ELECTRIC VEHICLES REVEALED:

Does towing and payload affect range?

LEADING THE CHARGE TO 2030

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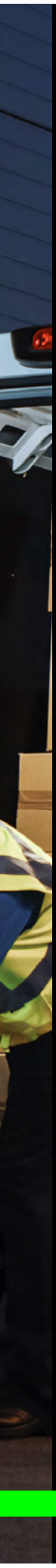
INTRODUCTION

Knowledge of how electric vehicles (EVs) perform for efficiency and range while towing is currently limited, and this goes double for commercial vehicles. Testing carried out on a cross-section of vehicle types and reflected in Arval's 'Electric Vehicles Revealed' report shines a spotlight on this subject.

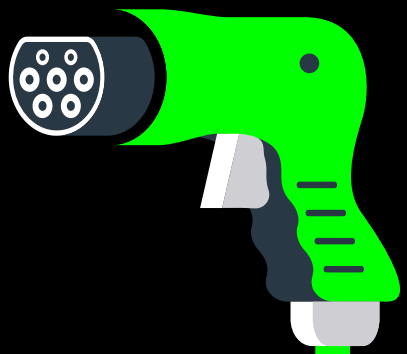
From the data this research reveals, fleets and businesses will be able to easily assess and calculate how their towing operations can adopt electric vehicles.

The study aims to support businesses on their journey to electrification and sustainable transport by being able to power decisions on the suitability of BEVs (Battery Electric Vehicles) for towing.

Equally important is the ability to rule them out - where they are not suitable - so as to avoid costly mistakes.



KEY FINDINGS



TOWING has a greater impact on range than vehicle load

Expected towing range is around **70-75%** OF WLTP RANGE

Impact of towing on top of maximum payload for LCVs is between

13-17 PERCENTAGE POINTS

CHARGING INFRASTRUCTURE

is not yet geared up for EVs that tow

Fleets that have a towing need may need to look at new business models to ADOPT **EVs**

METHODOLOGY

Testing was carried out for Arval by world-renowned UTAC at its test centre in Millbrook, Bedfordshire. The United Test and Assembly Centre (UTAC) specialises in vehicle testing and approval and is at the forefront of electrification with its dedicated battery test centre.

UTAC Millbrook also offers over 43 miles (70km) of unique tracks: high speed circuit, off-road tracks, alpine tracks, durability, as well as facilities dedicated to connected and automated vehicles.

Each test was identical and carried out on a dynamometer to accurately and consistently replicate real use driving with differing states of load and also while towing. Mirroring what happens in the real world, but in repeatable laboratory conditions, provides a real-use figure for range and efficiency.

WLTP vs real-use range

A focus on the impact of towing in eLCVs and cars necessitated first calculating the real world range for each category of vehicle. Simply using the official Worldwide Harmonised Light Vehicle Testing Procedure (WLTP) range as the start point for the impact of towing would not have produced clear or useful results. This is because it is already widely known and accepted that the manufacturer WLTP figures do not accurately reflect real-use electric vehicle efficiency data that fleets and individuals achieve in everyday driving.

In this testing, the full size eLCV saw a real-use range of 57% of its WLTP figure. The mid-size eLCV recorded a real-use range of 55% of WLTP and the car came in at 50% of WLTP.

FOUR SCENARIOS WERE TESTED

0%
payload & no towing

50%
payload & no towing

100%
payload & no towing

100%
payload & towing 500kg

Ahead of the dyno test, the vehicles were put through a 3.1 mile (5km) warm up and charged to 100%. Each test in each state of load was repeated three times to ensure accuracy and all were pre-conditioned at 23degC to negate the impact of temperature differences.

As previously recorded in Arval's 2021 research report, 'Electric fleet transition powered by real-world data', cold weather affects battery performance and on a combined driving cycle van operators should expect the range in winter to be 60-70% of the stated WLTP (Worldwide Harmonised Light Vehicle Test Procedure) figure.

Testing was carried out over more than 50 miles with the headlights on 'dipped' and the tyre pressures set at each manufacturer's recommended figure.

The vehicles were then charged back up to 100% and the amount of electricity consumed was recorded.

In the case of the two classes of eLCV (electric Light Commercial Vehicle), four scenarios were tested; 0% payload & no towing, 50% payload & no towing, 100% payload & no towing, 100% payload & towing 500kg.

For the electric car, two scenarios were tested; four people onboard & no towing, four people onboard & towing 500kg.

Impact of temperature on range

Arval's 'Electric fleet transition powered by real-world data' report from 2021 was the first independent investigation into the impact of temperature on electric LCV real-use range. It was also the first independent investigation into the impact of payload on electric LCV range.

Tests carried out for the report showed that lower ambient temperatures, typically found in a British winter, can more than halve an eLCV's official range. However, more typically, colder weather is more likely to cause a range reduction to around three-quarters (72%) of the official figure.

Payload also has an impact on an eLCV's real-use range, but with an average range reduction of 8% it is far less impactful than a cooler ambient temperature.

The total impact of cold weather combined with a full payload provides a vital baseline or worst case scenario for eLCV operators. This figure is 50% of the official WLTP range.

72%↓

Colder weather is more likely to cause a range reduction to around three-quarters (72%) of the official figure.

RESULTS

The figures show range under various conditions. They provide useful and usable information about what happens when using these types of vehicle to tow compared to the real-use range. At a headline level, these tests show that towing has a significant impact on range and a greater impact than simply adding load.

Large eLCV [fig 1-1]

Moving from unladen to a half load, the large van experienced an 11.3 percentage point drop in range (and efficiency). Moving on to a full load, there was a smaller 3 percentage point drop in range. Add in towing and the range dropped a further 17 percentage points.

Overall, the difference between the real-use range and towing with a full load resulted in a 31.4 percentage point drop. Or to put it another way, fleets and drivers can expect a range that's 68.6% of the real-use maximum when towing the same maximum load.

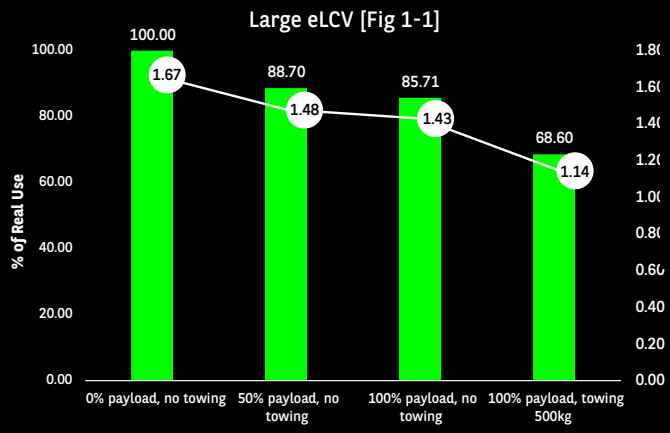
Mid-size eLCV [fig 1-2]

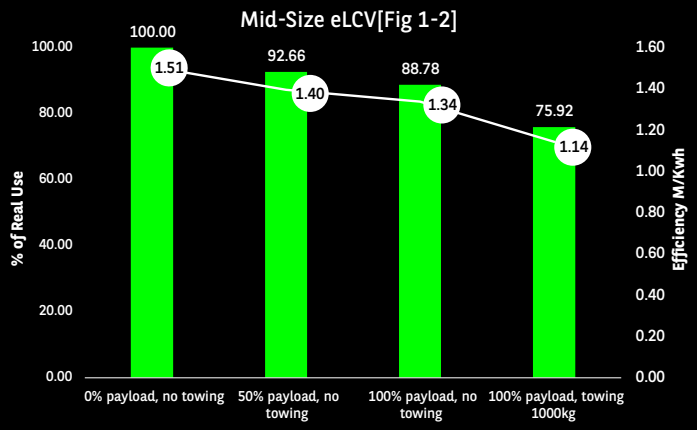
The initial drop in efficiency for the mid-size electric van from unladen to 50% load resulted in a 7.3 percentage point drop. A further 3.9 percentage point drop at 100% load and then an additional 12.9 percentage point drop when towing with a full load onboard.

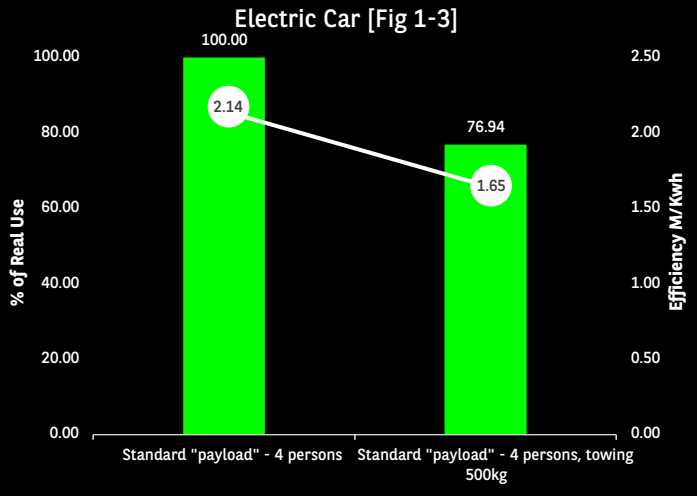
The combined drop in range from unladen to fully laden and towing was 24.1 percentage points, or a 75.9% range when compared to the real-use maximum when towing the same maximum load.

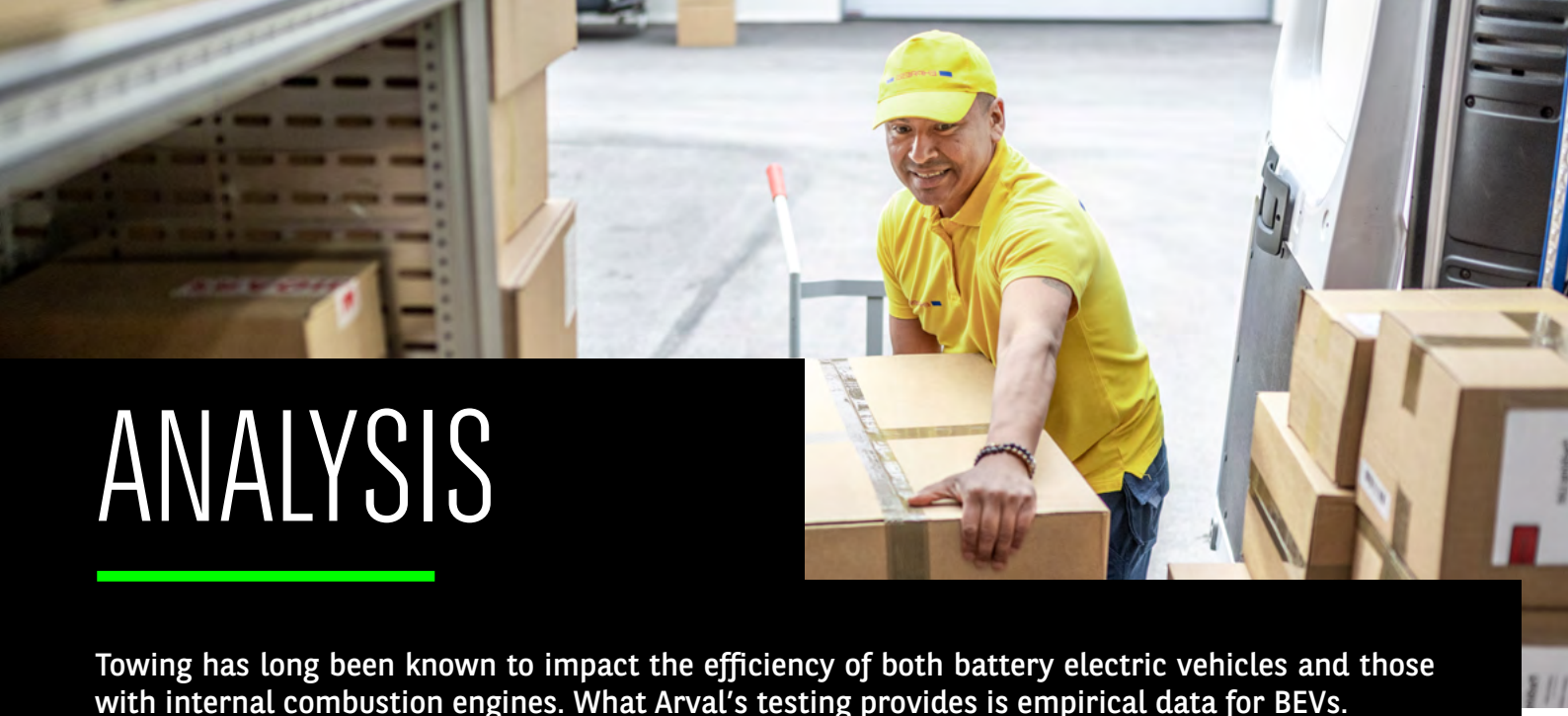
Electric car [fig 1-3]

In this test the real-use range was assessed with the equivalent of a driver and three passengers onboard. The impact of towing was a 23.1 percentage point reduction in range and efficiency. This equates to a range that's 76.9% of the real-use figure when towing the same maximum load.









ANALYSIS

Towing has long been known to impact the efficiency of both battery electric vehicles and those with internal combustion engines. What Arval's testing provides is empirical data for BEVs.

Having this information means businesses can make informed decisions about which vehicles could suit specific roles within a fleet and also which would not.

For commercial vehicles, which typically tow while also carrying a full load, the research found range was reduced by between a quarter and a third compared to the real-use figure.

What does this mean in reality? If your fully-charged range is typically 120 miles unladen, then you're looking at a 90 mile maximum while towing. If you're already operating on the basis of a range while at 100% payload, then the impact of towing is between 17-13 percentage points and a similar number of miles in our example.

By comparison, for diesel vans Arval's experts use a degradation in fuel efficiency of 15% when towing, against a van that's at 100% payload.

The impact on the car tested was actually greater than the eLCVs. The 23 percentage point impact on real-use range when towing saw a real-use range drop from 150 miles to 115 miles.

All of these figures are far more useful than the manufacturer's official numbers, which often state 'this vehicle can go up to...', but don't provide data for real-use operations either without a load or with one.

Towing capability

Towing capacity for BEVs is completely different to the diesel equivalent van or car.

While BEVs are more suitable for the action of towing, thanks to their typically larger torque and power figures and greater vehicle weight (which helps stability when towing), many manufacturers place significantly lower towing maximums on their vehicles.

A towing capacity of a mid-size electric van could typically be 750kg, yet its diesel equivalent would be 3,000kg.

However, the next generation of eLCVs have addressed this point and are likely to have significantly higher towing capacities.

By comparison, for **diesel vans** Arval's experts use **a degradation in fuel efficiency of**

15%

when towing, against a van that's at 100% payload.

To make informed decisions, the mystery of what happens when an eLCV or car is put to use on a fleet needs to be revealed.

At first glance, any reduction in range from the official numbers may look like bad news, but there is a positive too.

Based on a driver's mileage profile, accurate figures will support some drivers moving into electric vans; just not all of them.

Arval's research also means that as an industry we're still looking for the technological jump to cover 'bigger mileage ranges', including the impact of payload and towing.

Interestingly, the drop-off in range from towing isn't particularly great. The main issue stems from having an unladen real-use range that, in comparison to diesel vehicles, is significantly shorter.

With business operations having been built around LCVs (and cars) having a certain 'long' range coupled to the ability to refuel in a very short time, a switch to vehicles with a shorter range and longer refuelling time may prove difficult.

While accurate range figures in a wide range of scenarios will help many fleets make the switch to BEVs, many will also not be currently able to switch without major changes to their operations. Arval's vehicle load analysis backs up what was found in the first report in the Electric Vehicles Revealed series.

In this latest report, the range and efficiency of eLCVs fell by between eight and 12 percentage points for a half load and 12 to 15% for a full load.

The first report recorded an average drop in range of between one and nine percentage points for medium and large vans carrying 50% load and between eight and 11 percentage points when carrying a full load.

Zero Emission Vehicle Mandate

The importance of finding a solution should not be underestimated. If, as expected, the Government's ZEV Mandate moves from consultation to approval vehicle manufacturers will have to hit a 10% mix of new eLCVs registered in 2024, while for cars that figure will be 22%. Failure to do so will result in significant fines.

These figures then rise incrementally to 70% and 80% respectively in 2030. By 2035 the target will be 100% for both cars and vans.

What will challenge the manufacturers trying to hit the new targets is demand. Will fleets be able to take eLCVs if they don't do the job they're required to do?

The 2023 Arval Mobility Observatory report revealed that fleets only expected 18% of their LCVs to be BEVs by 2026 - somewhat behind the ZEV target at 22%

If supply is ahead of demand, rental companies could be used to register some of these eLCVs. However, this simply pushes the issue down the road.

Vehicle choices

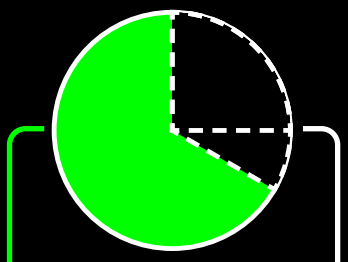
Longer mileage range EVs are needed because there's going to be large sectors of van operators that, at the moment, cannot carry out their transport needs on a shorter range with longer refuelling times.

Suitability is a particular issue for those operating larger vans.

The overarching point on 3.5t LCVs is that there's a real challenge to make EVs work for customers.

Small electric vans are working for fleets, particularly where there are usage, economic and environmental arguments.

Medium vans are close to working for most fleets and there are a large number of products soon to hit the market that will solve many of the issues in this sector.



120 mile range

90 mile range max when towing

For commercial vehicles, which typically tow while also carrying a full load, the research found range was **reduced** by between a **quarter** and **a third** compared to the real-use figure.

However, with large vans the vehicle manufacturers have not currently offered a suitable solution. There are vehicles which work for last mile delivery, however many other industries do not yet have sight of a solution. Sectors such as construction, civil engineering, pharmaceuticals and refrigerated transport do not yet have an electric van that's fit for purpose.

Infrastructure

Going hand-in-hand with vehicle range is the ability to conveniently recharge an electric vehicle. Many of the issues surrounding range would disappear if recharging was quicker, easier and if is there ample opportunity for all vehicles to recharge when stationary for the longest period i.e. at offices while working, or parked at a depot.

Over the last 100 years, with a diesel van there's always been somewhere to fill up. Fleets know that when you fully load a van and go to do your day's work, you're going to get fewer miles per gallon than officially claimed. However, this doesn't matter, because if you don't have enough fuel, you fill it up.

Critical for the transition to electric is that an eLCV must do the same job.

This is borne out by Arval's research with those fleets already using electric vans; the drivers like the way the vehicles drive, showing this isn't a hurdle.

Handling the charging down-time needed to operate higher mileage eLCV operators is, however, a hurdle. The latest Arval Mobility Observatory report shows 20% of fleets have workplace charging and 40% expect to install charging points in the next 12 months, but if the range of the vehicle is less than the daily mileage, use of the public or an alternative workplace-charging network comes into play.

For commercial vehicles, it isn't just the availability of charging points, but the design of the charge points that must be correct to allow for their use.

Very few charge points allow for 'side-on' charging similar to that seen on petrol and diesel forecourts. Instead, end-on charging means that larger LCVs either don't fit in the dedicated bay, have to spill into the roadway or park across several bays to recharge.

It's for this reason that at-work or home-charging is so important to fleets running eLCVs.

What fleets want is a van that can start and end the day's work on a single charge. However, for larger depot-based fleets, there are also considerations around cabling and the cost involved in trying to upgrade that site.

Solve the physical infrastructure issue of depot and en route van charging and another issue comes to the fore; downtime.

Some industries have either time-sensitive goods or high value personnel in play and any additional transport times can have significant cost consequences.

Hydrogen

While the Government's ZEV Mandate pushes BEVs into the market, there are also other zero-carbon solutions, with hydrogen topping the list.

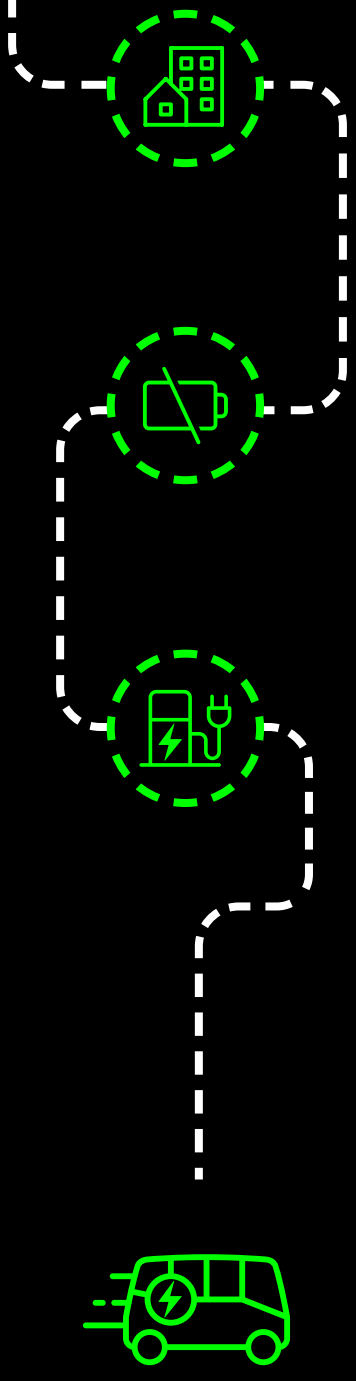
Initially, hydrogen is likely to be adopted in the HGV market as a way of reaching net-zero, as hydrogen can be produced in a carbon neutral way from renewable energy sources, such as wind and solar.

However, several OEMs, including Mercedes, Ford and Stellantis, are also producing LCVs that use hydrogen as a fuel. The advantage to hydrogen over electric vehicles is two-fold. Firstly, vehicles can be refuelled in a similar length of time to diesel and secondly their range is similar to that of a diesel van.

There is one major disadvantage. In the UK there are only 15 hydrogen refilling stations. Several firms are currently planning to install more, but this number is still significantly below the number of liquid fuel forecourts or public charging points.

Experts also argue that installing a hydrogen refuelling network would be easier than installing a an EV charging network, because hydrogen does not impact the electricity grid and the refuelling points could be installed at petrol and diesel forecourts in the same way LPG once was.

For commercial vehicles, it **isn't just the availability** of charging points but the **design of the charge points** that must be correct to allow for their use.



CONCLUSION

It may seem like there are many hurdles to towing with electric vehicles, but in reality there are few that are specific to towing. If the wider issues to BEV adoption are overcome, then towing could easily be no more difficult than it is for diesel vehicles.

As Arval's research has shown, the efficiency drop for electric commercial vehicles is no greater in percentage terms than it is for internal combustion engined vans at around 15%.

For the passenger car we tested, the figure was slightly higher at 25%.

Solving the BEV adoption hurdles in the wider LCV market may need some significant work, but in all but a couple of areas, progress is being made.

Van ranges in the small and medium sectors are improving rapidly. Charging infrastructure is seeing significant investment.

There are however still difficulties surrounding larger eLCVs that cover higher mileages.

Possibly the biggest nettle to grasp is by businesses that operate larger LCVs over higher mileages. These fleets may need to look at their entire transport and logistics business model.

Disruption in this area could provide a solution, perhaps through more vehicles and more localised operations. However, the immediate impact of such a move is currently a significant increase in costs.

Solutions could potentially include more vehicles, more locations, a hub and bespoke approach to distribution, and greater business charging infrastructure.

In the current initial stages of BEV adoption, clear, accurate information is the best way to reach a solution. Detailed information, as researched for this report, will allow some fleets to calculate if they can, or cannot currently, adopt electric vehicles without having to make significant changes to their business model.

In the current initial stages of BEV adoption, **clear, accurate information** is the best way to reach a solution.

For more information on how you can make the switch to an electric fleet, please visit: www.arval.co.uk/manage-fleet/go-electric.

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