



Scotland Zero Emission Bus (ScotZEB) Market Transition Scheme 2022/23

STREAM 1 Report
McCalls Coaches



Revision 5
13 MAR 2023



Contents

1. Project Scope	3
2. Current Status Overview	4
3. Approach	6
4. Baseline	7
5. Concept Trial with Opportunity Charging	8
6. Project Financial Evaluation and Implementation Timelines.....	13
Appendix A. List of Active Vehicles	15
Appendix B. Scottish Power Energy Networks Distribution Heat Maps	16
Appendix C. Summary evaluation of NEW OEM electric buses & coaches	17

1. Project Scope

McCalls Coaches have been offering coach hire in Dumfries and Galloway since 1997. Operating locally out of Lochmaben, into Lockerbie, Dumfries, Annan and Castle Douglas, McCalls Coaches also offer services right across the UK. A second-generation family run business which became a limited company in 2005.

The leadership team at McCall's wish to explore their options to decarbonised and electrify the vehicle fleet, in alignment with Transport Scotland objectives. This includes an interest in the potential for new electric vehicles, as well as the repowering of the existing diesel-powered fleet to electric (see Appendix C). The project scope covers scheduled municipal bus service operations which are active today. It is noted that service routes are due for tender in April 2023.

McCalls buses operate multiple service routes, each within a set of defined daily duty cycles. There are in total:

- [15 service routes](#)
- 12 duties which in turn split into workdays and weekends.

Vehicles evaluated, include McCall's own fleet and leased vehicles provided by the council to support operation of the service routes.

Project outcomes achieved in 3 phases: Concept trial, Phase 1 and Phase 2 of the full deployment.

1.1 Project Participants and Contributors

This project report was put together in collaboration with the following businesses, who contributed with product information, market statistics, their professional expertise and data analysis tools.



An organisation seeking to rapidly eliminate diesel emissions from our streets. Diesel bus emissions seriously threaten the health of urban residents, particularly children. Kleanbus provides a fast, innovative, and cost-effective solution to remove diesel engines from our bus transport network by repowering diesel vehicles to electric.

INDUCTEV

A technology specialist provider of automatic high-power inductive charging for commercial vehicles. InductEV permits commercial vehicles to carry smaller onboard battery capacities by providing duty cycle range from opportunity pick-up of energy on the go.



An energy asset management business, involved with renewable micro-grid generation and an award-winning platform which connects, controls and automates energy demand using machine learning technology. Also a Charge Point Operator offering modular electric vehicle charging solutions for both depot and opportunity charging. From design to deployment and ongoing management, GridBeyond team of charging experts will provide end-to-end services to fleets of all sizes.

Please note that all the calculations provided in this report are indicative and based on preliminary estimates and prices valid on the day the report is issued.

2. Current Status Overview

2.1 Fleet Overview

- 100% diesel fleet
- Current operating cost: diesel cost per litre £1.65
- 21 vehicles in total (see Appendix A):
- 6 minibus (Mercedes), 8 Midi-bus (Optare), 7 full size single deck (Volvo, Optare & Bova),
 - 11 privately owned buses used for both service routes and school runs and return overnight to either Lochmaben depot, Hallmuir Chapel car park or Dumfries & Galloway Council at Castle Douglas.
 - 10 leased council buses used for service routes and return overnight to Dumfries & Galloway Council at Castle Douglas.

2.2 Overnight Parking / Depot Facility

- Primary head office and depot is situated at Lochmaben.
- Buses return to this depot overnight or park in alternative car parks:
 - Lochmaben can hold up to 4 buses overnight.
 - Dumfries & Galloway Council at Castle Douglas for leased buses
 - Hallmuir Chapel, DG11 1BN for owned buses
- Three-phase supply fuse box provides energy for Lochmaben depot.
- Preliminary assessment suggests that the capacity of the energy supply is sufficient to power the limited charger approach defined within this recommendation.
- Supporting transformer shared with the housing estate at Lochmaben.
- There are currently no EV chargers installed.
- Current electricity costs: standard rates: £0.656 peak time, £0.311 overnight, standing charge of £0.274 per day.

2.3 NDO Status and New Connection Requirement

According to the map of the distribution network operators in the UK, in the national [Grid Connections and DNO guide](#), electricity in Lochmaben and Lockerbie areas is supplied by Scottish Power Energy Networks. Closer investigation confirmed that the local substation is operating at capacity. There are no upgrades planned until 2024 or later. Please refer to Appendix B for detailed illustrations.

Within the current allocated grid supply capacity at McCall's Lochmaben depot, the existing 3-phase supply, can accommodate the proposed 100kW dual charger (two 50kW chargers). Since the depot only has the scope to charge x2 vehicles due to the limited space availability, the existing depot power supply is sufficient. If future expansion, beyond the trial scope were considered, then the need for additional transformer power to the site would be necessary.

In this case, the fees are included into the installation quote, which including full design and installation which comes to £18,600 per charger.

Overnight chargers are recommended at Dumfries & Galloway Council car park in Castle Douglas to support council leased fleet. New connection application costs will be included into installation costs of the EV charger providers.

2.4 Financial Assessment of Current Operations

Total Current Diesel Fleet, 6 minibuses, 8 midi-bus and 7 full size single deck coaches. Applying McCall's current £1.65 per litre diesel rate.

This report uses a detailed fleet modelling tool, which requires the fleet operator to enter values and constants. What is displayed is an output based on the selected input values. McCalls, as a rural fleet operator has generally longer distances per day than the city-based fleets. 240 miles per duty cycle is common and applied here.

Fleet Details	# of vehicle type	mpg by type	Fuel cost per mile (£) by vehicle type	Average daily mileage by vehicle type	Annual mileage per vehicle by vehicle type	Total sub-fleet annual mileage by type	Total sub-fleet fuel cost by type (£)
# of minibus	6	18 e.g. Mercedes Sprinter	£0.42	240	81,600	489,600	204,024
# of midi-single deck	8	10 e.g. Optare Solo	£0.75	240	81,600	652,800	489,659
# of full size single deck	7	8 e.g. Volvo B7R	£0.94	240	81,600	571,200	535,564
# of double decker	0	6	£1.25	240	81,600	0	0

Figure 2.4.1 Current McCall's diesel fleet fuel costs

Total operational cost, including diesel fuel and Maintenance, Service and Repair (MS&R) for these diesel vehicles is captured within the modelling tool, with operator input to define average annual costs, typically increasing as the vehicles age and worn and components require replacement.

Fleet Details	Maintenance, Service & Repair (MS&R) (parts & Labour)							
	Years 1 - 3		Years 4 - 6		Years 7 - 15		Years 15 - 24	
	Annual MS&R	Total sub-fleet MS&R by type	Annual MS&R	Total sub-fleet MS&R by type	Annual MS&R	Total sub-fleet MS&R by type	Annual MS&R	Total sub-fleet MS&R by type
Minibus	£7,000	£42,000	£10,000	£60,000	£12,000	£72,000	£15,000	£90,000
Midi-single deck	£13,000	£104,000	£16,000	£128,000	£18,000	£144,000	£18,000	£144,000
Full size single deck	£17,000	£119,000	£19,000	£133,000	£22,000	£154,000	£24,000	£168,000

Figure 2.4.2 Current McCall's diesel fleet operational costs

Excluding the current Network Support Grant (NSG) payment, of £0.144 per kilometre on scheduled service duties, the cost of running this diesel fleet will be in the region of £0.87 per mile, or £0.54 per km, increasing to £0.59 as vehicles age further.

3. Approach

There are three elements to the recommended approach:

- (1). **Vehicles:** repowered diesel to electric vehicles, from within the existing McCall's fleet, working with specialist repowering partner Kleanbus.
- (2). **Charging:** a strategy of engaging three different charging approaches in combination to address the challenge of achieving the duty cycle each day, as follows; (i) high-power opportunity charging in bus stop / stand locations common with other services, routes and fleet operators (ii) medium power charging in natural schedule daily break points, in convenient locations, where the driver typically rest for lunch breaks (iii). Low-power overnight depot charging.
- (3). **Energy:** The deployment of micro-grid generation technologies to lower the cost of electricity power needed, and to provide long-term financial certainty of this supply.

3.1 Fleet

- 11 buses have been identified as suitable for Kleanbus repower (see Appendix A):
 - 4 owned Optares and 1 owned Volvo B7
 - 3 leased Optares and 3 leased Mercedes SprinterContact for Swestrans (owners of leased vehicles) - Douglas Kirkpatrick at douglas.kirkpatrick@dumgal.gov.uk
- Remaining x6 owned buses are unsuitable for repowering and so alternative options must be considered. New electric buses are available, however a suitable replacement for the Optare and Volvo vehicles is Yutong E-bus and E-coach (approx. price of new vehicle £375,000).
- One recommendation is to dispose of these diesel vehicles into the second-hand market and replace with pre-owned, Kleanbus repowered electric vehicles, at around 30% of the cost of a new electric vehicle, and due to the smaller installed battery capacity, lower Gross Vehicle Weight, will operate more efficiently in kWh/km.
- Remaining x4 leased vehicles which had a recent engine upgrade are recommended for refurbishment at a later stage (approx. price of the repower £115,000 - £180,000, incl. battery).

3.2 Overnight / Depot Charging

Provisionally, to migrate the whole fleet to electric the following charging infrastructure shall be required:

- x5 cable chargers, min spec 50kW DC double-gun (25kW per gun for dual use), shall be required for overnight charging at each location: Dumfries & Galloway Council car park and Hallmuir Chapel car park.
 - Contact for Dumfries and Galloway Council, Abercrombie Yard overnight parking - Gordon Bryce at gordon.bryce@dumgal.gov.uk
- x2 rapid chargers, 100kW DC double-gun (50kW per gun for dual use) shall be required at Lochmaben depot.

Microgrid energy generation options shall be evaluated, including solar, wind and hydro to support the chargers.

3.3 Opportunity Charging

Opportunity charging locations shall be initially evaluated via a desktop model for current service routes and once approved and installed, will remain available to use to whatever operator takes over those routes and associated vehicles. Provisionally, introduction of opportunity chargers is recommended for the concept trial and if successful, deployed to the remaining routes.

Opportunity charging solutions to be evaluated: high power wireless charging technology and inverted pantographs for quick top-ups at bus stops and rapid cable chargers 100kW+ at dwell points.

4. Baseline

4.1 Fleet

Focusing on the specific vehicles identified for a Kleanbus repower, assuming they covered each around 240 miles per “operational day” of service per year, using 340 operational days per year. At £1.65 per litre, the 720,000 miles would have cost just over £606,000 per year in diesel fuel.

Fleet Details	# of vehicle type	mpg by type	Fuel cost per mile (£) by vehicle type	Average daily mileage by vehicle type	Annual mileage per vehicle by vehicle type	Total sub-fleet annual mileage by type	Total sub-fleet fuel cost by type (£)
# of minibus	3	18	£0.36	240	81,600	244,800	88,905
		e.g. Mercedes Sprinter					
# of midi-single deck	7	11	£0.59	240	81,600	571,200	339,456
		e.g. Optare Solo					
# of full size single deck	1	8	£0.82	240	81,600	81,600	66,679
		e.g. Volvo B7R					

Figure 4.1 Current McCall's operational costs for vehicles proposed for repower

The operational cost of this sub-fleet of minibuses will be £0.37 per km, including the NSG payment (£0.51 per km without). This is the figure we establish as baseline cost of existing operations to compare future proposals against.

4.2 Depot Charging

The current energy rate at McCall's is relatively high at £0.31 / kWh. There is the opportunity to engage Grid Beyond, an energy asset management organisation to create a local micro-grid energy farm.

The roof of the steel-framed bus depot at Lochmaben is believed to be sufficient to support a photovoltaic solar panel array. The indicative business model offered by Grid Beyond is to fully finance and install the solar panels, and to establish their own energy export contract, via the McCall's standard grid supply. In exchange for the support of McCall's, Grid Beyond then propose a Power Purchase Agreement (PPA), for a period of 20 years, offering a set energy rate for all of McCall's electricity supply of only £0.11 per kWh.

In section 5 of the report we overlay the impact on the overall proposal with an energy rate with this solution deployed.

5. Concept Trial with Opportunity Charging

5.1 Service Routes

Suggested service routes for the concept trial: 501 (x1 CD) and 502 (2 Lochmaben + 1 CD)

5.2 Fleet

- 4 owned Optare buses are recommended for Kleanbus repowering for the concept trial phase. Recommended battery capacity of 282kW will provide 200 miles range for the bus of this size.
- Kleanbus price of the repower £110,000 + £60,000 for the battery purchase or alternatively to enter into a annual battery as a service contract for £9,400 p.a.

5.3 Opportunity Charging

- Potential opportunity charging sites, suitable for multiple routes and shared with other fleet operators:
 - Dumfries Railway Station and DG1 – shared with Houston’s
- Driver dwell points for opportunity charging:
 - Brooms Road coach park in Dumfries
 - Market Street car park in Castle Douglas
 - Kirkcudbright Harbour car park

Charger Type	Grid Beyond Price per unit
200kW DC charger	£42,000

*price includes equipment only, installation is subject to each site detailed survey

5.4 Overnight Charging

- x1 rapid charger, 100kW DC double-gun (50kW per gun for dual use) to be installed at Lochmaben depot for overnight and day time top-up charging.
- x1 overnight charger, 50kW DC double-gun (25kW per gun for dual use) will be required at Castle Douglas council car park.

Charger Type	Grid Beyond Price per unit*
100kW DC charger	£38,680
50kW DC charger	£19,000

*price includes installation estimate, subject to site survey and detail verification

5.5 Microgrid Generation

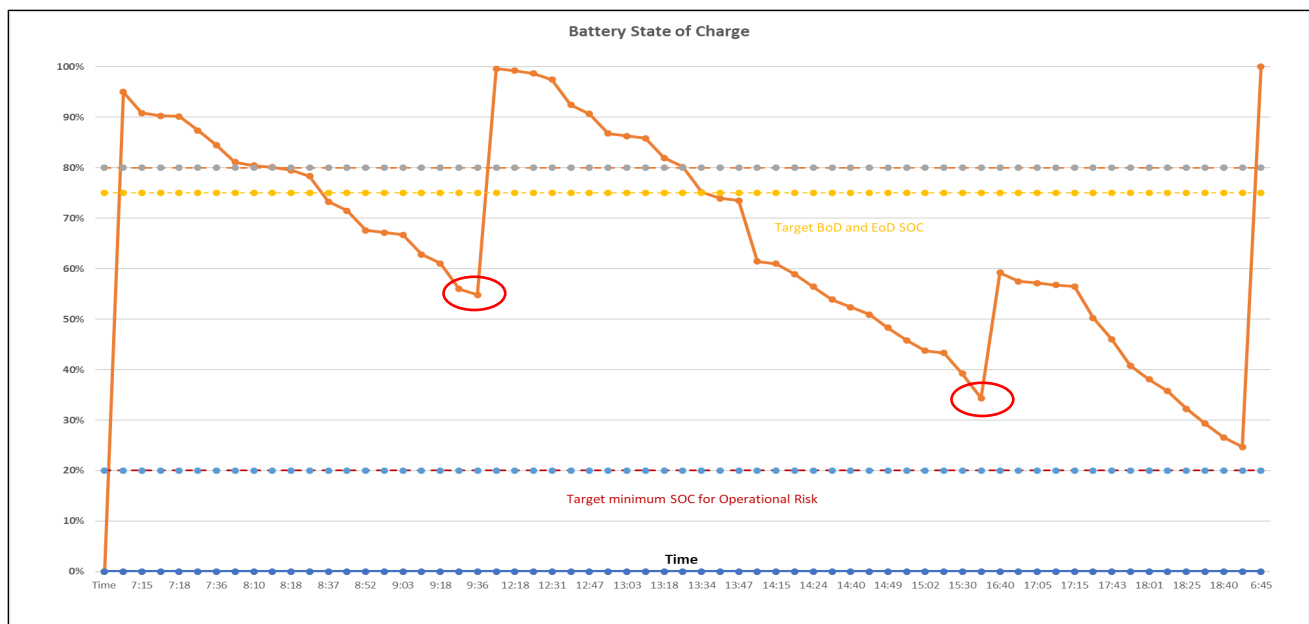
- Expected capacity of the solar panels on the roof of the warehouse = 100kW
- Expected generation = 96,509 kWh per year
- Savings current rate vs solar via PPA = £18,301.80 per year

5.6 Energy Models

Kleanbus repowered vehicle characteristics were used for building energy models below to verify vehicles will be able to complete daily service routes without disruption.

Duty 5 (routes 381, 502 and 521)

- Start time 06.45 - Finish at 19:00, return to Lochmaben
- Daily mileage = 238.9 miles
- Opportunity charging in all weather (winter 0°C depicted on the graph):
 - **45 min** on-route charging at Brooms Road car park with a 200kW charger, and
 - **30 min** on-route charging at Dumfries & Galloway College with a 200kW charger shall be sufficient to maintain bus operation all day.
- Sufficient 'buffer' time available in the schedule to increase charging time if required.
- **5.5 hrs** night-time charging with 50kW plug in charger or **11 hrs** with 25kW charger.



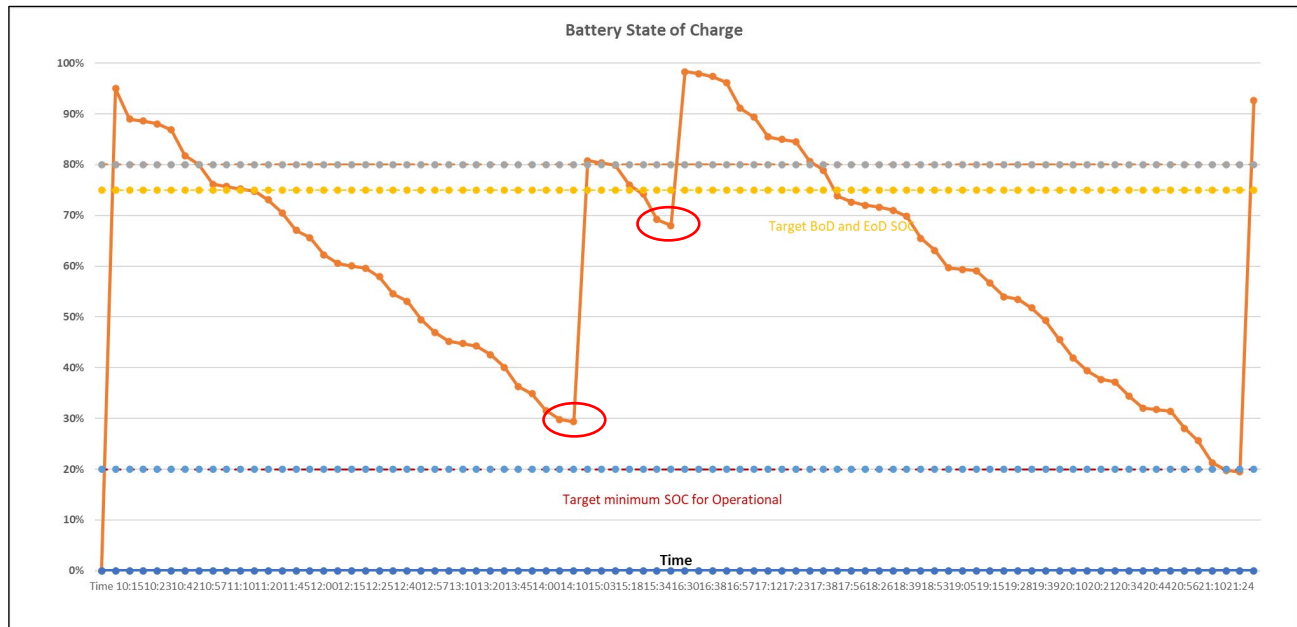
Stops/Potential Sites	Select Charger	Level-kW	Dwell Time	Max	Schedule
Dumfries Railway Station-lunch	Plug200	176.0	45.0	2:33	9:42-12:15
Dumfries & Galloway College	Plug200	176.0	30.0	0:30	16:10-16:40
LOCHMABEN Depot - Overnight	Plug50	44.0	330.0	11:00	19:30-6:30

Figure 5.6.1 Energy Model Duty 5



Duty 6 (routes 501 and 502) Charging Approach

- Start time 9:45 - Finish at 22:00, return to Lochmaben
- Daily mileage = 238 miles
- Opportunity charging in all weather (winter 0°C depicted on the graph):
 - **30 min** on-route charging with 200kW charger at Market Street car park in Castle Douglas and
 - **Min 30 min** on-route charging at Brooms Road car park with a 200kW charger shall be sufficient to maintain bus operation all day.
- Sufficient 'buffer' time available in the schedule to increase charging time if required.
- **8 hrs** night-time charging with 25kW plug in charger shall be sufficient.



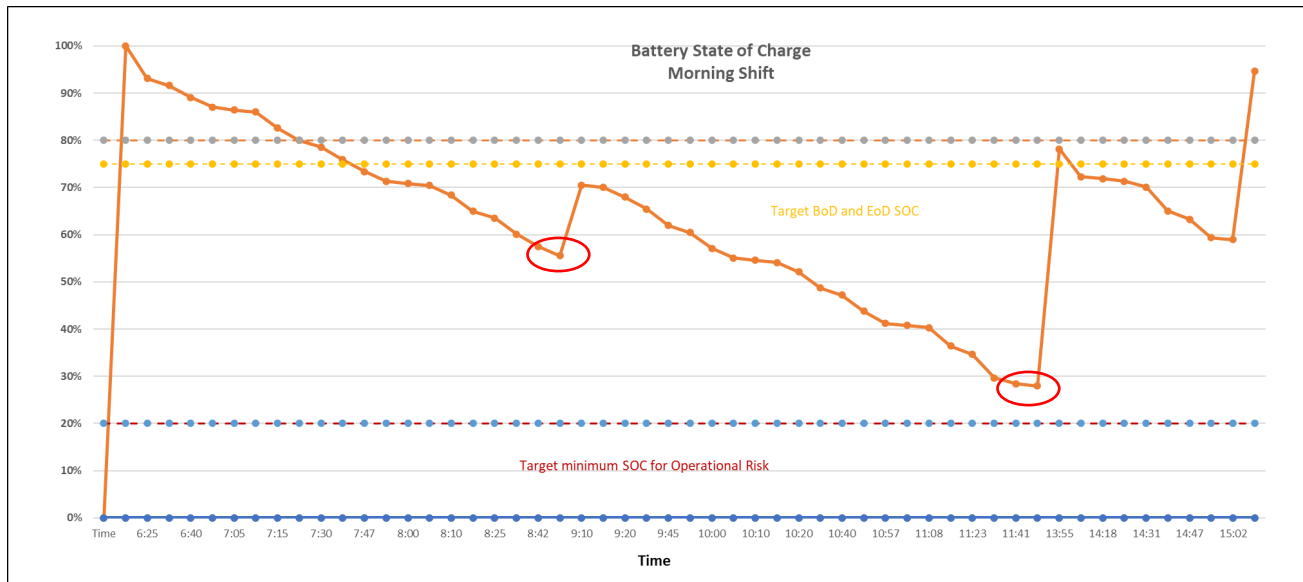
Stops/Potential Sites	Select Charger	Level-kW	Dwell Time	Max	Schedule
MARKET STREET CAR PARK DWELL	Plug200	176.0	50.0	0:50	14:12-15:02
Dumfries Railway Station-break1	Plug200	176.0	30.0	0:43	15:47-16:43
Dumfries Railway Station-break2	Plug200	176.0	-	0:20	18:02-18:22
LOCHMABEN Depot - Overnight	Plug25	22.0	560.0	12:00	21:45-9:45

Figure 5.6.2 Energy Model Duty 6



CD Duty 1 (route 502)

- Start time 06.00 - Finish at 15.15, return to Castle Douglas
- Daily mileage = 164.4 miles
- Opportunity charging in all weather (winter 0°C depicted on the graph):
 - **15 min** on-route charging at Market Street car park with a 200kW charger will be needed in cold weather, and
 - **110 min** charging at Lochmaben depot with 100kW charger
- Sufficient 'buffer' time available in the schedule to increase charging time if required.
- **4 hrs** night-time charging with 25kW plug in charger shall be sufficient



Stops/Potential Sites	Select Charger	Level-kW	Dwell Time	Max	Schedule
Castle Douglas Swimming Pool-break1	Plug200	176.0	-	0:15	6:50-7:05
Castle Douglas Swimming Pool-break2	Plug200	176.0	15.0	0:18	8:52-9:10
LOCHMABEN Depot - Clean&Charge	Plug100	88.0	110.0	1:52	12:03-13:55
CD Council INDUSTRIAL EST-Overnight	Plug25	22.0	240.0	14:00	16:00-6:00

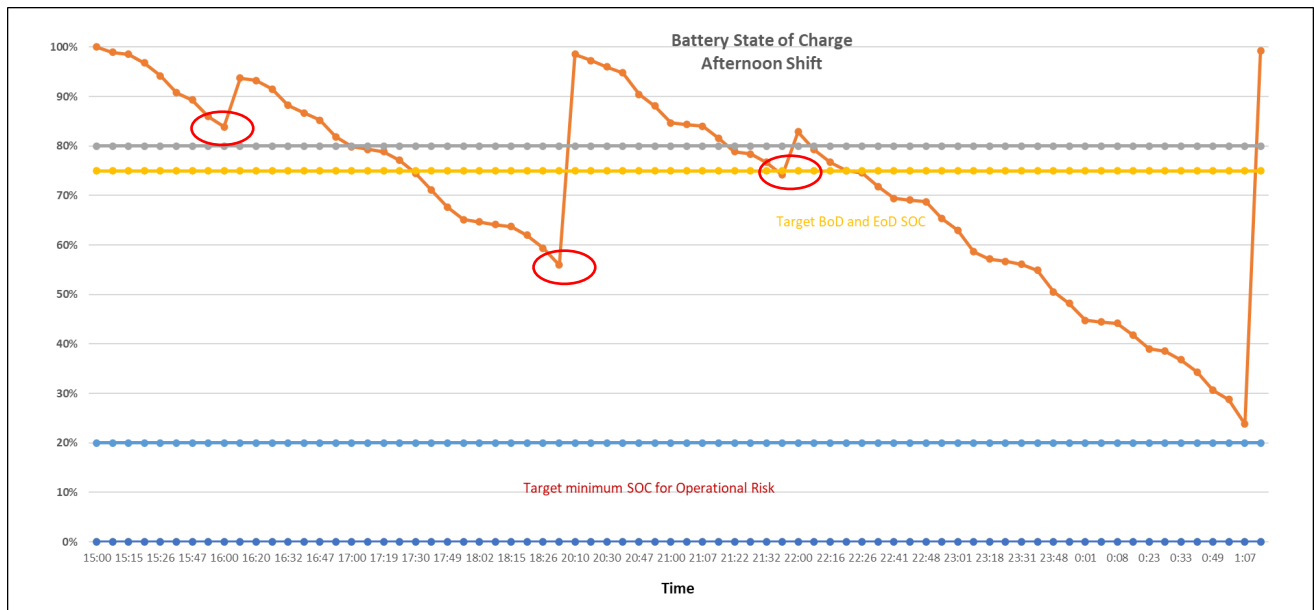
Figure 5.6.3 Energy Model CD Duty1 Morning Shift



Google Maps Image 3. McCall's Coaches, Lochmaben depot Infrastructure onsite will be supported by existing connection

CD Duty 2 (route 502)

- Start time 15.00 - Finish at 1.30, return to Castle Douglas
- Daily mileage = 247.6 miles
- Opportunity charging in all weather (winter 0°C depicted on the graph):
 - **10 min** on-route charging at Market Street car park with a rapid 200kW charger will be needed in cold weather,
 - **60 min** charging at Brooms Road car park with 200kW charger,
 - **12 min** charging at Kirkcudbright Harbour car park with 200kW charger is recommended to maintain bus operation in winter.
- Sufficient 'buffer' time available in the schedule to increase charging time if required.
- **12 hrs** night-time charging with 25kW plug in charger will be required



Stops/Potential Sites	Select Charger	Level-kW	Dwell Time	Max	Schedule
Castle Douglas Swimming Pool-break11	Plug200	176.0	10.0	0:10	16:05-16:15
Castle Douglas Swimming Pool-break12	Plug200	176.0	-	0:09	17:05-17:14
Dumfries Railway Station-eve_break	Plug200	176.0	60.0	1:00	19:10-20:10
Kirkcudbright-break20	Plug200	176.0	12.0	0:12	21:48-22:00
CD Council INDUSTRIAL EST-Overnight	Plug25	22.0	240.0	13:30	1:27-15:00

Figure 5.6.4 Energy Model CD Duty2 Afternoon Shift



6. Project Financial Evaluation and Implementation Timelines

6.1 Concept Trial

It is envisaged that the initial concept trial, once funded and deployed, would take 3-6 months to validate assumptions in the existing approach. If at the time of implementation the service routes operated by McCall's have changed and no longer include 501 and 502, new routes will be identified and opportunity charging locations will be re-evaluated and confirmed to suite new selected routes.

The first financial evaluation assesses the impact of a Kleanbus repower of the target x4 Optare Solo vehicles to electric.

	Kleanbus Repower Costs				Diesel Op. Cost	Kleanbus Op. Cost	Saving
	<i>Kleanbus Repower costs Optare Solo</i>	<i>Kleanbus Repower costs Optare Solo fleet</i>	<i>Kleanbus Repower battery lease 7-year fleet total 282 kWh</i>	<i>Kleanbus Repower Midi-Bus x4 vehicles fleet</i>	<i>Total Operational Cost x4 diesel midi-buses Total 7 years</i>	<i>Total operational cost x4 Kleanbus Midi-Bus Total first 7 years</i>	<i>7-Year total operational cost saving, including repower costs</i>
	<i>Single Vehicle</i>	<i>x4 Vehicles</i>	<i>Battery as a Service</i>	<i>Repower + Battery</i>	<i>Diesel Optare Solo</i>	<i>Electricity + MS&R</i>	
Standard Kleanbus Repower of a midi-bus sized bus	£110,000	£440,000	£329,000	£769,000	£1,688,427	£623,504	£295,923
	Assuming £1.65 diesel costs per litre		£47,000 annually for			Including £0.144 NSG	
	Assuming £0.31 / kWh at McCall's depot		7 years				

Figure 6.1.1 ROI based on current energy rates

Accounting for the vehicle repower costs, battery and then the operational cost of running the electric fleet, compared to diesel fleet, there is an overall financial benefit.

Over a 7-year period, the savings of adopting these recommendations are calculated as £75,725.

Mentioned earlier in the report was the opportunity for a solar photovoltaic energy farm on the roof at the Lochmaben depot. This fully financed scheme, offered by grid Beyond would also offer the potential of a 20-year Power Purchase Agreement (PPA), indicatively at £0.11 per kWh.

Replacing the current McCall's energy rate with this Grid Beyond rate improves the savings made on the x4 Optare Solos to £1 million. This energy transition has made the cost of energy a vitally important factor.

	Kleanbus Repower Costs				Diesel Op. Cost	Kleanbus Op. Cost	Saving
	<i>Kleanbus Repower costs Optare Solo</i>	<i>Kleanbus Repower costs Optare Solo fleet</i>	<i>Kleanbus Repower battery lease 7-year fleet total 282 kWh</i>	<i>Kleanbus Repower Midi-Bus x4 vehicles fleet</i>	<i>Total Operational Cost x4 diesel midi-buses Total 7 years</i>	<i>Total operational cost x4 Kleanbus Midi-Bus Total first 7 years</i>	<i>7-Year total operational cost saving, including repower costs</i>
	<i>Single Vehicle</i>	<i>x4 Vehicles</i>	<i>Battery as a Service</i>	<i>Repower + Battery</i>	<i>Diesel Optare Solo</i>	<i>Electricity + MS&R</i>	
Standard Kleanbus Repower of a midi-bus sized bus	£110,000	£440,000	£329,000	£769,000	£1,688,427	£111,440	£1,030,867
	Assuming £1.65 diesel costs per litre		£47,000 annually for			Including £0.144 NSG	
	Assuming £0.11 / kWh at McCall's depot		7 years				

Figure 6.1.2 ROI with GridBeyond PPA

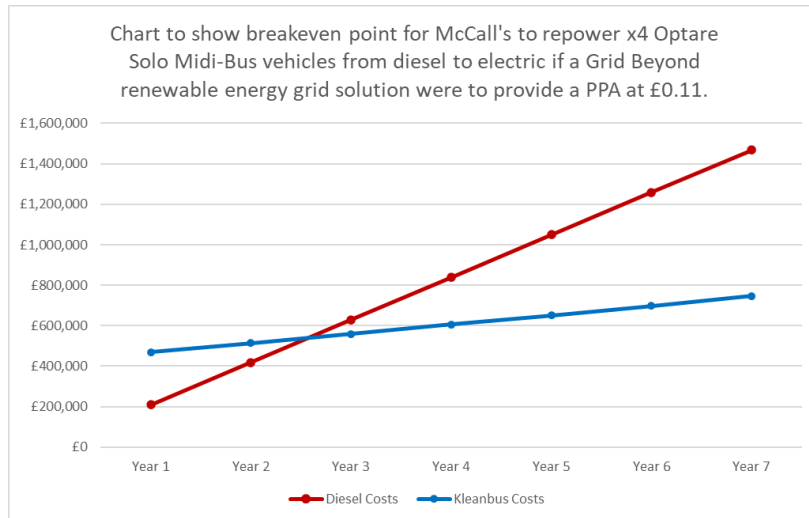


Figure 6.1.3 Breakeven point with GridBeyond PPA

Assessing the financial payback return of embarking on this approach is clear.

Breakeven point occurs after 2.5 years from the point of Kleanbus repowering, assuming the Lochmaben PPA can be achieved with Grid Beyond at a 20-year rate of £0.11.

This would present the leadership team at McCall's with 20-year planning horizon of known energy costs and the resulting stability in future planning.

6.2 Implementation Timeline

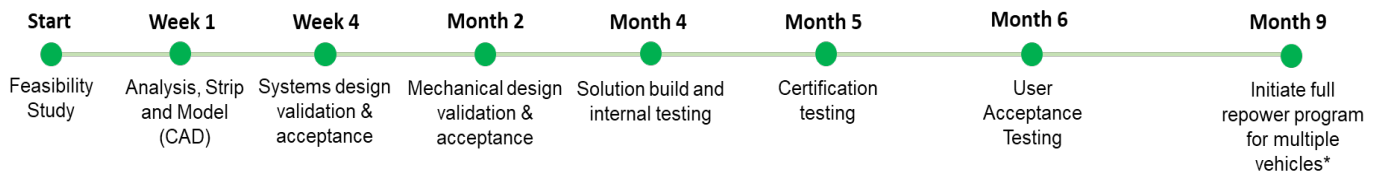


Figure 6.2 Kleanbus Repower Timeline

Subsequent vehicles of the same type can be repowered in less than a week.
 Note: For solutions already modelled these timelines should reduce significantly.

6.3 Phase 1

Phase 1 of the deployment would be to replicate the concept completed with improvements to the remainder of the fleet and replace the old vehicles, not suitable for retrofit, with new electric ones. Also introduce opportunity charging into more service routes. It is also envisaged that pre-owned diesel vehicles disposed out of city fleets could be routed for Kleanbus repowering and deployed into McCalls as electric, to avoid the cost of new BEV commercial coaches.

6.4 Phase 2

Phase 2 and the final step would be either to retrofit or replace all the "leased" buses marked up having new diesel engines today.

Appendix A. List of Active Vehicles

Reg No	Type	Year	Duty	Seating Capacity	Comments	Owned/Leased	Used on Routes
YJ13 HKG	OPTARE SOLO	2013	Service	33	New diesel engine Jan 2023	Leased	112, 382, 521, 385, 501, 502
RJ65 WZK	Mercedes Sprinter	2015	Service	18	New Diesel Engine March 2022	Leased	503, 520, 521, 385
BF62UYM	VOLVO B7R	2012	School/Service	44	School Bus, Low Floor. Good for service as well	Owned	236
YJ10EZA	OPTARE Solo	2010	Service	30	Good for conversion?	Owned	112, 382, 521, 385, 501, 502
PJ13746	VOLVO	2008	School Bus	50	School Coach. Too Old for Conversion? Replace with New	Owned	School Contracts
YJ62 FAM	OPTARE	2012	Service	33	Good for conversion	Owned	112, 382, 521, 385, 501, 502
YJ15APO	OPTARE	2015	Service	33	Good for Conversion	Leased	112, 382, 521, 385, 501, 502
SJ57AAE	OPTARE	2017	Service	42	Good for Conversion	Owned	112, 382, 521, 385, 501, 502
YJ22AYM	OPTARE	2022	Service	33	Good for conversion	Leased	112, 382, 521, 385, 501, 502
YJ60KHD	OPTARE Versa	2010	Service	42	Good for conversion	Leased	112, 382, 521, 385, 501, 502
LN69 OJD	Mercedes Sprinter	2019	Service	18	Good for conversion	Leased	503, 520, 521, 385
BIG 5211	BOVA	2007	School/Private Hire	53	School bus. Too old for conversion? Replace with New	Owned	School Contracts
V33KLT	VOLVO	2008	School/Private Hire	51	School bus. Too old for conversion? Replace with New	Owned	School Contracts
LM17 VWJ	Mercedes Sprinter	2017	Service	18	New Diesel Engine December 2022	Leased	503, 520, 521, 385
YJ07VRL	OPTARE	2007	Service	30	Good bus. Possibly too old? Replace with New	Owned	112, 382, 521, 385, 501, 502
YJ14 BGE	OPTARE	2014	Service	33	Good for conversion	Owned	112, 382, 521, 385, 501, 502
LN17 NHP	Mercedes Sprinter	2017	Service	18	New diesel engine May 2022	Leased	503, 520, 521, 385
LN69 OGL	Mercedes Sprinter	2019	Service	18	Good for conversion	Leased	503, 520, 521, 385
BEZ 3135	Volvo	2002	School/Private Hire	70	School Bus. Too old for conversion. Replace with New	Owned	School Contracts
LM17 VWH	Mercedes Sprinter	2017	Service	18	Good for conversion	Leased	503, 520, 521, 385
VEZ 5233	Volvo	2008	School/Private Hire	51	School Bus/Private hire. Too old? Replace with New	Owned	School Contracts

Appendix B. Scottish Power Energy Networks Distribution Heat Maps

[Scottish Power Energy Networks Distribution Heat Maps application](#) provides an indication of the potential opportunities to connect Distributed Generation (DG) to the 11kV and 33kV network in the SP Distribution plc license area (Central & Southern Scotland).

Category	Description
Green	All operational factors are within tolerable limits and so opportunities may exist to connect additional Distributed Generation without reinforcing the network (subject to detailed studies).
Amber	At least one factor is nearing its operational limit and hence, depending on the nature of the application, network reinforcement may be required. However, this can only be confirmed by detailed network analysis.
Red	At least one factor is close to its operational limit and so installation of most levels of Distributed Generation and a local connection is highly unlikely. It may also require extensive reinforcement works or given the lack of a local connection, require an extensive amount of sole user assets to facilitate such a connection.

Each substation and circuit have been assigned one of the following categories:

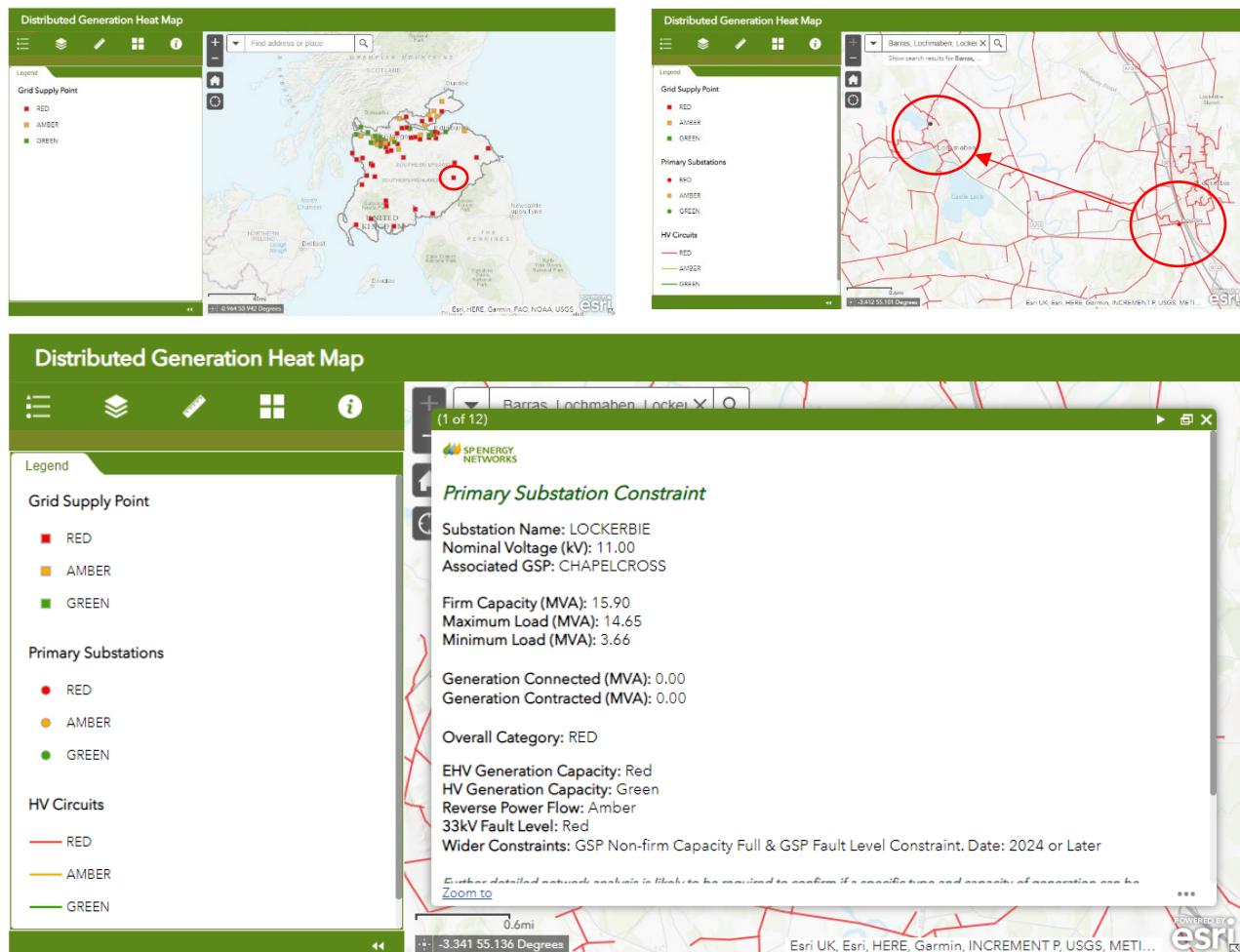


Figure B1 McCall's Lochmaben depot supporting sub-station

Appendix C. Summary evaluation of NEW OEM electric buses & coaches

The leadership team at McCall's are interested in the acquisition of new OEM electric vehicles, as well as the potential to re-power diesel vehicles.

Below is a summary evaluation of the types of vehicles which could be considered.

All values are indicative and identified to the best ability of the author at the time of writing.

NEW OEM Electric Vehicles	Vehicle Type	Max. Passenger Capacity	Capacity (kWh)	Battery Specification	Calculated* Battery Weight (kg)	Range claim miles (km) (Fleet Actual)	Efficiency kWh/km (actual)	Gross Vehicle Weight (kg)	Vehicle Cost **Online and advised figures
EVM Altas E- Cityline Mercedes eSprinter	Minibus	19 (15 seats)	115	Lithium NMC	442 kg	150 (241)	0.47	5,800 kg	£227,000
Yutong E12	Single deck	70 (39 seats)	422	LFP (Lithium Iron Phosphate)	3,516 kg	229 (370) 180 miles	1.1	13,750 kg	£375,000
Wrightbus "GB Kite" electroliner	Single deck	88	567	Lithium NMC	4,725 kg	250 (402)	1.41	19,500 kg	-
BYD ADL Enviro 200EV	Single deck	80 (40 seats)	348	LFP (Lithium Iron Phosphate)	2,900 kg	160 (257) 90 miles	1.35	18,700 kg	-
MAN Lion City E	Single deck	104	640	Lithium NMC	2,462 kg	220 (350)	1.82	-	£525,000
BYD ADL Enviro 400EV	Double deck	85 (67 seats)	382	LFP (Lithium Iron Phosphate)	3,183 kg	160 (257) 90 miles	1.6 kWh/km (1.8 kWh/km)	19,200 kg	£475,000
Wright Bus "Streetdeck" Electroliner	Double deck	96	454	LFP (Lithium Iron Phosphate)	3,783 kg	200 (320)	1.41	19,500 kg	£450,000