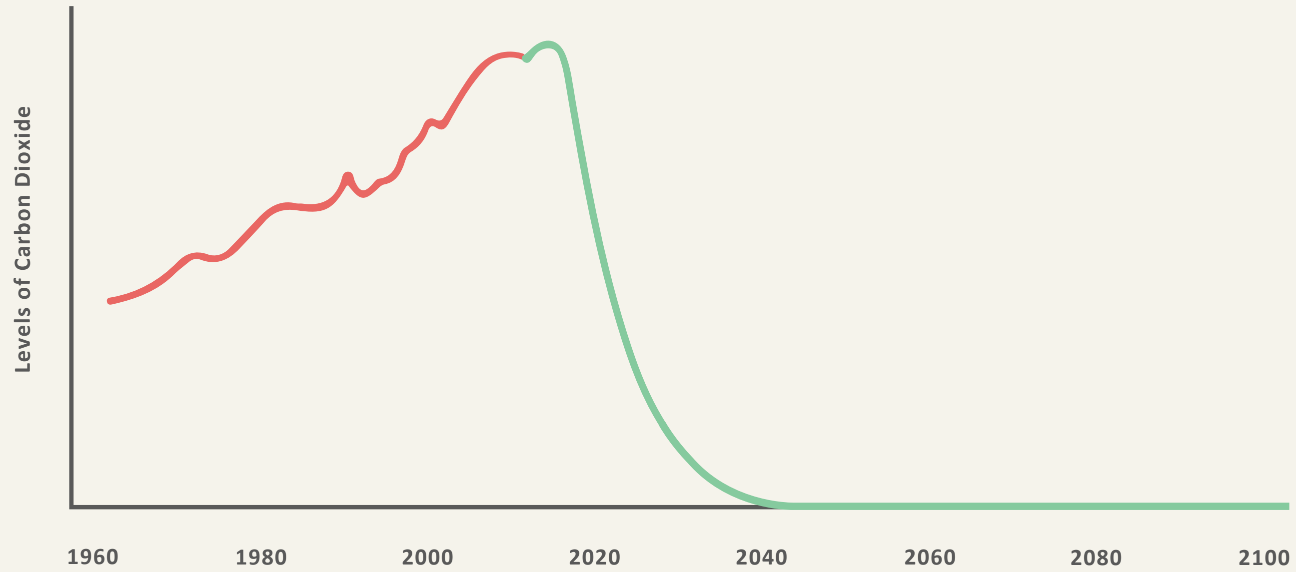


Figure 1: The required carbon reduction curve if we are to achieve net zero by 2050 (adapted from CarbonBrief/McKinsey)[1]

The scale of the challenge

Current projections are that UK electricity supply will need to triple by 2050 as we move away from fossil fuel heating and transport, which will be a vast challenge.

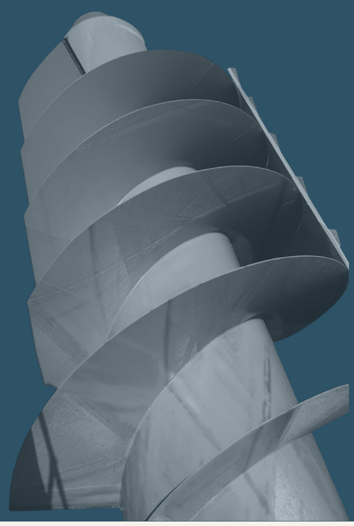
But if we reduce demand by insulating existing homes, building new zero-carbon homes, we may be able to keep additional supply down to double the present electricity use.[2] And if we spread our use away from peak times, we may be able to reduce the amount that the local electricity network needs to grow, and so help both to keep our electricity more affordable and to make the changes in the time we have to meet our national carbon targets.

To meet our climate change targets this must be zero-carbon energy.

[1] www.mckinsey.com/industries/oil-and-gas/our-insights/charting-the-global-energy-landscape-to-2050-emissions

[2] The need to reduce demand is set out in CREDS research here: www.creds.ac.uk/creds-research-findings/ and here: low-energy.creds.ac.uk/the-report/

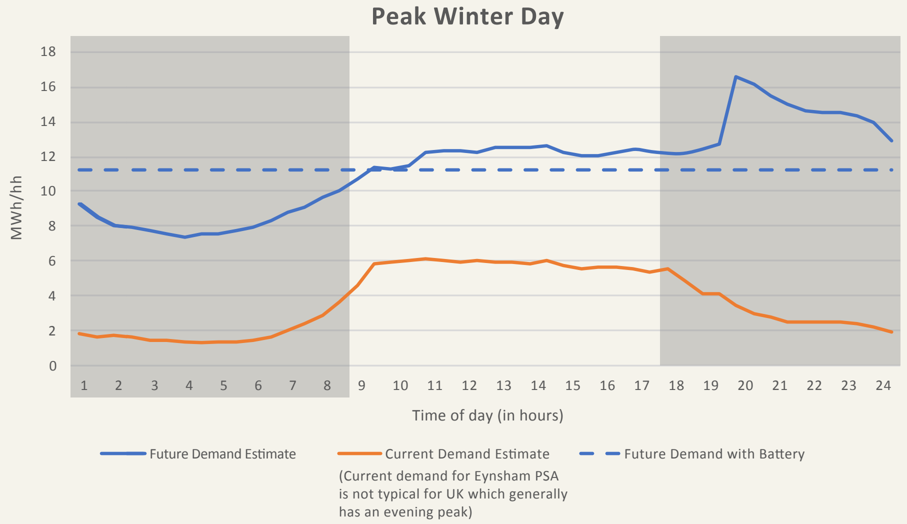
What is a zero-carbon energy system?



We need to change to an energy system powered just by zero-carbon renewable energy.

That means using mainly electricity for all our needs, not gas or oil, nor biomass. It is a big change so we have tried to answer the major immediate questions people might have in the table below.

Is a net zero energy system possible? Yes, if we act locally as well as nationally.

Questions	UK answer	Local area answer	
Can we actually produce enough renewable electricity for all our needs?	Yes. The UK Has abundant offshore and onshore wind, solar and hydro potential.	Yes. Enough solar PV can be developed on rooftops and in fields to match the amount of electricity we will need in an average year.	100 MWh needed in 2050 | 100 MWh solar PV available in 2050 Demand Supply
Can it be available when we need it, given that the wind doesn't always blow and the sun doesn't shine at night?	Yes, **if**... • We store in batteries what we don't need at any given moment. • We all learn to shift our use across the day and night to help generation and demand balance.	Yes, **but**... • It means we will be dependent on sources from outside our boundaries when the day is overcast or during the night. • Zero carbon does not mean self-sufficiency, it means that our net use is zero carbon but we don't produce all the electricity we need locally all the time.	MWh solar electricity needed at any given moment ← Import if not enough → Export if too much Use as much as possible within PSA
Will the wires and switches of the electricity transmission system and distribution network be able to cope?	No, **but**...	... we can all help to reduce the amount of network upgrading needed **if** we make our buildings more energy efficient. ... and **if** we shift the time we use electricity from peak times to off-peak times or to times when local supply is abundant.	 Figure 2: The pattern of electricity demand on a peak winter day
Can we make the change quickly enough?	Yes, **but**...	... only **if** we all take steps to reduce our energy demand and shift the times we use it. ... **if** we make our buildings more energy efficient.	
Can we afford it?	Yes, **but**...	... the cost of the changes we need to make will be offset by reduced energy bills in the long run.	**££ now, £ in 2050**

Our vision for 2050: everything, everywhere... starting now!

Image 3: Our vision for 2050. Credits: Country lane, Dave_S./Flickr, CC BY 2.0 Deed; Ray Valley Solar, copyright Low Carbon Hub; Sandford Lock Hydro, copyright Low Carbon Hub

We want to lead the way to net zero so that by 2050:

- We will all have halved our energy use in our houses and businesses
  - By changing to electricity for our heat and transport
  - And by improving the fabric (thermal performance) of all our buildings
- This means we will have doubled our electricity use while completely eliminating use of fossil fuels
- We will generate enough electricity[3] locally to meet our net needs in total over the year[4]
- We will use battery or other energy storage to keep our peak import need in the winter down to around 20MWp

To achieve this vision, we recognise that the implementation of this change will need to be fair, and be seen to be fair, to maximise acceptance of the need for the changes and engagement with the energy system both as individuals and as part of the wider community. We have included as Appendix 1 to this plan the Ethical Framework for Local Energy Approaches produced by Low Carbon Hub as part of Project LEO. These are the principles we would expect to work to in stewarding and delivering this plan.

[3] For the Eynsham primary substation area this will be solar PV; there is no wind or hydro resource available.
[4] Meeting our net needs means balancing imports when the sun is not shining with exports when we have a surplus.

Background to our vision

National level

Our vision recognises that the UK has set a legally binding commitment to carbon reduction by 2050 in the Climate Change Act 2008, with the Climate Change Committee setting carbon budgets for each 5-year period to ensure that commitment is met.[5]

The UK's sixth carbon budget (2033-2037) requires us to reduce emissions by 78% by 2035 compared with 1990 levels and the IPCC report (AR6 Synthesis report 20 March 2023) gives us a 'final warning' to act now and cut emissions by half by 2030 and 100% by 2040 in developed countries such as the UK.[6]

Our vision also recognises, however, that the UK has some work to do to if it is to stay on track to reach its 2050 target.

Funding for households and businesses to become more energy efficient has gone down in the UK by 90% from the levels in place in 2012. As a result, households are using 15-20% more energy than we would be had the policy framework in place then been maintained. As a result, our bills are correspondingly 15-20% higher than they could have been by now.[7]

For this reason, we have chosen the National Grid 'Leading the Way' scenario, from the four possible Future Energy Scenarios,[8] as the one required to ensure that the UK catches up and then speeds up delivery of its legally binding targets.

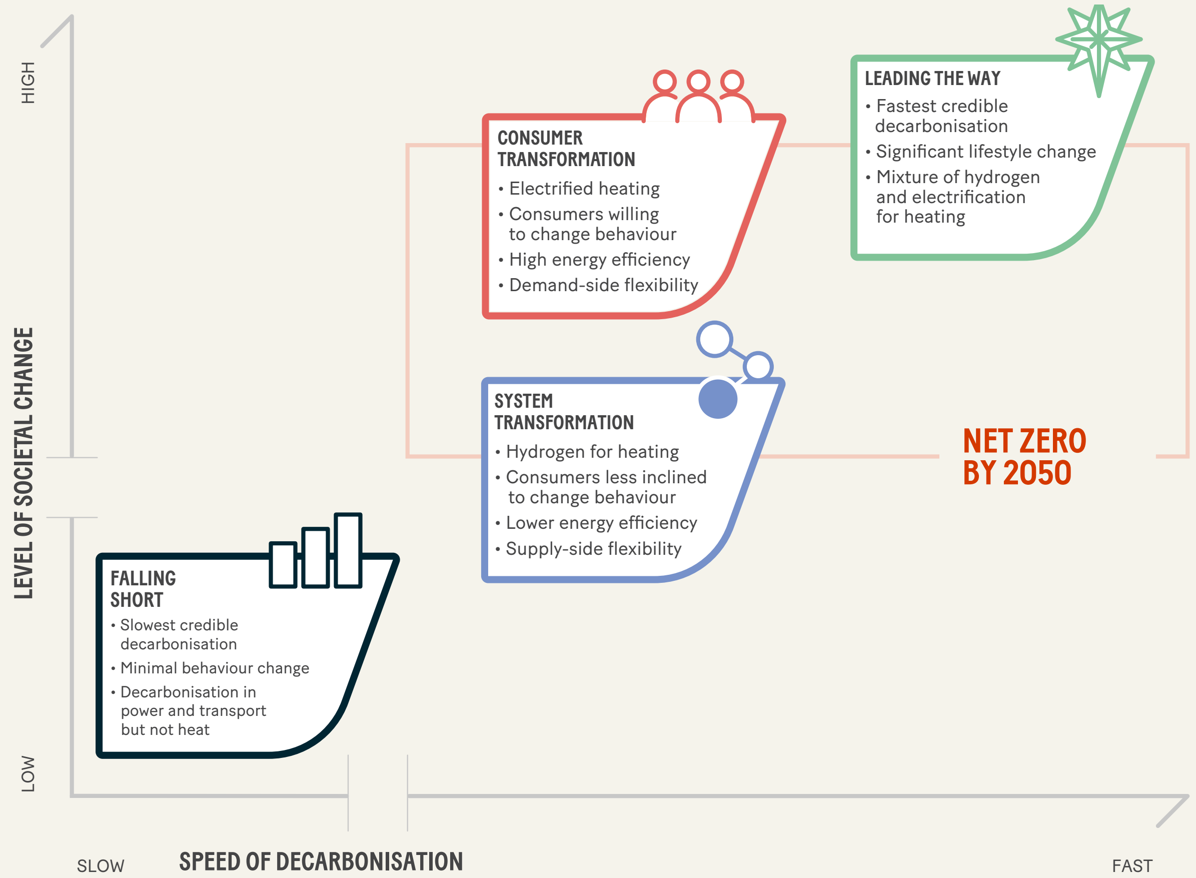


Figure 3: National Grid Future Energy Scenarios 2022

[5] www.theccc.org.uk/wp-content/uploads/2020/10/CCC-Insights-Briefing-1-The-UK-Climate-Change-Act.pdf ; www.theccc.org.uk/
[6] www.theccc.org.uk/publication/sixth-carbon-budget/ https://www.ipcc.ch/report/sixth-assessment-report-cycle/
[7] www.creds.ac.uk/creds-research-findings/
[8] www.nationalgrideso.com/future-energy/future-energy-scenarios

Image 4: Eynsham Village Hall, credit Sarah Couch

The chosen scenario requires the highest level of societal change if we are to implement it. We think this is needed anyway, given that the most transformative change to our energy system will be at the low voltage level, or the 'Grid Edge', where we all live and work.

The change will be massive:

- To renewable electricity, much of the production being local
- To electric heating, mostly via heat pumps (using a variety of heat sources)
- To electric vehicles (for most vehicles)

So the local, low voltage (220-240V) network is where most of the change needs to be planned and managed, involving everyone who lives and works there. The Primary Substation Area, with its secondary substations, is the obvious scale for planning the change.[9]

This means that our whole energy system will need to change radically, as will the way that each and every one of us interacts with that system. By 2050, we will all be balancing our energy use as much as possible behind our own meter (in our homes, businesses etc). This will help ensure there is enough capacity on the wires and switches of the electricity network so that we can change to electric heating via heat pumps, and be able to charge our electric vehicles.

Balancing behind your meter

Figure 5: What does balancing behind the meter mean for each household?

County level

Our vision also recognises that Oxfordshire has already put much work into understanding how the county moves to net zero in the 'Pathways to a Zero Carbon Oxfordshire' report.[10]

This is also based on the Future Energy Scenarios and has analysed the actions necessary if the county were to follow any of the four scenarios, with 'Societal Transformation' or 'Leading the Way' being the preferred ones. These metrics are included at Appendix 2. The County Council and district councils have developed the Oxford Net Zero Route Map and Action Plan for achieving these scenarios.

Our Zero Carbon Energy Action Plan for the Eynsham Primary Substation Area is clearly 'nested' within this county-level work.

We took the report and its proposed metrics as our starting point and we derived metrics from it based on the population in our area. We then we asked the Energy Systems Catapult[11] to use their models and tools to help us understand what would be possible in our area, and what our choices for action might be. This work is included in Appendix 3. This approach has been used at the regional level before (around 300,000 population) but this is the first time it has been used at this scale (around 10,500 population). The modelling built on detailed energy analysis of Salt Cross Garden Village by the University of Oxford and EDF Urbanomy.[12] This showed how net zero standards and 100% energy balance could be achieved with high energy efficiency designed in at the outset.

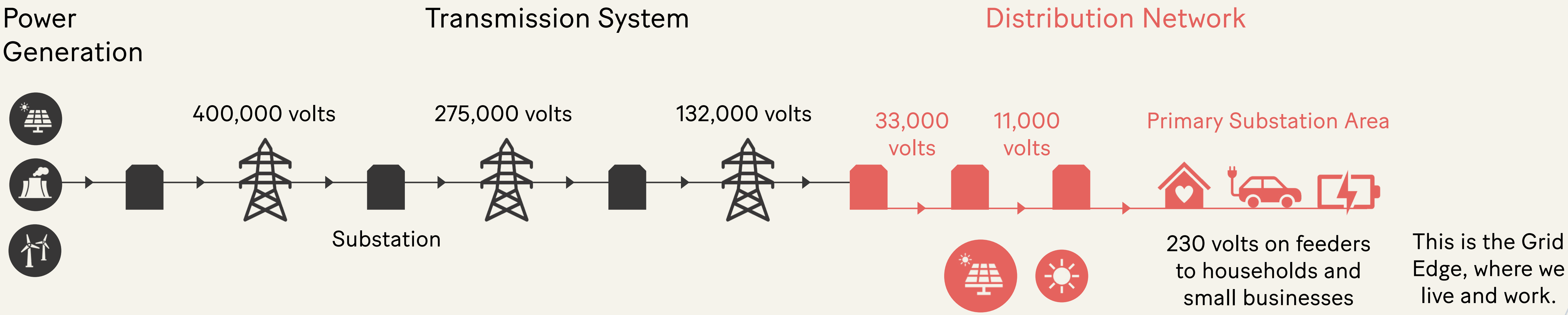


Figure 4: From large-scale power generation to the Grid Edge

[9] Oxfordshire has 63 primary substation areas and around 7,500 secondary substations

[10] www.eci.ox.ac.uk/research/pathways-zero-carbon-oxfordshire
[11] es.catapult.org.uk/tools-and-labs/our-place-net-zero-toolkit/
[12] www.westoxon.gov.uk/media/velkvuwf/ev18-oxfordshire-cotswolds-garden-village-energy-plan-may-2020.pdf
www.westoxon.gov.uk/media/hdnjcnnf/trajectory-for-net-zero-buildings-for-the-oxfordshire-garden-village.pdf
www.urbanomy.io/en/our-references-salt-cross-garden-village

Primary Substation level

We decided to use the Primary Substation Area (PSA) boundary for our work because this is the 'local' scale of the electricity system where the distribution network steps the voltage in the wires down from 33kV to 11kV.

It is then sent to Secondary Substations where the voltage is stepped down again from 11kV to 230 volts and sent along the feeder wires that we all have passing our front doors, and from which the electricity comes into our homes, businesses, and schools (when we are importing electricity) or out (when we are exporting electricity).

It is also a scale that bridges well between local communities in parishes and town council areas, and the local authority in district areas.

There are around 12 PSAs[13] within the West Oxfordshire District Council (WODC) boundary, and so we think it is quite feasible that WODC could work with its parishes and communities at the PSA level to join together the electricity planning and local planning systems in a way that could really involve local citizens in taking actions to help the transition work smoothly. We also wanted to produce a plan that would be replicable for other PSAs.

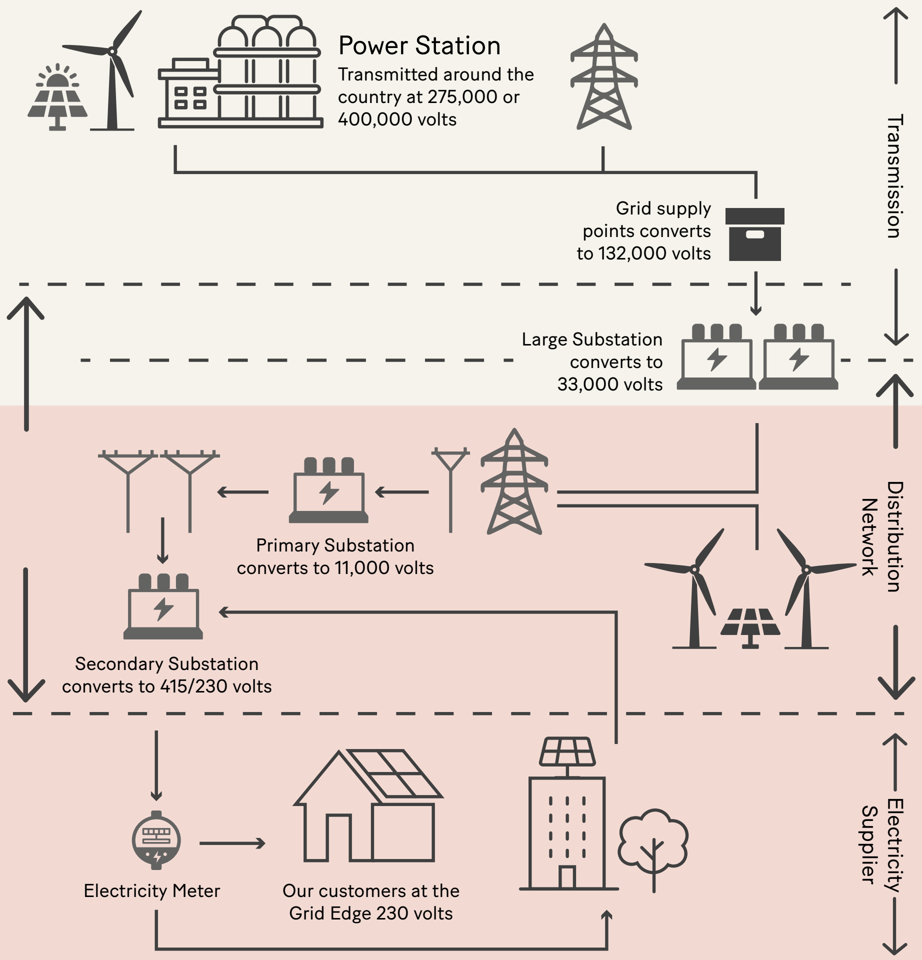


Figure 6: How the electricity system fits together

[13] This is an approximate number because the electricity system does not map exactly onto local administrative boundaries and so some Primary Substation Areas lie wholly within the West Oxfordshire District Council area but some lie partially within.

A word of caution, however: none of the spatial boundaries we use to organise ourselves map neatly on top of each other.

The Primary Substation Area lies within the WODC administrative area but it includes parts of eight different parishes and it also doesn't map onto the postcode areas used for mapping energy use in households or businesses. This is a fact of life we will all have to deal with as we move forward in the transition. In as far as this sort of ambiguity can be helpful, it signals the need to get used to planning flexibly, so not expecting, for example, that any area of the electricity network can, or should be, self-sufficient to the last unit of electricity throughout the whole year.

Image 5: Eynsham Primary Substation Area with parish boundaries. Only Freeland parish sits entirely within the PSA.

Figure 6: Low carbon houses in Eynsham, credit Sarah Couch

Zero-carbon energy balance in the Eynsham Primary Substation Area by 2050

The charts to the right tell us what our current energy use is and how that needs to change by 2050.

In putting the numbers together, we need to recognise that there is much new development planned for the Eynsham PSA, including possible introduction of: 2,200 new houses at Salt Cross, at least 1,000 at West Eynsham, 75 at Myrtle Farm and Oliver's Garage, 150 more in Hanborough, 80 in Freeland and others in the pipeline. We have assumed ambitious energy efficiency standards for new build and retrofit. If these are not achieved, total energy demand will go up.

We have shown:

- Existing demand
- How that changes by 2050
- Demand for new build
- The combination of the two for 2050
- How that demand could be balanced by solar PV generation

Current demand of existing buildings	Peak Power Demand (MW)	Annual Energy Demand (MWh)
Current Domestic Electricity Demand	4.5	14,200
Current Domestic Gas Demand	27.8	30,600
Current Commercial and Industrial Electricity Demand	5.4	23,300
Current Commercial and Industrial Gas Demand	36.1	42,300
	73.8	**110,400**
Future demand of existing buildings		
Future Domestic Electricity Demand (Note 1)	12.4	21,120
Future Commercial and Industrial Electricity Demand	14.9	31,600
Future Domestic EV Charging	1.5	4,200
Future Commercial and Industrial EV Charging	1.1	4,800
(Note 2)	**29.9**	**61,720**
New Builds		
New Build Domestic Electricity Demand (Note 3)	2	9,380
New Build Commercial and Industrial Electricity Demand	3.7	26,100
New Build Domestic EV Charging	1.1	3,100
Park and Ride EV Charging	0.2	100
	7	**38,680**
Final proposed - combining future demand of existing plus new builds		
Domestic Electricity Demand	14.4	30,500
Commercial and Industrial Electricity Demand	18.6	57,700
New Build Domestic EV Charging	2.6	7,300
Park and Ride EV Charging	1.3	4,900
(Note 2)	**36.9**	**100,400**
Proposed generation	**Max Generation (MW)**	**Annual Generation (MWh)**
Future Domestic PV Generation Potential	6.6	6,300
Future Commercial and Industrial PV Generation Potential	10	9,400
Existing Solar Ground Mount	45	47,000
Future Ground Mount PV Generation Required	37.8	37,700
(Note 4)	**99.4**	**100,400**

Notes	
1	Assume efficiency of 60kWh/m^2 and an average dwelling size of 80m^2. The UK average house size is 76m^2.
2	Peak demand is kept down to 20MWp more than the existing electricity demand of 9.9MWp. New build adds another 7MWp but also more network capacity.
3	CAPZero standard is agreed as the LETI exemplar new build of 35 kWh/m^2 and an average dwelling size of 80m^2.
4	The peak generation number is bigger because the solar generation nets out in MWh production but in practice a lot will be exported given peak generation in the summer.

Table 2: Our current energy use and how it needs to change by 2050

As we have said before, the intention here is not to show that the Eynsham PSA could be self-sufficient, but that it could have a net zero energy system by moving to electricity and producing the same amount of solar electricity as its electricity demand for a year.[14]

[14] Because we are showing the net position, the annual energy demand and generation figures in units of MWh match but the peak power demand and maximum generation figures in units of MWp do not. This is because all of the local generation will be solar PV, which generates the majority of its electricity during the summer and so does not match the realtime demand at all times; there will be some export out of the area during the summer and import during the winter.

The importance of peak demand

More important than the net demand and production balance over the year, however, is managing the electricity demand moment by moment. The highest value of this instantaneous demand is called the peak demand.

This is important because the wires and switches of the electricity distribution network have a limit as to how much electricity they can deal with at any moment. Therefore we need to smooth out our demand if we are to limit the costs of upgrading the electricity network. And this is essential to make the change in the years remaining – it is not practically possible to triple the capacity of the electricity network by 2050.[15]

For the Eynsham PSA, this means that overall existing annual energy demand will have to halve from 127 kWh per square metre of building to 60 kWh.

Energy demand for new housing developments will be less than a third of this if they are built to 'exemplar' standard of 35 kWh per square[16] metre per year (25% current use). If, in addition to improving energy efficiency in buildings, we use electricity storage to help us flatten the peaks in energy demand, modelling has shown that we can limit the increase in the peak for the coldest, darkest winter day to 10MW more than now. This will allow us to make the change to heat pumps and electric vehicles.

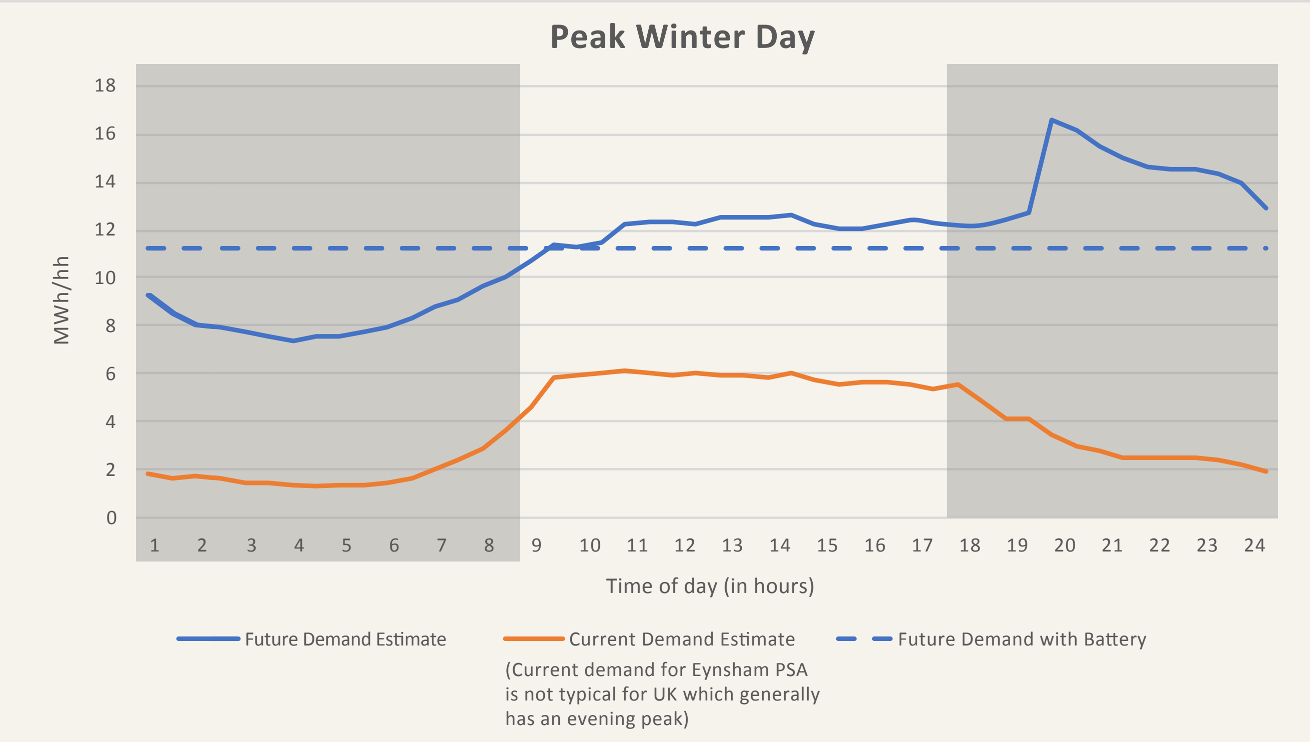


Figure 7: The pattern of electricity demand on a peak winter day

[15] https://low-energy.creds.ac.uk/the-report/

[16] LETI recommends offices and schools achieve an EUI of 55 and 65 kWh/m²/yr respectively. RIBA recommend that all non-domestic buildings achieve 55 kWh/m²/yr.

Note of caution

In putting these numbers together, we have used the best data currently available and our understanding of current and potential technologies, but these will change throughout the life of the energy transition and the stewardship of the plan will need to adapt accordingly.

But that current data is not yet as complete as it needs to be if we are to manage our energy system at the Grid Edge as we are proposing here. As our independent adviser, Graham Oakes, explained it to us:

'We're at an inflection point in the way the energy system operates, shifting from the stable fossil-fuel led paradigm of the last century to a new paradigm led by greater uncertainty and variability in both demand and supply. The transition is likely to be chaotic, in the sense that small changes to the starting point and assumptions could lead to large changes in outcome (e.g. in terms of the mix and location of generation). This is exacerbated by the fact that people's assumptions are often implicit and not well documented.

Data is a key tool for managing chaos — you need to be able to see fine-grained data (in both location and time) to have a sense of where you are and where things are going at any point. This data wasn't necessary for the stable paradigm — you could manage pretty well from top-down assumptions and rules of thumb that had emerged over decades. Project LEO has identified that the networks are data-poor. One reason for this is that they don't really value data for this chaos-management function — they're still assessing its value against the measures of the old paradigm. So they're still under-investing in data. The same goes for all the other data needed to plan and manage local energy — energy-efficiency data for housing, etc., etc.

So part of our conclusions should probably be that you need to plan and manage energy at a much more fine-grained scale than has been historically required. This is partly recognised in current energy system thinking, but I don't think it has fully sunk in — there's still a strong tendency to impose top-down, simplifying assumptions. The corollary to this is that we need to invest in capturing data, and in building the skills to exploit it, both in the energy system and in the local planning system (which need to be merged into one).'

Image 6: Rose Hill battery, copyright Low Carbon Hub

Image 7: Solar panels on Osney Island, copyright Low Carbon Hub

Image 8: EV car charging, copyright Low Carbon Hub

Image 9: Air source heat pump, copyright Low Carbon Hub

Our zero carbon energy system in 2050 at a glance

Balancing energy needs to meet demand[17]

Reducing our energy demand from the grid

Homes

- All existing homes halve their energy demand and new homes meet 'exemplar' standard of 35 kWh per square metre (25% current use)
- All houses have either air or ground source heat pumps
- All existing homes have improved insulation
- 2,100 existing homes have solar panels, all new homes have solar panels

Transport

- Active travel routes are available to all
- EV bus routes and car share are available to all
- All vehicles zero emissions
- Up to 4000 domestic charge points, public charge points available to all

Businesses and other non-domestic buildings

- 10MWp of solar panels on non-domestic buildings
- Workplaces have accessible EV charge points
- Businesses heated with zero carbon heating
- All businesses have implemented energy plan to reduce their energy use, produce their own energy and buy only green energy

Managing our energy demand from the grid

At least 85 MWp of ground mounted solar panels:

- 45MWp already built in 2023
- 37.7MWp new

Total around 2.3% of the primary substation land area*

53 MWh of storage

Peak electricity demand increase capped at 10MWp by using smart controls and local energy storage

The primary substation area is c. 3700 hectares, each MWp of solar groundmount needs c. 1 hectare of land

Figure 8: Our possible zero-carbon energy system in 2050 at a glance: the full list of metrics is included in Appendix 2.

[17] With these improvements, we only need to double our electricity generation; without, we will need at least three times as much generation.

A note about land use

We have included the pie chart below to show the impact of our 2050 vision on land use in the Eynsham (Cuckoo Lane) Primary Substation Area.

Approximately 3700 total hectares in Primary Substation Area

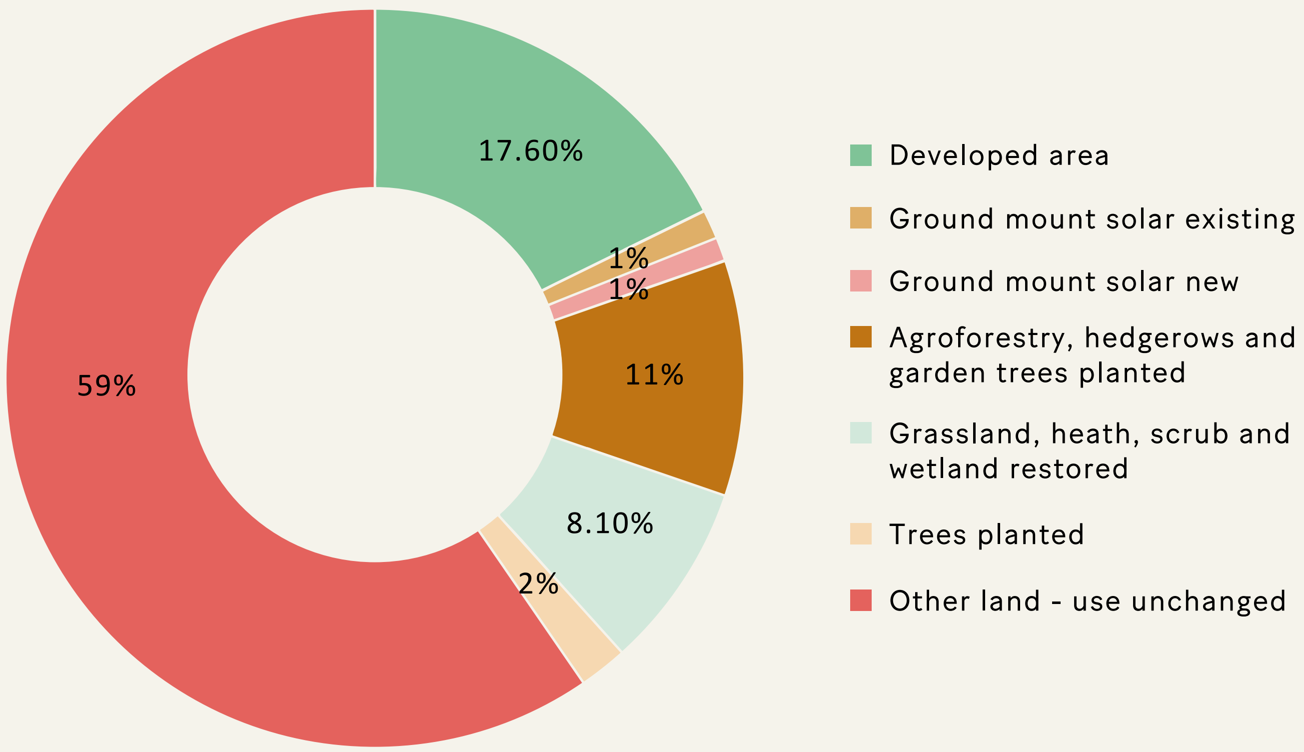


Figure 9: Impact of our 2050 vision on land use

The Botley West solar farm was proposed after this analysis, but would cover 13% of the PSA, or similar.

Image 10: Eynsham countryside, copyright Low Carbon Hub

It will be vital for the ecological quality of the area that we achieve the projected 20% of land enhanced with agroforestry, grassland and wetland restoration and tree planting and that is managed and monitored in the long term.[18] And that the new developments contribute to this improvement.

It is important also to note that the total land area needed for our target amount of ground mount solar is just over 2% and could be done without taking land out of agricultural production.

Given that the Eynsham (Cuckoo Lane) Primary Substation Area is relatively rural, it has more scope to accommodate large-scale renewable energy schemes than in, for example, dense urban areas like Oxford City. But this does not negate the necessity to ensure that schemes contribute a biodiversity net gain.

In developing a response to any new proposal, will expect to take account of the West Oxfordshire Nature Recovery Plan and our Local Nature Recovery Strategy. These are a new, England-wide system of spatial strategies that will establish priorities and map proposals for specific actions to drive nature's recovery and provide wider environmental benefits. The requirement for there to be Local Nature Recovery Strategies, what they are and how they should generally work will be established by the Environment Bill once it completes its current passage through Parliament. There is a local infrastructure of organisations working to develop these locally including the Oxfordshire Nature Recovery Network and the Thames Valley Environmental Records Centre, that has mapped some recovery zones and priority habitats around Eynsham, and there is also a local network - a real local strength with great national research links through the Floodplain Meadows Partnership .

We will not advocate for the planting of bioenergy crops in the Eynsham PSA that were included in the PaZCO scenarios. We do not believe these are necessary, economically viable or good for air quality.

Finally, we have not addressed local food production or low-meat diets in this plan.

[18] https://solarenergyuk.org/resource/solar-habitat-a-look-into-ecological-trends-on-solar-farms-in-the-uk/ A standardised approach to ecological monitoring on solar farms, providing a uniform approach to how the solar industry collects ecological monitoring data on solar sites draws on 10 years of data. Ongoing research is needed.

Our priority actions by 2030

2050 is a long way off, so we are setting interim targets for 2030 with priority actions to achieve them.

Our 2030 targets assume that households will make improvements to their houses that are cost effective now. The ESC work for this project shows that this can eliminate 80% of current emissions.

Carbon Emissions

Total emissions in the Eynsham PSA each year are around 12,000 tCO_2e from our domestic energy demand and 15,000 tCO_2e from our non-domestic energy demand.

The bulk of that is from burning gas and petrol, with about 5,500 tCO_2e coming from the electricity we use for domestic and non-domestic demand.

It is possible to reduce our emissions by around 20,000 tCO_2e by 2030, with an additional 2,000 tCO_2e eliminated by 2050.[17]

The carbon savings from solar electricity decline over time as we move to renewable electricity, but of course we need it to meet our future net electricity demand.

This leaves around 5,000 tCO_2e each year to be eliminated by 2050 (27,000 current emissions minus 22,000 2050 savings). Plus emissions associated with the new developments.

From this, it is clear that the further the new developments are from achieving net-zero energy themselves, the bigger the deficit we will have to address, probably by having to install more solar generation.

[17] We achieve the bulk of savings quickly because the energy supply nationally will be largely decarbonised during this period. But this does not mean we stop implementing the changes by installing new equipment because we need the whole change, not just a part of it. The current Government target is to achieve a zero-carbon electricity grid by 2035.

Image 11: Home assessment in progress, copyright Low Carbon Hub

Image 12: Norbar installation, copyright Low Carbon Hub

Summary of priority actions by 2030

- 40% of households do cost-effective energy efficiency improvements
- Keen households learn how to balance their energy behind their meter
- New houses built by 2030 are designed to require only 35 kWh of electricity per square metre
- The new development at Salt Cross has innovative ways of using and owning energy infrastructure
- 70% of large businesses are implementing a net zero energy strategy
- The Primary Substation Area is a smart and connected community

Priority actions for households

1. 40% of existing households do cost-effective home improvements

Around 300 of our existing households have had home improvements and we want another 1,760 to do them by 2030. That is about 250 households doing cost-effective home improvements per year, a big step up from previous rates.

Great insulation plus elimination of draughts and heat bridges means that the energy needed to heat each house goes down and so the demand goes down from 127 kWh per square metre to around 60 kWh per square metre. This will mean that households will make significant savings on their energy bills, if they can find the capital to make the changes to the fabric of their house.

The transition to electric heating via heat pumps is starting:

- 100 ground source heat pumps are fitted where households have a big enough garden for them
- 1,100 homes (25%) have air source heat pumps fitted where the insulation of the house is good enough for them to be economic
- No houses remain on oil, the 260 houses that are not connected to the gas grid have fitted heat pumps to replace their oil boilers

Image 13: Wrapping a house in insulation through the Cosy Homes Oxfordshire Service, copyright Cosy Homes Oxfordshire

Image 14: Homeowners in Oxfordshire with their heat pump, copyright Low Carbon Hub

Households can be helped to make these changes by the Cosy Homes Oxfordshire service: www.cosyhomesoxfordshire.org[19]

With the help of its online tools, and the handholding provided by its retrofit coordinators, this service takes its customers on a journey. It begins with an understanding of their house as it stands, moving to a 'whole house' understanding of what needs to be done to upgrade it, and then offering a complete service to do the work with trusted local contractors to the right standards.

We know that this is a big ask for households, especially in current times of economic uncertainty and very high energy bills. We stand ready to support the National Government as and when it introduces a comprehensive policy framework and funding support for households to make the big changes required, such as emerging schemes like the Great British Insulation Scheme.[20]

Case study examples:

- cosyhomesoxfordshire.org/case-studies/environmental-retrofitting-an-east-oxford-terrace/
- cosyhomesoxfordshire.org/case-studies/wrapping-our-whole-house-in-insulation/
- cosyhomesoxfordshire.org/case-studies/paddox-estate-oxford-retrofit/

Image 15: Eco-retrofit of an East Oxford terrace through the Cosy Homes Oxfordshire Service, copyright Cosy Homes Oxfordshire

[19] The service is offered as a partnership between two social enterprises, Low Carbon Hub in Oxfordshire (www.lowcarbonhub.org) and RetrofitWorks (www.retrofitworks.co.uk/). Hopefully other services will become available over time as momentum increases.
[20] www.gov.uk/apply-great-british-insulation-scheme. Local sustainable warmth schemes are available too.

2. Keen households learn how to balance their energy behind their meter

We already have around 630 households with their own solar electricity generation and 63 households with an electric vehicle.

To be consistent with emission reduction targets, that number needs to increase to 2,100 households with solar PV by 2030 and 2,900 owning or leasing electric vehicles (or fewer cars owned, whether EV or internal combustion engine).

In making these changes, it is important to maximise the solar electricity generated which is captured for use behind the meter, ie. in the building where it is generated, with demand for the electric vehicles supplied as far as possible by the household, or imported from the electricity network when other demands are low.

This will be aided if keen households install battery storage alongside their solar PV and their electric vehicles. This would help them to capture up to 94% of their solar generation.[21] It would also help them to benefit from what are known as 'time of use tariffs' from electricity supply companies when households are paid for turning their use down or up as the network requires.

If each household with solar PV installed an 8kWh battery, we would have a local 'fleet' of battery storage totalling nearly 22MWh, most of our target for 2030, which would help make the transition to a zero carbon electricity network while making the minimum extra demand on the wires and switches of the network.

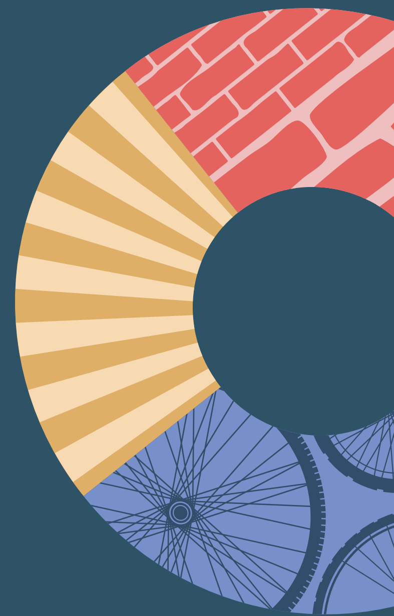
Examples:

- www.lowcarbonhub.org/p/projects/osney-supercharge-smart-and-fair-neighbourhood/
- www.lowcarbonhub.org/p/creating-a-smart-community-energy-system-at-osney-island-oxford/

Image 16: Creating a smart community energy system at Osney Island in Oxford, copyright Low Carbon Hub

[21] https://mcscertified.com/mcs-publishes-updated-guidance-for-solar-pv-self-consumption/ 'MGD 003 Solar PV Self Consumption – guidance document and look up tables'

Priority actions for new housing in new developments by 2030



1. All new houses are built to an exemplar standard

All new houses at Salt Cross and West Eynsham should achieve the LETI zero-carbon standard[22] of 35 kWh per square metre per year. The new housing at Hanborough should achieve this because it is aiming for the Passivhaus standard.

Medium and large scale housing

Operational energy

Implement the following indicative design measures:

Fabric U-values (W/m².K)	
Walls	0.13 - 0.15
Floor	0.08 - 0.10
Roof	0.10 - 0.12
Exposed cellings/floors	0.13 - 0.18
Windows	1.0 (triple glazing)
Doors	1.00

Efficiency measures	
Air tightness	<1 (m ³/h.m ²@50Pa)
Thermal bridging	0.04 (y-value)
G-value of glass	0.6 - 0.5
MVHR	90% (efficiency) ≤2m (duct length from unit to external wall)

Maximise renewables so that 70% of the roof is covered

Form factor of <0.8 - 1.5

Window areas guide (% of wall area)	
North	10-20%
East	10-15%
South	20-25%
West	10-15%

Balance daylight and overheating

Include external shading

Include openable windows and cross ventilation

Reduce energy consumption to: 35 kWh/m².yr Energy Use Intensity (EUI) in General Internal Area, excluding renewable energy contribution

Reduce space heating demand to: 15 kWh/m².yr

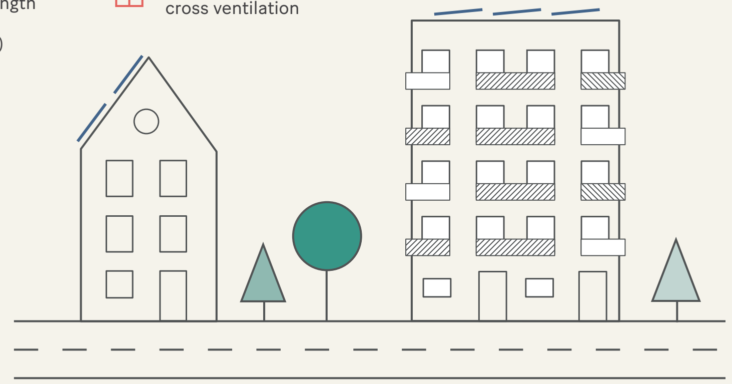


Figure 10: the LETI standard for medium and large scale housing

We know this standard exceeds current building regulations because these are very far from what is required to achieve a zero-carbon energy system in new developments. But Local Planning Authorities have higher aspirations and the Steering Group will continue to engage in consultations and other communications with developers and planners whenever there are opportunities to influence the building standards implemented in new developments.

[22] www.leti.uk LETI is a voluntary network of over 1,100 built environment professionals working together to put the UK on the path to a zero carbon future

2. The Steering Group will work with the developers at Salt Cross to include innovative energy service provision models

Our aspiration for Salt Cross is that it should be developed as one or more microgrids with a Local Energy Service Company in place, working with an iDNO (an independent distribution network operator) to balance energy use for the development as far as possible behind a single, shared meter connected to the Grid.

Hook Norton Community Land Trust is an example of such a microgrid.

Image 17: Artist's impression of Hook Norton Community Land Trust's affordable housing development in Hook Norton, copyright Hook Norton Community Land Trust / Charlie Luxton Design

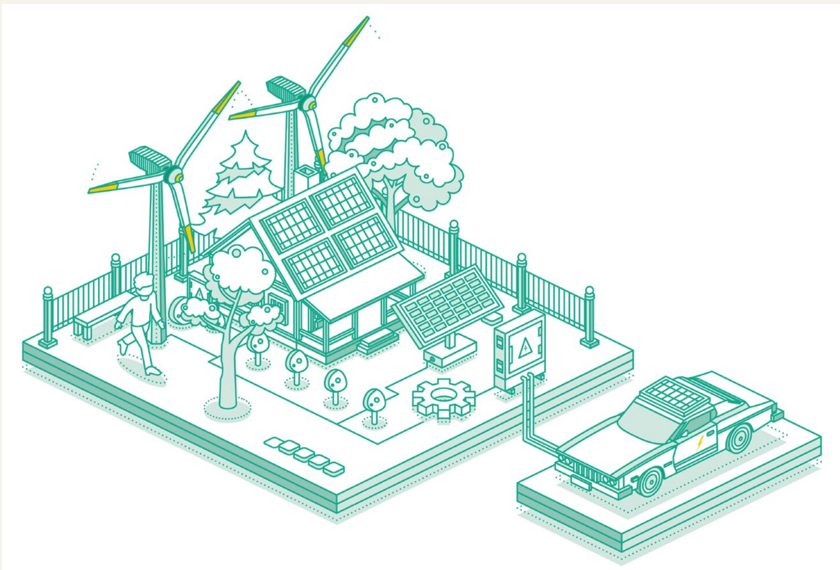


Image 18: schematic of a microgrid

Priority actions for businesses by 2030

1. We help 20% of our businesses to reduce their energy demand

There are 1,211 businesses in the Eynsham PSA. By 2030, we want 20%, or nearly 250, of them to critically monitor their energy demand because they audit their use annually, and act to reduce their demand:

- Around 30 of them will have made the transition to electric heating by installing heat pumps
- Around 20 will have installed at least one electric vehicle charging point
- 100 will have installed up to 50kW of solar PV on their rooftop
- 25% of their workforce will work at home regularly
- We also want them to improve the fabric of their buildings, but recognise it is much more complicated to put a number on this than it is for houses

We will help businesses to make these changes by putting them in touch with Energy Solutions Oxfordshire (ESOx) (www.energysolutionsoxfordshire.org), a partnership between Low Carbon Hub and the Environmental Information Exchange at Oxford Brookes University. ESOx helps businesses to understand how to reduce their energy demand by conducting detailed audits of their buildings and business processes and proposing cost-effective solutions.

2. We expect 70% of our large businesses to be "leading the way"

There are some large businesses in the Eynsham PSA including for example Siemens, Eynsham Hall (Estelle Manor), and Polar Technology that we would expect to actively manage their energy demand and who should be the exemplars for smaller businesses to follow. The Market Garden, a smaller business in Eynsham, is already an example of good practice.

Image 19: Rooftop solar array at Norbar Torque Tools Ltd., copyright Low Carbon Hub

Priority actions to develop a smart and connected community in the Eynsham PSA by 2030

1. We can walk and cycle to key places within and between our communities

Active travel is a key component of both a zero carbon and a healthy lifestyle. The main missing off-road routes for safe cycling and walking which we expect to be provided by community benefit funds associated with new developments are:

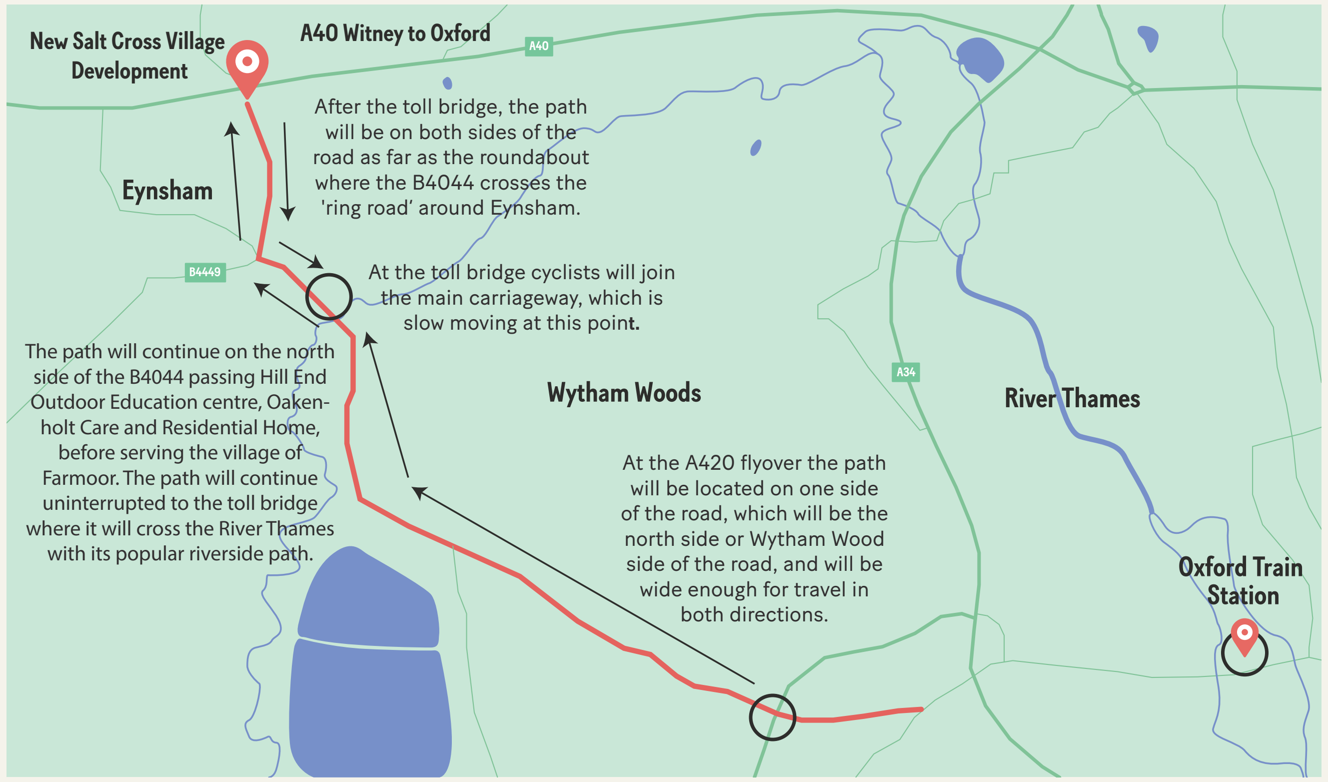
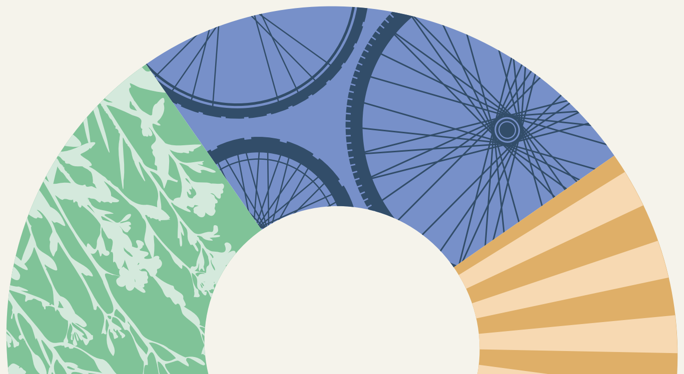


Image 20: proposed community path from Eynsham to Oxford along the B4044 www.b4044path.org/map



Existing cycle routes:

- A4095 shared-use cycle path through Hanborough village
- New community path from Hanborough station to Bladon through Blenheim Park
- Witney to Oxford along A40 (to be upgraded with A40 works to include a bus route)

Planned cycle routes:

- Eynsham to Oxford B4044 community path
- Long Hanborough station to Eynsham along Lower Road and then from there through to the B4044; the top of Lower Road to Bladon is improved already
- Walking and cycling routes through West Eynsham and Salt Cross
- Routes to the south of Eynsham to Stanton Harcourt and South Leigh are desirable but not yet planned

2. Electric bus services for all

The First and Last Mile CIC runs the 411 and 418 minibus services that join all the communities together between the Hanboroughs and Standlake. It is essential for a zero-carbon energy future that these services are maintained and expanded, with electric buses taking over from the current diesel ones, with smart vehicle-to-grid charging points.

Image 21: A First and Last Mile CIC minibus, copyright First and Last Mile

3. Technologies and services that enable the flexible use of electricity are increasingly available

- We have a growing number of vehicle-to-grid (V2G) electric vehicle chargers, some available publicly, so that a vehicle battery can be discharged onto the grid and people can programme their vehicles to charge at the best time for the network and so the cheapest or lowest carbon time for them.
    - We expect that this technology will be pioneered by our big businesses and the new developments in the run up to 2030.
- Our target is for 35%, that's about 1500, of our existing households to be saving on their electricity bills by having 'time of use tariffs' with their supplier where they turn their use up or down according to the best time of use for the electricity network.
- We expect that these tariffs will be taken up first by those keen households who have installed solar PV and battery storage of their own, who have installed a heat pump and transitioned to owning an electric vehicle, perhaps with their own charging point.
- By 2030 the PSA has installed 34MWp of new solar ground mount, over and above the 13.2MWp already operational at Barnard Gate making a total of 47.2MWp in operation by 2030. A further 38MWp will need to be installed by 2050, though this could be reduced by around 7MWp if all new housing has 3kW installed on each rooftop. Any new proposals should come with proper community benefit proposals: for example, support to the community EV bus services; or to contribute to the new active travel routes; or to a Community Energy Services Company (CESCO).
- The PSA has also installed 25MWh of battery storage that will help us smooth out our peaks of demand and help to limit the increase in the highest peak on the worst winter day.
- Since the work on this plan was completed in early 2023, an application for an 840MW solar groundmount called Botley West has been submitted to the National Infrastructure Planning System. Should the development be approved, approximately 34%, or 478ha would be in the Eynsham PSA. This land area represents approximately 13% of the PSA land area of 3700 ha. It would be a matter for the planning process how much of this area would provide landscape and biodiversity net gain improvements. The approximately 286MW of solar ground mount capacity in the Eynsham PSA would be just under 3 times that proposed by this plan. The team at Low Carbon Hub is working to understand the impact of this and how it might be implemented, if approved, for community benefit and biodiversity net gain.

Battery storage could be achieved in many ways:

- Either households install a domestic-sized battery (about 8kWh) alongside solar PV (see above).
- Or community-scale batteries are installed by secondary substations (see below).
- Or utility-scale batteries could be installed alongside solar ground mount. This is starting to happen but the economic model for doing it is still uncertain.
- Or a combination of the above.

Image 22: Battery at Rose Hill Primary School, Oxford, copyright Low Carbon Hub

How much will it cost by 2030 and who pays?

The table on the following page shows an estimate of costs by 2030 in today's prices and who will likely pay.

Please note that these numbers are estimates to give a sense of scale and context. The estimates for business action to reduce their energy demand look very low because of the difficulty of estimation: our commercial building stock has diverse construction, standards used, and ownership (freehold or leasehold).

Broadly, the numbers show that households should expect to upgrade the fabric of their homes and install new technology such as heat pumps, solar PV, battery storage and potentially electric vehicle charging.

On average, this will cost around:

- £8,000 per household for fabric measures to 1,760 houses.
- £11,000 per household for heat pumps in 1,460 houses.
- £5,000 per household for solar PV on 2,100 rooftops.

We might then expect some keen households to install battery storage and electric vehicle chargers. However, batteries and chargers could also be provided at a community scale, for example by locating batteries alongside suitable secondary substations or with ground mount solar, and putting chargers in public places or workplaces. We have made estimates but the spend on these is more discretionary than the costs we have listed above that are the actions that every household really must make if we are to achieve a net zero energy system.

We recognise that upfront capital costs of at least £24,000 per household at current prices is expensive but this investment could halve energy demand and make householders less exposed to the sort of volatility in the energy prices we have seen over the last year.

But we do think that the Government should be helping because it is in the national interest to do so. We hope the Department for Energy Security and Net Zero will restore us to a consistent and coherent policy framework and funding programmes that were in place in 2012.

Eynsham Leading the Way	2021-2030	Source
Indicator		
Buildings		
Housing retrofit and heat pumps	£47,240,000.00	
- fabric retrofit measures	£14,200,000.00	Householders
- domestic heat pumps - existing houses	£16,520,000.00	Householders
- domestic heat pumps - new housing	£16,520,000.00	Developers
Transport		
Active travel	£1,450,000.00	Public funds
Electric charging infrastructure	£8,388,298.00	
- residential chargers	£8,250,000.00	Householders
- public car park chargers	£68,298.00	Public funds
- public buildings chargers	£68,298.00	Public funds
- commercial/industrial chargers	£70,000.00	Businesses
Electricity supply		
Solar generation	£44,356,250.00	
- ground mount	£20,000,000.00	Developers
- solar rooftops existing domestic	£10,500,000.00	Householders
- solar rooftops new domestic	£9,006,250.00	Developers
- solar rooftops non-domestic	£4,850,000.00	Businesses
Flexibility		
Battery storage	£4,200,000.00	
- domestic batteries	£2,750,000.00	Householders
- LV network batteries (19 sites)	£435,000.00	Developers
- ground mount co-location	£1,015,000.00	Developers
Network reinforcement cost reduction	-£3,700,000.00	Customer cost reduction
% households with time-of-use tariffs	0	Energy Suppliers
% households using vehicle-to-grid technology	0	Householders
Total	**£101,934,548.00**	
Householders	**£52,220,000.00**	
Businesses	**£4,920,000.00**	
Developers	**£46,976,250.00**	
Public funds	**£1,518,298.00**	

Table 3: Estimated costs to 2030

Please note that these figures need refinement in some areas, particularly the level of investment in active travel and EV bus services. In the first plan period we will look to develop more accurate estimates for the cost of providing new walking and cycling routes and new EV buses.

Funding will be required for energy advice services to households and businesses, particularly for those less able to pay. As an example, the cost to do a Cosy Homes Whole House Plan for 1,760 houses would be £836,000 at a unit price of £475 and an ESOx energy assessment for 250 businesses would be £275,000 at a unit cost of £1,100. The annual cost would be £159,000.

What new opportunities should we explore now to be ready from 2030?

As well as the costs we can estimate now, there are some opportunities identified by the Energy Systems Catapult that the Steering Group will want to work on now, so that we are ready for implementation probably beyond 2030.

This means that we will need to secure feasibility funding for us to explore the opportunities and start to develop financial and business models that we can take to potential funders. The prime candidates for this approach are identified below.

Shared Finance

A key area to address with new financial and business models is how to help reduce the costs of finance for household and SME energy efficiency.

There are many examples of how to do this that have been trialled from straight grant funding, through shared contracting in communities to guarantees provided to unlock bank and investor finance. The difficulty of achieving a scalable model is shown by the fact that none of these trials has yet reached scale. The opportunities we hope to explore in the first plan period are:

- The role of Low Carbon Hub and other community energy organisations' grant funding from their community benefit surpluses in helping with the cost of energy assessments and whole house plans for those less able to pay;
- Innovative financing models to help with the upfront costs of retrofitting, working with local authority and university partners, such as:
  - Salary sacrifice schemes as currently exist for things like bicycle purchase;
  - Insetting, where local businesses pay for carbon reductions locally in their supply chains or in their local area, rather than relying on carbon offsetting in far-off countries;
  - The potential for using Council Tax and Business Rates as a route for long-term borrowing and repayment of loan funds.

Shared Heat

One way of sharing the costs of installing heat pumps is ambient shared ground loops.[23] The loop is treated as a utility like gas infrastructure and then a heat pump is installed in the house with smart controls on it so that electricity can be imported to run it during times it is cheaper or when electricity is lower carbon.

This approach to heating is new, and so it needs subsidy now to bring costs down so that it will work in future. The cost now is around £20k/house for retrofit and £4-8k more than gas in new build. The heat source for the ambient shared loops could be either from the ground or from rivers or large lakes.

[23] Examples of shared heat schemes:
- Blackbird Leys in Oxford www.kensacontracting.com/live-retrofit-project-blog-follow-world-first-smart-city-scheme-pilot/
- Swaffham Prior in Cambridgeshire www.cambridgeshire.gov.uk/residents/climate-change-energy-and-environment/climate-change-action/low-carbon-energy/community-heating/swaffham-prior-heat-network
- Stithians village in Cornwall https://heatthestreets.co.uk/

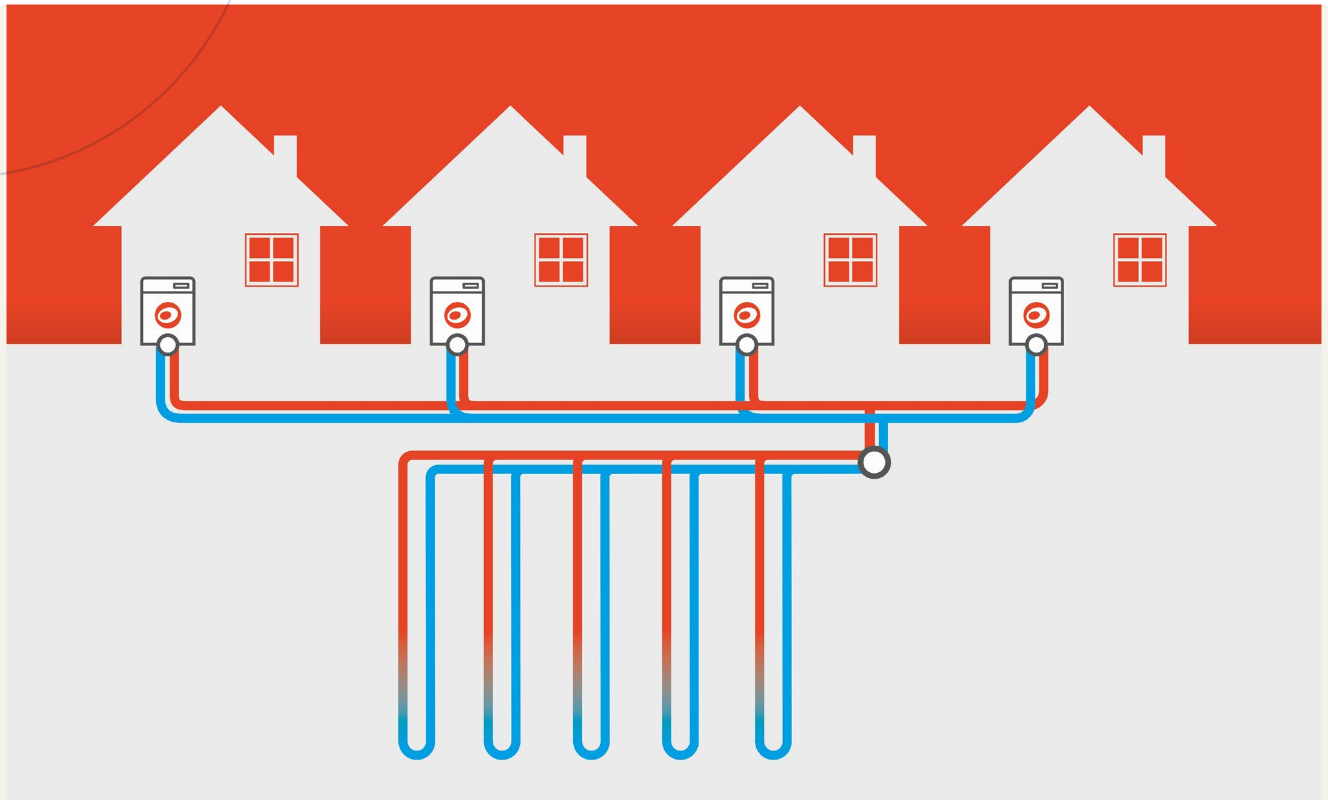


Image 23: schematic of an ambient shared loop ground array, image courtesy of Kensa (www.kensaheatpumps.com)

ESC has identified three areas of existing houses in the Eynsham PSA for exploration. These are in Eynsham, Freeland and Hanborough as shown in the maps below.

Potential for Domestic Shared Heat Source

Eynsham | Freeland | Long Hanborough

Image 24: Areas of suitable housing to be explored for shared loop heat pump systems. Suitable houses from analysis of available datasets are shown in red.[24]

This form of heating is also particularly good for new developments where the shared infrastructure could be put in at the beginning through a Local Energy Services Company with a microgrid for renewable electricity. A shared ambient loop system was modelled in detail for the new development at Salt Cross. We expect to raise and pursue these ideas with the promoter developer and subsequent developers of Salt Cross and other new developments.

[24] These opportunities have been identified using national datasets and would clearly need to be validated in any feasibility study.

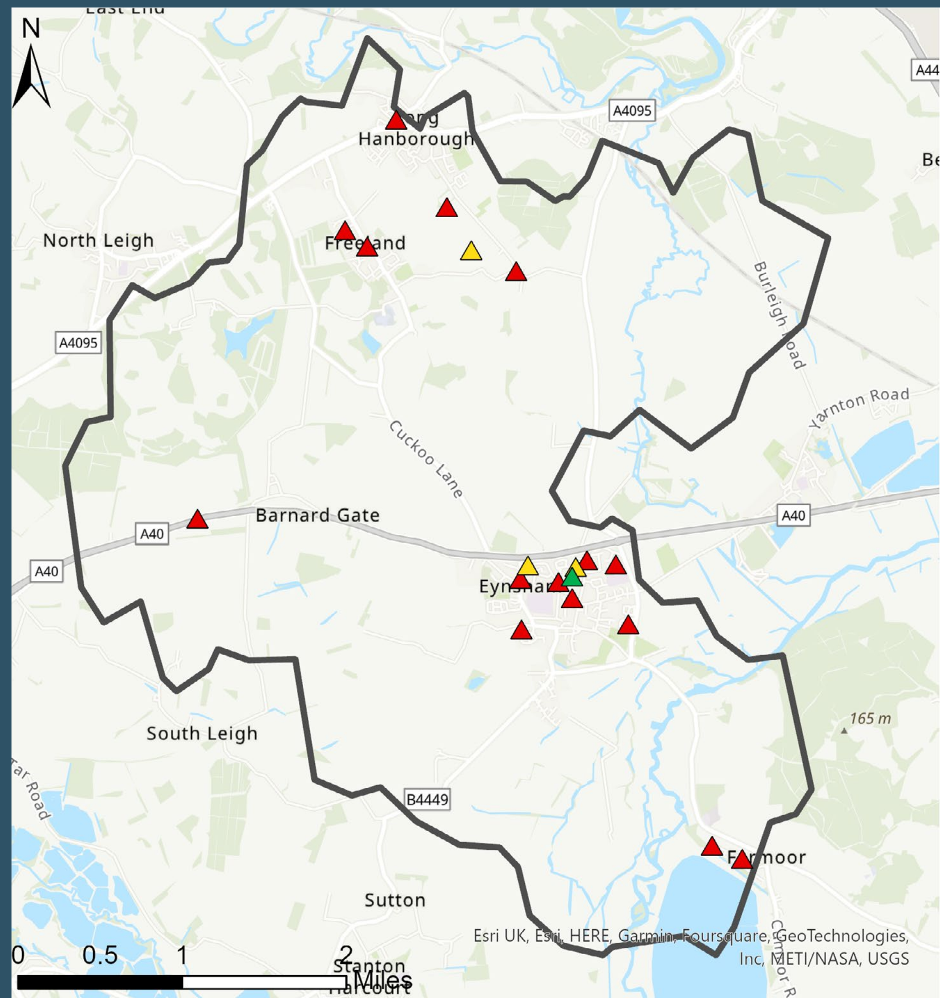
Shared Storage

The Energy Systems Catapult identified 19 secondary substations in the Eynsham PSA where co-located community-scale battery storage could be useful for the network and viable commercially.

These are locations where battery storage, alongside rooftop solar PV installation, would be of the most benefit, to reduce the risk of large surpluses of solar generation causing problems due to insufficient current-carrying capacity on the wires and switches for electricity export. ESC estimates that the cost of a scheme like this would be around £870k and could work well with some households also having their own battery.

Clearly, this is an initial view and would need funding to produce a proper technical and commercial feasibility study.

Secondary Substations With Battery Storage Potential From PV Generation



Secondary Substations With Potential for Battery Storage in the Seasons:

- Red triangle: Summer and Spring
- Yellow triangle: Summer, Spring and Autumn
- Green triangle: Summer, Spring, Autumn and Winter

Image 25: map of the Eynsham PSA showing substations with potential for battery storage

Shared energy

People are excited about the possibility of buying electricity direct from 'their' local renewable energy installation.

They are generally disappointed to find that the current rules governing our energy system in the UK do not allow direct selling in that way. Pressure is growing for this to change.[25] And at the same time, innovative models for Smart Community Energy Schemes are being developed that include the ability to trade energy locally. Given the solar potential in the Eynsham PSA, both rooftop and ground mount, and the amount of new development scheduled at Salt Cross in particular, this appears to be a good opportunity to explore the technical and commercial feasibility of such innovations.

Image 26: a solar farm on the scale of those being developed in the Eynsham PSA, copyright Westmill Wind & Solar Cooperatives

A model for a Community Energy Service Company (CESCO):

1. A CESCO could write a Power Purchase Agreement (PPA) with a solar farm for, say, 2,000kWh per year per home in the community. UK average consumption is 3,000-4,000kWh, so this is a significant fraction of a typical home's load, and a good target to encourage people to bring their consumption down via insulation and other energy saving measures.
2. The CESCO could use flexibility within the community's electricity demand and battery storage to manage many of the risks of matching availability of this 2,000kWh from the solar farm to demand in the homes. Template contracts would need to be developed, so that generators and customers can easily contract on "approved" terms.
3. The CESCO would then sell a progressive tariff to its members, with the first 2,000kWh per year being reasonably cheap and backed by the PPA with a mix of generators. Subsequent kWh would be progressively more expensive, reflecting (a) that they would need to be bought on shorter term PPAs or wholesale markets, so were likely to be more risky and expensive for the CESCO, (b) this would create an incentive for energy efficiency, while still keeping the basic supply reasonably priced.
4. The solar farm could be asked to reserve a certain amount of their generation for community PPAs like this, so that the local community can be seen to benefit. There's no reason why they would need to make any commercial sacrifice in doing this — a long-term PPA at a wholesale stable price is good for both parties.
5. More thought should be given to how a CESCO could combine the progressive tariff with Time of Use pricing because we do want to steer demand away from peak times.

[25] powerforpeople.org.uk/local-electricity-bill-briefing-for-councillors

Long-term governance model

This plan has been produced by the Eynsham Smart and Fair Futures project as part of Project LEO, one of four UK Smart Energy Demonstrators (www.project-leo.co.uk). The Local Steering Group for this project has been chaired by Green TEA and has included representatives from West Oxfordshire District Council, Eynsham and South Leigh Parish Councils, a governor of the local Multi-Academy Trust and local residents. The Local Steering Group has been supported by resource from Low Carbon Hub (www.lowcarbonhub.org) as part of its commitment to Project LEO.

One of the priorities for this project has always been to identify a long-term governance model that could steward implementation of the plan through to 2050. Funding for this has been assumed to be available from two solar ground mount projects. Green TEA introduced the developer, Low Carbon Ltd to Low Carbon Hub and engaged with them and their planning and construction process; one of these is the 12 Acre Farm (Aurora) solar ground mount project within the Eynsham Cuckoo Lane PSA, and the other is the Ray Valley Solar ground mount project just south of Bicester that is owned by Low Carbon Hub.

This process is highly experimental but could be repeated by any community for any Primary Substation Area if we get both the development and implementation of the plan right. We are working with West Oxfordshire District Council on the contribution they might make to strengthen Low Carbon Hub's ongoing commitment to supporting the team, coordinating a Steering Group and Working Group with local representation to manage implementation of the plan for its first three-years, from 2023-2025, finishing with an interim review in March 2026 that will decide on a course for the following five years to 2030. We will publish an update to the CAPZero once their internal planning is complete. We expect this to be by the end of March 2024.

A Steering Group to meet quarterly:

To include representatives from:

- Local sustainability groups such as/ including Green TEA
- Parish Councils and District Council
- Neighbourhood Planning Groups
- Business
- The Eynsham Partnership Academy Trust

A Working Group, with a dedicated project manager/co-ordinator, to:

- Act as the secretariat for the Steering Group
- Provide support for community engagement across the Eynsham PSA
- Provide support for marketing and communications
- Co-ordinate feasibility studies and prepare funding proposals to develop innovative new opportunities
- Co-ordinate community responses to major planning applications
- Lead on priority areas using Low Carbon Hub's delivery mechanisms
  - Cosy Homes Oxfordshire for household demand reduction
  - Energy Solutions Oxfordshire for business demand reduction
- Provide resources for working with key developers to implement community benefit models for new energy infrastructure

Actions and timelines

The first action period for this Plan is the three-year period 2023-2026 with an interim review in March 2026.

A full set of actions with accompanying resourcing plan is being developed over the first year 2023-24. It will be published as an update to this Plan once complete. We are particularly pleased that West Oxfordshire District Council (WODC) members and officers are taking such a strong interest in the Plan and are looking to understand how they can best support it through Members' decisions and officer support.

Low Carbon Hub is committed to supporting the Plan through the community benefit gained from both the Aurora solar ground mount at 12 Acre Farm within the Eynsham PSA and the Ray Valley Solar ground mount south of Bicester. This recognises the material contribution made by Green TEA to both projects.

The actions for 2023-24 and beyond are set out in summary headlines below.

Year 1 (2023-24):

Governance

- Agree with WODC what their contribution to the project will be
- Low Carbon Hub to continue supporting and agree their long-term support alongside WODC
- Continue interim group and institute the Steering Group once WODC has finished its work
- Bid for 3-year Service Level Agreement funding from WODC to supplement Low Carbon Hub and WODC resources
- Work with WODC to embed the CAPZero into the Local Plan
- Work to embed the CAPZero into Neighbourhood Plans
- Set up and run the long-term stewardship model

Pilot projects: households and businesses

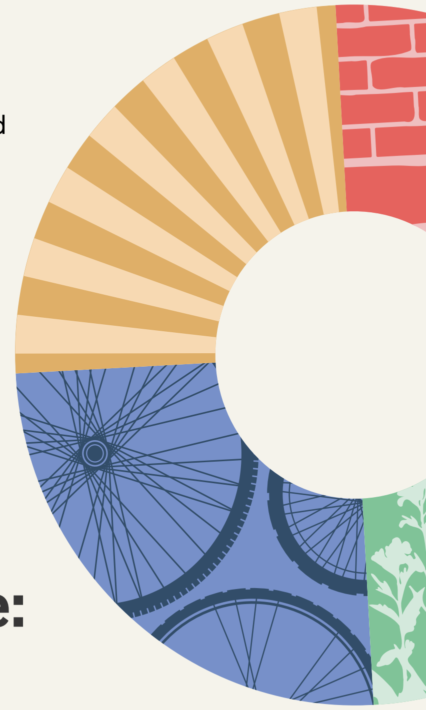
- Identify exemplars and partners for innovation projects and recruit 50 households
- Work with a first exemplar retrofit project for a group of similar houses using the typologies and customer journey approach developed by Cosy Homes Oxfordshire
- Support households and businesses to do solar PV on their rooftops. In particular produce guidance on the connections process for doing 'street-scale' projects
- Work with affected communities in the PSA to understand and make reasoned responses to the Botley West solar ground mount application
- Recruit 10 businesses to develop an energy strategy; encourage large businesses to lead the way
- Work with the LEO-N project, the follow-up to Project LEO, to understand how the CAPZero Plan could fit into the application for Beta-stage funding and identify potential projects

New development

- Work with developers at Salt Cross to include innovative energy service provision models
- Re-engage with West Eynsham developers and other major developments on zero carbon standards

Smart and connected community

- Review active travel options; support First and Last Mile CIC business planning and investigate options for electric buses
- Consider technologies and services that enable the flexible use of electricity; commercial rooftop solar options including the Park and Ride; and solar groundmount options
- Innovative commercial models: scope, cost and prioritise models for feasibility funding such as neighbourhood funding; shared heat; shared energy; and shared storage
- Scope out vehicle to grid (V2G) potential projects



Years 2 and 3 (2024-2026) could include:

- Engagement plan on scaling up to 2030
- Embedding the long-term stewardship model - major stakeholders across the Eynsham PSA contribute to management and funding of CAPZero
- Rolling out plans for other PSAs in Oxfordshire
- Recruiting 700 households to do cost-effective home improvements such as FutureFit pilots
- Implementing agreed pilot projects including a neighbourhood funding model
- Engaging with developers and press for all new houses built by 2030 to be LETI exemplar standard
- Organising community response to outline and detailed Planning Applications
- Working with developers at Salt Cross to include innovative energy service provision models
- Recruitment of 90 businesses to develop an energy strategy; all large businesses leading the way
- Commercial rooftop solar options: pipeline developed to 300kW installed and 500kW in development
- Continued work on active travel options
- Progressing technologies and services that enable the flexible use of electricity: innovative models; V2G projects funded; feasibility and funding for up to 43MWp new solar development

Appendix 1:

Ethical Framework Principles

A. Equitable Local Energy Service Offering

- Collaborative design
- Inclusive offering
- Fair distribution of benefits and costs
- Minimise risk
- Informed consent
- Choice
- Respectful
- Data fairness

B. Ethical Trial Delivery

- Clarity of scope
- Collaborative design
- Inclusive participation
- Do no harm
- Rewarding experience
- Informed consent
- Respectful
- Continuous improvement

Stakeholder Engagement Principles

- Energy provision and use is understood as a socio-technical system
- Engagement is informed by the needs and priorities of stakeholders
- Engagement is evidence-based
- Engagement is reflexive
- Engagement facilitates learning and replication by others
- Ethical and inclusive engagement
- Compliance
- Engagement meets project objectives

Appendix 2: Metrics

Scenarios	Oxfordshire leading the way		Eynsham leading the way			(Note 1)
Indicator	2030 target	2050 target	Existing	2030 target	2050 target	Total
Buildings						
Number of pre-2020 homes renovated	130	4,400	322	2,065	2,335	4,400
Number of pre-2020 homes with rooftop PV			629	2,100	0	2,100
Energy standard for retrofits, kWh/m²/year	100	60	127	100	60	60
Average EPC rating for all buildings	D	B	D	C	B	B
Eynsham PSA businesses conducting annual carbon footprints and/or energy audits	20%	80%		242	727	969
% large businesses with published net-zero strategies	70%	100%		70%	30%	100%
Coverage of business networks dedicated to achieving zero carbon	272	544		272	272	544
Heat						
Natural gas demand (GWh)	47.85	0	73	48	0	0
- existing homes			31	20	0	0
- existing commercial and industrial			42	28	0	0
Hydrogen demand (GWh)	0.435	26.1	0	0.4	26	26
Number of heat pumps (total installations)	1,885	5,655		1,372	6,228	7,600
- existing homes - air source				1,122	3,278	4,400
- existing homes - ground source				250	900	1,150
- new homes				1,081	1,269	2,350
- commercial/industrial	32	1,087		32	1,055	1,087
Shared heat schemes			0			
Off-gas dwellings all off oil and onto heat pumps			0	260	0	260
Transport						
Battery electric vehicles (BEVs) as a proportion of all light vehicles on the road	40%	99%	1%	40%	59%	100%
Number of BEVs (Note 2)	3,045	6,525	63	2,900	4,000	6,963
Domestic and workplace charge points (Note 3)	841	2175		841-3,024	1,334-2,436	2,175-5,460
- domestic				335-2,985	274-2,415	609-5,400
- commercial/industrial				21	39	60
Public charge points	232	522	15	18-232	29-522	47-522
% working at home	25%	35%		25%	10%	35%
Active travel investment	£247,500	£396,000		£450,000	£1,000,000	£1,450,000
Electricity supply						
Solar generation (GWh)	15.95	56.55				
- ground mount			13	34	38	85
- domestic existing			1.3	5	0	6
- domestic new						
- commercial/industrial			1.2	5	3	9
Total renewable energy supply (GWh)	18.85	58	15.7	44	41	100
Total electricity demand (GWh)			37.5	69	100	100
Renewable electricity as percentage of energy demand	31%	52%	42%			100%

Scenarios	Oxfordshire leading the way		Eynsham leading the way			
Flexibility						
Peak electricity demand (MW)			9.9	20	20	40
Peak energy demand increase restricted to.... (MW)				10	12	22
Battery storage (MWh)				25	28	53
Smart controls:						
- heat pumps						
- EVs - including vehicle-to-grid (V2G)				5%	40%	45%
% households with time-of-use tariffs	35%	83%		35%	48%	83%
Land use						Total to 2050
Hectares of trees planted per year	6.235	6.235		2.8	2.8	75
Hectares of agroforestry, hedgerows and garden trees planted per year	20.3	20.3		14	14	390
Hectares of natural grassland, heath, scrub and wetland restored per year	2.9	2.9		11.1	11.1	300
Total percentage of land used for ground mount solar generation existing and new	0.23%	0.99%	0.36%	0.92%	1.02%	2.29%
Percentage of food demand met in Oxfordshire - currently 74% equivalent produced here	87%	55%				

Notes

1	Eynsham PSA is 1.45 % of current Oxfordshire population
2	Number of BEVs: assume total number of cars currently in Eynsham is 1.24 per household (UK average) so 5456
3	Domestic and workplace chargepoints: range depending on whether mainly public or private domestic charging

2050 by Parish

Parishes of North Leigh, Stanton Harcourt and Cassington do not have settlements within the PSA, so figures only done for land use in second table below.

Scenarios	PSA	Eynsham	Hanborough	Freeland	Farmoor	South Leigh
Indicator	Total	70%	19%	8%	1.27%	1.70%
Buildings						
Number of pre-2020 homes renovated	4,400	3,080	836	352	56	75
Number of pre-2020 homes with rooftop PV	2,100	1,470	399	168	27	36
Energy standard for retrofits, kWh/m²/year	60	42	11	5	1	1
Average EPC rating for all buildings	B	B	B	B	B	B
Eynsham PSA businesses conducting annual carbon footprints and/or energy audits	969	678	184	78	12	16
% large businesses with published net-zero strategies	100%	1	0	0	0	0
Coverage of business networks dedicated to achieving zero carbon	544	381	103	44	7	9
Heat						
Natural gas demand (GWh)	0	0	0	0	0	0
- existing homes	0	0	0	0	0	0
- existing commercial and industrial	0	0	0	0	0	0
Hydrogen demand (GWh)	26	18	5	2	0	0
Number of heat pumps (total installations)	7,600	5,320	1,444	608	97	129
- existing homes - air sourced	4,400	3,080	836	352	56	75
- existing homes - ground sourced	1,150	805	219	92	15	20
- new homes	2,350	1,645	447	188	30	40
- commercial/industrial	1,087	761	207	87	14	18
Shared heat schemes						
Off-gas dwellings all off oil and onto heat pumps	260					

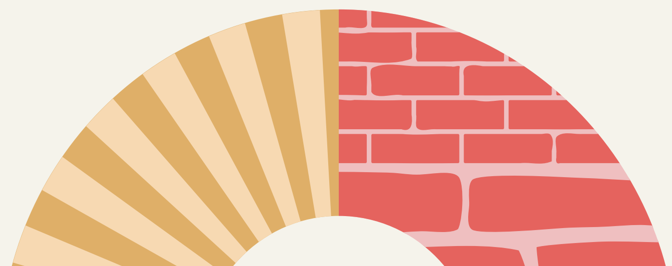
Scenarios	PSA	Eynsham	Hanborough	Freeland	Farmoor	South Leigh
Transport						
Battery electric vehicles (BEVs) as a proportion of all light vehicles on the road	99%	99%	99%	99%	99%	99%
Number of BEVs	6,900	4,830	1,311	552	88	117
Domestic and workplace charge points	2175-5460	1523-3822	413-1037	174-437	28-69	37-93
- domestic	609-5400	426-3780	116-1026	49-432	8 to 69	10 to 92
- commercial/industrial	60	42	11	5	1	1
Public charge points	47-522	33-365	9-100	4 to 42	1 to 7	1 to 9
% working at home	35%	35%	35%	35%	35%	35%
Active travel investment	£1,450,000	1,015,000	275,500	116,000	18,415	24,650
Electricity supply						
Solar generation (GWh)		0	0	0	0	0
- ground mount	85	14	16	7	1	1
- domestic existing	6	4	1	1	0	0
- domestic new		0	0	0	0	0
- commercial/industrial	9	6	2	1	0	0
Total renewable energy supply (GWh)	100	70	19	8	1	2
Total electricity demand (GWh)	100	70	19	8	1	2
Renewable electricity as percentage of energy demand	100%	100%	100%	100%	100%	100%
Flexibility						
Peak electricity demand (MW)	40	28	8	3	1	1
Peak energy demand increase restricted to.... (MW)	22	15	4	2	0	0
Battery storage (MWh)	53	37	10	4	1	1
Smart controls:						
- heat pumps						
- EVs - including vehicle-to-grid (V2G)	45%	45%	45%	45%	45%	45%
% households with time-of-use tariffs	83%	83%	83%	83%	83%	83%

Scenarios	PSA	Eynsham	Hanborough	Freeland	Farmoor	South Leigh	North Leigh	Stanton Harcourt	Cassington
Land use by hectare in the PSA	**3700**	**1370**	**560**	**420**	**280**	**270**	**290**	**250**	**290**
Hectares of trees planted total	75	28	11	9	6	5	6	5	6
Hectares of agroforestry, hedgerows and garden trees planted total	390	144	59	44	30	28	31	26	31
Hectares of natural grassland, heath, scrub and wetland restored total	300	111	45	34	23	22	24	20	24
Hectares of land used for ground mount	84.9	31	13	10	6	6	7	6	7

These figures are a rough guide based on the proportion of population or land area of each parish within the PSA.

Key

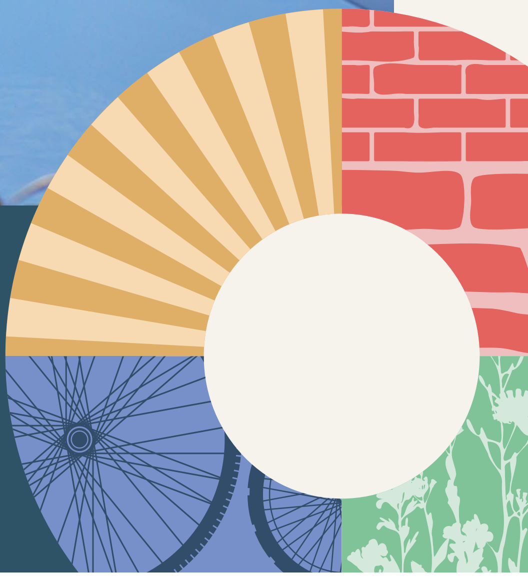
(green)	Items additional to PaZCO table
(grey)	No information
(yellow)	Potential new programmes



Appendix 3:

Scan the QR code to download Appendix 3.

https://www.lowcarbonhub.org/wp-content/uploads/2024/01/Eynsham-Zero-Carbon-Energy-Action-Plan-v1.0-FINAL-edited-to-clarify-Eynsham-Neighbourhood-Plan-references-Appendix-3.pdf



We believe the transition to zero carbon will build a stronger and a healthier world.

Everything, everywhere...starting now!

Find out more at:

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