LMEHA

Sustainability

Draft Plan

Version 1.2

Purpose

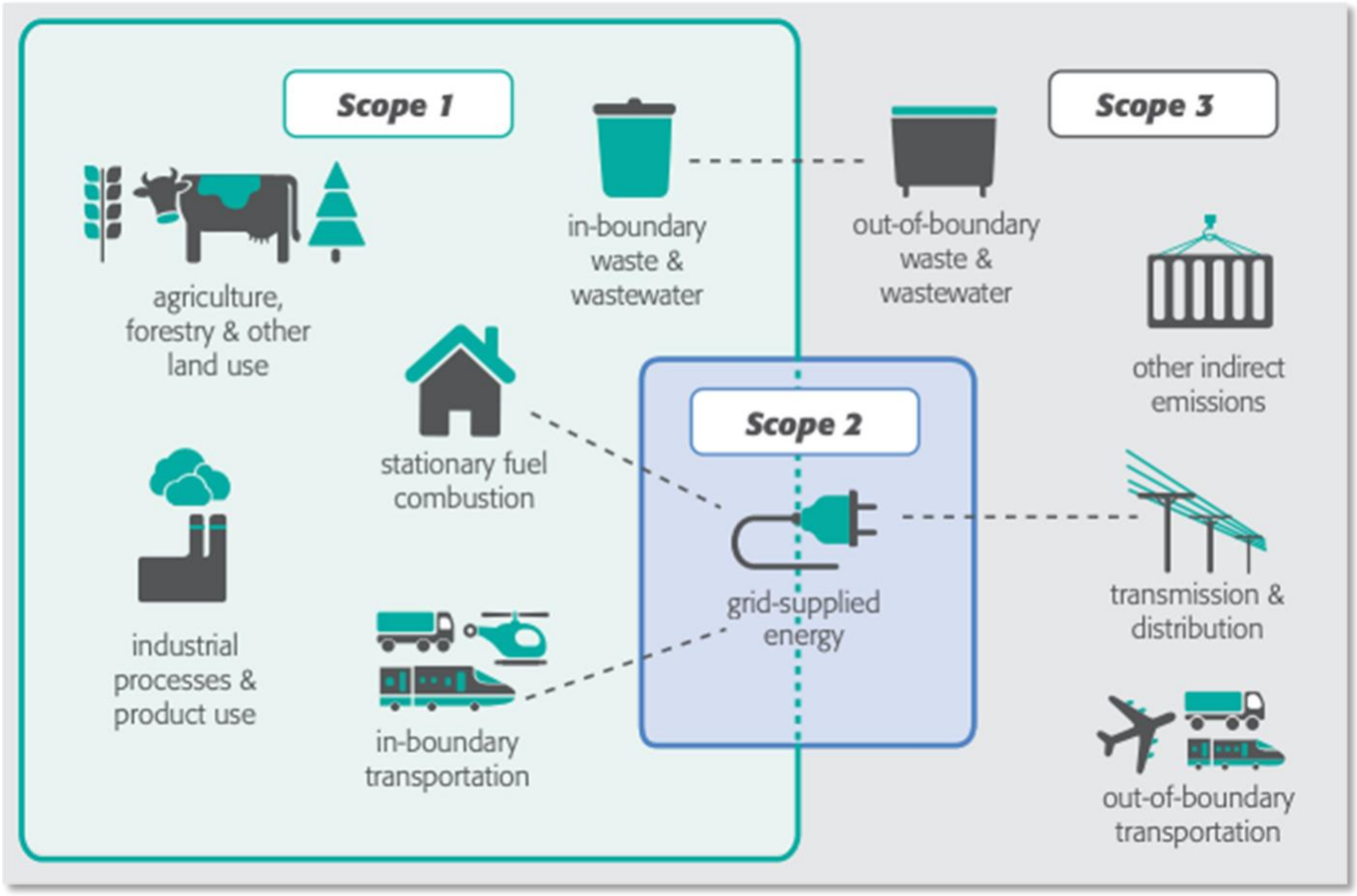
The ultimate purpose of this document is to create a plan aligned with LMEHA, homeowners, HFG and HML that will lead to LMEHA reaching a Net-Zero Green House Gas (GHG) footprint. The initial purpose of the document is as a tool to help progress this is alignment in collaborative stages

1. LMEHA Committee – Create an initial draft approved by the committee
2. HFG/HML – Basis for collaboration between LMEHA, HFG and HML on creating a mutually aligned plan. The first part of this would be sharing the initial plan, then meeting to discuss and finally a medium to long term collaboration to complete the plan and execute
3. Homeowners – To run in parallel with the HFG/HML stage. Initially to brief and gain input from homeowners and over time to create a plan that they can be part of executing

Scope

The scope of the plan is to enable LME to reach Net-Zero GHG footprint.

While there are other aspects of sustainability, such as recycling, these are out of scope for the plan, except where they also impact net-zero. The construction of new buildings by HFG is also out of scope since this is a matter for HFG and construction at LME is expected to complete within a few years. However minor construction, such as extensions and refurbishments that may be undertaken by homeowners is in scope.



Any form of human caused GHG emissions from LME is within direct scope (1). GHG caused by travel to and from the estate is not directly in scope since it is not something that can be directly controlled and there are government initiatives to address transport. However, facilitating and encouraging travel related GHG reduction is within scope (3), for example EV charging.

GHG from food is out of scope since this is not an area LME community action can affect. It's either a personal decision on diet or off-LME actions on farming methods.

Note: As the document progresses, we expect the numbers and plans to become more detailed. For example, calculating the actual GHG footprint in future versions and creating costed plans.

Note: Frequently net-zero CO2 or carbon natural terms are used. Strictly climate change is caused by several GHGs, with CO2 being the largest source. Often CO2e is used, meaning CO2 equiveillance, where calculations are made to enabled talking about other gases in equivalent terms, for example methane is around 80 times more potent than CO2 in causing climate change.

Version Control

Version	Change Author	Changes	Date
1.0	Mike McKeown	First draft	January 2022
1.1	Mike McKeown	Amendments from sub-committee review	February 2022
1.2	Mike McKeown	Added heat store boilers, solar thermal and insulation	February 2022

Contents

Management Summary

The preliminary goals are for LME to reach:

- Net-zero for all shared facilities by 2030
- Net-zero for all houses by 2035
- Net-zero for transportation by 2040

This is a living and developing plan for the LME community to engage with homeowners, HFG, and HML to develop and then execute a plan that will lead LME to its goal of net-zero CO2. This first iteration outlines the plan for initial consultation. Once the outline plan is revised and approved by the LMEHA committee we will start engaging HFG, HML and homeowners, including creating a sustainability sub-committee to work on this.

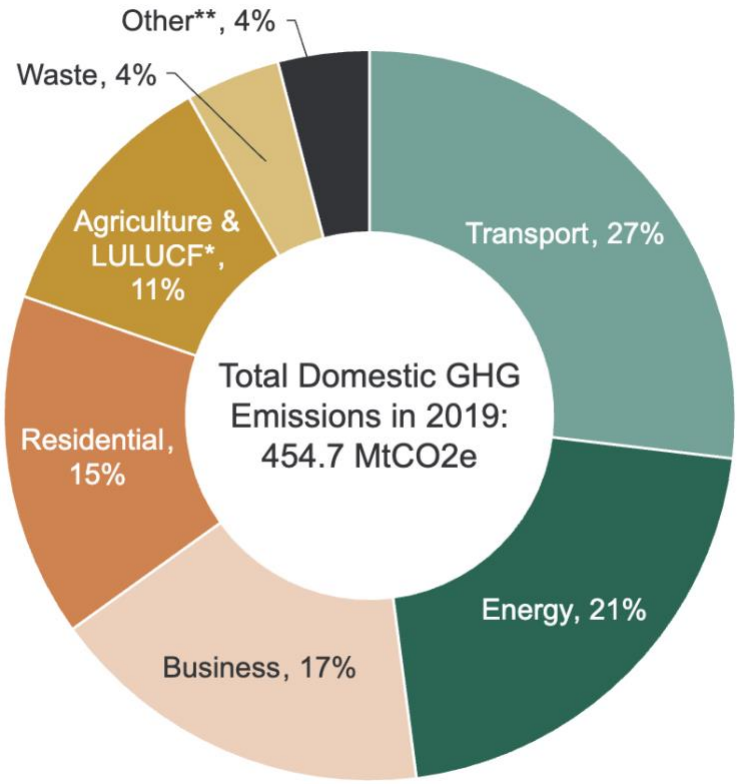
We have identified six key areas to explore and develop plans for:

1. **House Heating**: Converting homes from gas and oil to either heat-pump, hydrogen or community heating
2. **Electricity Generation and Storage**: Using solar, wind, and hydro to generate electricity together with storage
3. **Transportation and EV Charging**: Encouraging the adoption of EVs for transport to and around the estate by ensuring LME has robust charging infrastructure
4. **Estate Services**: Converting estate services, such as pool and building heating, from gas to heat-pump or community heating and transitioning all estate vehicles and equipment from Internal Combustion Engines to electric power
5. **Waste**: Ensuring all waste disposal is net-zero, particularly food waste and potentially using anaerobic disgestion to reduce emissions from sewage waste
6. **Construction**: Encouraging and supporting homeowners to adopt low carbon and ultimately net-zero materials and techniques for renovations and extensions

While implementing this plan will likely involve significant capital expenditure to build, we do expect strong returns on reduced running costs. We will seek funding and financing from government and the private sector to both reduce and spread the costs.

Sources Of CO2

The sources of CO2 for the UK by sector:



Note: More than 50% of transport is cars, residential is mostly heating (gas and oil) and energy is CO2 from electricity generation, waste is methane from rotting food.

This gives a perspective on the areas that we can have an impact as a community in LME:

- **Residential:** Mainly gas and for some oil used to heat our homes.
- **Energy:** Electricity used in both our homes and the shared estate facilities.
- **Transportation:** Mainly our car journey's to and from the estate. Plus, transportation used by the estate team.
- **Business:** Mainly heating shared facilities such as the pools, spa, etc., using gas.
- **Waste:** This is a mix of our individual and Ballihoo food waste.

Net-Zero Plan

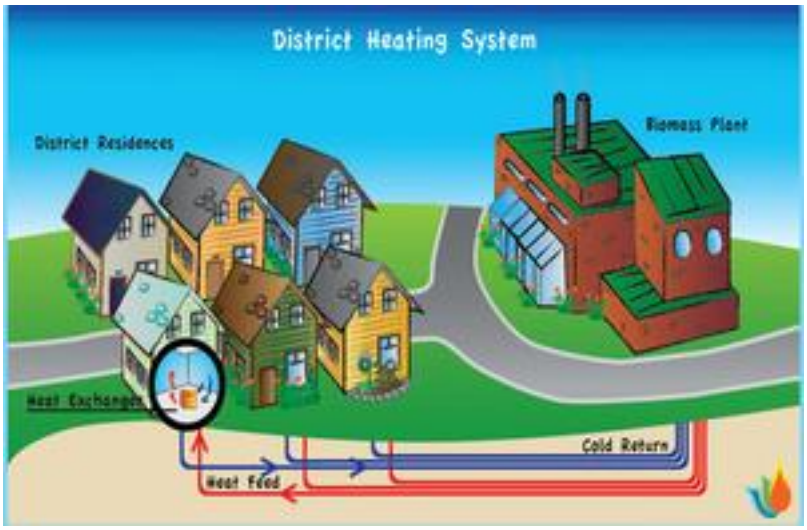
HOUSE HEATING NET-ZERO PLAN

There are multiple routes that could be taken to replace the gas and oil heating taking a community approach that could be faster and more cost effective than individual houses migrating. These routes may also be suitable for the Mill Village houses that use electric heating where it could reduce running costs. Given the multiple routes the initial step would be to get expert advice to help evaluate the best option and investigate if any government grants could be applied for – LME could be a large scheme that attracts government interest in an area where there is a lot of government and private investment.
The options include a heat network (district heating), heat-pumps (air, or ground or water source) and hydrogen.

HEAT NETWORK

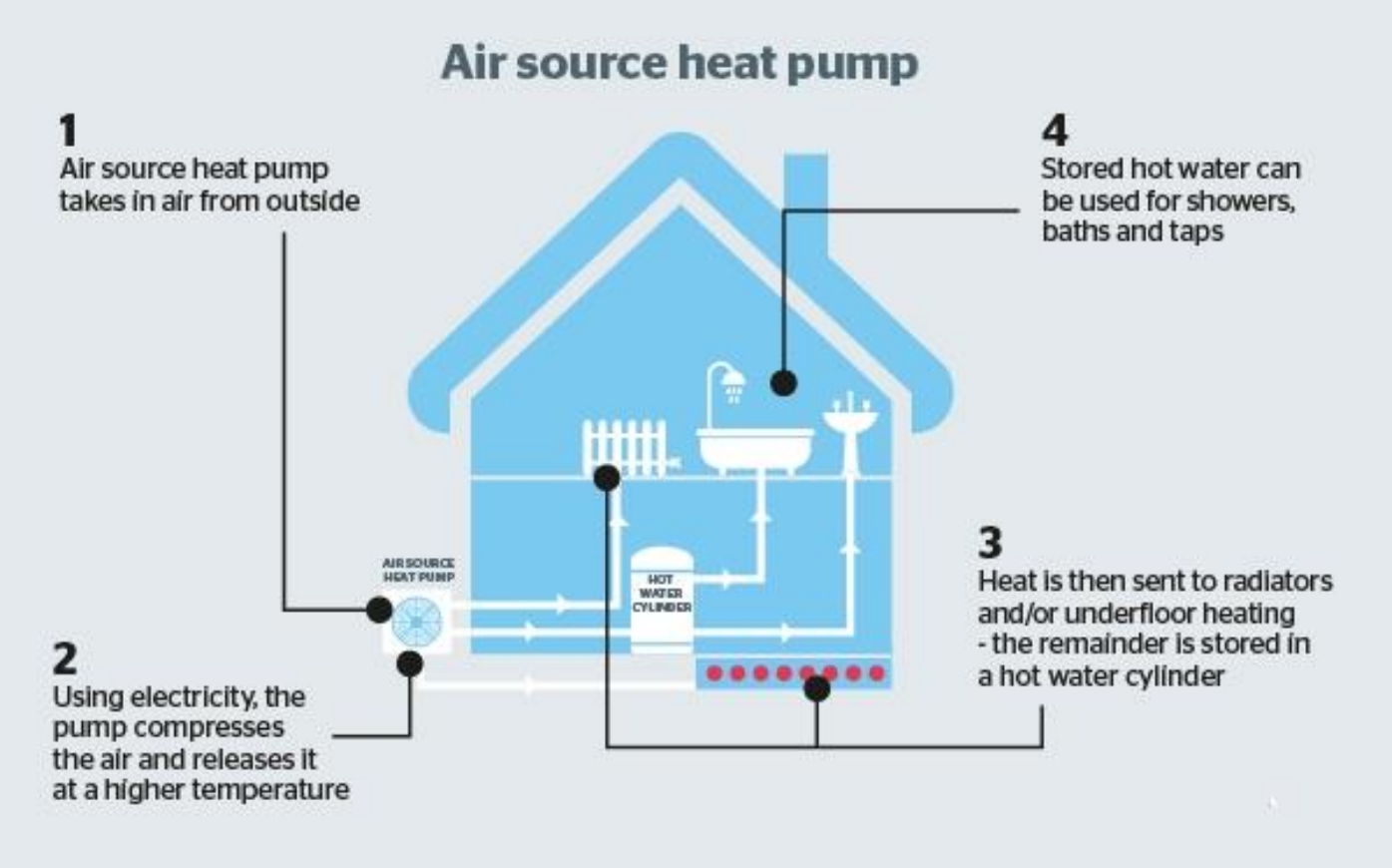
A heat network has one or more centrally located heat sources and a network of insulated water pipes between the homes. The individual homes draw their heat from the network. The heat sources could be heat-pumps and/or direct electric.

This would be relatively disruptive due to the need to lay piping and heat interface units. But may be more cost effective to install and operate due to the economies of scale using centralised heating.



AIR SOURCE HEAT PUMPS

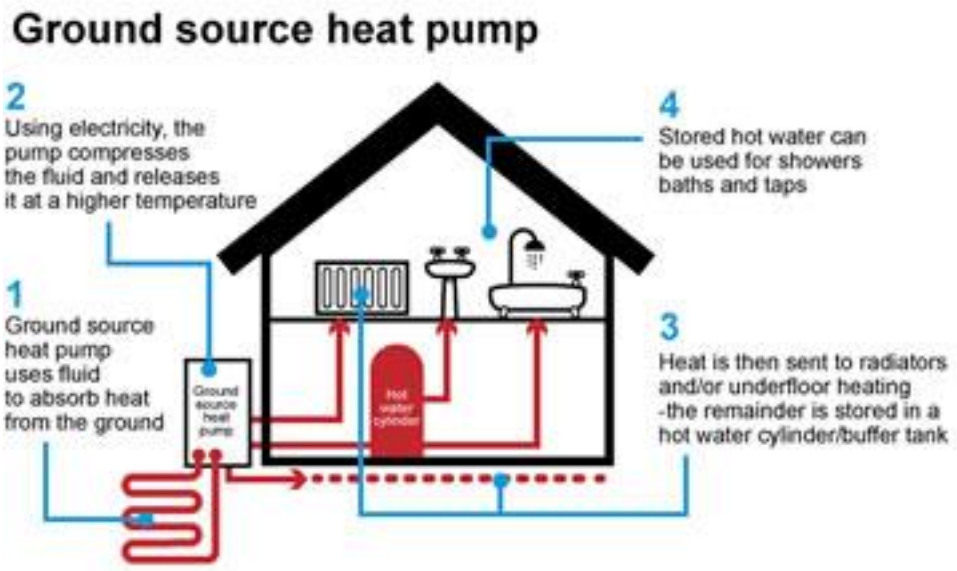
These would be fitted individually to each home, replacing their boiler. They draw heat from the air. The main benefit of a community scheme could be reducing the cost from scale of purchase. A few properties have already installed these. They are the main option that the UK government is driving to convert home heating.



All types of heat pumps work in the same way – they extract heat from the source (air, ground, or water) in the same way a fridge extracts heat from within it and emits heat from the coils at the back. The heat pump heats up water that flows through the hot water and heating system of the house. Typically, the water temperature is ~50C, which is cooler than traditional boilers. Generally, the house must be quite well insulated to keep warm with the cooler water and the heating system has to be able to radiate the heat well, which favours underfloor heating or at larger radiators. However, high temperature heat pumps have recently come on the market, which may give more options. Exactly what will be required will depend on the individual house. Fortunately, there are a set number of home designs at LME, which should make it easier for us to assess the options.

GROUND SOURCE HEAT PUMPS

Like air source heat pumps these are fitted to individual homes, but they draw their heat from the ground using piping in either bore holes going vertically down or laid horizontally a little under the surface of open areas of ground. Given the housing density of LME the bore hole option is likely the most practical. The piping could be shared between groups of housing. At least one home has such a system installed and it was found LME was very well suited to this due to water flowing deep in the ground which gives higher efficiency than typical ground source heat pumps. The main benefit of ground over air source heat pumps are greater efficiency, giving lower running costs. Although installation costs are higher.

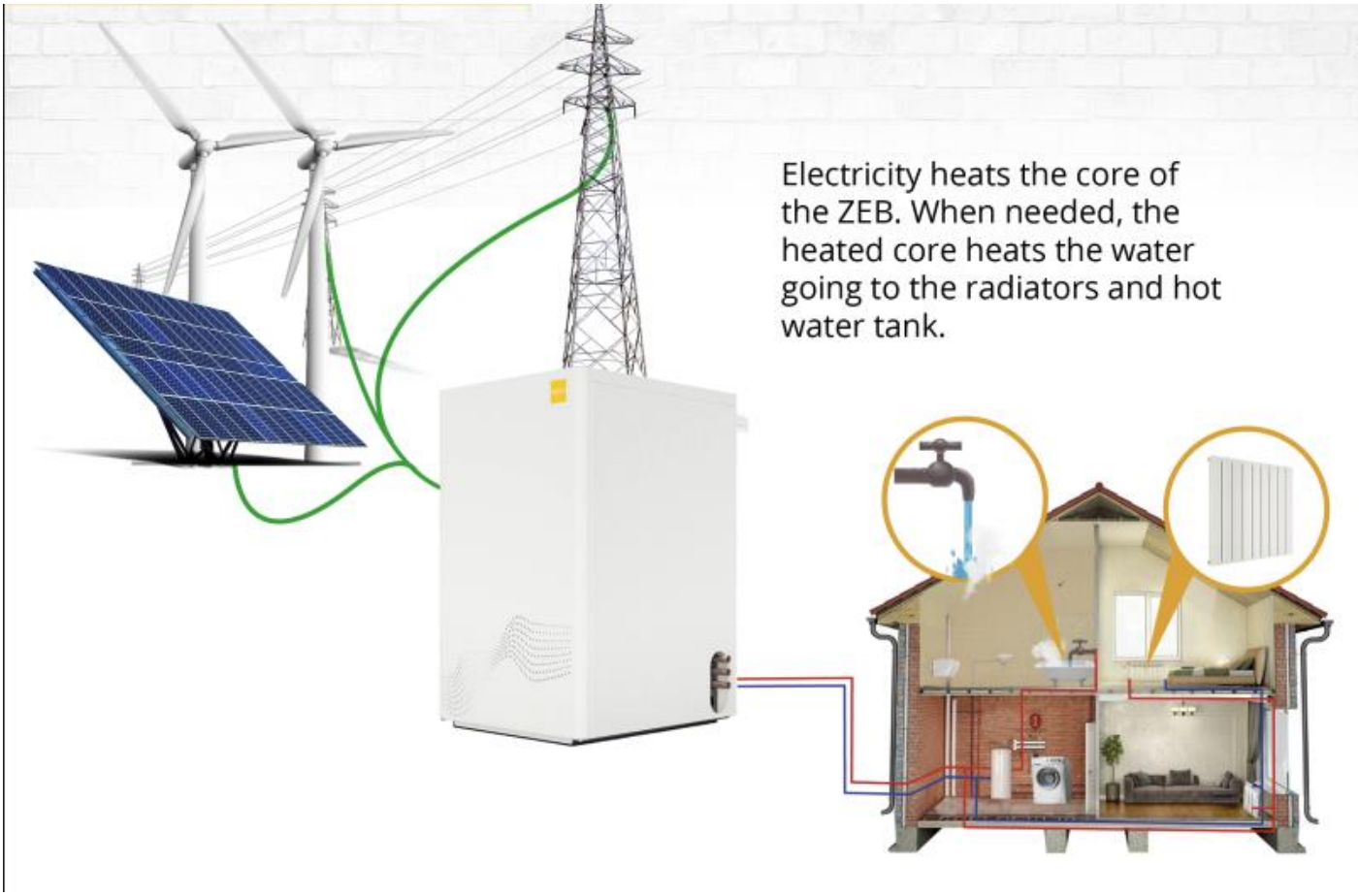


WATER SOURCE HEAT PUMPS

Again, the heat pump is fitted to individual homes, but they draw their heat from water. Given the amount of water at LME this is a particularly interesting option, especially as water source heat pumps are the most efficient type of heat pump, with the lowest running costs. There are two types, closed and open. With a closed system the piping may be in the form of a mat that is floated out onto a lake and sunk to the bottom. Fluid flows through the pipes that absorb heat from the water. An open system draws lake water directly, passes it through the heat pumps and sends in back into the lake. This would of course need some environment investigation to understand if the mats (closed) or pumping (open) would have any adverse effect on the lakes and for closed the mats selected use a safe fluid that would not risk contaminating a lake in case of leak. Given the shared nature of the water souring it may be possible to share the system between multiple home and estate facility use, for example heating the spa.

ZERO EMISSION STORAGE BOILERS

This is a relatively new solution, evolved from the old storage heater concept. A special unit that is both a boiler and heat energy store replace the traditional boiler. It's heated when electric is cheap, typically overnight, but could also be during the day when combined with solar. It connects to your existing radiator or underflow heating system. This solution is less efficient than heat pumps but may be an option where heat-pumps are not possible, particularly if we are generating low cost electricity at LME using Solar, hydro and wind.



SOLAR THERMAL

This would deploy solar thermal panels on the roof of a home, which heats water for both heating and hot water. On its own solar thermal would be unlikely to able to heat a home all year around, but it may be an option when combined with other sources. We will need to evaluate the options as solar thermal and solar PV (electric generation) would be mutually exclusive except on very large roofs.

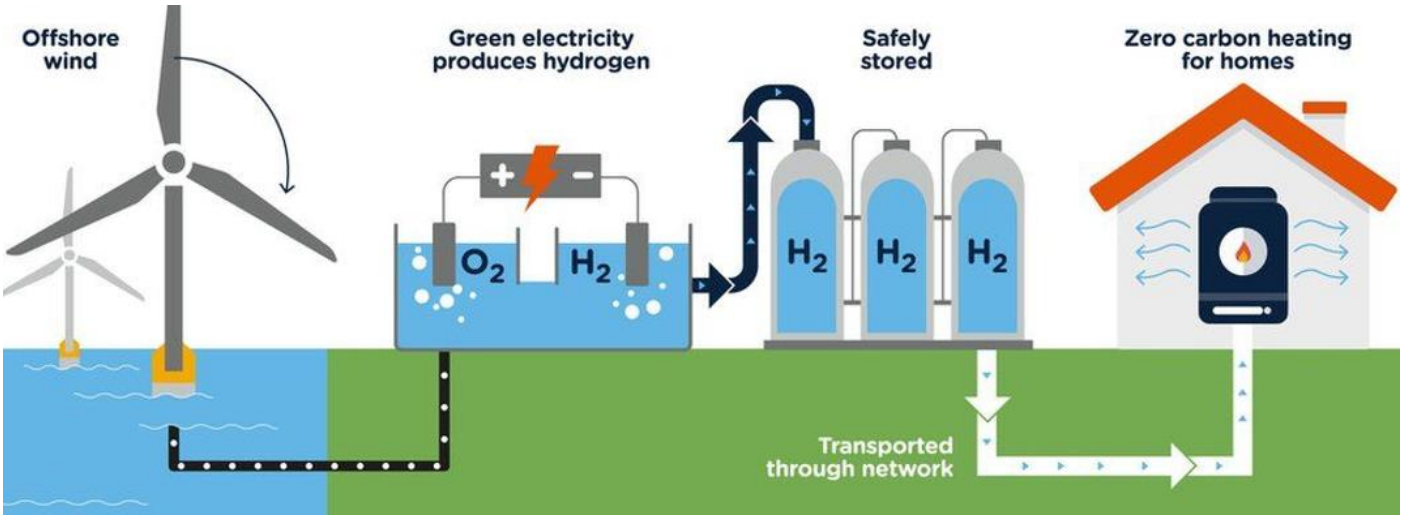
HYDROGEN HEATING

Hydrogen can be burned in a boiler as an alternative to Calor gas. This would at least require boiler conversion and potentially replacement. It should (subject to survey) be possible to use the existing pipes. Hydrogen doesn't produce any CO2 when it burns, but it can emit Nitrogen Oxides (NOx). The large-scale viability of hydrogen heating is currently under evaluation by the UK and other governments, with significant cost and GHG emission considerations to be resolved.

Currently most hydrogen is created by stream reforming of natural gas (methane) and releases a lot of CO2 and methane; this is called grey hydrogen and has little or no GHG reduction benefits.

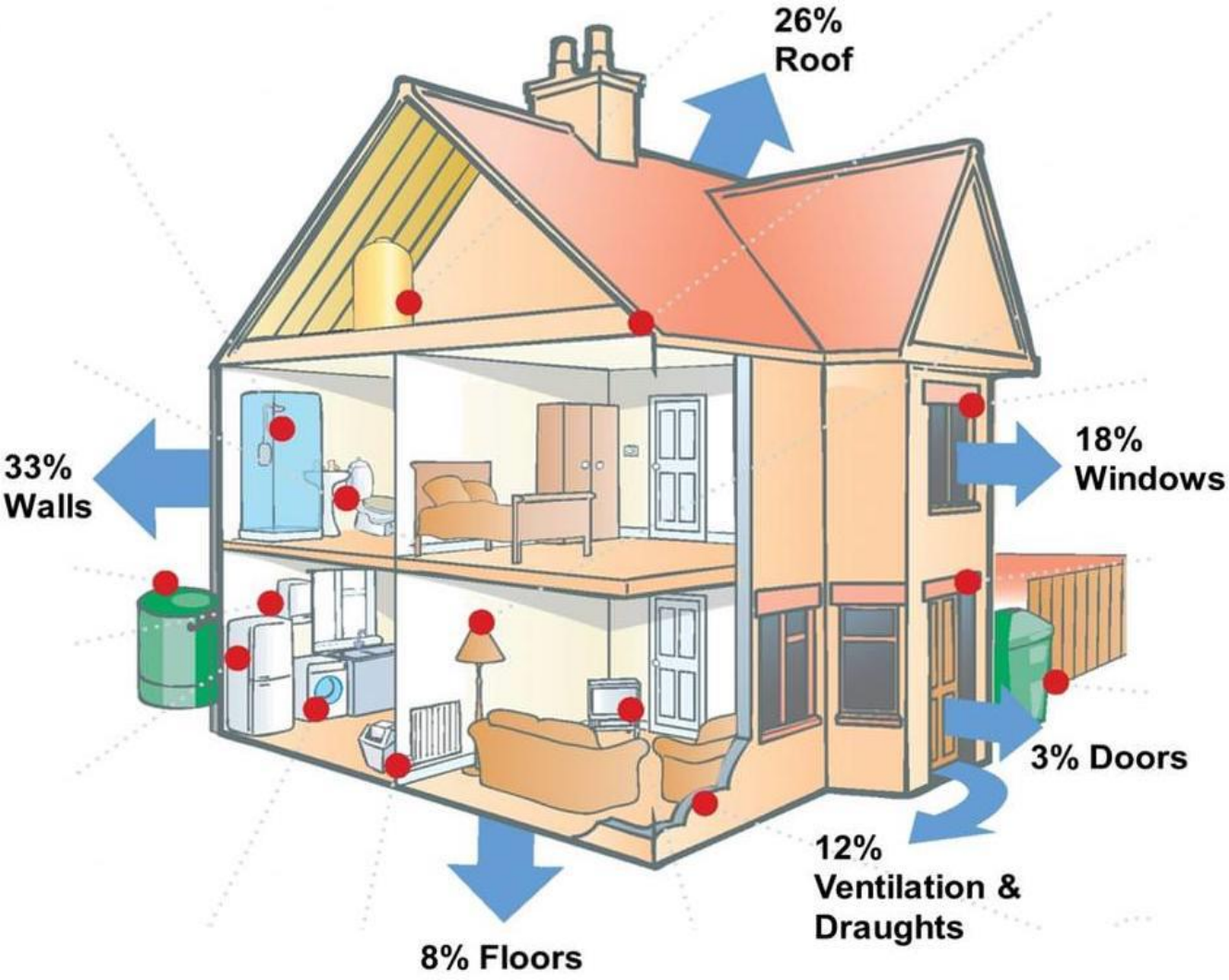
Blue hydrogen is being developed at scale, this is still produced from methane but promises to capture the escaping methane and CO2 using Carbon Capture and Storage (CCS). However, it is not yet clear if and when CCS technology will improve sufficiently in performance and cost to make this work well.

Green hydrogen is also being developed; it uses electrolysis of water to create hydrogen. If the electricity used is generated sustainably then green hydrogen is net-zero. However, it uses a lot of electricity and is hence relatively expensive compared to using electricity directly for heating. The theory is that one day there will be a lot of cheap excess electricity from renewables at times of peak wind or solar that can be used to generate hydrogen. However, this is likely many years away as we are far from having enough capacity now and for even 100% sustainable at peak output, and even when we do much of the excess will be needed for grid storage charging. It's unlikely the capitol costs would make it viable to generate hydrogen at LME.



HOME HEAT EFFICIENCY AND INSULATION

We will review the heat efficiency of the various house types at LME. This will be an important part of assessing the home heating options. It will also enable us to understand where there are opportunities to improve home heat efficiency and what options may be available to improve it by improving insultation and if a community wide initiative could reduce the costs of implementing changes compared to individual action.



ELECTRICITY GENERATION AND STORAGE

The UK's electricity generation in 2021 was around 42% fossil fuel (mainly gas) with the remaining 58% of zero-CO2 sources such as wind, solar, nuclear, etc. Electricity generation is expected to reach zero emissions over the next few years driven mainly by growth in wind and solar, and to a smaller extent by nuclear and hydroelectric. There is also a large investment in international interconnects and storage, such as grid scale batteries, hydrogen, gravity and heat-based storage to smooth out intermittent wind and solar.

There are several ways the LME community could participate in reducing electricity CO2 and potentially reduce costs of both individual homes and LME service charge electricity costs. Like home heating this needs some expert advice and a lot of consultation on the impacts.

ROOF TOP HOME SOLAR

Solar Photovoltaic (PV) could be installed on individual homes and storage barns. A potential benefit of a community wide initiative would be to reduce costs by scale of purchase and of storage barns sharing some of the infrastructure. This would reduce electricity bills for individual homes while lowing their CO2. Establishing a cooperative electricity exchange across the site would enable homeowners to contribute excess electricity to the estate whilst those with higher usage would benefit by drawing it down. Such a network, if achievable, would encourage even low-usage homeowners to install rooftop PVs and avoid the demand for unsightly ground-based PV fields and linked infrastructure elsewhere in the estate.

ROOF TOP ESTATE SOLAR

Could be installed on estate buildings, such as the Spa and other pool buildings and help reduce the cost on the service charge and estate CO2.

SOLAR FARM

Could be deployed on one or more locations around the estate and either reduce electricity costs or provide an income stream, directly or indirectly reducing CO2. Obviously, major considerations would be the location(s) and how this impacted the ecology and look of the estate. Ground, lake and building based solar can be considered.

WIND TURBINE(S)

Could be installed away from homes and like solar used to generate electricity and either create income or save costs and reduce CO2. However, visual impact would be a much bigger concern than for solar, plus there would be considerations on the impact to the bird and bat population depending on location.

HYDRO

LME has a significant amount of flowing water, most notably between Spinney Lake and Somerford Lagoon. This is strongest in the winter, which makes it complementary to solar, which is stronger in the summer. A hydroelectric generator could be installed between these two lakes and possibly other areas of high-water flow – however it's unlikely the Environment Agency would allow hydro in the Thames. Visual impact would need careful consideration and consultation, together with a fully hydrology evaluation.

STORAGE

Battery storage is becoming an increasingly attractive and more cost effect way of storing energy at scales ranging from individual house up to grid-scale. It could be used in combination with wind/solar/hydro generation to store excess energy (for example on a sunny day) to supply power when there is less locally produced power, for example at night. Battery storage can also be used to reduce costs by charging on low cost / low-CO2 off-peak electricity for use during the day when electricity is typically 3x more expensive and higher CO2.

TRANSPORTATION AND EV CHARGING NET-ZERO PLAN

This is split into two areas – the transport used by individuals to travel to and from LME, and the transport used by LME staff on the estate. Both of which can become net-zero, over time, by switching to EVs.

INDIVIDUAL TRANSPORT AND EV CHARGING

The UK government is driving this through incentives and a plan to ban sale of new pure Internal Combustion Engine (ICE) cars by 2030 and plug-in hybrids by 2035, with the average 15-year life of a car meaning most cars on the road by 2050 will be EVs.

The main LME community action we can take in this area is making sure LME is EV friendly, thus encouraging owners to purchase EVs and visitors to use EVs they own when coming to the estate. EV friendly means it should be easy and worry free to charge an EV at LME, particularly as large-scale adoption means there will be many EVs at LME. Currently there are very few shared chargers. Some properties, particularly those in Minety Lake have off-street parking where it is easy for homeowners to install chargers on the house. However, many properties don't have parking adjacent to the house or if they do only one such space, hence there is heavy use of shared car parks.

Therefore, there should be a planned deployment of EV charging in the car parks and parking spaces that are not adjacent to their property. This could be a mix of shared "public" chargers in shared parking spaces and private chargers connected to homes that have non-adjacent parking spaces. This may also require the local District Network Operator (DNO), Scottish and Southern, to upgrade some of the infrastructure for LME, such as cabling and transformers and hence planning should be done together with the DNO, this may also be affected by the additional load of community or heat-pump home and building heating. Charger installation will require a significant amount of groundwork to lay cables. This disruptive cabling should happen once, so should be scaled to support the eventual 100% EV population, even if the number of chargers increases of time. It should also be synchronised with other aspects of this plan that could require extensive ground works, for example network heating or ground / water source heat-pumps, to save costs and avoid double disruptions. It should also be undertaken before large scale planned maintenance on road surfaces to avoid digging up recently re-laid roads and paths.

Shared chargers would need to be part of a charger company network in order to charge for use. A likely model would be electricity, operation and maintenance costs are covered by the usage fees. It would be possible to charge different prices for different users (e.g., homeowners vs visitors) and different times of day (e.g. off peak).

Offsetting is another option for transportation, although the effectiveness of this is questionable.

LME TRANSPORT AND EQUIPMENT

LME staff travel to and from LME by car, they should be encouraged to switch to EVs. Part of this will be charging infrastructure – there should be chargers where the staff park, which could be implemented alongside residents' charging. LME and HML, as the employers could further encourage EV adoption by implementing an EV salary sacrifice scheme, which is a government incentive to reduce the cost of EVs.

LME on site "transportation" should move fully to electric as soon as possible. Some of the vehicles are already electric, all new ones should be electric. Plus, any ICE equipment, such as mowers should be moved to electric as soon as possible.

ESTATE SERVICES NET-ZERO PLAN

This addresses the CO2 generated by the shared services on the estate, mainly the gas heating of the pools and shared building, such as the spa. It should also reduce the running costs.

Much as with homes the estate heating could be converted to either community heating or heat-pump or solar thermal or hydrogen. Potentially this could be done together with home heating and insultation to reduce costs, for example shared mats for water source heat pumps. This should be part of the scope of the professional consultation on LME heating that looks holistically at homes and shared facilities.

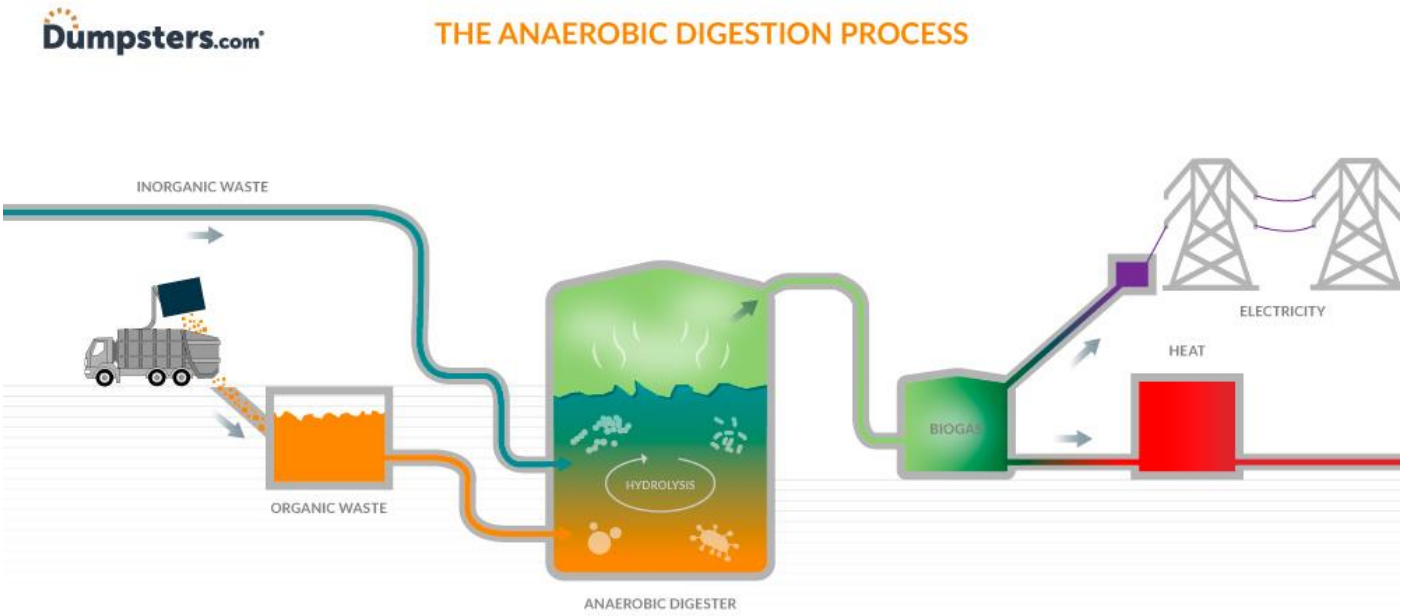
ESTATE LAND NET-ZERO PLAN

GHGs from agriculture is a significant part of the UK's emissions. While the scale agriculture on LME is very small this will still be part of the plan – adopting techniques to reduce GHG emissions from lane use at LME.

WASTE NET-ZERO PLAN

Food and sewage waste are the main source of climate changing emissions (methane and CO2), if left to rot, for example if food is mixed with general waste and sent to landfill. Therefore, the plan is to collect food waste separately and ensure the waste management company that LME contracts disposes of the food waste using net-zero methods. This will include all food waste, including from homes, share facilities such as Ballihoo and LME staff. Ensuring the waste management company handles non-food waste net-zero is also an important area for CO2 reduction.

An anaerobic digester system could be used with LME sewage and other digestible waste. This create methane which can be burnt to generate heat and/or electricity. However, further investigation would be required to understand both the cost effectiveness and if the reduction in methane emissions would be worthwhile given such as system will still emit CO2.



CONSTRUCTION NET-ZERO PLAN

LMEs construction of new homes is out of scope as that is controlled by HFG, who have their own net-zero plans and construction will be complete within a few years.

However, homeowners will undertake "construction" on an ongoing basis. For example, building extensions or replacing parts of their home that have worn out, such as windows and patios.

While the such construction is an individual homeowner's choice there are community actions we can take to help and encourage homeowners to "construct" at or near net-zero. For example, advice on materials, products and contractors that have net-zero embodied CO2 – meaning the manufacturing and installation doesn't generate CO2. Plus of course the result of the work should help reduce energy usage and maybe a good opportunity to install a heat-pump.

Potential net-zero or at least CO2 reducing construction practices include

- Using wood from sustainable sources. For example, wood in windows, patios and construction materials.
- Using wood or composites for doors and windows rather than uPVC or aluminum – for example producing one ton of aluminum creates over 11 tons of CO2.
- Where metals are used ensuring they are produced net-zero, or at least low CO2. This is a significant area – steel production alone is 8% of global CO2 emissions.
- Avoiding the use of concrete by using alternative construction materials and where concrete is necessary using net-zero or at least low carbon concrete. Concrete is like steel in carbon emissions – around 8% of the total.
- Using net-zero or at least low carbon composite materials for patios, doors, and windows.
- Reducing the landfilling of removed fittings and fixtures, and any surplus building materials, through careful disassembly, and their sale or donation for reuse. (Life-cycle emissions savings)
- Ensuring that waste that cannot be reused, is recycled, or composted

In additional the plan will require assessing the heat efficiency of homes on LME, this may reveal a need to improve insulation of some homes, both to save energy and cost and make some forms of heating viable.

FINANCING PLAN

The implementation of the plan will have significant investment costs but should provide significant running cost savings.

Part of the planning will be to find ways to reduce and spread the costs:

- **Government grants and funding** – There is programmatic funding we will seek to tap into, such as funding towards heat pumps and EV chargers. There may also be opportunities to apply for special funding for larger scale community initiatives
- **Private and community funding** – We will explore private funding that could spread the investment costs as well as other models such as revenue share from renewable electricity generation and new innovative ways of raising funding such as NFTs

NEXT STEPS

The next steps to develop the plan will include:

- Broadening the sub-committee with additional interested homeowners and particularly homeowners with expertise in sustainability technologies and funding
- Engaging and consulting homeowners
- Engaging and collaborating with HFG and HML
- Develop GHG emissions inventory for the estate
- Identify and go after the low hanging fruit where we can make incremental improvements for little or no cost and effort
- Prioritse and complete feasibility studies for larger CAPEX projects (e.g. solar arrays)
- Develop governance model and decision making framework for CAPEX project
- Create a detailed, costed, plan with HFG and HML and consult with homeowners to approve a final plan and implement it