NET ZERO ADVISORY

Planning Energy Strategy Report

Client:	Dudsbury Homes Ltd
Project:	Alderholt Meadows
Title:	Planning Energy Strategy Report
Date Issued:	28/11/2023
Document Ref:	23040-XX-XX-X-RP-0001
Revision:	P02

Contents

Executive Summary

This report presents the energy strategy for Alderholt Meadows, an innovative development designed to meet the challenges of the future energy landscape. An assessment of the utility network has determined that a 6.2 MVA supply is necessary to accommodate the anticipated annual energy requirement of more than 700,000 kWh, upon the project's completion.

Dudsbury Homes' commitment to sustainability is reflected in the proposal to install extensive solar PV arrays, a mixture of roof-mounted and ground-based, to achieve a net-zero energy balance across the site. The introduction of microgrids, serving approximately 200 homes each, will ensure efficient energy distribution and management for each phase of the development. These microgrids will be equipped with advanced Battery Energy Storage Systems (BESS) and intelligent control mechanisms, providing resilience and optimising the local energy economy.

A cost-viability analysis has revealed that by deploying a smart grid with solar PV and batteries at Alderholt Meadows, there is significant potnetial to generate revenue from energy sales, enhancing the financial sustainability of the scheme.

This report introduce necessary stakeholder considerations, regulatory compliance, and potential ESCo structures, ensuring the project aligns with best practices and legal standards. Predicted energy consumption models demonstrate that the implementation of microgrids could increase on-site energy self-consumption from 33% to 55%, effectively reducing the dependency on the local and national grid. Additionally, a cost-benefit analysis highlights the economic returns of the microgrid system, with the potential for savings to be passed on to residents, making sustainable living both accessible and affordable.

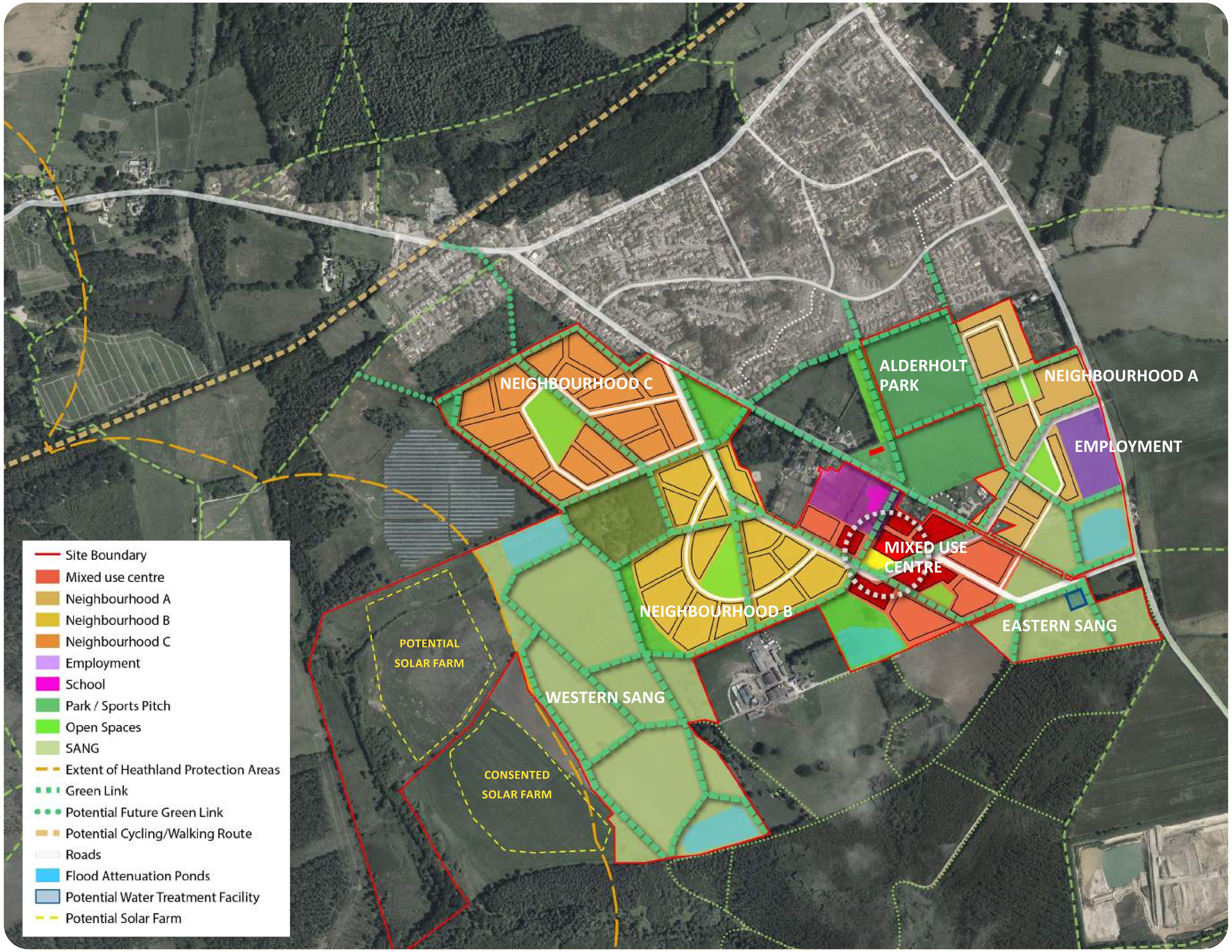
Alderholt Meadows is designed to be a leader in the transition to a more sustainable energy future, showcasing how innovative planning and technology can come together to create an communal energy scheme that aligns with our net zero targets.

1.0 Introduction

1.0 Introduction

1.1 Site Overview

Alderholt Meadows, located near Fordingbridge, Verwood, Ringwood, and Wimborne in Dorset, is set to become a landmark development in sustainable living. Spanning 122 hectares to the south and west of Alderholt village, the proposed site is designed to accommodate up to 1,700 new dwellings, with a focus on affordable housing and integrated care facilities. In addition, plans for 10,000 square meters of business park aim to create significant employment opportunities. The village centre will bring together retail, commercial, community, and health services, complemented by open spaces for recreation, including Suitable Alternative Natural Greenspace (SANG) and initiatives for biodiversity enhancement. The development is also set to feature a solar array to support clean energy generation, alongside the construction of new roads and access infrastructure, making Alderholt Meadows a blueprint for future developments in the region.



1.2 Purpose of this Report

This report outlines Dudsbury Homes' commitment to establishing a microgrid for Alderholt Meadows. Our objective is to create a flexible power network that can adapt to varying energy demands, maximise the utilisation of onsite renewable energy generation, and minimise reliance on the external grid. This will not only reduce the overall environmental impact but also empower residents to be active participants in a progressive, demand-responsive energy system. The strategy is designed to future-proof energy provision, ensuring that Alderholt Meadows leads the way in sustainable development.

1.0 Introduction

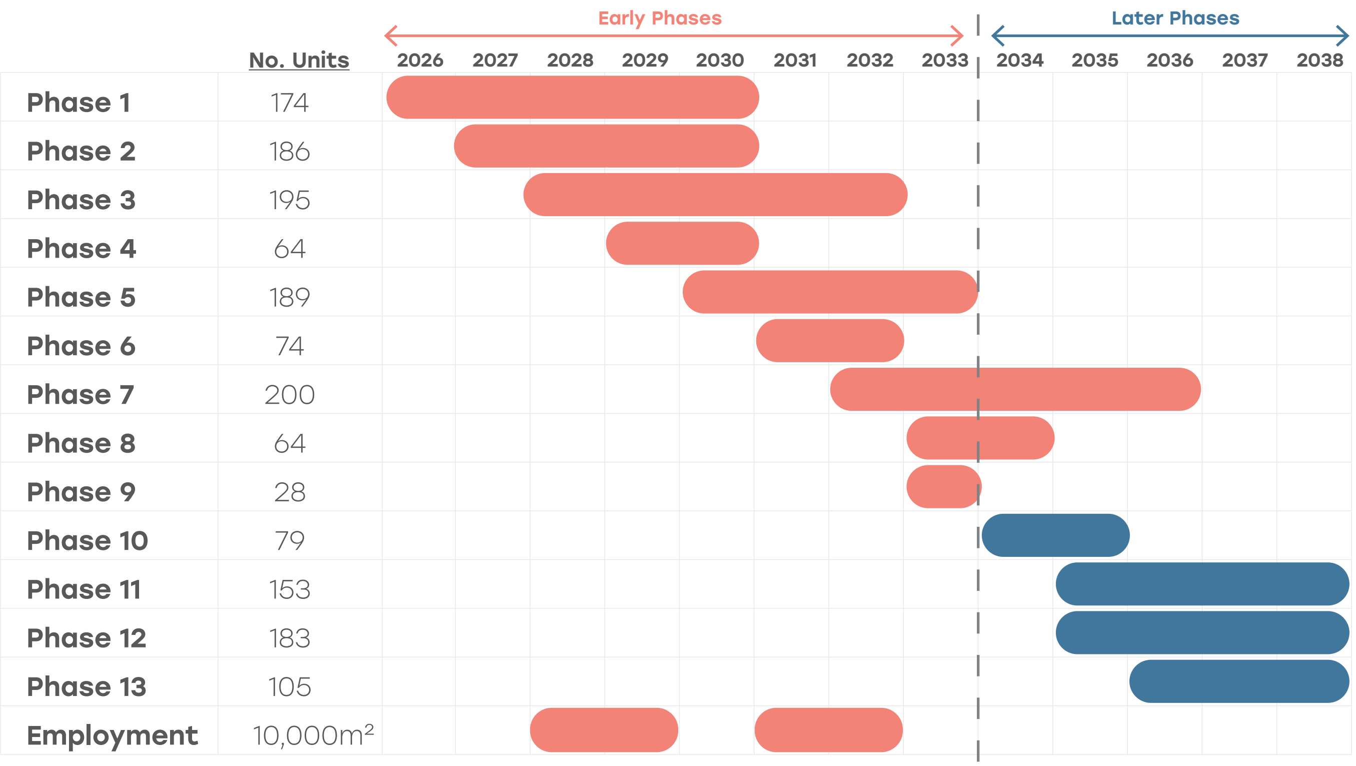
1.3 Development Information

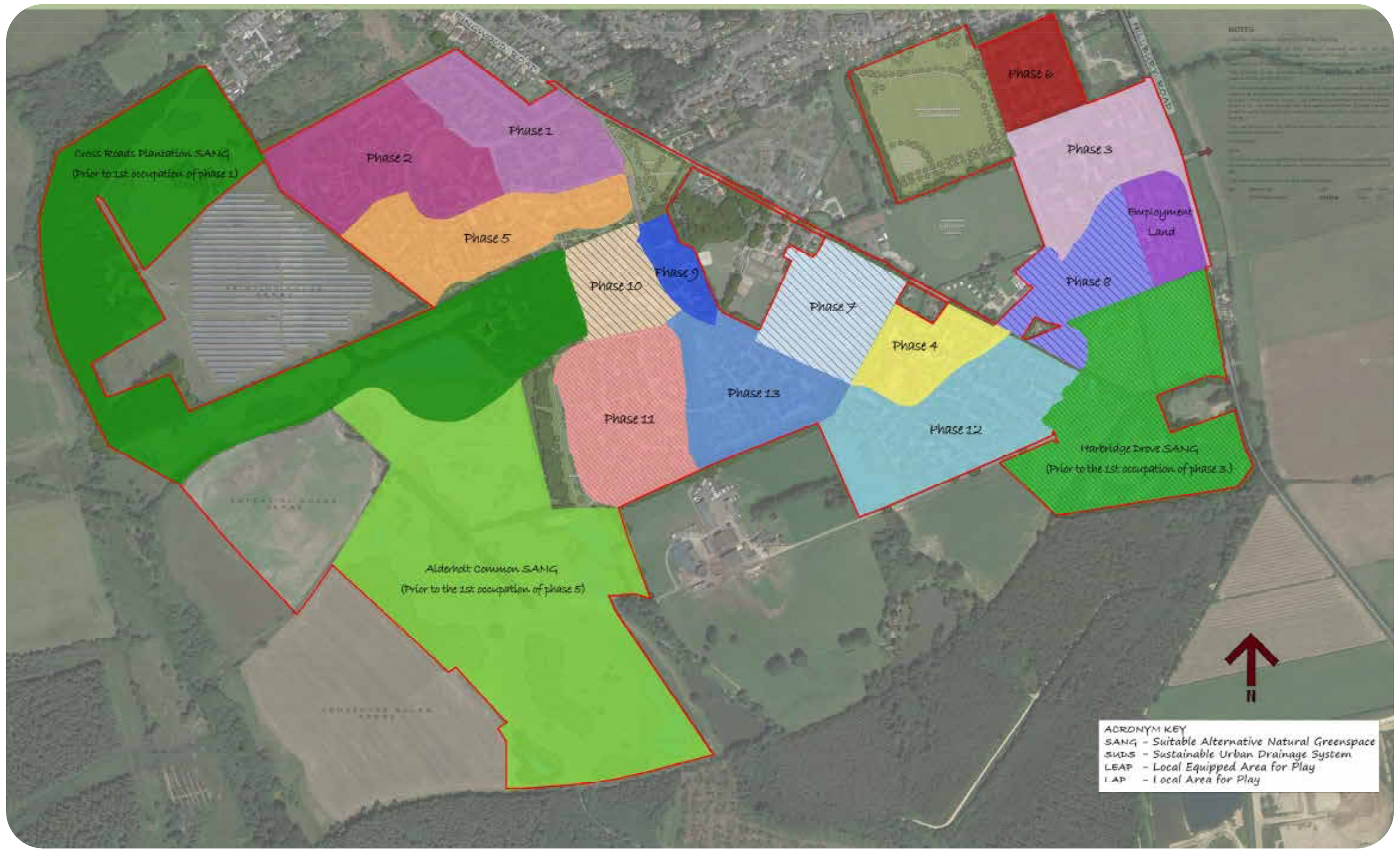
Alderholt Meadows is envisioned as a garden village that will become home to approximately 1,700 new households, located between Cranborne Chase and the New Forest. The development is set to be a vibrant community with a mix of residential and key non-residential facilities, including employment spacesl, and health and retail services.

This report does not delve in to the indivdiual building-level specifcs of energy demand as this will be refined durig the early design stages of each phase.. However, these elements will play an important role in influencing the overall energy strategy for Alderholt Meadows. Consequently, this report serves as a flexible guideline to inform the energy strategy as the design of the village evolves through each stage of development.

The phased construction of Alderholt Meadows is scheduled to commence in 2026, with initial development focused on the northeastern and western sections of the site with site completion targetted for 2034. Throughout the site, there is a prime opportunity to integrate extensive solar PV installations, both ground-mounted and on rooftops, to bolster the site's commitment to sustainable energy – details of which are explored in section 2.2.

To guarantee consistent energy availability and security for all residents, the development of site-wide infrastructure will be designed so suit the phasing plan, ensuring a seamless transition into a future-proofed, energy-efficient community.





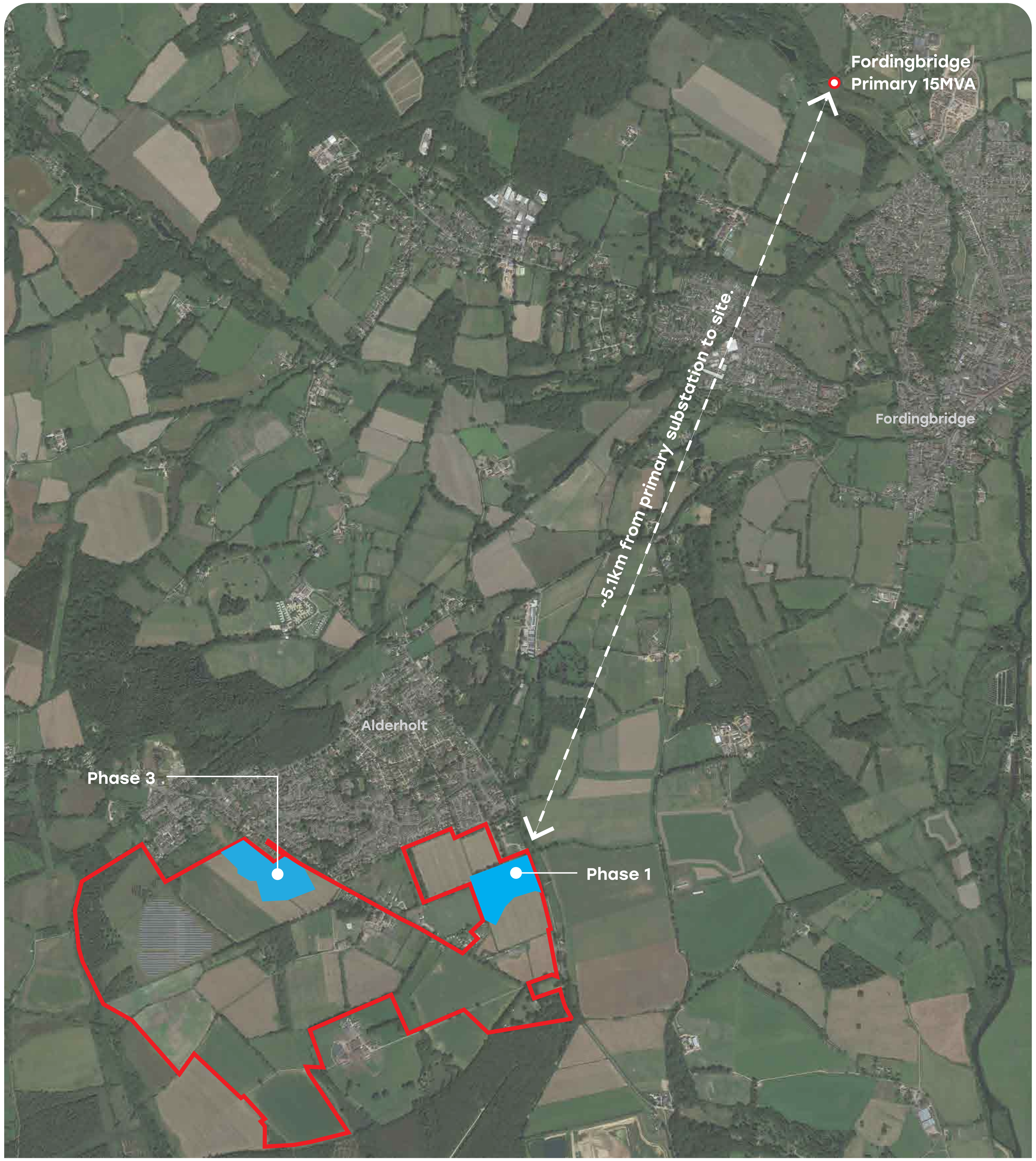
1.0 Introduction

1.4 Power Capacity

The regional Distribution Network Operator (DNO), Scottish and Southern Electricity Networks (SSEN), has been involved in preliminary assessments for Alderholt Meadows. Hydrock Consultants Ltd conducted an Outline Utilities Strategy report, which includes a load calculation. This analysis indicates that the development will require a 6.2 MVA supply. A quote from SSEN places the estimated cost for this new supply between £8.2 million and £9 million for all non-contestable and contestable works. Further details can be found in Hydrock report 20016-EUTI-XX-XX-DD-Y-3000.

A more detailed feasibility study by SSEN estimates the infrastructure costs for providing this power at £6.4 million. This investment would cover a new 11kV Point of Connection (PoC) at the site's boundary, network upgrades, and two new high voltage cables extending to the Fordingbridge Primary substation, approximately 5 kilometers from the site. On-site work would also be required to ensure energy distribution for each development phase, the costs for which have been allowed in Rapleys' Infrastructure Cost Estimate document.

SSEN has confirmed the availability of the full site load, and indicated that it could be delivered to site within three years from placing the order. To ensure that construction can begin at the earliest stage possible, Net Zero Advisory (NZA) has submitted additional budget applications to SSEN for the first and third phases, aiming to determine the timeline for these phases to become operational. Furthermore, a review of SSEN's capacity mapping tool and Long Term Development Statement (LTSD) suggests that there is capacity within the network to provide a 6.2 MVA supply for Alderholt Meadows. Based on similar works undertaken by other DNOs, the timeframe to supply the site could be well within three years before site works commence.



2.0 Energy Assessment

2.0 Energy Assessment

2.1 Building Energy Demand

Dudsbury Homes is committed to delivering excellence in building design, with a commitment to sustainability and energy efficiency. To significantly reduce energy demand, our strategy incorporates a 'fabric first' approach, which includes the following measures:

- **Intelligent Design and Orientation**: The layout of each building will be strategically designed to harness natural light and warmth, reducing the need for artificial heating and lighting.
- **High Performance Insulation**: Homes will be wrapped in high-performance insulation, cutting heat loss and maintaining comfort with less energy.
- **Minimised Thermal Bridging**: Construction methods will be employed to minimise thermal bridging, ensuring that junctions do not act as pathways for heat loss..
- **Airtightness**: Precision detailing will ensure homes are airtight, locking in warmth and efficiency.
- **Efficient Building Systems:** Energy systems within homes will be high efficiency, incorporating features such as mechanical ventilation with heat recovery (MVHR) for minimal energy use.
- **Optimised Glazing:** Windows and will be optimised for solar gain, allowing for natural heating during cooler months while mitigating overheating through shading solutions.

Embracing an all-electric design ethos, the development will leverage heat pump technologies to provide heating solutions that are both cost-effective and energy-efficient. Complementing this, solar PV installations will play a crucial role in on-site energy generation, contributing substantially to the buildings' energy requirements (further details are provided on the following page).

2.1.1 FHS vs LETI

Coinciding with the introduction of the government's Future Homes Standard (FHS) in 2025, Alderholt Meadows is positioned to be at the forefront of this initiative. The FHS targets a significant reduction in carbon emissions, aiming for homes to achieve 60% lower CO2 emissions compared to the current standards outlined in Part L 2021.

Alderholt Meadows aspires to exceed the baseline set by Building Regulations and will be guided by the London Energy Transformation Initiative (LETI) Climate Emergency Design Guide to attain net-zero operational carbon. This includes surpassing the fabric thermal performance and energy efficiency standards of the FHS and generating each building's annual energy needs through on-site solar PV.

LETI describes a building with net-zero operational carbon as "**one that operates without fossil fuels, is entirely powered by renewable energy, and aligns with our national climate targets**". Alderholt Meadows aims to not only meet these standards but is actively pushing the boundaries to set a new benchmark for sustainable living.

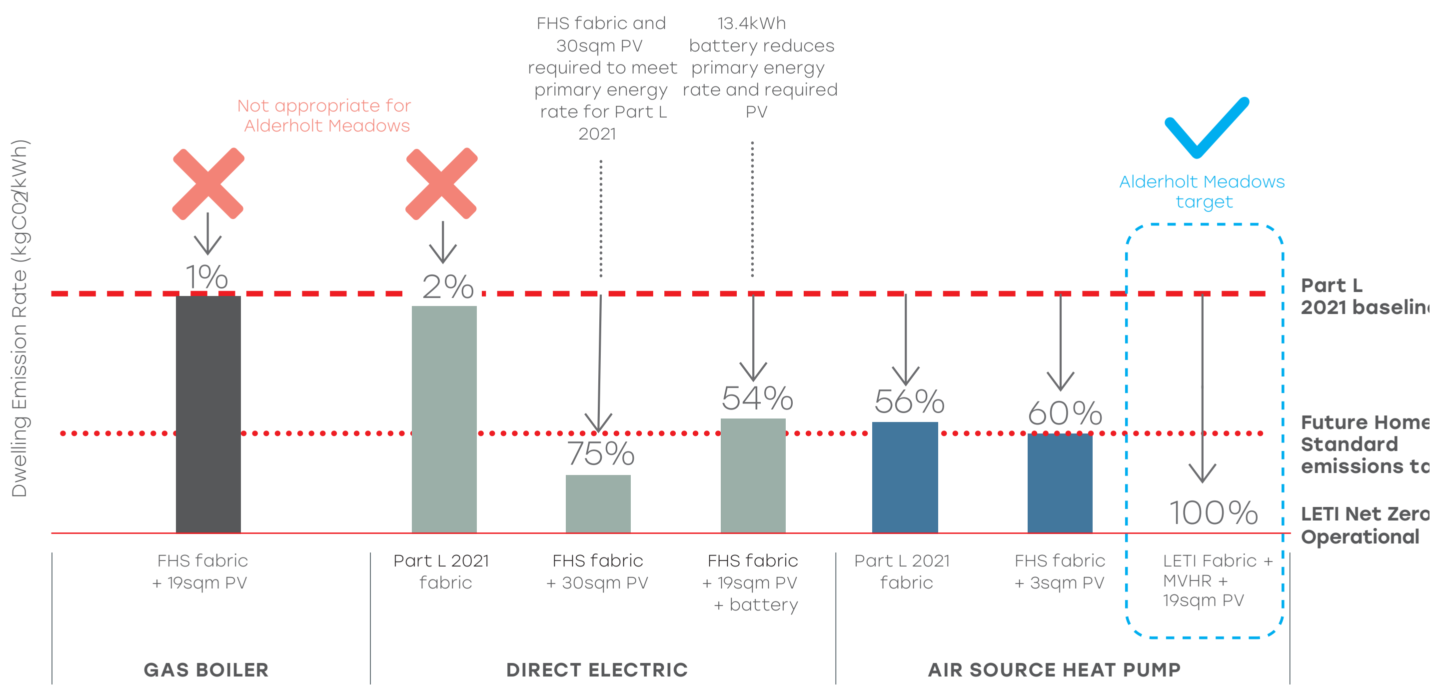


Figure 1: Dwelling emissions rate for a typical 3-bed semi-detached home under a variety of servicing strategies under the emerging SAP/Part L 2021 methodology (source: Hoare Lea)

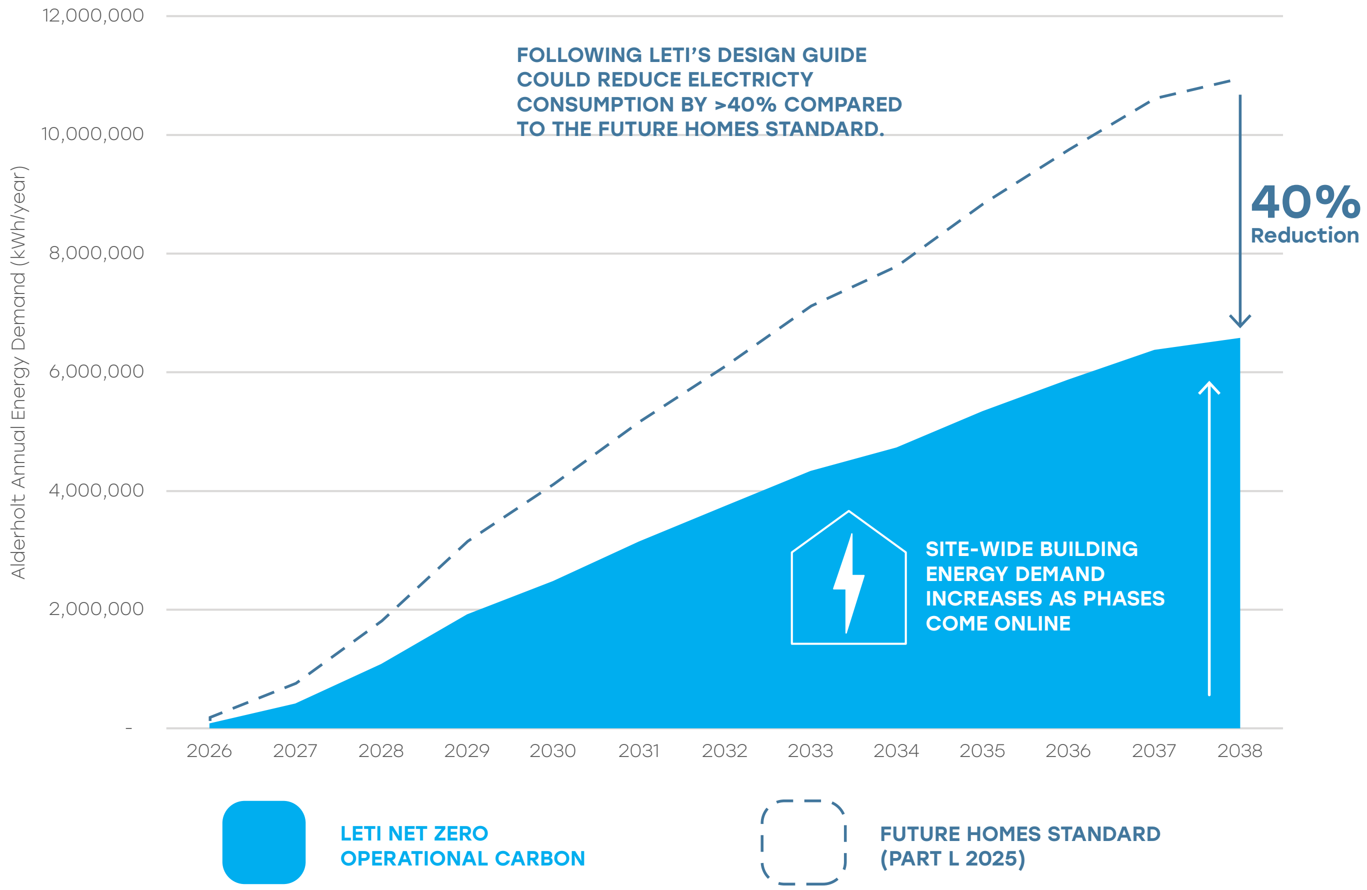


Figure 2: Alderholt Meadows sitewide annual building energy demand during phased construction

2.0 Energy Assessment

2.2 Generation

Alderholt Meadows aims to maximise energy self-sufficiency with a significant solar PV initiative. The goal is to achieve a net zero energy balance, where annual solar generation aligns with the site's consumption needs.

Approximately 18.5 acres within the development have been earmarked for a ground-mounted solar array, with an adjacent 16.4 acres already consented for use. This area could support a combined 7 MWp solar farm, projected to produce around 7,329,000 kWh annually – exceeding the development's estimated building energy demand by an additional 10%.

Given the arrays' location, the energy distribution system's design will be crucial to avoid excessive cabling costs. Dudsbury Homes is committed to implementing the most cost-efficient energy solutions as the project evolves. The strategy may include a combination of ground and rooftop-mounted PV systems to ensure low energy costs and enhance site resilience.

Dudsbury Homes will adopt the most cost effective approach to meeting the site's energy needs and this will be reviewed as the design develops. The design could include a mixture of ground-mounted and roof-mounted PV to minimise the cost of energy to residents and provide the greatest reslience to the site.The figure below illustrates the potential of solar PV systems relative to the annual energy demand across Alderholt Meadows as it progresses through its phases.

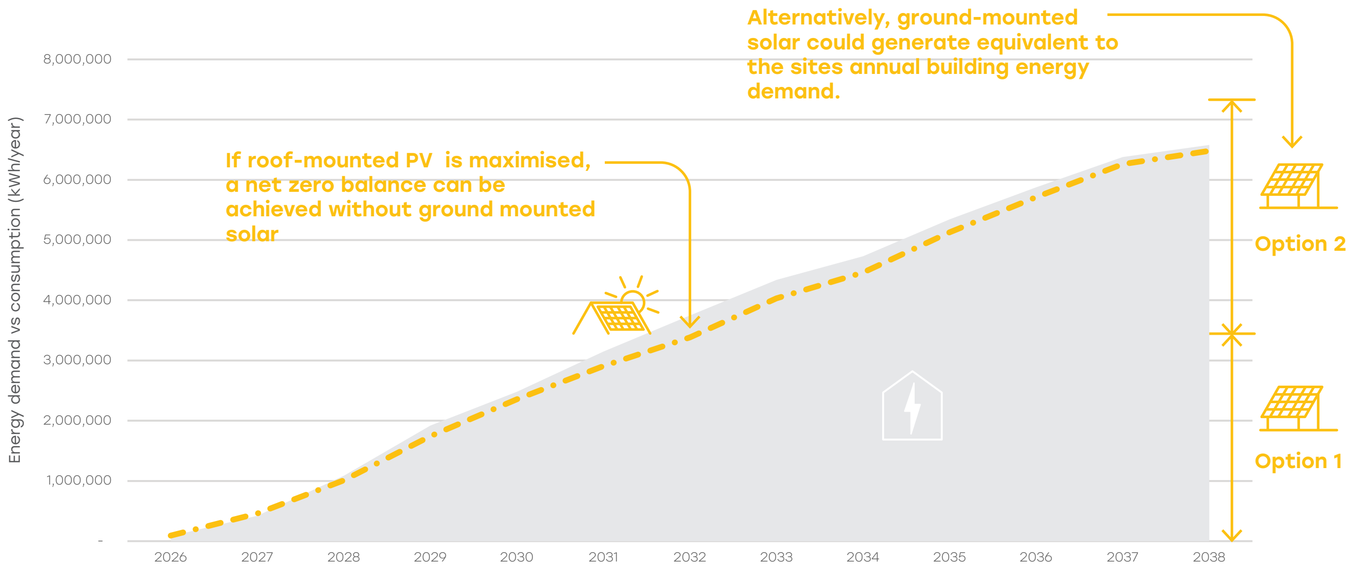


Figure 3: Alderholt Meadows annual building energy demand compared to potential solar PV generation

3.0 Microgrid Overview

3.0 Microgrid Overview

3.1 Traditional vs Micrograds

3.1.1 Traditional Grid

Historically, the flow of energy has been primarily ‘one way’ – from the large, industrial-scale coal- and gas-fired power plants on the transmission network, through the distribution networks, to consumers. As we move towards more renewable sources and storage solutions at the consumer level, the system is shifting towards a bidirectional flow. This ‘decentralisation’ presents challenges in balancing the energy supply with demand.

The shift from predictable, controllable fossil-fuel generation to intermittent renewables such as wind and solar complicates the management of peak demands. While low carbon solutions like energy storage are emerging, fossil fuels often fill the gap when demand outstrips renewable supply. Conversely, excess renewable energy can go to waste when not managed effectively.

The path to a net zero carbon electricity system necessitates enhanced flexibility in energy demand. Buildings that actively contribute to the energy network are crucial for this transition, aligning with our Net Zero ambitions. This is the ambition for Alderholt Meadows.

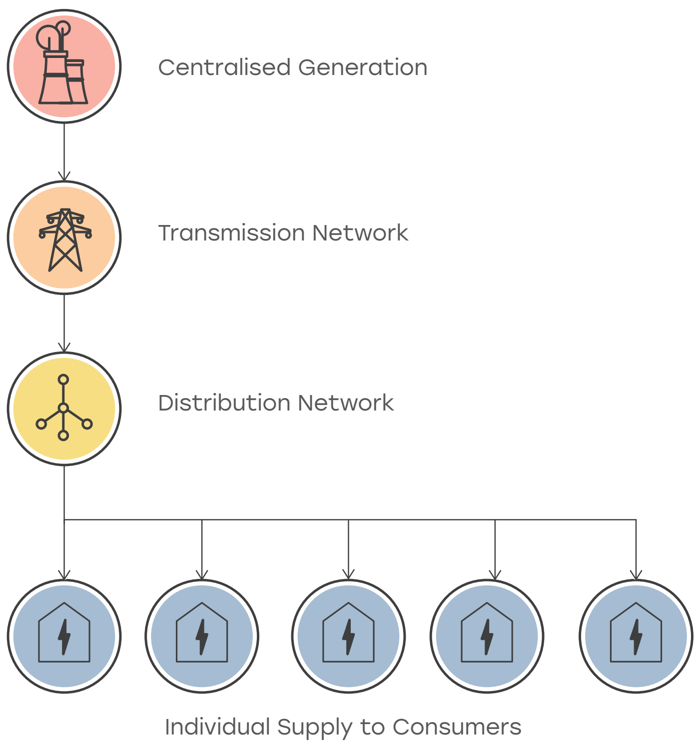
3.1.1 Microgrids

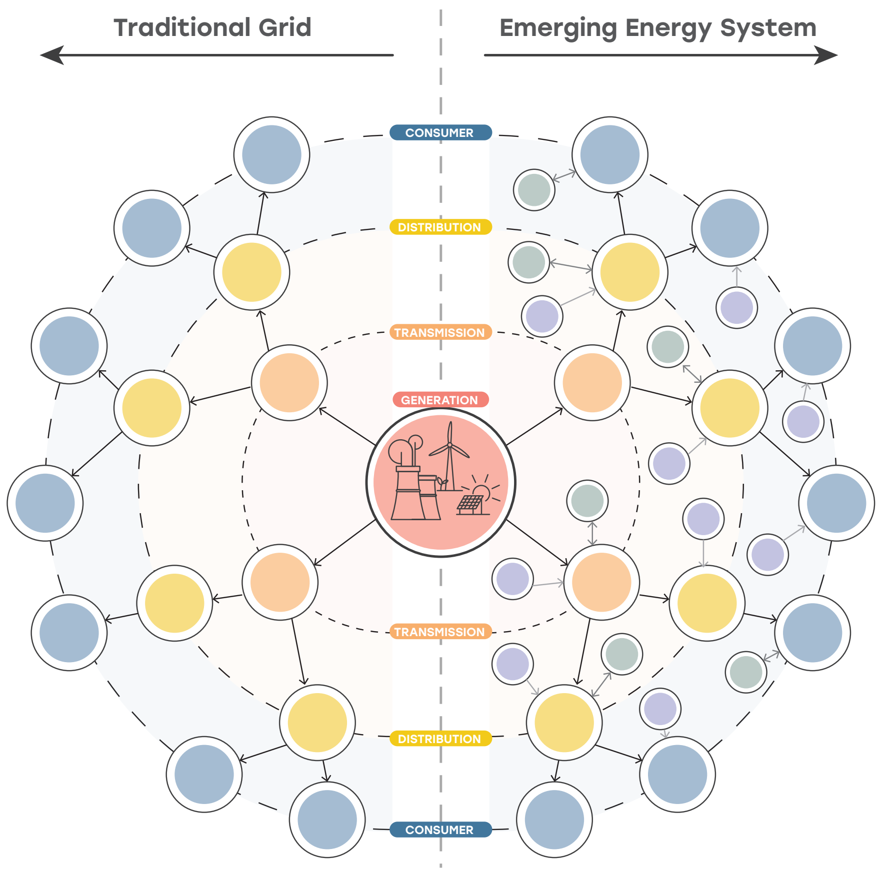
Microgrids embody a paradigm shift in energy management, operating as self-contained power ecosystems at a smaller scale. They integrate distributed energy resources (DERs) like solar panels, wind turbines, and batteries to balance local energy production and consumption. They offer a cleaner, more sustainable energy alternative by generating power close to where it’s used.

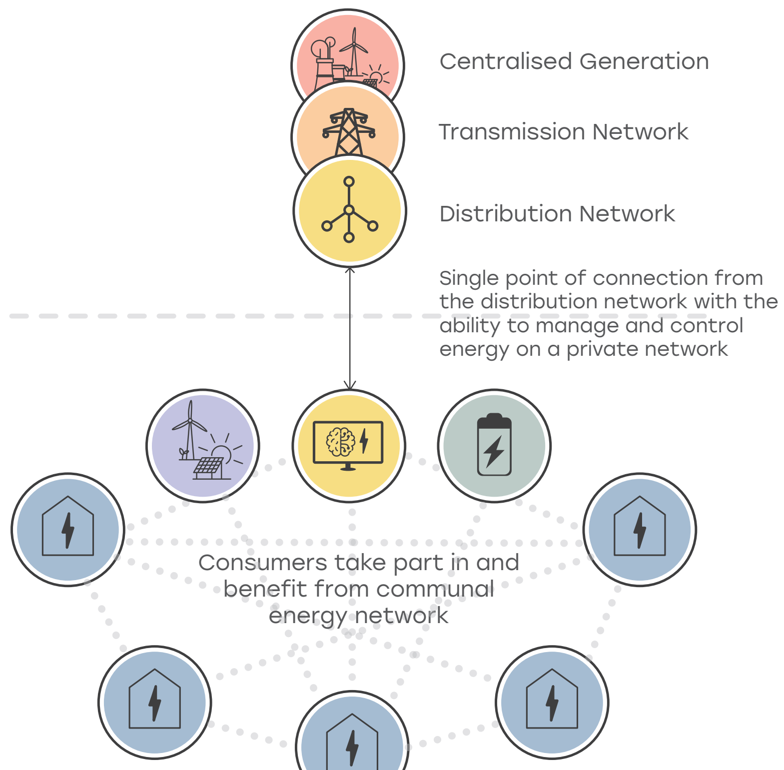
These systems typically maintain a connection to the main grid for resilience, but the true innovation lies in their ability to operate independently, ensuring reliability even during outages. Microgrids are managed through sophisticated control systems, optimising energy use and providing a seamless, efficient service.

What truly sets microgrids apart is their ability to make energy procurement decisions. They can purchase energy when prices are low and store it for use when prices are high–a practice known as energy arbitrage. This not only saves money but also stabilises the grid by leveling out the peaks and troughs of energy demand. Moreover, during times when the microgrid produces more energy than it needs, it can sell the surplus back to the main grid. This turns a community into a small-scale power plant, capable of generating revenue while contributing to a sustainable energy ecosystem.

For residents and businesses within Alderholt Meadows, the microgrid isn’t just about reliability; it’s about actively participating in a greener, more resilient future.





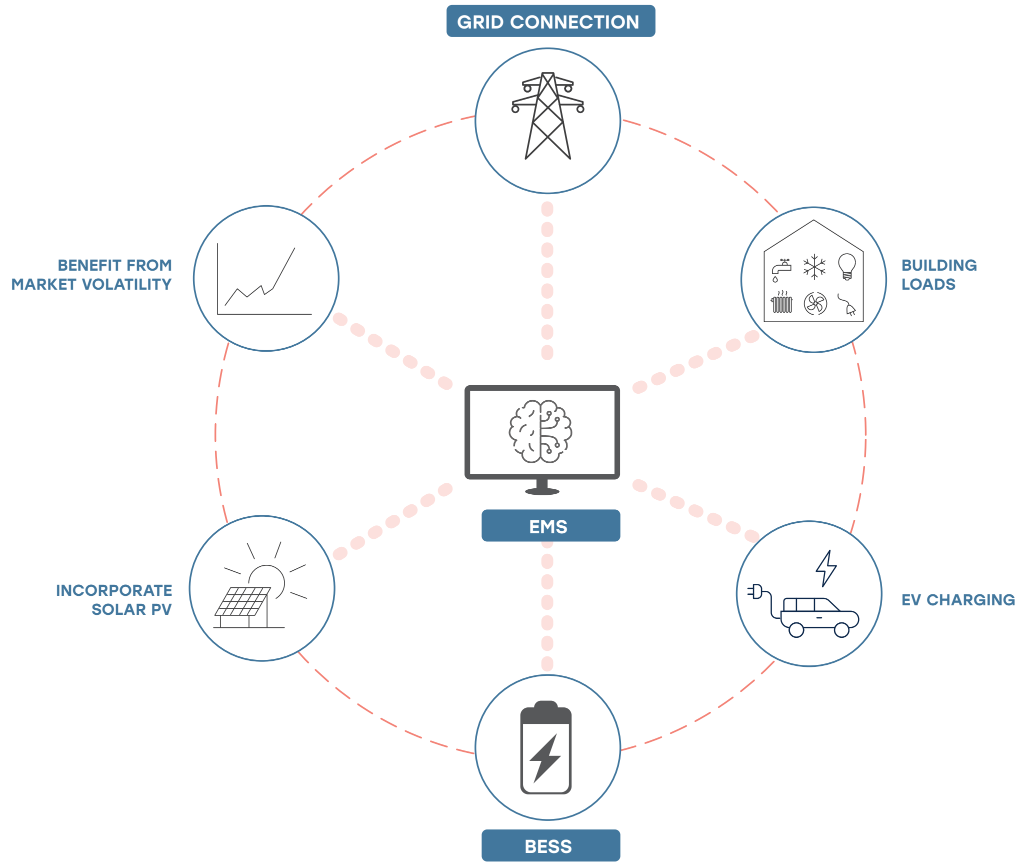


3.0 Microgrid Overview

3.2 Microgrid Operation

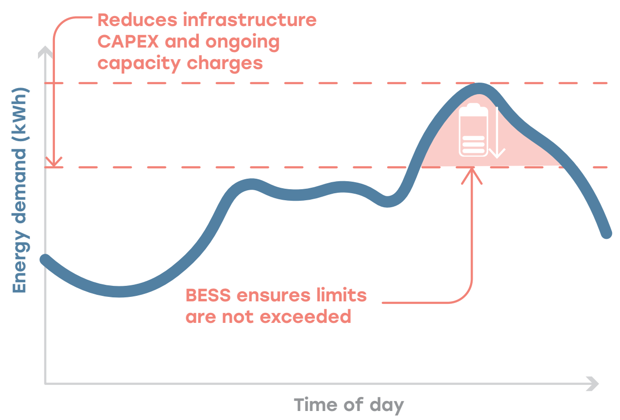
Battery Energy Storage Systems (BESS) are the cornerstone of a modern microgrid's functionality, offering unparalleled rapid response capabilities. This unique attribute allows BESS to react instantaneously to changes in energy demand or supply, a feat unattainable by more traditional energy technologies. At the core of these systems are advanced Energy Management Systems (EMS), which perform real-time analysis and automated decision-making, ensuring optimal energy distribution. This ability not only enhances the stability and efficiency of the microgrid but also unlocks access to a variety of energy markets while supporting the broader grid network.

The images on this page clearly show the role of the BESS and EMS in integrating Alderholt Meadows' homes, electric vehicle (EV) charging infrastructure, energy storage, and on-site generation with the wider grid. This integration is key to delivering a sustainable, resilient, and cost-efficient energy supply for the community.



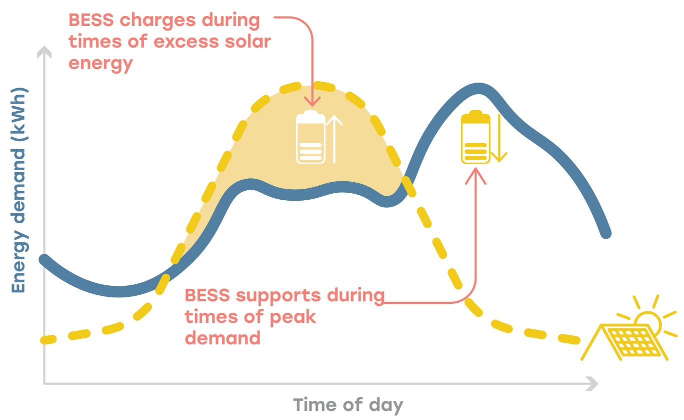
Peak Shaving

BESS can reduce energy usage during high-demand periods, which not only minimises the size of the grid connection needed but also cuts ongoing operational costs. A lower peak load benefits the Distribution Network Operator (SSEN) by alleviating strain on their network.



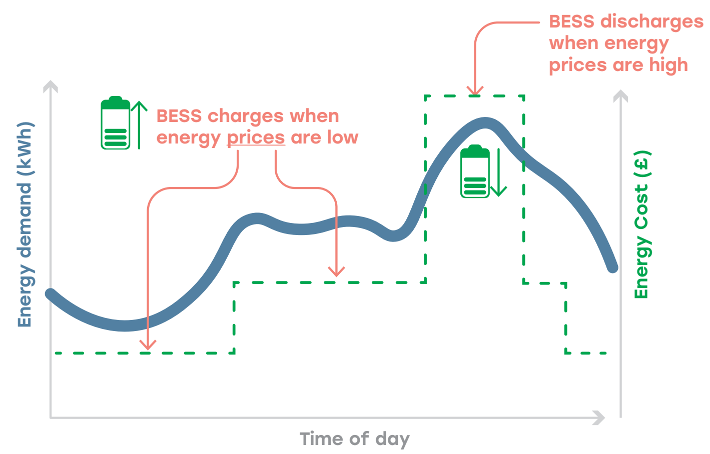
Solar Load Shifting

A fundamental benefit of BESS is its ability to store excess solar energy produced during periods of low demand. This enhances the site's energy independence and reduces the need for grid imports.



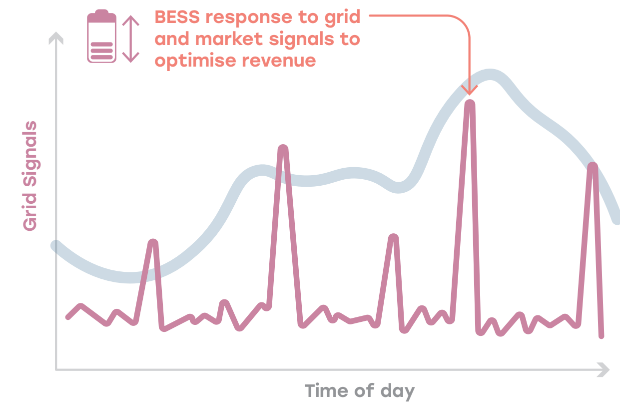
Smart Charging

Intelligent BESS utilise energy market data to determine the most economical times for charging. By tapping into day-ahead or intra-day markets, the system can exploit price dips—even profiting by charging when excess renewable energy is abundant.



Grid Services

Beyond managing site energy needs, BESS can participate in various grid support markets, such as the Balancing Mechanism and Frequency Response. These services offer additional income streams, optimizing the financial viability of the microgrid during times when on-site demand is low.



3.0 Microgrid Overview

3.3 Stakeholder Assessment

When planning the development of a microgrid, it is crucial to consider the perspectives and impacts on various stakeholders involved. Each group – from energy providers and developers to residents – plays a unique role and stands to benefit differently from the implementation of a microgrid. Understanding these roles and potential advantages is essential for creating a system that is not only operationally effective but also supports the interests and requirements of all parties.

The table below summarises the stakeholder impact assessment for Alderholt Meadows' microgrid initiative:

Stakeholder	Role in Microgrid Development	Benefits of Microgrid Implementation
National Grid, OFGEM and SSEN	Provide infrastructure and regulatory framework; facilitate grid connection and energy distribution.	Improved load management, reduced peak demand stress, potential revenue from energy transactions with the microgrid.
Dudsbury Homes	Oversee development, integrate microgrid into housing projects, maintain stakeholder relationships.	Enhanced marketability of homes, potential for increased property value, reduced long-term operational costs.
Energy Services Company (ESCo)	Manage energy generation, storage, and supply within the microgrid; handle contracts and energy sales.	Stable revenue through energy sales and services, increased customer engagement, leadership in sustainable energy solutions.
Residents	Consume energy, interact with the microgrid through smart home systems and EV charging.	Access to reliable and clean energy, potential cost savings on energy bills, active participation in a sustainable community.

3.4 Regulations

The deployment of a microgrid at Alderholt Meadows is subject to regulatory frameworks, particularly the Electricity Act 1989, which sets out the licence exemption criteria for electricity generation, distribution, and supply. The thresholds established by this legislation* define the scale at which a microgrid can operate without requiring a full license.

Licence Exemption Thresholds: The microgrid's physical infrastructure must align with specific criteria for residential and commercial entities regarding generation, distribution, and supply to avoid the need for a full license.

	GENERATION	DISTRIBUTION	SUPPLY
Residential	10 MW	1 MW	1 MW
Commercial	10 MW	None	100 MW

Licensing Requirements: Exceeding these exemption thresholds necessitates obtaining the appropriate license, potentially requiring collaboration with an Independent Distribution Network Operator (IDNO) or other entities to maintain compliance.

In alignment with the Electricity Act 1989, residents at Alderholt Meadows must be afforded the ability to choose their energy supplier freely. Even though an ESCo would provide energy services within the microgrid, it is legally mandated that residents can access the open market if they prefer alternative options. This requirement serves as a powerful incentive for the ESCo to offer competitive rates and services, knowing that residents have the liberty to switch providers. While the ESCo is designed to deliver bespoke energy solutions to the community, it must also ensure its offerings are compelling enough to mitigate the complexity and cost implications of residents choosing to leave the microgrid.

It's important to note that while the information provided acts as a general guideline, it is essential to conduct a detailed, project-specific review to ensure full regulatory compliance.

3.5 ESCo Structure

An Energy Services Company (ESCo) is a dedicated business that provides energy solutions, including the design, implementation, and management of energy-saving projects, retrofitting, energy conservation, infrastructure services, power generation, energy supply, and risk management.

At its core, an ESCo aims to ensure energy efficiency and reliability, aligning its financial success with the sustained performance of the systems it operates. This alignment creates a win-win situation–increasing energy efficiency not only reduces operational costs and carbon footprint for residents and businesses but also generates consistent revenue for the ESCo.

Within the context of microgrids, an ESCo typically takes on the role of energy supplier, managing the complexities of energy generation and distribution. ESCos can be structured in various ways, ranging from non-profit, community-owned models to more traditional commercial entities, reflecting the diverse needs and goals of different projects.

For the Alderholt development, Dudsbury Homes is considering the establishment of an ESCo to spearhead its low carbon energy strategy. This could involve several potential structures:

- **Third-Party ESCo**: Engaging with an external provider through an Energy Services Agreement (ESA) to manage the energy scheme.
- **Joint Venture (JV)**: Collaborating with a partner to form an ESCo that will jointly develop the energy scheme.
- **Project Sponsor ESCo**: Creating a fully owned ESCo subsidiary to directly manage the project's energy needs.
- **In-House Delivery**: Developing the energy scheme internally, without a separate ESCo structure.

Choosing the right model for Alderholt will hinge on several factors, such as financial objectives, control over the project, and long-term sustainability goals. The selection process will involve a careful assessment of the potential structures, each with its unique implications for delivery, management, and profitability.

4.0 Alderholt Smart Grid

4.0 Alderholt Smart Grid

4.1 Microgrid Arrangement

Alderholt Meadows will be built in phases as outlined in section 1.3, with its microgrid infrastructure expanding to support the development's phased construction. This approach ensures the energy network adapts seamlessly to the community's growing needs.

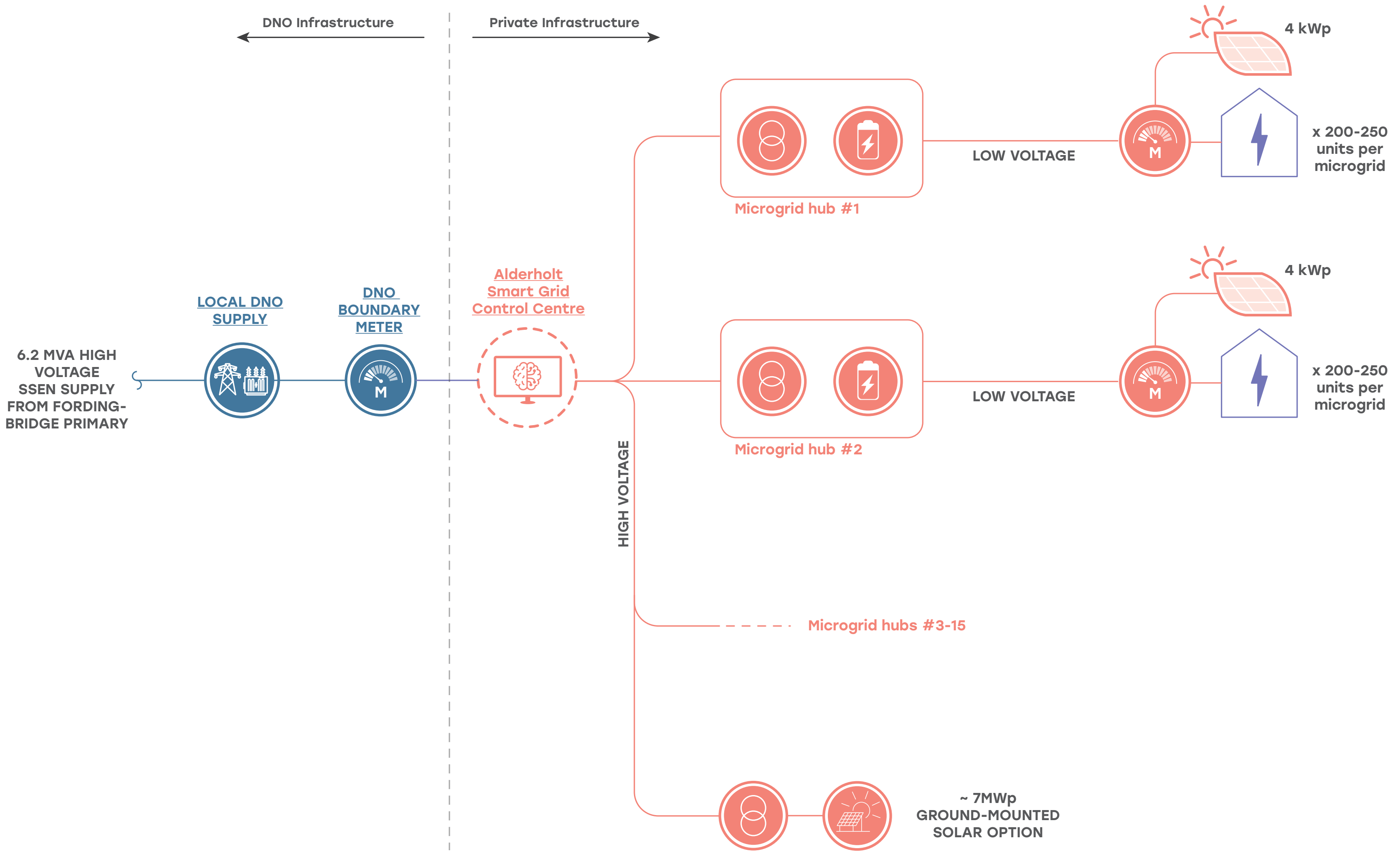
The physical arrangement of each microgrid is guided by the licence exemption thresholds for distribution and supply, as detailed in section 3.4 of the report. This means that each microgrid will capably serve between 200-250 homes, based on the all-electric, energy-efficient design of the buildings. For the non-residential elements, the system will be custom-tailored to meet the specific demands of each segment.

Key components of each microgrid include:

- **High Voltage (HV) Connection**: Each microgrid will be linked to the site's HV network, which may be managed by the ESCo or an Independent Distribution Network Operator (IDNO), depending on the final design.
- **Energy Management Hub**: Central to the microgrid will be a compact unit housing a transformer, a Battery Energy Storage System (BESS), inverters, and control systems. This hub, approximately the size of a 40ft shipping container, will be integrated into the landscape with design consideration for local architectural styles.
- **Private Low Voltage (LV) Network**: A dedicated LV network will distribute energy to each property, complete with resident meters and the digital framework required for active participation in the microgrid.
- **Solar PV Integration**: Both roof-mounted and ground-mounted solar PV will contribute to the network, with a fair distribution system ensuring equitable energy sharing, regardless of individual properties' solar potential. The specific configuration of solar connectivity remains to be finalised.

Furthermore, the microgrid could incorporate public EV charging stations and facilitate community EV clubs as part of the ESCo's services. It may also serve as a community hub, fostering initiatives like local delivery services for last-mile logistics, shared community spaces for sustainability workshops, or even urban farming projects to promote local produce.

As Alderholt Meadows develops, additional microgrids will be constructed, each capable of inter-communication and energy sharing. This interconnectedness not only enhances site-wide resilience but also brings the cumulative advantages of a larger, integrated energy system.

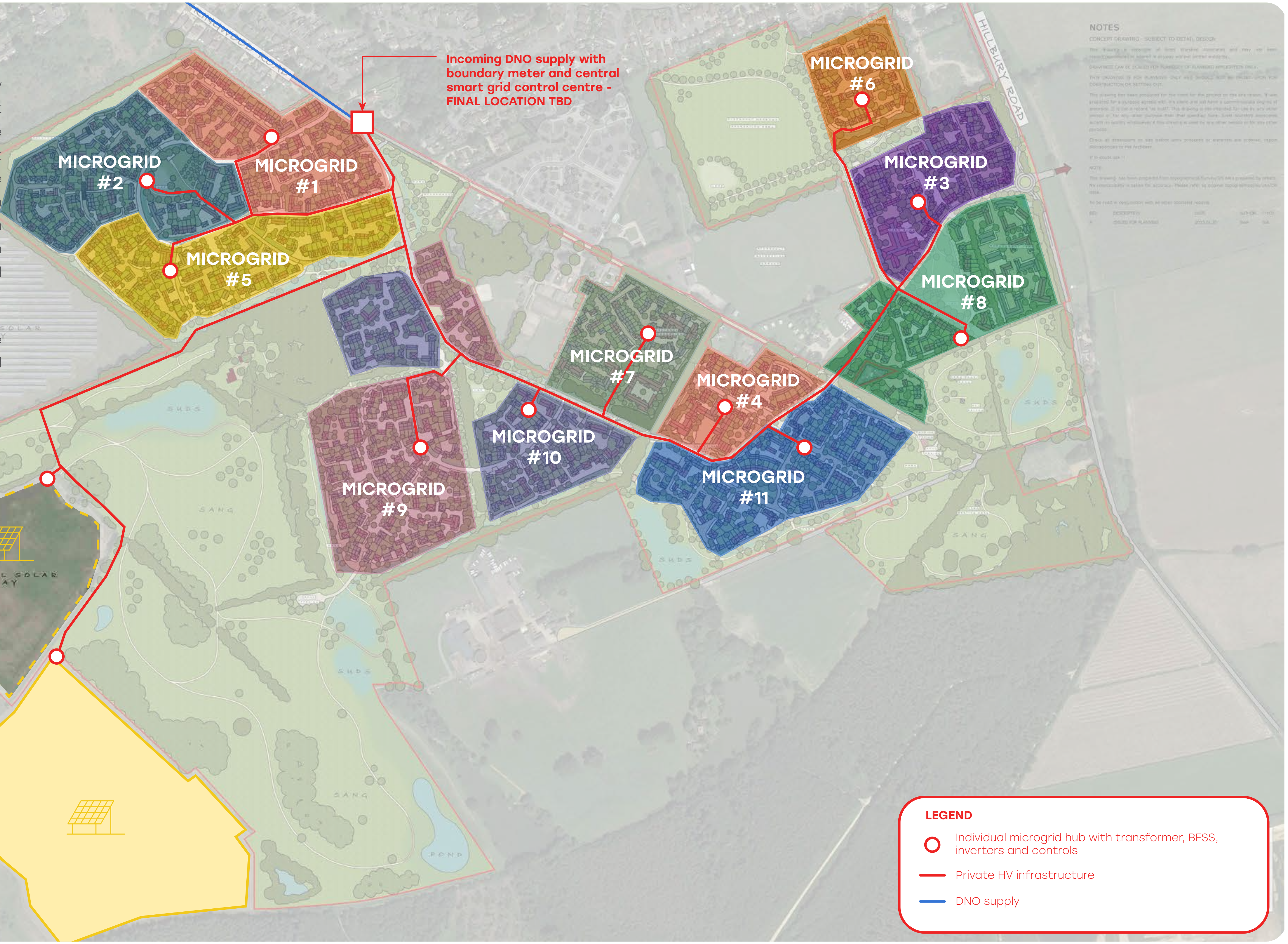


4.0 Alderholt Smart Grid

4.2 Sitewide Strategy

The accompanying figure presents an overview of the proposed microgrid setup at Alderholt Meadows, illustrating how each microgrid zone could be configured within the development. It highlights the high-voltage (HV) infrastructure that forms the backbone of energy distribution across the various phases of construction with packaged microgrid hubs (complete with transformer, battery system, inverters and controls) within each microgrid zone.

All locations, routes and quantities are indicative and subject to final design by the microgrid contractor.



4.0 Alderholt Smart Grid

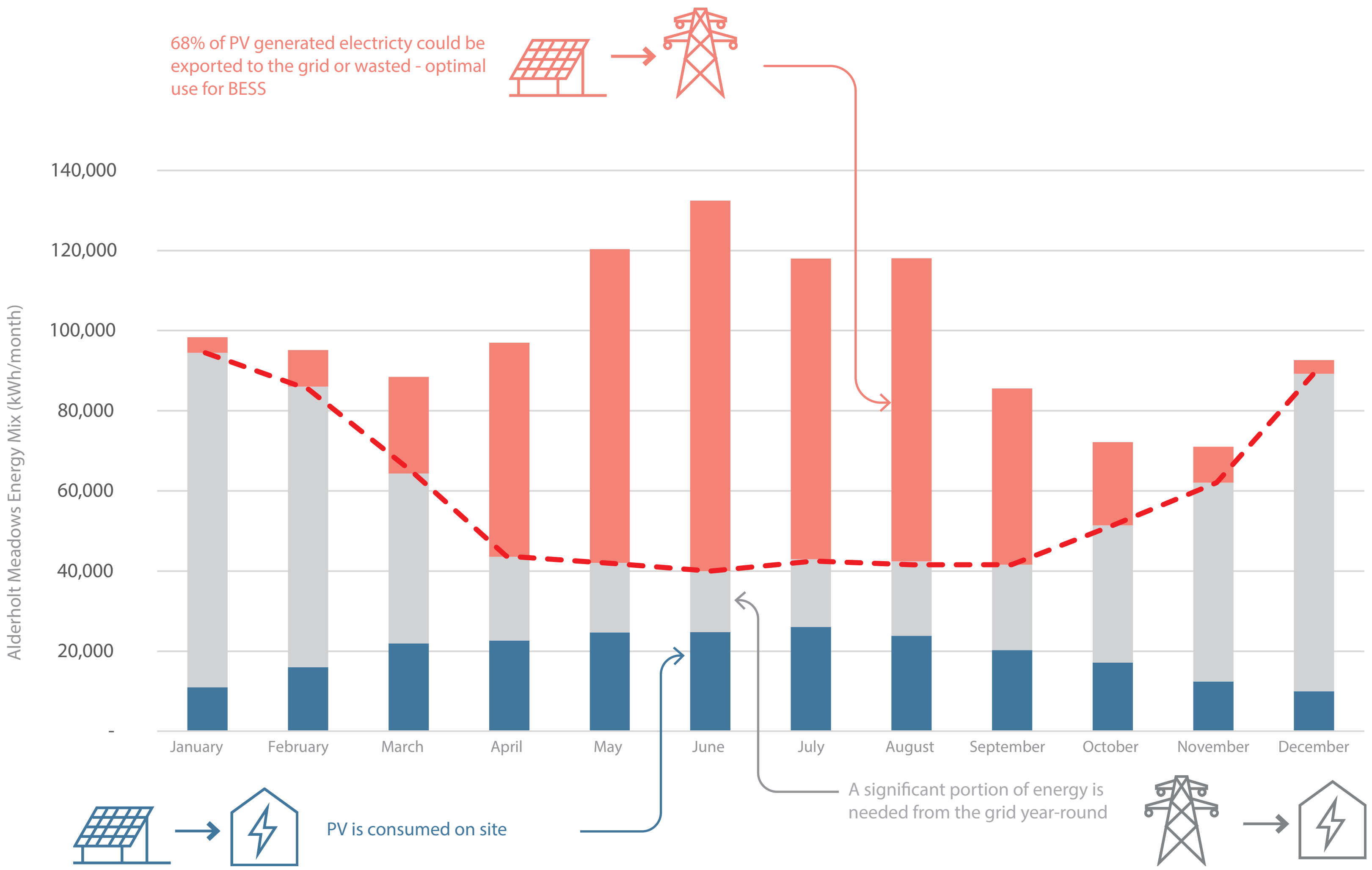
4.3 Energy Balance

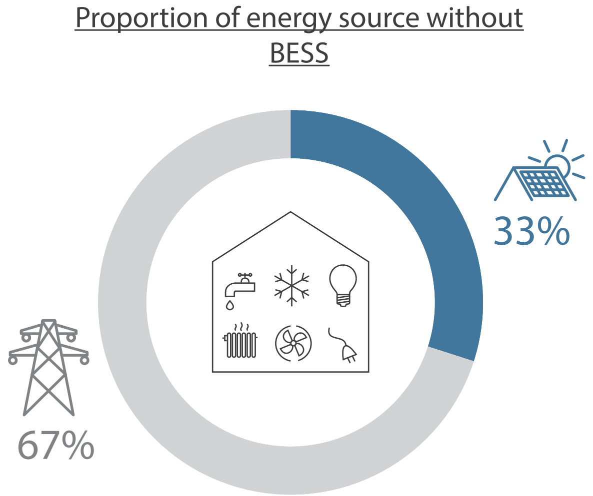
To assess the energy dynamics at Alderholt Park, we conducted a load profile analysis based on a representative all-electric residential consumption model for a microgrid comprising 200 properties. This analysis incorporated solar PV generation data, assuming an average installation size of roughly 4kWp per property, totaling 800 kWp for the microgrid.

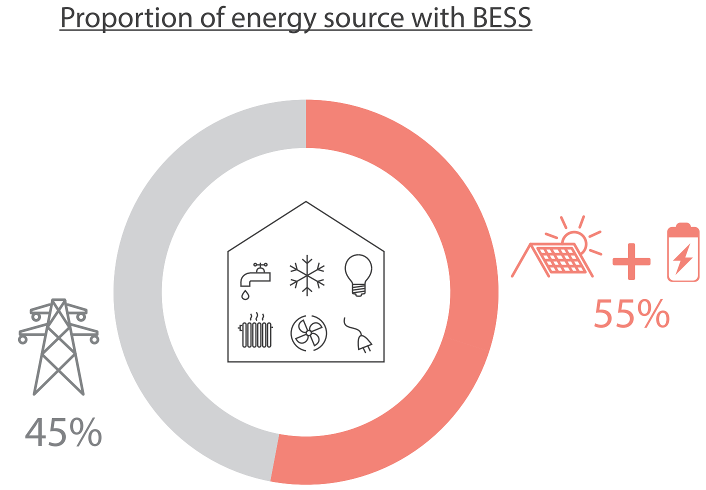
The figure to the right illustrates the seasonal fluctuations in energy production versus consumption. During the sun-rich summer months, the solar array's output substantially exceeds the energy requirements of the buildings. Conversely, in the winter, reliance on grid-supplied energy increases due to lower solar generation. **We estimate 43% of the site's annual energy demand will be grid-dependent using the microgrid solution.**

Our simulations with various BESS capacities led us to identify a 1MWh BESS as the optimal size for harnessing the surplus energy from the rooftop PV installations. Although the BESS cannot capture all of the surplus solar energy (~40% is excess generation), the surplus could be integrated into the wider grid or allocated to public electric vehicle charging points, boosting on-site consumption.

Furthermore, the smart charging feature of the BESS enhances this model by allowing for strategic grid energy intake. By charging from the grid during periods of high renewable generation, such as windy days when electricity prices are low or even negative, the BESS can ensure that the carbon intensity of imported electricity is minimised.







4.0 Alderholt Smart Grid

4.4 Cost Model

To illustrate the financial advantages of the proposed microgrid for Alderholt Meadows, we conducted a preliminary cost-benefit analysis focused on a 200-unit microgrid across four scenarios:

1. **Baseline**: This scenario establishes a benchmark where properties meet the LETI standard with an Energy Use Intensity (EUI) target of 35 kWh/m².year, excluding solar PV installations.
2. **Solar PV**: Each property is equipped with a 4kWp solar PV array, representing a significant step towards renewable energy use.
3. **BESS for Solar Load Shifting**: Incorporation of a 1MWh BESS to store and utilise excess solar energy, enhancing self-sufficiency.
4. **BESS for Smart Charging**: Utilisation of the BESS to strategically purchase and store energy from the day-ahead market, which is then supplied to residents.

Additional potential benefits include:

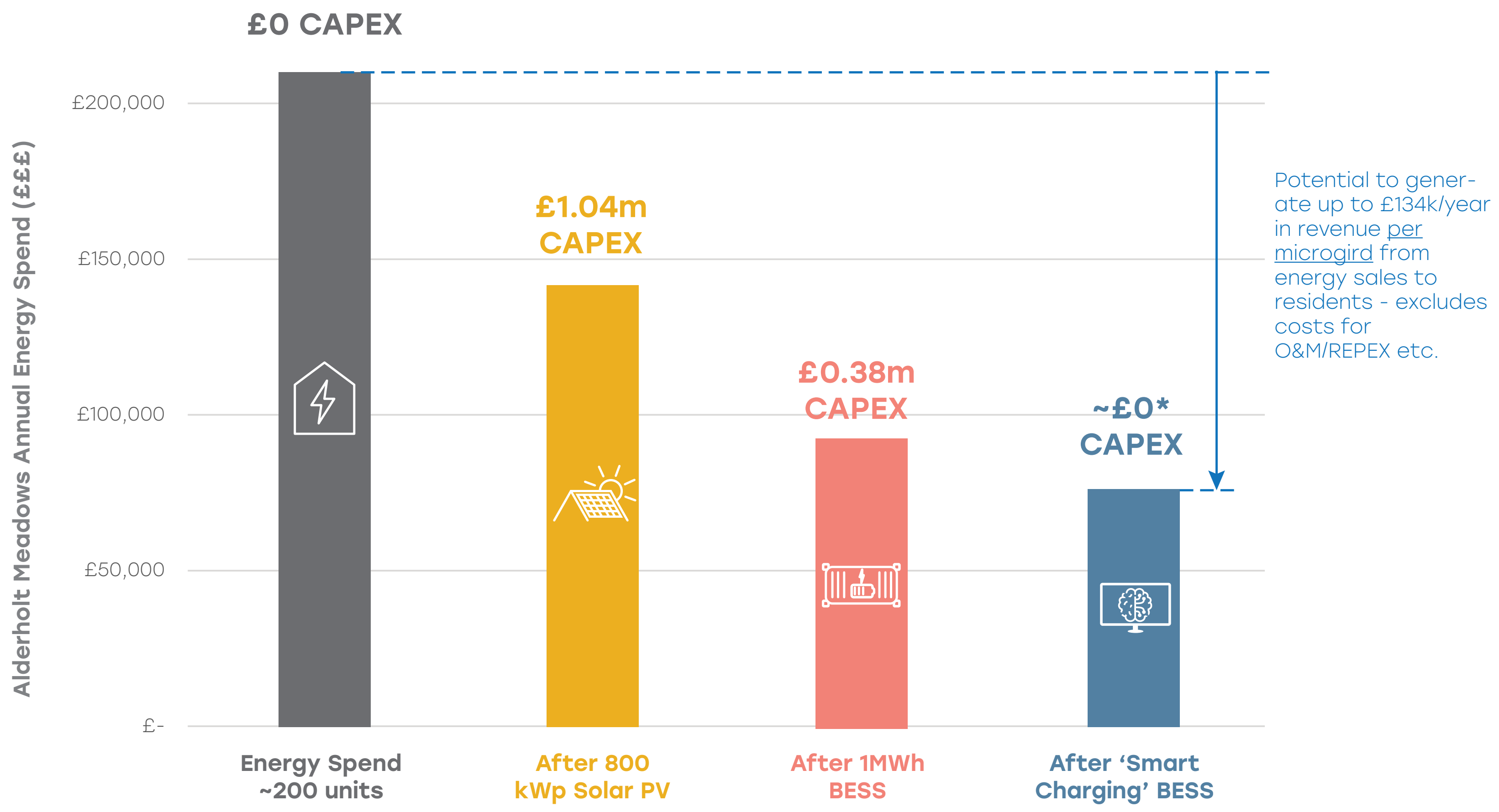
- **Peak Shaving**: By reducing peak energy demand, we project a 25% decrease in the required capacity from the DNO's grid, which could significantly lower connection costs.
- **Grid Services**: Exploring revenue streams by providing services to the grid, though these are subject to market fluctuations and would need careful consideration.cost of the micrgrid.

The figures presented are indicative and subject to refinement through detailed analysis with current equipment and energy costs at the time of site development. However, our initial estimates suggest that the microgrid could reduce household electricity bills (baseline energy spend = £1,050 per year per household*) and decrease overall microgrid's electricity running costs by up to 64%**. These savings could be partially passed on to Alderholt Meadows' residents, providing them with access to affordable, locally-generated green energy that offers energy resilience and a pathway to a more sustainable community-based energy system.

It should be noted that the costs for the Smart Grid system are not currently included within the IDP cost plan. These would be seen as an over and above cost that could be recouped through the operation of the Smart Grid via an Energy Services Company (ESCo).

*Based on standard residential electricty tariff of 30p/kWh. Does not include standing charge

**The cost data and financial estimates presented in this report by Net Zero Advisory are provided for general informational purposes and preliminary planning. They are intended to offer a guideline based on current market rates and conditions for the concept and feasibility phases of this project.



*Fee will be applicable to microgrid operator service provider

CHRISSCOTT@THENZA.CO.UK
07437889836
WWW.THENZA.CO.UK
/THE-NZA