# Final Report: Shetland Bus Decarbonisation Study

**24 November 2025**

# Executive Summary

The objectives of the Rural Energy Hub project can be summarised as follows:

**1. Accelerate Decarbonisation:** Address non-technical barriers to advance the transition to net-zero in rural areas of Shetland.

**2. Develop a Pilot Rural Energy Hub:** Establish a functional Hub in Brae, Shetland, as a model for future Hubs, featuring renewable energy solutions, shared spaces, rapid charging facilities, and transport decarbonisation initiatives.

**3. Demonstrate Integrated Services:** Trial and showcase products, services, and facilities, such as electric buses, HGV recharging for longer routes, car clubs, e-bikes, and district heating schemes.

**4. Engage Communities and Stakeholders:** Use the pilot Hub as a focal point for consumer engagement, behaviour change, and addressing regulatory and grid challenges.

**5. Foster Locally Led Action:** Build a place-based approach to coordinate decarbonisation efforts, ensuring practical and community-centred solutions.

**6. Design a Scalable Model:** Create a framework for replicating and expanding Rural Energy Hubs across Orkney and Shetland to maximise environmental, economic, and social benefits.

In this context, this study synthesises three strands of work: the North Mainland baseline study, an electric bus pilot, supplemented by an Exceliamus' independent evaluation (appended to this report), and analysis of non-technical barriers, to assess the feasibility and pathway for decarbonising Shetland's public and school bus network. Set against the Public and School Bus Transport Business Case considered by ZetTrans in June 2025, the evidence is clear: full electrification is not achievable for the next contract start in 2026. Constraints include vehicle range under Shetland duty cycles, depot and grid readiness, and contract alignment exist.

A pragmatic, two-stage pathway is therefore recommended: (i) a 2026–31 readiness phase with incremental pilots, workforce training, depot planning, and EV-readiness in contracts; and (ii) a post-2031 transition phase once grid reinforcement and depot upgrades are complete and operators are institutionally and financially prepared.

While these findings are Shetland-specific, the non-technical barriers identified: procurement, contract structures, depot readiness, workforce skills, and governance, are common across rural and island contexts. Shetland's innovations (Rural Energy Hubs, community involvement, and digital integration) offer replicable models for other places.

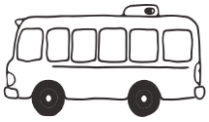
# Introduction

This report has been prepared as part of the Rural Energy Hubs project, supported by Innovate UK, to demonstrate and evaluate the practical operation of electric buses in Shetland. It will contribute to a wider body of evidence exploring options for decarbonising Shetland's public and school transport network and will form part of ZetTrans' Regional Transport Strategy Delivery Plan workstream on transport decarbonisation. The findings are intended to inform future planning and investment decisions by Shetland Islands Council and ZetTrans as part of their broader transport decarbonisation work.

The report has been prepared to consolidate and interpret the evidence gathered through the electric bus trial and related assessments, as part of exploring options for decarbonising Shetland's public and school bus network. It brings together findings from a staged programme of work undertaken between 2024 and 2025, including:

**Baseline Study**

A baseline study of transport challenges and opportunities in the North Mainland, which highlighted the distinctive geography, settlement patterns, and service requirements that shape Shetland's transport system.



**Trial**

A practical trial of an 8-metre Mellor Sigma electric bus on Shetland's mainland routes in 2025.

Analysis of trial data by Exceliamus, which provided valuable data on vehicle performance under local operating conditions.

**Assessment**

An assessment of non-technical barriers to electrification, considering issues of procurement, depot readiness, workforce skills, governance, and financial viability; and in the context of the Consideration of Bus Business Case process.

The overarching aim of this report is to provide Shetland Islands Council (SIC), ZetTrans, and local stakeholders with a realistic and evidence-based assessment of the opportunities and challenges associated with transitioning towards a low- or zero-carbon bus fleet. It is intended to act as both a practical tool for decision-making in Shetland and as a reference point for other rural and island areas facing similar questions.

While every community has its own geography and service patterns, the barriers identified in Shetland are not unique. The issues of fleet procurement, contract alignment, depot and grid readiness, and workforce training resonate across many rural parts of Scotland and beyond. By documenting these non-technical barriers in detail, the report aims to support a wider audience of policymakers, operators, and community organisations in understanding the complexities that rural contexts bring to the transition agenda.

Equally, Shetland's experience also highlights opportunities. The way in which Rural Energy Hubs, community anchor organisations, and digital integration tools are and could be developed can provide models for replication elsewhere. In this sense, the points identified could contribute to a broader dialogue on how rural and island areas

can adapt to the national ambition for decarbonised transport into practical, place-based solutions.

**Why this work matters**

Shetland's bus and school transport services are a lifeline for many communities. They provide essential access to education, healthcare, employment, and services, including in the more remote areas. At the same time, they form part of Scotland's wider public transport system, which is expected to play a central role in meeting net-zero carbon targets by 2045. Ensuring that Shetland is best prepared for this transition is therefore both a local, regional and national priority.

Electrification of buses is a key focus of decarbonisation strategies across Scotland and the UK, supported by government funding programmes and industry investment. However, Shetland presents a distinctive case. Its maritime climate, dispersed settlements, and unique operating patterns with multiple smaller operators, and where buses typically switch between different routes throughout the day, inter-working school and public services, create challenges not faced in more urban contexts. Understanding these differences is vital if policy and investment are to be appropriately tailored.

**Scope and approach**

This report cannot and does not seek to provide a definitive business case for immediate electrification. Instead, it provides a synthesis of available evidence, identifies the barriers that currently limit transition, and sets out a realistic pathway for progress. The analysis focuses on Shetland's main public and school bus network, and also considers the role of community transport, Rural Energy Hubs, and digital integration in shaping the future system.

The approach has been iterative and collaborative, drawing on engagement with communities, and public sector partners. It recognises that the transport system is not just about vehicles and timetables, but about people, places, and the way services interact with daily life. As such, the report places equal emphasis on technical feasibility, institutional readiness, and community perspectives.

**Structure of the report**

The chapters that follow are structured as follows:

- Section 2 outlines the baseline context for transport in Shetland, with particular focus on the North Mainland study and the characteristics of the existing bus network.
- Section 3 presents the findings of the electric bus trial, exploring performance under local conditions and implications for fleet transition drawn from the Exceliamus analysis and review. The Exceliamus report itself is included with this report as Appendix A.
- Section 4 expands on the non-technical barriers identified, presenting them in a structured table and narrative.
- Section 5 summarises the policy and business case context, including the outcomes of the 2024–25 engagement and the Outline Business Case considered by ZetTrans in June 2025.

- Section 6 draws conclusions from the evidence and sets out a staged approach to transition.
- Section 7 explores wider opportunities for integration and innovation, including Rural Energy Hubs, digital platforms, and active travel.
- Section 8 presents summary and recommendations.

# Section 2: Baseline Context: Transport in Shetland

Shetland's geography and settlement pattern create a distinctive context for public transport provision. The archipelago is characterised by scattered islands, low population density, and a reliance on inter-island connections for both people and goods. While the main population centre of Lerwick acts as a hub, many communities are small, dispersed, and separated by long stretches of rural road and often water. This geography makes provision of frequent and flexible public transport particularly challenging, and has historically fostered high levels of dependency on the private car.

The North Mainland report, completed in 2024 as part of the Rural Energy Hubs project, provided detailed insights into these challenges. It highlighted the dispersed nature of settlements across the North Mainland, where trips are often long and circuitous, and where small population centres are interspersed with areas of very low density.

It emphasised the importance of Brae as a strategic hub, given its proximity to the Sullom Voe Terminal, the presence of schools, healthcare facilities, and shops, and its role as a gathering point for surrounding communities. The report also drew attention to the limited infrastructure for active travel, with narrow roads, few pavements, and limited safe cycling routes, all of which constrain opportunities for shifting shorter journeys away from the car. At the same time, it noted opportunities for integrating feeder services, community-led transport, and Rural Energy Hubs as part of a broader move towards sustainable mobility. These aspects are consistently reported elsewhere, such as the Shetland Active Travel Strategy 2021-2026, which sets out that Brae is identified as a key hub settlement, with local services and facilities that make it a priority for walking and cycling audits and improved active travel links to surrounding communities.

Despite these structural challenges, Shetland's bus network is relatively extensive when compared with that of Orkney and other rural island areas. According to the Shetland Public and School Bus Transport Business Case, there are currently 28 timetabled bus services operating across Shetland, supplemented by 30 Dial-a-Ride services that require booking by 4pm on the previous day. Services are delivered by 15 different operators, reflecting the diverse and locally rooted nature of provision in the islands. This model not only brings flexibility but also provides important local economic opportunities, with small businesses and community-based operators playing a central role in delivering lifeline services.

Access to bus stops is relatively strong, with most households across the islands located within a ten-minute walk of a stop. Coverage is particularly high in Lerwick and Bressay (98%), the Central Mainland including Scalloway, Burra, and Trondra (95%), the South Mainland and Fair Isle (95%), and the North Mainland (83%). Coverage is slightly lower in the West Mainland, Papa Stour, and Foula (77%), and in the North Isles (71%), but the overall picture is one of relatively comprehensive geographical reach.

This comparatively strong baseline means that community transport in Shetland has evolved differently from that in Orkney and other rural and island areas. In Orkney many Community Anchor Organisations (such as Development Trusts) have focused on providing traditional community transport models. This includes examples such as minibuses for group bookings, demand-responsive services for individuals, or

transport to fill significant geographic gaps. In Shetland, community initiatives have often concentrated on meeting more individualised needs. These include van hire schemes within local communities, and arrangements for the movement of goods and parcels from Lerwick to outlying areas. In this sense, community transport in Shetland functions more as a complement to the mainstream bus network than as a substitute or 'gap filler' for it.

The baseline context therefore presents both opportunities and constraints. On the one hand, Shetland begins from a position of relatively strong bus coverage, supported by the presence of multiple operators and a wide-reaching Dial-a-Ride system. On the other hand, the dispersed nature of settlements, the importance of school and interworked services, and the limitations of active travel infrastructure all mean that any transition to low- or zero-carbon operation must be carefully tailored to these local conditions.

# Section 3: Electric Bus Trial

## 3.1 Overview

As part of this project, Shetland Islands Council undertook a pilot deployment of an electric bus to test the feasibility of zero-emission operation in the islands. While the exercise might appear straightforward, acquiring a vehicle and measuring its range in a 'real world' scenario, the practical reality proved considerably more complex. A wide range of legal, contractual, and operational issues needed to be addressed before the trial could commence.

The Council's direct acquisition of the trial vehicle immediately raised questions of responsibility: who would be accountable for the vehicle itself, how charging infrastructure would be managed, and how these responsibilities aligned with the existing contractual arrangements between the Council and its operators.

A further consideration was whether the vehicle could lawfully be used to carry fare-paying passengers. All registered bus services in Shetland fall under the oversight of the Traffic Commissioner. Any operator providing such services must hold a valid Operator's Licence, and each vehicle must be individually specified on the operator's licence and maintained in accordance with the licence undertakings under that licence before entering service. Compliance obligations include testing, inspection, safety checks, and reporting, all governed through the Vehicle Operator Licensing (VOL) system administered by the Traffic Commissioner.

Introducing a vehicle that was not part of an established operator's fleet therefore presented both regulatory and contractual challenges. In the absence of adding the electric bus to an operator's licence, requiring demonstrable maintenance arrangements, qualified staff, and appropriate facilities, the vehicle could not be used to carry passengers in service. These constraints were critical in shaping both the scope of the pilot and what could realistically be achieved within the timescales available within the project.

Following the completion of the trial, SIC commissioned Exceliamus Ltd to provide an independent evaluation of the outcomes. Exceliamus reviewed the data, modelled the performance of larger vehicles, and assessed the wider opportunities and challenges for Shetland. This report should be considered in parallel with the Exceliamus report.

## 3.2 Challenges of Securing a Vehicle

One of the first and most significant challenges in setting up the Shetland pilot was securing access to a suitable electric bus. In recent years, government funding programmes to support the transition to zero-emission fleets have been heavily targeted at larger, primarily therefore urban / inter-urban operators. As a result, many operators had already acquired and committed their available electric vehicles across their fleets in order to meet funding requirements and operational targets.

This was not unexpected, but it did mean that the project team faced real difficulties in sourcing a vehicle. Despite reaching out to numerous operators, manufacturers, and sales channels, availability remained limited. In the end, it was only through engagement with the Confederation of Passenger Transport (CPT) network that any option was identified: a Mellor Sigma 10 vehicle that could be leased to the pilot.

However, the Sigma 10 was not immediately available. To allow the trial to begin within the required timeframe, a smaller Sigma 8 vehicle, which shares the same base powertrain, was available and was brought to Shetland for the initial phase of the project. It was concluded that the Sigma 8 could still provide reliable data for the purposes of the study, even if its passenger capacity was smaller than would normally be required for Shetland services. The Sigma 10 vehicle was then to replace the smaller vehicle halfway through the trial.

Unfortunately however, the Sigma 10 was subsequently retained — purchased by the prior lessee — before Shetland Islands Council could take delivery. Several further attempts were made to secure an alternative larger vehicle, but these proved unsuccessful. As a result, the pilot proceeded with the smaller Sigma 8 vehicle throughout. This experience illustrates the difficulty of securing vehicles for trials, particularly in rural and island settings.

### 3.3 Training and Workforce Engagement

Given the regulatory and contractual challenges of operator licensing, and following liaison with SIC's legal services, it was determined that the only viable option for undertaking the trial runs was to use SIC insured drivers rather than contracted operators. This avoided the complexities of adding the trial vehicle to an operator's licence, while still enabling realistic test scenarios. In practice, a combination of drivers hired to, and insured by the SIC, alongside in-house employed drivers were scheduled to take part in the trial, fitting this around their other duties.

The trial therefore required careful planning to accommodate driver availability, which could be fragmented and limited to evenings, weekends, or off-peak periods.

As part of the lease arrangement, a Shetland-based electrical support was put in place to deal with any vehicle-related electrical issues during the pilot. A dedicated vehicle trainer travelled with the bus, providing hands-on instruction in real-world conditions, including start-up and shut-down procedures, charging protocols, and the specific operational requirements of the Sigma. In practice, the training did not fully cover all operational essentials, which resulted in some procedural issues and impacts on vehicle performance. This experience underlines the inherent challenges of introducing and trialling new technology in an unfamiliar operating environment.

That said, the pilot experience ensured that drivers and engineers could gain confidence with the technology, though there were inevitably some teething issues in the early stages. These experiences emphasised the importance of embedding training and technical support into any future vehicle deployments, and of building flexibility into scheduling arrangements for small fleets with limited spare capacity.

### 3.4 Infrastructure and Charging

A mobile charger was brought to Shetland to support the trial, capable of dual charging, alongside a rapid charger installed at a Council site.

Overnight DC charging at 40kW was used, which was sufficient for the Sigma 8 vehicle but would not be viable at fleet scale to achieve the speed of charging required.

Exceliamus in their report note that scaling up will require high-power DC charging depots and, critically, grid reinforcement works which are not expected to be completed until at least 2029 in Shetland.

### 3.5 Operational Scenarios

The pilot was carefully structured under the oversight of Shetland Islands Council's Transport Planning team to ensure that it provided robust and transferable evidence. The trial included mileage tests and later sought to replicate a range of realistic operating conditions and duty cycles that reflect the way buses are deployed in Shetland.

The programme of testing included:

- **Direct A to B runs on existing routes**: to establish baseline efficiency and performance over point-to-point journeys representative of core services.
- **Stop–start operations at bus stops**: to simulate the demands of in-service running, where frequent acceleration and deceleration could have a marked effect on energy consumption and performance.
- **Multi-board duty cycles** (both with and without stopping): to reflect the inter-worked nature of Shetland's bus network, where a single vehicle may undertake multiple different route boards over the course of a day.
- **Operation with different loading conditions**: including unladen runs and those with simulated full passenger loads, in order to test the effect of weight on efficiency and range.
- **Operation under different weather and temperature conditions**: including the use of onboard heating, windscreen demisting and clearing systems, and other ancillary services such as lighting and wipers. These scenarios were critical in understanding the additional energy demands created by Shetland's maritime climate, particularly in colder months, and the impact this has on overall range and reliability.

Wherever possible, the electric bus replicated conventional diesel operations to allow for meaningful comparison of performance under identical conditions. This approach was intended to provide a realistic assessment of the viability of zero-emission buses within the specific characteristics of Shetland's network, while also identifying the constraints and considerations that would need to be addressed in any future deployment.

### 3.6 Technical Performance

Across the phases of the pilot, the Mellor Sigma demonstrated an average efficiency of around 0.8 miles per kilowatt-hour, which, under temperate conditions, equates to a range of approximately 102 miles on a full charge (Exceliamus, 2025). One of the more significant findings was that Shetland's steep gradients, perhaps considered a potential barrier, did not materially reduce efficiency. Even on demanding climbs such as the Scord of Weisdale or Windy Grind, performance remained stable, confirming that topography alone is not a prohibitive factor for zero-emission operation.

Extrapolation from the trial data suggests that with a full passenger load and onboard heating engaged at an ambient temperature of around 0 °C, efficiency would reduce to closer to 0.5 mile per kilowatt-hour, bringing the effective range down to around 63 miles.

Heating, demisting, wipers, and other ancillary demands were identified as significant contributors to this reduction, with resistance heating in particular drawing large amounts of energy.

It should be noted, however, that the trial period itself did not include Shetland's coldest months; actual recorded temperatures were above freezing. The 0°C figures presented in the Exceliamus evaluation were therefore extrapolated from observed data and modelling.

This caveat is important, as performance in prolonged sub-zero conditions remains untested locally and may present additional risks.

### 3.7 Limitations of Evidence

While the pilot generated valuable insights into the feasibility of zero-emission buses in Shetland, it is important to acknowledge the limitations of the evidence base. These constraints shape the extent to which the results can be generalised across the full public and school bus network:

- **Temperature conditions:** Although the pilot was undertaken during the winter months, the 2024/25 winter was relatively mild, with recorded temperatures generally above freezing. As a result, the vehicle was not operated with heating engaged at sustained sub-zero temperatures. Results for colder winter conditions (e.g. 0°C and below) were therefore extrapolated from available data and modelling in the Exceliamus evaluation, rather than observed directly. This is an important caveat given that a *typical Shetland winter* often brings extended periods close to or below 0°C, with strong winds, driving rain, sleet, and occasional snow creating conditions more demanding than those encountered during the trial.
- **Passenger service conditions:** The vehicle was not deployed in live service with fare-paying passengers. While operational data on efficiency and range was robust, passenger perceptions of comfort, accessibility, noise, and reliability remain untested in a Shetland context.
- **Vehicle size:** The pilot used a smaller Mellor Sigma 8 vehicle, rather than the larger Sigma 10 originally intended or the full-size vehicles typically deployed on Shetland's mainline routes. Although the core powertrain was the same, this limits direct comparability with the higher-capacity vehicles that would be required for much of the network.
- **Operational structure:** The pilot was mainly operated directly by SIC insured drivers and not by contracted operators under an Operator's Licence. As such, some regulatory, workforce, and contractual issues associated with day-to-day service delivery were not tested in practice during the pilot.

Taken together, these limitations mean that while the pilot confirmed the technical feasibility of EV operation in Shetland, further evidence will be required, particularly through live passenger trials in harsher winter conditions and with vehicles of representative size, before confident conclusions can be drawn about full network transition.

Furthermore, Exceliamus (2025) emphasised that the Mellor Sigma used in the Shetland pilot should be regarded as a baseline demonstrator rather than representative of the best available technology. Since the vehicle was manufactured, newer electric bus models have entered the market offering greater

battery capacity, more efficient thermal management systems (including heat pumps), and designs optimised for higher passenger loads and harsher winter conditions. These developments suggest that future procurements could achieve stronger performance than that observed in the trial, reinforcing the importance of treating the Sigma results as indicative rather than definitive.

### 3.8 Communications and Public Perception

From the outset, communications were seen as central to the trial's success. Concerns had been raised by elected members that running an electric bus in parallel to existing services might appear wasteful, particularly if vehicles were observed carrying no passengers. A media trip and a trip on the bus for elected members were organised. Three of Shetland's news outlets attended to experience a journey on the bus and interview Council officers and the chair of the Council's Environment and Transport Committee.


Picture left to right: Moraig Lyall, Steven Maclean, Elaine Park

Picture Credit: BBC Radio Shetland

Public discussion of the electric bus pilot, as seen for example in Facebook comments on the back of proactive press releases, generated a wide range of views.

While these provide useful insights into how people perceive the trial, they should be treated with caution. Social media commentary is not representative of the wider community, often reflects strongly held personal views, and is influenced by broader debates on energy, cost of living, and renewable developments.

**Key themes emerging from online comments included:**

- **Scepticism about "green" credentials:**
  - Some contributors argued that electric buses cannot be considered environmentally friendly while Shetland's grid still draws on diesel generation.
  - Others noted that the energy system is in transition, with Viking wind farm and the interconnector expected to increase renewable penetration.
  - A number of comments linked the trial directly to wider debates on wind farms, energy bills, and ownership of generation assets.

- **Trial design and credibility**
  - Several comments suggested the trial would be a “success because it has been paid for to be a success,” reflecting cynicism about this type of investment.
  - Others argued that the real test would come from *regular drivers with regular passengers*, not from short-term demonstrations.
  - There were repeated calls for trials to be held in the *harshest winter months* (December–February), when heating and weather conditions would test vehicles to their limits.
- **Driver perspectives and workforce issues**
  - Some contributors raised concerns that drivers might be reluctant to operate EVs, although this was challenged by others asking for clarification.
  - Debate also emerged around the reliability of diesel buses with AdBlue systems, and comparisons with emissions performance from internal combustion engines.
- **Technical debates about EV capability**
  - Discussions covered the impact of heating, lighting, and cold weather on range, with some emphasising that real-world range could be reduced by up to 20% in extreme conditions.
  - Concerns were raised about battery placement and safety in winter driving. Some pointed to roof-mounted battery designs as problematic, though others countered that most current buses use underfloor battery packs.
  - Several contributors with stated experience of EVs in other parts of the UK argued that technology had improved significantly in recent years, and that Shetland should “give it a chance.”
- **Comparisons with other places**
  - Some questioned why a trial was needed at all, given electric buses already operate in Coventry, Aberdeen, Norwich, Glasgow, and elsewhere.
  - Others insisted Shetland’s conditions, with long duty cycles, steep climbs, single-track roads, salt air, and strong winds, justified the need for local testing.
- **Safety, reliability, and humour**
  - As with many online discussions, humour featured prominently. Comments joked about buses needing passengers to push them up hills, or glowing in the dark if parked overnight.
  - Concerns about fire risk were raised, though countered by references to data showing internal combustion vehicles are statistically more likely to catch fire.
- **Cost and value for money**
  - Some questioned whether the trial represented good use of public funds and comparisons to other trials perceived as unreliable.

- Others pointed out that government funding, rather than SICs core budget, covered the trial.

**Overall reflection**

Public reaction to the trial highlighted deep scepticism, rooted as much in wider debates about Shetland's energy system and economic benefits, as in the specifics of bus technology. At the same time, some contributors pointed to successful examples of EV operation elsewhere and argued that Shetland should not be left behind.

The lesson for future communication is that technical data alone will not shift perceptions. Clear explanations of costs, performance, and benefits, alongside opportunities for local people and drivers to experience the technology directly, is essential if public trust in transition is to be built over time.

### 3.9 Key Lessons from Bus Trial

The electric bus pilot demonstrated that zero-emission operation in Shetland is technically viable under specific conditions, but only with careful planning and within certain limits. The trial highlighted not only issues of vehicle performance but also the wider institutional, contractual, and operational factors that must be addressed to deliver successful transition.

#### Phased and Incremental Transition

The findings point to the need for a phased and incremental approach. Early opportunities are likely to be concentrated on shorter, more predictable routes / groups of routes, with those in and around Lerwick offering the most immediate potential for deployment. To support this, future procurement rounds could be shaped to encourage or require the use of zero-emission vehicles. One option may be to structure contracts so that suitable vehicles are supplied as part of the package awarded to any interested operator. However, such an approach would require detailed consideration of the legal and operational framework, and a significant lead-in time to ensure successful set up and delivery.

#### School Transport and Dual-Use Opportunities

In addition to the main public service network, certain school transport contracts present potential early opportunities. These services, some of which are not typically inter-worked with public routes, offer more contained duty cycles and therefore fewer operational risks. Moreover, a number of the school vehicles used are coaches that fulfil a dual role: providing education transport during term time while also supporting the cruise and visitor market during the school day (between drop off and collection), in the summer months, and particularly throughout the holiday period. Targeting such contracts for early transition could deliver wider benefits, aligning decarbonisation objectives with Shetland's tourism economy.

#### Institutional and Operational Readiness

The trial demonstrated that transitioning to zero-emission operation is not simply a matter of acquiring vehicles. Regulatory frameworks, operator licensing, insurance, depot arrangements, workforce training, and public perception all require alignment. The pilot provided valuable evidence of where readiness exists and where further development will be needed.

The lessons learned provide an essential foundation for shaping decisions within the 2026–31 contract cycle and beyond, ensuring that Shetland's pathway to decarbonisation is realistic, evidence-based, and deliverable.

# Section 4 Non-Technical Barriers

## 4.1 Non-Technical Barriers Overview

The Shetland pilot confirmed that the transition to zero-emission buses is not simply a technical challenge. A range of non-technical barriers exist, many of which may be more complex to address than the performance of the vehicles themselves. These include financial, regulatory, contractual, and organisational challenges which collectively shape the readiness of the network for electrification.

## 4.2 Fleet Procurement

The high upfront cost of zero-emission buses (typically £300,000+ per unit) poses a significant barrier for small Shetland-based operators, many of whom run only a handful of vehicles. Current contract lengths do not align with the 12–15 year lifespan of buses, creating residual value risk if contracts are lost at retender. This misalignment also means the investment would not generally be consistent with commercial borrowing opportunities, leaving most operators unable to access the finance needed to procure new vehicles without external support.

Without intervention, Shetland's small operators cannot reasonably be expected to shoulder the costs of transitioning to zero-emission buses. The scale of investment required is disproportionate to their size and financial capacity, particularly given the short contract durations and the limited opportunity to spread risk across a large fleet. To overcome this, several potential approaches could be considered:

- **Direct procurement and leasing by SIC / ZetTrans**, whereby vehicles are purchased centrally and leased to operators as part of their service contracts. This model would remove the upfront capital burden from operators while still enabling local delivery of services.
- **Aggregated purchasing models**, in which ZetTrans or SIC work collectively with multiple operators to pool demand and secure lower prices from manufacturers. This could help overcome the diseconomies of scale that small operators face when acting individually.
- **Targeted Scottish Government support**, recognising that national funding streams for bus decarbonisation (and other bus policy) have historically been directed towards large, urban / inter-urban operators with the scale and financial resilience to deploy multiple zero-emission buses. Rural and island contexts have been left comparatively underserved by these programmes, despite facing some of the steepest challenges in decarbonisation.

Taken together, these options highlight the importance of a bespoke funding and procurement strategy for Shetland. Without such mechanisms, the structural barriers facing small operators will remain a critical constraint on progress. At the same time, transition models should explicitly protect embedded local economic benefits, e.g. via central leasing and shared depots, so that small operators can participate fully.

## 4.3 Depot and Charging Infrastructure

Most local bus 'depots' in Shetland are small, dispersed, and lack the space or electrical capacity to host high-powered chargers; this in keeping with the nature of the smaller operator set up. In addition, grid reinforcement works, which are critical to scaling up zero-emission bus operations, are not expected to be complete in Shetland until at least 2029. As a result, the Exceliamus evaluation highlighted that

scaling up charging infrastructure is not a simple technical task, but a major programme of investment that will need coordinated planning across operators, SIC, ZetTrans, and the Distribution Network Operator (SSE).

One way to mitigate these challenges is through the development of shared charging depots, serving multiple operators rather than requiring each small company to invest individually. Co-location with Rural Energy Hubs (REHs) offers an important opportunity in this regard. These hubs could be designed as community assets that combine renewable energy generation, EV charging, and other local services in one place. Locating bus charging within such hubs would not only provide access to higher-capacity grid connections, but also anchor the depots in sites that are already destinations in themselves, for example, community centres, health facilities, or near shops, schools etc. This approach would maximise utilisation of infrastructure, reduce duplication of investment, and create wider community benefits by making charging part of a broader local energy and service ecosystem.

### 4.4 Workforce Skills

The trial showed that EV operation requires new knowledge among both drivers and engineering staff. For drivers, this extends beyond the basics of starting and charging the vehicle, to include understanding regenerative braking, energy-efficient driving styles, and responding to fault codes in real time. For engineering staff, the challenges are greater still, and most local operators lack in-house expertise on high-voltage systems, battery management, and advanced diagnostics. Without comprehensive training programmes and consistent support from Original Equipment Manufacturers (OEMs), there is a risk that skills gaps will undermine vehicle reliability and operator confidence.

This raises the question of whether Shetland would benefit from pursuing a more standardised fleet strategy. At present, the network is operated by multiple small companies, each maintaining its own small set of vehicles. If electrification were to proceed in a fragmented way, with different OEMs supplying different technologies across operators, the result would be a patchwork of vehicles each requiring distinct training, parts, and maintenance regimes. This would multiply the challenges of developing and sustaining local skills.

By contrast, adopting a degree of fleet standardisation, for example, selecting one or two OEM platforms for use across the area could bring significant efficiencies. Drivers and engineers would be trained on common systems, and spare parts and diagnostic tools could be pooled, with shared technical support. While complete uniformity may not be realistic, particularly where different route types require different vehicle sizes, a more coordinated approach to fleet specification could help build capacity and resilience in Shetland.

A coordinated approach led by SIC / ZetTrans, supported by local training providers and in partnership with selected OEMs, could therefore be essential to ensure workforce readiness and long-term operational reliability.

### 4.5 Operational Reliability

While the Sigma vehicle performed well in temperate conditions, the fact that the 2024/25 winter was unusually mild meant that no sustained sub-zero testing was undertaken. As a result, the range figures at 0°C reported in the Exceliamus evaluation were extrapolated from observed data and modelling rather than based on direct operational evidence (Exceliamus, 2025). This creates uncertainty around

how the vehicle, and by extension, future zero-emission buses, would perform in a typical Shetland winter, which can bring extended periods of temperatures close to or below freezing, combined with high winds, driving rain, sleet, and occasional snow. These conditions are particularly demanding because of the energy required for heating, screen clearing, and demisting, as well as the additional drag of operating in strong crosswinds.

To validate performance more robustly, further winter trials would be beneficial, ideally with newer vehicles equipped with heat pumps or other advanced thermal management systems, which can significantly reduce the heavy draw of resistive heating. Testing under real-world sub-zero conditions, across multiple duty cycles and load conditions, would provide critical reassurance on reliability and range. Exceliamus recommend that future pilots prioritise extended winter testing, with robust monitoring of auxiliary loads such as heating, wipers, and demisting systems, to build an evidence base directly relevant to Shetland's operating environment (Exceliamus, 2025).

Beyond technical performance, resilience is also a concern. Shetland operators will typically have limited spare capacity within their fleets. If an electric bus were to be unavailable due to technical issues or charging downtime, operators may struggle to provide immediate cover, with a disproportionate impact on service continuity. Unlike larger urban operators, they do not have larger or neighbouring standby fleets to draw upon.

One potential mitigation could be the creation of a centrally managed pool of spare vehicles, maintained by SIC or ZetTrans and made available across the network when required. This approach would reduce the burden on individual operators, while providing greater resilience and confidence in service delivery. Exceliamus note that such a model, especially if combined with a degree of fleet standardisation, could also deliver economies of scale in training, maintenance, and parts provision (Exceliamus, 2025).

In short, while the pilot confirmed that EV operation is technically feasible, the absence of harsh winter testing and the structural vulnerabilities of small-operator fleets mean that significant uncertainties remain. Addressing these will require both further evidence gathering and innovations in resilience planning, with Exceliamus' recommendations pointing to the need for phased deployment, winter-specific trials, and centralised support structures to underpin operator capacity.

### 4.6 Financial Viability

Cash flow is a major constraint for small operators. Even if capital funding could be secured for vehicle purchase, the ongoing financing of loan repayments or lease agreements would create significant pressure on possibly tight operating margins. This challenge is compounded by uncertainty over the future of national subsidy regimes, such as the Scottish Zero Emission Bus Challenge Fund (ScotZEB), which to date has largely been directed towards larger operators with the scale to deliver multiple vehicle deployments (Exceliamus, 2025). For small, rural operators, the absence of tailored, long-term funding streams makes financial planning difficult.

There is also anecdotal evidence that insurance premiums for electric buses are higher than for conventional diesel vehicles, reflecting both the higher replacement cost and perceived risks around battery safety. These additional overheads further

weaken the investment case for small businesses working on relatively short contract cycles.

Importantly, the mismatch between bus lifespan (Around 10-12 years typically, and possibly at the lower end in the Shetland maritime climate) and contract duration (typically 5 years) means that traditional commercial borrowing routes are rarely viable, particularly in geographical areas where operations are based on supported rather than commercial routes. Lenders are unlikely to provide finance if there is no guarantee of continuity of work beyond a single contract term. This structural misalignment, already a barrier for diesel investment, becomes critical when the cost of zero-emission vehicles is significantly higher.

Potential mitigations might include:

- **Aligning subsidy or lease payments with contract cashflows**, so that operators are not required to carry disproportionate financial risk within short-term contract cycles.
- **Developing pooled insurance schemes** across multiple operators, potentially facilitated by SIC or ZetTrans, to spread risk and reduce individual exposure to high premiums.
- **Exploring centralised leasing models**, where SIC or ZetTrans act as the asset owner and lease vehicles back to operators, thereby removing the need for each small company to access finance independently.

Taken together, these measures could provide a more stable financial framework within which small operators could engage with vehicle transition, without undermining their commercial viability.

### 4.7 Service Integration

Shetland's public bus network is characterised by a high degree of interworking, with individual vehicles often covering multiple different routes and service types over an area over the course of a single day. A bus may begin on a mainline service, switch to a school run, and then operate a feeder or shopper service before returning to the mainline network. This interwoven structure makes efficient use of limited fleet resources, but it also means that the knock-on effects of any disruption are amplified across the network.

Unlike diesel vehicles, which can refuel relatively quickly and operate with little downtime, EVs require scheduled charging windows. If charging requirements are not carefully aligned with the duty cycle, there is a risk that vehicles may not complete their boards, with ripple effects across school transport, feeder services, and mainline connections.

Potential solutions could include:

- **Timetable optimisation**, reviewing duty cycles to build in sufficient charging windows without undermining service reliability. However, this is likely to come at an additional subsidy cost, as it would require either additional vehicles or changes to operating patterns to make the timetable deliverable.
- **Opportunity charging**, where higher-powered chargers at key nodes (e.g. Lerwick, Brae, Sumburgh) allow vehicles to take on partial charges between boards. This could be especially valuable on routes with long dwell times between legs.

- **Vehicle or driver changeovers**, whereby an EV could be swapped out for another vehicle mid-duty, or a driver change could be synchronised with a charging break. While logistically more complex, this approach may be necessary on longer or more demanding duty cycles.

Exceliamus (2025) emphasised that the interworked nature of Shetland's network makes service integration one of the most significant barriers to full fleet transition. They recommend that future trials focus not only on technical range, but also on modelling how charging downtime interacts with real duty cycles. This will be critical to identifying which services can be electrified first, and which may require alternative solutions (such as hybrid, hydrogen, or retained diesel capacity) in the medium term.

In short, without careful planning, charging downtime could undermine the resilience of the network. With optimised scheduling, strategically located charging hubs, and a phased introduction of EVs onto the most suitable routes, however, these risks can be mitigated, though likely at higher cost than the current operating model, at least in the early phases of transition.

### 4.8 Public Perception

As highlighted in Section 3.7, the pilot generated widespread scepticism among the public, particularly around the costs of electric buses, their true carbon credentials given Shetland's current energy mix, and their reliability in harsh winter conditions. Much of this debate was amplified through social media, where discussions often extended beyond the specifics of the trial to wider issues such as energy policy, wind farms, and the cost of living. This demonstrates that public acceptance of zero-emission buses cannot be taken for granted and will be shaped by perceptions of fairness and credibility as well as technical performance.

If these concerns are not addressed directly, there is a clear risk of resistance to investment, which could undermine political support and limit the willingness of operators and communities to engage with the transition. To build confidence, future work could focus on:

- **Passenger-facing in-service trials:** allowing local people to experience electric buses first-hand, rather than observing them in isolated demonstrations. This would help to address concerns about comfort, noise, and accessibility, and provide an evidence base for how vehicles perform under real-world conditions in Shetland.
- **Improved heating and comfort systems:** since many comments focused on the risk of cold, damp, and discomfort, it will be critical to ensure that vehicles are specified with appropriate heating, demisting, and weather protection. Demonstrating that passenger experience will be equal to or better than on diesel buses is essential.
- **Transparent and proactive communications:** explaining the purpose, scope, and limitations of trials clearly, and reporting results honestly, will help counter the perception that outcomes are pre-determined. Communications should not just highlight environmental benefits, but also the practical improvements (e.g. smoother rides, quieter operation, reduced local emissions) that matter directly to passengers.

Exceliamus (2025) also emphasised that public confidence will be central to enabling a successful transition. Technical data alone will not shift opinion; it must be paired with visible demonstrations, community engagement, and opportunities for local people to shape how new technology is introduced.

### 4.9 Governance & Coordination

Responsibility for delivering Shetland's bus services, and for enabling the transition to zero-emission operation, is distributed across a wide range of actors. ZetTrans sets strategic direction; ZetTrans on behalf of Shetland Islands Council manages contracts; national government provides funding streams such as ScotZEB; and services themselves are operated by several small local companies. This landscape of roles and responsibilities makes coordination complex, and the pilot demonstrated that without a strategy, efforts risk becoming piecemeal and inefficient.

In practice, the introduction of even a single trial vehicle required legal services, transport planning, environment / estates, depot staff, operators, and external manufacturers to work together. Scaling this up to a fleet-wide transition would multiply these complexities unless stronger governance structures are put in place.

One option would be the creation of a ZetTrans-led operator transition working group, bringing together SIC officers, operators (existing and prospective), and external partners to provide a shared forum for planning the transition. This group could coordinate:

- **Vehicle specifications:** ensuring that buses procured are appropriate for Shetland's operating environment, and minimising the risks of fragmentation across multiple OEM platforms.
- **Training and workforce development:** identifying common needs across operators and designing joint training programmes to build local skills efficiently.
- **Depot and charging strategy:** coordinating investments so that infrastructure is shared where possible, aligned with Rural Energy Hubs, and matched to the requirements of the grid.

Such a group would not replace the statutory responsibilities of ZetTrans or SIC, but would provide a practical mechanism for collective problem-solving and knowledge-sharing. It could also strengthen the islands' voice in national discussions, presenting a single coordinated position to funders and policymakers on what Shetland requires to deliver its transition.

Exceliamus (2025) noted that fragmented governance is a barrier across many rural networks, but is particularly acute in Shetland given the diversity of small operators. Establishing clearer structures for coordination will therefore be a prerequisite for successful long-term fleet decarbonisation. However, it must also be recognised that this will not be straightforward. Operators are independent businesses, each with their own commercial priorities (perhaps as part of larger business interests), contract arrangements, and legacy fleets. Bringing them together into a coordinated framework will require time, trust-building, and clear incentives, as well as careful management of issues such as commercial confidentiality. In short, while strong governance is essential, delivering it will require sustained effort and may be one of the more challenging aspects of the transition.

### 4.10 Grid Capacity

Shetland's ability to transition to a zero-emission bus fleet is constrained by the capacity of the local electricity grid. While a single trial vehicle could be supported through a mobile charger and a modest depot installation, scaling to a network-wide deployment would require a step change in available capacity. Current projections indicate that significant grid reinforcement works are not expected to be completed in Shetland until at least 2029 (Exceliamus, 2025). Until then, the scope for introducing multiple electric buses operating from dispersed depots will remain extremely limited.

This constraint is not unique to Shetland, but its impact is magnified by Shetland's dispersed geography. Smaller rural 'depots' will typically be connected to the low-voltage network, which is insufficient for rapid or multiple-vehicle charging. Even in Lerwick, available headroom is limited.

Early and proactive engagement with Scottish and Southern Electricity Networks (SSE) will therefore be essential. A coordinated programme of phased demand planning, setting out how many vehicles could be introduced, on which routes, and by what date, will help shape reinforcement priorities. Equally important will be strategic depot siting, aligning future charging hubs with locations where high-voltage connections are either available or can be delivered most cost-effectively. Co-location with Rural Energy Hubs could offer a particularly efficient approach, combining bus charging with wider community energy and service functions.

Exceliamus (2025) caution that without clear alignment between transport planning and grid investment, there is a risk of "stranded" projects, with vehicles procured before the supporting infrastructure is in place. This underlines that progress will need to be carefully sequenced, with grid readiness acting as the critical path constraint for fleet decarbonisation in Shetland.

### 4.11 Contractual Alignment

The next contract cycle (2026–31) represents both a risk and an opportunity for Shetland's transition. On the one hand, there is a significant danger of diesel lock-in: if operators procure new diesel vehicles in order to meet contract requirements, those assets are likely to remain in service for 10–15 years, extending reliance on fossil fuels well into the 2030s. This risk is heightened by the fact that current contract lengths (typically five years) are not aligned with bus lifespans, meaning operators may feel compelled to invest in the lowest-cost, most immediately viable option, almost always diesel, unless alternative models are provided.

On the other hand, the 2026–31 cycle also offers an opportunity to lay the foundations for long-term transition. Realistically, the conditions for a full fleet shift, including grid reinforcement, depot upgrades, long-term funding mechanisms, and operator readiness, will not be in place until the post-2031 contract cycle (Exceliamus, 2025). The intervening period should therefore be treated as a readiness phase.

Practical steps that could be embedded into or more likely during the 2026–31 contracts include:

- **EV milestones in contract design:** for example, enabling / requiring operators to participate in trials, training, and data collection, even if vehicles remain diesel-powered.

- **Trialling limited deployments:** building in flexibility to then allow a focus on shorter routes in and around Lerwick or stand-alone school contracts, where EVs could be introduced with manageable risk and high visibility.
- **Flexible procurement models that enable later flexibility / adaptability:** such as SIC / ZetTrans leasing vehicles directly to operators, to prevent new diesel purchases while infrastructure is still being developed.
- **Institutional preparation:** using the contract cycle to strengthen governance, build operator skills, align depots with Rural Energy Hubs, and engage the community in shaping the transition.

In short, the next cycle should not be seen as the point of transition itself, but as a roadmap to a post-2031 future in which large-scale zero-emission deployment becomes viable. Managing this cycle effectively will determine whether Shetland is ready to capitalise on new infrastructure and funding when / if it becomes available, or whether it remains locked into diesel dependency.

### 4.12 Summary of Non-Technical Barriers and Mitigations

| Barrier Area | Description | Potential Mitigations | Timescale |
|---|---|---|---|
| **Fleet Procurement** | Small operators lack capital for £300k+ EVs; bus lifespan (10–15 yrs) exceeds 5-yr contracts, making commercial borrowing unviable. | SIC/ZetTrans leasing models; aggregated purchasing; tailored Scottish Govt support (beyond ScotZEB focus on large fleets). | Short term (2026+) |
| **Depot & Charging** | Small dispersed depots with limited grid access; reinforcement not due until around 2029. | Shared depots; co-location with Rural Energy Hubs; early SSE engagement; phased depot planning. | Medium term (2029+) |
| **Workforce Skills** | Drivers/engineers lack EV and HV expertise; fragmented training across multiple OEM platforms. | Joint training programmes; OEM support; move towards partial fleet standardisation to simplify training & spares. | Short–medium term |
| **Operational Reliability** | Mild 2024/25 winter meant no sub-zero testing; small operators lack spare buses for resilience. | Further winter trials (with heat pumps); create central pool of spare EVs; Exceliamus recommend extended cold-weather pilots. | Short–medium term |
| **Financial Viability** | High upfront costs; uncertain subsidies; higher EV insurance premiums; misaligned contracts vs bus lifespan. | Align lease/subsidy with contract cashflows; pooled insurance schemes; SIC/ZetTrans vehicle leasing. | Short term (2026+) |
| **Service Integration** | Highly interworked network; charging downtime could disrupt timetables; optimisation likely to add subsidy cost. | Timetable redesign; opportunity charging; vehicle / driver changeovers; funding to support extra resources if required. | Medium term (2026–31+) |
| **Public Perception** | Scepticism on costs, carbon intensity, reliability; influenced by energy debates & social media. | Passenger-facing trials; improved comfort/heating; x comms; ongoing community engagement. | Immediate–short term |

| Barrier Area | Description | Potential Mitigations | Timescale |
|---|---|---|---|
| **Governance and Coordination** | Fragmented responsibilities (ZetTrans, SIC, 15+ operators, national funders); building coordination will be difficult. | ZetTrans-led working group on fleet transition; joint procurement; shared training / depot planning; incentives for participation. | Immediate–ongoing |
| **Grid Capacity** | Local grid cannot support large-scale EV charging until reinforcement (not before 2029). | Early SSE dialogue; phased demand planning; align depots with HV nodes; integrate with Rural Energy Hubs. | Immediate–medium term |
| **Contractual Alignment** | 2026–31 cycle risks diesel lock-in; full EV transition only realistic post-2031. | Use 2026–31 as readiness phase: embed EV milestones, trial deployments, strengthen governance and depots. | Immediate–long term (post-2031 for full transition) |

# Section 5 Policy and Business Case Context

## 5.1 Timeline of Key Developments

The planning for Shetland's public and school bus network has been formulated within a wider policy and business case process led by Shetland Islands Council and ZetTrans. Key milestones included:

- **October 2024** – Strategic Business Case (SBC) approved, setting out the rationale for reviewing Shetland's public and school bus services and identifying the need for long-term transformation.
- **2024** – A major engagement exercise was undertaken, generating nearly 1,000 responses from across Shetland. This provided insight into community priorities and expectations, highlighting issues of coverage, frequency, reliability, and accessibility.
- **May 2025** – it was shared that the current contract cycle would be extended by 12 months, with the new cycle now scheduled to begin in August 2026. It was noted at the time that this extension reflected both the volume of engagement responses and the time required to complete a robust Outline Business Case.
- **May 2025** – An interactive StoryMap was published, illustrating up to 15 scenarios for future network design. These scenarios explored variations in mainline, feeder, shopper, and health centre services, as well as integration with community transport and active travel options.
- **26 June 2025** – The Outline Business Case (OBC) was considered by ZetTrans, testing options against strategic objectives, affordability, and deliverability.

## 5.2 Outline Business Case Findings

The OBC evaluated a wide range of network scenarios, but placed particular emphasis on:

- **Hub-and-spoke models (Options 4a and 4b)** – consolidating services into key hubs (e.g. Lerwick, Brae, Scalloway), with feeder routes and demand-responsive services extending coverage into rural areas.
- **Feeder and community services** – building strong integration between contracted services and community transport provision, recognising the role of local organisations in filling gaps in the network.
- **Integration with active travel** – ensuring that walking, cycling, and micro-mobility could complement bus services, especially for first- and last-mile connections.

Central to the analysis were the trade-offs between coverage, frequency, and cost. As would be expected, options that maximised coverage often require higher subsidy, while those that seek efficiency risk reducing service availability, particularly for more peripheral communities, that will often have higher (per head / per mile) operating costs.

## 5.3 Implications for Zero-Emission Transition

The absence of explicit zero-emission requirements in the forthcoming contracts may result in operators procuring new diesel vehicles to meet service obligations during the 2026–31 cycle, which could extend reliance on conventional fleets.

This also means that while fleet transition is not realistic until the post-2031 cycle, the OBC and procurement process for 2026–31 could be used to incorporate provisions within contracts that invite operators to take part in EV trials, training, and data collection, supporting shared learning and readiness across the network.

Furthermore, there is the opportunity in the coming years prior to the next tendering window to develop subsidy and procurement models that provide flexibility for operators, while helping to reduce reliance on diesel in the interim as grid and depot upgrades can be advanced.

By explicitly linking the business case process with the decarbonisation pathway, ZetTrans and SIC can ensure that Shetland's future bus network is more efficient and integrated, and is better prepared for the transition to zero emissions in the following contract cycle.

# Section 6 Conclusions

The evidence gathered through the Shetland electric bus pilot, the earlier review, and then the supporting analysis by Exceliamus, and the wider policy and business case context, demonstrates that a full transition to electric buses cannot realistically be achieved within the 2026–31 contract period.

Three key factors underpin this conclusion:

- **Vehicle capability:** Current EV ranges remain insufficient to cover the cumulative daily mileage of Shetland's interworked routes, particularly under winter conditions when heating loads are high.
- **Infrastructure and skills readiness:** Grid reinforcement will not be in place before 2029, and depot upgrades and workforce training are required, limiting the ability to support a larger zero-emission fleet for some time.
- **Contract dynamics:** In the absence of transitional milestones, the forthcoming contracts will likely lead to continued procurement of diesel vehicles, which could extend reliance on conventional fleets well into the 2030s.

A two-stage approach is therefore required:

- **Stage 1 (2026–31): Readiness Phase**
    - Develop the business case for incremental EV pilots on suitable routes, such as stand-alone school services, feeder routes, and (possibly connected) summer tourism contracts (e.g. cruise coaches).
    - Build practical experience across operators and drivers, supported by training, OEM partnerships, and shared technical support.
    - Advance depot and charging infrastructure planning, aligned with further consideration of Rural Energy Hubs and community facilities.
    - Embed participation in trials, data-sharing, and readiness measures within contract structures.
- **Stage 2 (Post-2031): Transition Phase**
    - Investigate and set out the case for a large-scale transition to electric buses once grid reinforcement works are complete, depot infrastructure is operational, and operators are institutionally and financially prepared.
    - At this stage, consideration should be given to shaping contract structures and procurement models in ways that enable sustained investment in zero-emission fleets, reducing reliance on diesel and supporting long-term decarbonisation goals. The small operator historic set up should however be factored in, with the embedded local economic benefits being protected through transition models (e.g. central leasing, shared depots) that enable participation by small operators.

This staged approach provides a pragmatic pathway, enabling Shetland to make early progress through targeted pilots and planning, while laying the foundations for a comprehensive transition in the following contract cycle.

# Section 7 Wider Opportunities for Integration and Innovation

The evidence from the pilot and wider engagement highlights that the transition to zero-emission transport in Shetland cannot be seen in isolation. Opportunities exist to align with digital innovation, community development, and wider policy agendas to maximise impact and resilience. Key opportunities include:

## 7.1 Digital Integration



The introduction of digital platforms such as the HITRANS MooveFlexi App presents a clear opportunity to modernise how passengers plan, book, and use services. Demonstrations of systems such as Liftango could help evaluate their suitability for Shetland, enabling more flexible booking, integrated ticketing, and real-time service updates. This has the potential not only to improve user experience but also to strengthen operational resilience across a complex, interworked network. This could cover any community-delivered services, or local authority procured or run services, such as the m.connect service that has expanded in Moray operated by Moray Council.

Using platforms such as Liftango or MooveFlexi offers a range of benefits for rural and island transport. By bringing booking and payment into a single app, passengers can plan journeys with confidence and move more easily between different modes. This reduces friction in the user experience and makes public and community transport feel more reliable and modern.

The systems also build flexibility and resilience, allowing services to respond dynamically to real-time demand rather than being tied to fixed timetables; or to operate part way between fixed and flexible.

A further strength lies in the quality of data these platforms generate. Live insights into demand patterns, journey types, and service use can inform better decisions by operators and authorities, making it easier to refine services and target investment. Because the platforms can be piloted quickly in specific areas without major upfront infrastructure, they also provide a low-risk way to test new approaches before scaling up.

Perhaps most importantly, systems like Liftango and MooveFlexi can help build community confidence. A simple, visible, and easy-to-use booking system makes sustainable transport the straightforward choice, encouraging more people to leave the car at home and supporting long-term modal shift. Crucially, this does not replace traditional call-in booking methods that many frequent users value; instead, it adds another layer of accessibility, creating confidence among those who do not currently use the services.

## 7.2 Rural Energy Hubs

Development of fully integrated transport systems inevitably takes time, often many years from initial concept to full delivery. In the meantime, there is real value in piloting services that can demonstrate the potential and build confidence among communities, operators, and funders. The Rural Energy Hub (REH) model, piloted in

Brae, offers a valuable anchor point for such approaches, showing how transport can be integrated with other community services.

Rather than requiring the establishment of entirely new transport hubs, the REH concept builds on locations that already act as natural centres of gravity within the community. For example, Brae REH has the potential to provide a positive and accessible waiting environment for bus passengers, while also supporting feeder services and active travel connections. Co-locating charging infrastructure with REHs could deliver further efficiencies, benefiting both public transport operators and the wider community. Over time, this approach could evolve into a network of locally rooted, multi-purpose hubs that underpin rural and island transport, while pilot services in the shorter term showcase the model's practical benefits.

### 7.3 Adaptability and Community Capacity

Shetland has shown a willingness to innovate across many areas. Much of transport delivery remains embedded within public sector structures however. Community Interest Companies (CICs) and Development Trusts could act as a bridge, enabling more dynamic approaches while still working in partnership with SIC and ZetTrans. This raises important questions about governance, capacity, and intent: where communities have both the willingness and local leadership to 'try new things,' and the mandate from their boards and residents to address identified gaps in transport provision.

That said, much of Shetland already benefits from relatively good coverage of public transport, so the gaps are not always obvious. For any shift towards greater community provision, appropriate support will be essential to ensure services can be delivered sustainably, compliantly, and in a way that complements existing provision rather than competing with it.

To help shape this space, an Expert Community of Practice (ECoP) has been established through this project, with participation from local Development Trusts and support from Community Energy Scotland.

The ECoP provides a structured forum for knowledge exchange and peer learning, with activities including:

- **Monthly peer-to-peer meetings** bringing Trusts and partners together.
- **Knowledge exchange trips** between Orkney and Shetland to share learning and experience.
- **Tailored community engagement** led by anchor organisations in each area, ensuring transport planning is locally rooted.
- **Development of low-carbon transport and mobility strategies** specific to participating communities.

This bus decarbonisation study has linked closely into the ECoP, attending meetings and engaging directly with both individual groups and the network as a whole.

A key lesson from this collaboration is the way local priorities differ between contexts. In Orkney, the focus has been primarily on the movement of people, supporting access to services, work, and leisure, and for visitors to the areas. In Shetland,

however, attention has been drawn more to the movement of goods to meet identified local needs, alongside the availability of self-drive and van-hire opportunities for residents and community use.

As a result, Shetland's readiness to move into the passenger transport space is not as advanced as in Orkney. This reflects a multitude of factors, including the stronger baseline of conventional public bus provision in Shetland, which has meant there has been less immediate pressure on communities to step into passenger service delivery to fill identified gaps. This reinforces the importance of tailoring transition models to local realities, ensuring that community-led initiatives develop in ways that are complementary to the existing network.

### 7.4 Active Travel Integration

While funding for active travel schemes is available, the main barriers are often procedural, such as securing permissions from Roads authorities and clarifying future maintenance responsibilities, rather than always financial. This can take significant time. Developing responsive and locally tailored programmes, that perhaps are community-driven, and aligned with transport planning, could help overcome these barriers. This would ensure that active travel measures are integrated into transport solutions associated with REHs, rather than seen as standalone projects.

### 7.5 Cultural Shift, Contract Models and Community Integration

Across remote, rural, and island places, there is scope for a wider cultural shift in how transport is developed and delivered. Moving from a model of the Council "doing for" communities, towards approaches of "doing with" and "doing by," would create more opportunities for innovation and ownership. Embedding this shift requires supportive frameworks, including contract models that enable stronger integration between public authorities and community organisations.

The bus contract model used in Orkney provides a useful reference point. Under the (School and) Public Bus Contract, operators are required to supply the Council with detailed information on passenger numbers, ticket types (adults, children, concessionary), and total fare income. Since February 2022, fare income has been returned to and retained by the Council, and directed into the Sustainable and Green Transport Fund, which is then reinvested to:

- Improve existing public transport networks.
- Provide match funding to community transport projects.
- Support the roll-out of active travel schemes.
- Deliver transport infrastructure improvements across the county.

This approach has been described as an example of good practice. By linking fare income directly to reinvestment, it helps create a virtuous cycle of improving services and infrastructure, while also enabling clearer alignment with community transport initiatives.

For Shetland, drawing on elements of this model could support the cultural shift towards "doing with" and "doing by." It would strengthen accountability and transparency in service reporting, while creating a dedicated mechanism to channel passenger revenue back into service improvement, infrastructure upgrades, and

potentially the development of new opportunities such as EV pilots or community e-mobility hubs.

### 7.6 Policy Alignment

There is a clear opportunity to align Shetland's work with wider national and regional policy frameworks, ensuring that the unique needs of island and rural communities are fully recognised in the transition to net zero transport.

The Scottish Government's *Just Transition* commitments emphasise the need for a fair and inclusive pathway to decarbonisation, while funding mechanisms such as ScotZEB provide targeted support for zero-emission buses. At the same time, regional partnerships such as ZetTrans and HITRANS can advocate for channels through which Shetland's experience can influence investment priorities and policy design.

The *Act Local* report (Community Transport Association, 2023) highlights that community transport is at the heart of community-led climate action, and that Scotland cannot deliver a Just Transition to net zero without harnessing the capacity of local operators and community providers. Shetland's context, with its smaller bus operators and strong tradition of community-based solutions (in other delivery areas particularly), illustrates this principle in practice.

By embedding Shetland's experience into national strategies, there is scope both to secure greater support for island-proofed solutions and to contribute valuable evidence on how zero-emission transport can be delivered in some of Scotland's most challenging operating environments. In return, Shetland can continue to position itself as a demonstrator of innovation, offering lessons that can be scaled across other rural and island contexts.

# Section 8 Summary and Recommendations

## 8.1 Summary of Findings

The evidence gathered through the electric bus pilot, Exceliamus' evaluation, and wider engagement highlights both opportunities and constraints for Shetland's transition to zero-emission buses. The findings show that while technical feasibility has been demonstrated under certain conditions, a range of structural, financial, and institutional barriers remain. These include the interworked nature of the network, grid and 'depot' limitations, the multiple operator base, and the importance of building public confidence and workforce skills. Together, these factors point to the need for a phased approach: using the 2026–31 contract cycle as a readiness phase, while preparing for a fuller transition in the post-2031 period.

### Technical feasibility with limitations

The pilot confirmed that electric buses can operate effectively on Shetland routes, with steep gradients posing no significant barrier. However, range is reduced under colder conditions, and further winter testing will be required. Importantly, Shetland's bus network is highly *interworked*, with vehicles commonly operating multiple boards across different routes in a single day. This means that in practice, buses must cover substantially greater daily mileage than simple point-to-point and return journeys, further challenging the available range of current electric vehicles.

While the pilot confirmed the technical feasibility of EV operation in Shetland, it is important to recognise that the Mellor Sigma 7 used in the trial was not necessarily representative of the most advanced technology now available. As highlighted by Exceliamus (2025), newer electric bus models offer greater battery capacities, improved thermal management systems, and higher passenger capacity, all of which could better meet Shetland's operational requirements. This underlines that the conclusions of this study should be seen as a foundation for further exploration, with future pilots expected to deliver stronger performance as technology continues to evolve.

### Grid and depot readiness

Grid and depot infrastructure remain the single most binding constraint, with reinforcement not expected until at least 2029. Small dispersed 'depots' would lack the capacity for rapid charging, highlighting the need for shared hubs and possible early alignment with Rural Energy Hubs.

### Small operator structure

The reliance on (and opportunity of) small operators magnifies barriers: high upfront vehicle costs, short contract lengths, and a lack of spare fleet capacity make transition especially difficult without central support.

However, from an economic perspective, this structure also delivers important benefits. The presence of numerous small, locally rooted operators ensures that economic value is generated within communities and, by and large, retained within Shetland. This embedded local contribution is a strength of the current system and should be factored into future transition planning alongside the operational challenges.

### Public perception and workforce readiness

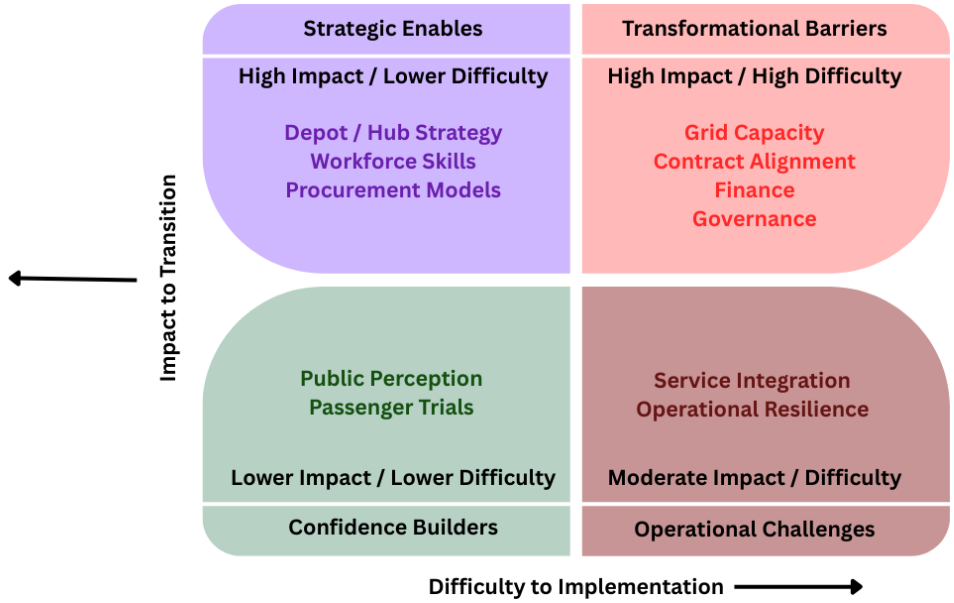
Acceptance and confidence are as important as technical performance. Visible trials, transparent communications, and structured training for both drivers and engineers will be essential to building readiness and trust.

### Contract cycle dynamics

The 2026–31 contract cycle should be treated as a readiness phase, embedding participation, data collection, and incremental deployment, while avoiding long-term diesel lock-in. A full transition is only realistic in the post-2031 cycle, once infrastructure and finance are in place.

## 8.2 Non-Technical Barriers: Impact vs Difficulty

The transition to zero-emission buses in Shetland is shaped both by vehicle technology and by a set of structural, financial, and institutional factors. The matrix below maps these non-technical barriers by impact on transition (vertical axis) and difficulty of implementation (horizontal axis). It highlights where early action can generate momentum (high impact / lower difficulty), and where long-term strategies are needed to address transformational challenges.




## 8.3 Recommendations

Expanding this matrix, and building on the findings of the pilot, the Exceliamus evaluation, and the wider business case context, a set of recommendations has been developed to guide transition to zero-emission buses. These recommendations recognise the scale of the challenges but also highlight the opportunities for Shetland (and elsewhere) to lead as a demonstrator of island- / rural-proofed solutions. They are structured around five key themes: strategic approach, fleet procurement and finance, depot and grid, workforce and operations, and governance and engagement.

### Strategic Approach

- Adopt a two-stage transition pathway, balancing realism with ambition.

- Use 2026–31 to develop the business case for EV deployment, advance depot and grid planning, and build institutional and workforce readiness.
- Prepare for a system-wide transition post-2031, once infrastructure and finance align.

**Fleet Procurement and Finance**

- Explore SIC / ZetTrans central procurement and leasing models, reducing the capital burden on small operators.
- Investigate aggregated purchasing to secure better prices from OEMs.
- Engage with Scottish Government for tailored rural / island support, recognising that current funding models favour large urban fleets; liaising with other local authorities and RTPs, such as HITRANS.
- Consider pooled insurance schemes and align lease payments with contract cashflows.

**Depot and Grid**

- Plan for shared charging depots, co-located with Rural Energy Hubs, anchoring infrastructure in community facilities.
- Engage early with SSE on phased reinforcement and depot siting aligned to high-voltage nodes.

**Workforce and Operations**

- Develop a joint training programme for drivers and engineers, in partnership with OEMs and the local UHI college.
- Move towards a standardised fleet specification to simplify training, maintenance, and spares.
- Create a central pool of spare EVs, providing resilience for small operators.
- Model timetable adjustments and opportunity charging, recognising that this could require additional subsidy.

**Governance and Engagement**

- Establish a ZetTrans / SIC-led operator working group to explore and coordinate fleet specification, depot strategy, and training.
- Ensure public perception is addressed through in-service passenger trials, improved comfort, and transparent communications.
- Position Shetland as a national demonstrator, embedding its learning into Scottish decarbonisation policy and funding.

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