

# The Benefits of Operating Electric Vehicles in an Urban Environment

## Case Study



**Companies  
Involved:** Allied Vehicles Ltd  
TNT Express Ltd



**The Scottish  
Government**

*Department for*  
**Transport**

# Acknowledgements

This case study was compiled with assistance from:

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# Introduction

## What Are Electric Vehicles?

Electric vehicles use an onboard battery supply to power an electric motor for propulsion. Unlike diesel and hybrid vehicles, they rely entirely on mains electricity to charge batteries to power the motor.

## How Do Electric Vehicles Work?

Current technology restricts battery charging of electric delivery vehicles to industrial three-phase supply, which makes them unsuitable for charging at a domestic property. Future designs may allow vehicles to be charged by plugging in to a conventional 240 volt socket.

As an electric vehicle brakes energy can be passed back to the battery (known as 'regenerative braking'). This is done alongside normal service brakes. With an electric motor there is no need to change gear – the harder the driver presses the pedal the faster the motor turns, driving the vehicle forward.

Due to the high torque of an electric motor, electric delivery vehicles accelerate faster than diesel vehicles, even at maximum weight. This, combined with no need for gear changes, ensures that operation in the urban environment is comparable and at times even better than diesel equivalents. Overnight charging of these vehicles ensures that they are ready for a full

10-hour working day. Electric vehicles being used in current delivery applications are able to achieve up to 100 miles before requiring recharge.

## Considering a Change to Electric Delivery Vehicles?

Moving from diesel vehicles to electric vehicles requires some changes to operational practices.

The key operational changes that your company might need to consider are outlined below.

### Cost Benefits

- ➔ Zero Vehicle Excise Duty (VED)
- ➔ No requirement for yearly MOT, Tachograph or Operating Licence for 7.5t GVW





- ➔ Fuel cost approximately 20% of diesel equivalent
- ➔ Potential for reduced maintenance through fewer mechanical parts

## Charging

Battery-powered electric vehicles need to be at a standstill to be charged, which means that the 'downtime' of vehicles needs to be planned into a full

24-hour day. Charging can be done overnight. Vehicle parking facilities at your depot may need to be adapted, with the installation of charging equipment in order that each vehicle has a re-charging point.

## Operating Benefits

Whilst previous generations of electric vehicles may not have been able to meet the needs of modern multi-drop operations, the present generation of vehicles can operate at speeds up to 70 miles per hour and with up to a 100-mile range between charges. This means that they are ideally suited to working in an urban environment, but may not be suited to inter-urban working. The main benefits are:

- ➔ Faster acceleration in traffic
- ➔ No gear changes — perfect for stop-start applications, fewer gear changes and clutch movements equals less stress and fatigue for drivers

- ➔ Ideal for multi-drop use — range up to 100 miles
- ➔ Zero emissions at point of use
- ➔ Lower total CO<sub>2</sub> emissions overall – electricity from the National Grid has a cleaner make-up.
- ➔ Many components are 100% recyclable
- ➔ Quiet running vehicles – which may be a benefit for operating in noise-restricted areas, but may also pose an issue for pedestrian safety (if the vehicles are too quiet)

Electric vehicles are gaining popularity across Europe, as they are proving themselves more able to take on work that was traditionally undertaken by diesel vehicles. There are now 4,000 registered electric vans in the United Kingdom. It is worth noting that electric vehicles are relatively new within their development cycle.

## Costs Associated With Electric Vehicles

- ➔ Higher purchase / leasing cost than a diesel vehicle
- ➔ Emissions are associated with electricity generation at source, not at point of use (0.537 kg CO<sub>2</sub> / kWh, as per DEFRA National Grid rolling average [2008]). However utilising renewable sources may negate this

- ➔ Uncertainty over the depreciation of vehicle values, with nominal residual values common
- ➔ Changes may be required in operating practices, as well as the installation of charging equipment
- ➔ Potential of reduced operating range in cold weather
- ➔ Manufacturers' warranties can vary

Manufacturers including DAF, Volvo and Mercedes Benz offer hybrid diesel-electric vehicles for midweight operations in the urban environment, such as night delivery and refuse collection vehicles, and offer a longer range than usual for electric vehicles.

Choosing the vehicle that is fit for your purpose is the biggest challenge for potential buyers. Freight Best Practice provides a range of information to assist you in specifying the right vehicle.

## Manufacturers of Electric Vehicles

In the UK there are currently a number of electric vehicle manufacturers, including Dragon, Modec, Smith and Allied Vehicles. One of these, Allied Vehicles, is based in Glasgow. Vehicles are based upon existing van or chassis / cab configurations.





# Manufacturer Case Study

## Allied Vehicles, Glasgow

Allied Vehicles manufactures a range of Zero Emissions Vehicles (ZEV) at its factory situated on Balmore Road in Glasgow. It is one of the largest employers in the area with nearly 400 employees.

Its range of ZEVs includes Peugeot-based vans on Boxer 3.5t and Expert 2.9t chassis, Minibus variants are also available. Both vehicles employ the same power plant with asynchronous three-phase motors powered by lithium ion phosphate batteries mounted under the chassis.

The range of both vehicle designs is up to 100 miles with an operational battery life of around 2 years. Charging time is 6–8 hours from a three-phase 410V supply meaning that charging can only be done from commercial premises at present. A mains 240V charging facility is being investigated along with heavier chassis derivatives for further commercial development.

Experience of these vehicles shows a familiar Peugeot dashboard with a couple of modifications for showing power supply and charging of the batteries. They stop, start and brake in the same way as the base diesel models, but without the usual gearbox or clutch, with little to concern new drivers.



# TNT

## Introduction to TNT

TNT Express is one of the big four global courier companies, alongside FedEx, UPS and DHL. It provides a range of delivery services to customers across the world, ranging from same / next day small parcels to larger packages with longer delivery timescales.

In August 2007, TNT launched a carbon emission reduction programme, Planet ME, where they set themselves the challenge to become the first zero emission mail and express delivery company.

## Electric Vehicle Decision

To meet the zero emission target, as specified by Planet ME, TNT decided on the use of electric vehicles. They determined their requirements, reviewed potential suppliers, and ordered one hundred 7.5 tonne Smith Newton delivery trucks, manufactured by Smith Electric Vehicles. The vehicles will eventually replace a fleet of diesel vehicles and will be put to use on urban routes. TNT believes that when all one hundred vehicles are in operation, they will reduce the company's CO<sub>2</sub> emissions by 1,300 tonnes annually.

TNT Express in the UK are not the only company to embrace the potential of Smith Electric Vehicles, other companies include TNT (Netherlands), Fedex, UPS, CEVA Logistics, Sainsbury's Online, Marks & Spencer, Tesco, DHL, Royal Mail, the Co-operative Group, Speedy Plant Hire and Enterprise plc.

“On average it costs just £40-a-week to power a zero emission vehicle as opposed to around £200 spent on diesel fuel. The electric vehicles are also exempt from the London congestion charge - approximately £1,750 a year - and do not incur road tax in the UK.”

**Tom Bell, Managing Director of Express Services UK & Ireland, TNT Ltd**

## Electric Vehicles in Scottish Operations

TNT's Edinburgh express operations are based at Turnhouse. This depot is home to a fleet of twenty-five 7.5 tonne delivery trucks, an assortment of Sprinter and Luton vans plus three Smith electric Vehicles. The electric vehicles are considered part of the normal fleet and are utilised on the same delivery patterns dictated by postal codes as their diesel equivalents. All three work in Edinburgh City Centre, a World Heritage Site, and are only restricted in use by a maximum range of around 85 miles. The vehicles have been in use for about six months and are expected to be in service for up to five years.

## Vehicle Specification

These vehicles represent three of the one hundred Smith electric vehicles currently being built and operated for TNT Express in the UK. The vehicle, based upon the Avia chassis/cab design, has been specifically designed for TNT's multi-drop use requirements. The vehicle's sliding rear doors with external keys and slamlocks, plus a tail-lift have been specified allowing TNT's drivers to respond to the varying requirements of multi-drop deliveries.

Overnight charging by way of a three-phase loading dock-mounted supply allows these vehicles to 'trickle charge' over night, while being loaded and unloaded, with full charge achieved after approximately eight hours. The batteries have no 'memory effect', and can be partially charged halfway through the day or fully charged without affecting overall performance. They also cannot be overcharged by leaving plugs attached longer than one night. Overnight security at the depot is tasked with ensuring that the vehicles remain 'on charge' during the night to ensure that they are ready to roll in the morning.





## Vehicle Operation

These vehicles are exempt from tachograph laws but have been fitted with digital tachographs by TNT in order to monitor driver performance and keep within drivers' hours and Working Time Directive regulations.

Local deliveries ensure that the vehicle's maximum range is never reached, with 45–50 miles being a more realistic distance covered per day per vehicle. TNT's experience gained over the last six months shows that each vehicle is expected to complete a ten hour working day with up to 30% charge in reserve. Technologies such as regenerative braking allow a light-footed driver to prolong battery life through 'coasting' in order to re-charge the batteries whilst in traffic and descending Edinburgh's many hills.

“They are expected to fit straight into the fleet and do the same job, I don't treat them any different to the diesel trucks. So far the drivers like them too.

“In the event of a breakdown Smith are very quick to repair the vehicles, any major repairs mean the vehicles are taken away to be fixed but most can be done on site by their service vans.”

**Raymond Masterson, Depot Manager, TNT Ltd**

Following basic operational training, drivers new to these vehicles are expected to complete up to 60 deliveries and over 12 contract collections in the course of a working day. The job is made easier by the two pedal driving set up where no gear changes (and therefore clutch movements) are required. The

knock-on effect of this reduction in movement is a reduction in driver fatigue both physically and mentally. However, as they are so similar to normal vehicles, no special driver training is required. In addition to this the vehicles are very quiet and thus are more comfortable to drive without the louder background noise that diesel engines can produce.

“Overall there's been good feedback from drivers. Many of them saying they are less fatigued at the end of the day due to near silent running of the vehicles and the lack of gear changes. This allows more awareness when driving in the city centre.”

**Steve Davies, National Engineering Director, TNT Ltd**



Table 1 Electric Versus Diesel

	TNT Electric Vehicle	7.5 tonne Diesel Equivalent
Vehicle Excise Duty	Nil	£165 / year
Weekly Fuel Cost	£30 off peak electricity	£150 diesel
Maximum Speed	50mph	56mph (limited)
Range	85 miles	250+ miles
Tachograph Exempt	Yes	No
Gear Changes	None	Up to 400 per day
Driver Comfort	Very quiet	Normal operation

Table 1 shows the comparison between the electric vehicles and the diesel vehicles that they are replacing within the TNT Fleet.

## Public Image

With the first vehicles on Edinburgh's roads in the summer of 2008, both the general public and customers paid a great deal of attention to the vehicles. The positive effect of these vehicles on TNT's green credentials, as well as operating in the historical city centre combined with operational benefits and increased driver comfort will continue to serve TNT proud.

"The customers like seeing the (electric) vehicle – so it's good for the company."

**Barry McMahon, Driver, TNT Ltd**

# Conclusions

Electric vehicles have many advantages for operating in urban environments and they are becoming a realistic solution in urban areas to the problems faced by the Transport Freight sector, such as:

- Volatile fuel prices
- Carbon emissions associated with operations
- Concerns of long term supply of fossil fuel

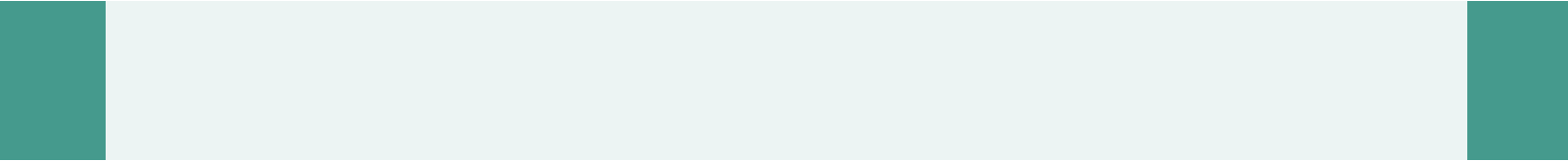
The benefits of an electric vehicle can include a reduction in delivery point emissions, potentially lower fuel running costs, reduced administration, and exemption from Vehicle Excise Duty (VED).

The drawbacks include the higher purchase cost of electric vehicles than their diesel counterparts, and the uncertainty over residual values of vehicles.

The design and efficiency of electric vehicles continues to improve. They have advantages and disadvantages when used as low-mileage urban delivery vehicles, but have sufficient potential to now be integrated into the fleets of some large transport operators such as TNT. Early trials of these vehicles have been positive and time will tell if TNT's commitment to expanding their use of alternative fuel technology will be pursued further.

The information provided in this publication should help you decide if electric vehicles might be right for your operation.







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