
MEETING THE CHALLENGE OF CHARGING ELECTRIC VEHICLES

For many years, now, all of the world's largest express parcels delivery companies have been investing heavily in electric and alternative fuel vehicles. This has been as a result of increasingly strict emissions targets being set by regulators and the threat of an outright ban on diesel engine vehicles in many cities around the world.

It is not just regulators who are pushing for change. The Financial Times newspaper has published a story suggesting that larger customers for road freight services are pressing the European Commission to introduce regulations to dramatically reduce CO2 emissions from trucks.

The newspaper states that, "Unilever, Ikea, Nestlé and Carrefour [have] called for a 24 per cent cut in trucks' fuel consumption by 2025, saying such a reduction would help the EU to meet commitments made in the 2015 Paris climate accord and push manufacturers to innovate in making low-emission vehicles." The signatories of the letter are said to demand that compulsory targets be set for the number of electric freight vehicles on the road.

The challenges to achieve these goals should not be under-estimated. These include developing:

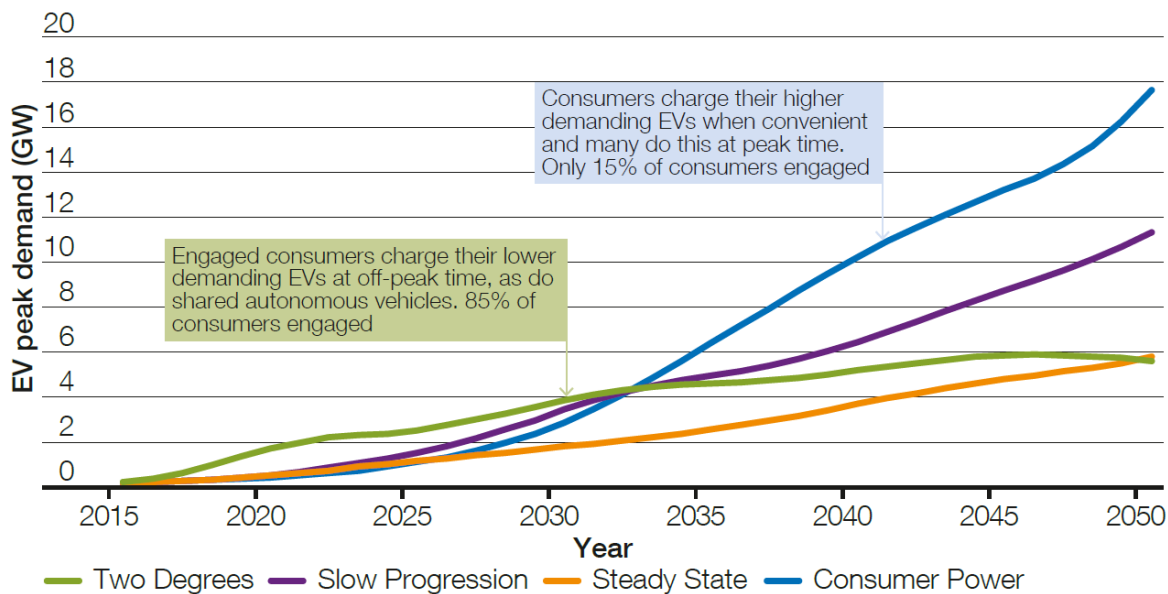
- battery technology to allow for vans to carry higher payloads over longer distances
- charging networks which allow vans to be re-charged 'on-the-go'
- smart-grid solutions which allow vans to be re-charged overnight at the depot within the constraints of local grid infrastructure.

The aim of this paper is to discuss some of the recent developments related to charging electric vehicles and the challenges being faced. This will involve a considerable crossover between electric cars and vans which in many cases will use the same charging infrastructure at least when 'on-the-go' during the day.

The charging challenge

A fundamental question for all administrators around the world is whether enough electricity can be generated to cope with the vast numbers which are being forecast for this new type of vehicle. One piece of research undertaken for power network provider, National Grid, forecasts that an additional 18GW of demand would be created in the UK alone by a take up of electric vehicles (both cars as well as commercial vehicles) by 2050 – almost a third more than the peak power required in 2017. Cars and electric vehicles will be competing with industry and domestic requirements for power. However, National Grid asserts, the demand from electric vehicles could be dramatically reduced by the use of smart technology (discussed below).

Electric Vehicle Peak Demand Scenarios



Source: National Grid

The National Grid research uses four scenarios to set out possible futures. Two Degrees (high economic growth and meeting climate change targets committed to by national governments); Slow Progression (Low economic growth and policy interventions limited by affordability); Steady State (Low growth rate and austerity) and Consumer Power (High economic growth rate and consumer-led society).

Although the research relates to consumer behaviour and its effect on demand, it is relevant in terms of attitudes to business as well. It shows that power demand will be at its highest if consumers (and businesses) charge their vehicles at peak times – a real challenge to the grid in developed countries and perhaps overwhelming in many countries with less developed generation capacities. However, the best case scenario suggests that if consumers and businesses charge at off-peak times, the peak demand will be much more manageable.

To spread demand there will need to be a combination of:

- tariffs to encourage efficient charging behaviour by consumers and businesses
- smart technology which identifies the best time to charge vehicles.

Charging options

One of the most important factors inhibiting EV uptake has been lack of confidence by consumers that they will be able to find a re-charging point, especially if they are undertaking journeys outside of urban areas. As we will see, this has prompted huge investment by a large range of different players, encouraged by government subsidy. The extent to which this impacts on parcels delivery companies is not so clear. Many vans will be re-charged at a depot overnight and the charge may be sufficient to last for a day depending on routes and loads. In which case, charging 'on-the-go' may not be so important, at least for urban deliveries.

Consequently, in addition to national networks of charging points, a proportion of infrastructure investment will need to be focused on centralized re-charging hubs where the demands of charging considerable numbers of vans over a short period of time will place considerable strain on local power networks.

Of course, not all parcels companies will operate on this basis. In a sector which is increasingly dominated by the use of owner-drivers (the so-called 'gig economy') many drivers take their vehicles home at night and will therefore be charging their vans from a domestic charging point. This will spread the intensity of demand over a larger area, although it will not, of course, reduce the overall demand placed upon the power generation companies.

Charging In the depot

As highlighted above, there are challenges related to charging large numbers of electric freight vehicles. When announcing a recent partnership with UPS related to a project undertaken in a London depot, Tanja Dalle-Muenchmeyer, programme manager electric freight at Cross River Partnership, said, "Our previous work on electric freight vehicles has shown that local grid infrastructure constraints are one of the main barriers to their large-scale uptake. We need to find smarter solutions to electric vehicle charging if we want to benefit from the significant air quality and environmental benefits these vehicles offer."

Upgrading the external power grid to a depot is a very expensive undertaking which would put off many companies from adopting electric freight vehicles. However, the UPS smart grid solution uses a central server which is connected to each EV charge post as well as the grid power supply and the on-site energy storage. This has allowed the company to increase the number of trucks it charges from 65 to 170 by spreading the charge throughout the night, in tandem with the other power requirements of the building, without exceeding the maximum power available from the grid.

The smart-grid solution will be rolled out in conjunction with other innovations. These include conventional power grid upgrade, smart grid, on-site energy storage with batteries and local power generation (using, for example, solar energy generated on facility roof tops).

Also in the UK, London-based delivery company Gnewt Cargo, with EO Charging, has installed what it believes to be the UK's largest single-site EV charge point location with a total of 40 new EO smart-chargers at Gnewt Cargo's depot in Bow, London. A further 63 smart-chargers have been ordered. Gnewt claims that it has the world's largest fully-electric delivery fleet in the world at around 100 vehicles. It delivered in excess of 2.6 million parcels in London in 2017.

In the US, Italian energy company, Enel, has acquired eMotorwerks, smart technology which allows charging stations to be controlled remotely for what is termed 'grid balancing' purposes. This decides the best time for connected vehicles to be charged. The stations also have a storage element that can be charged at off-peak times and can then be used to charge the vehicle once connected.

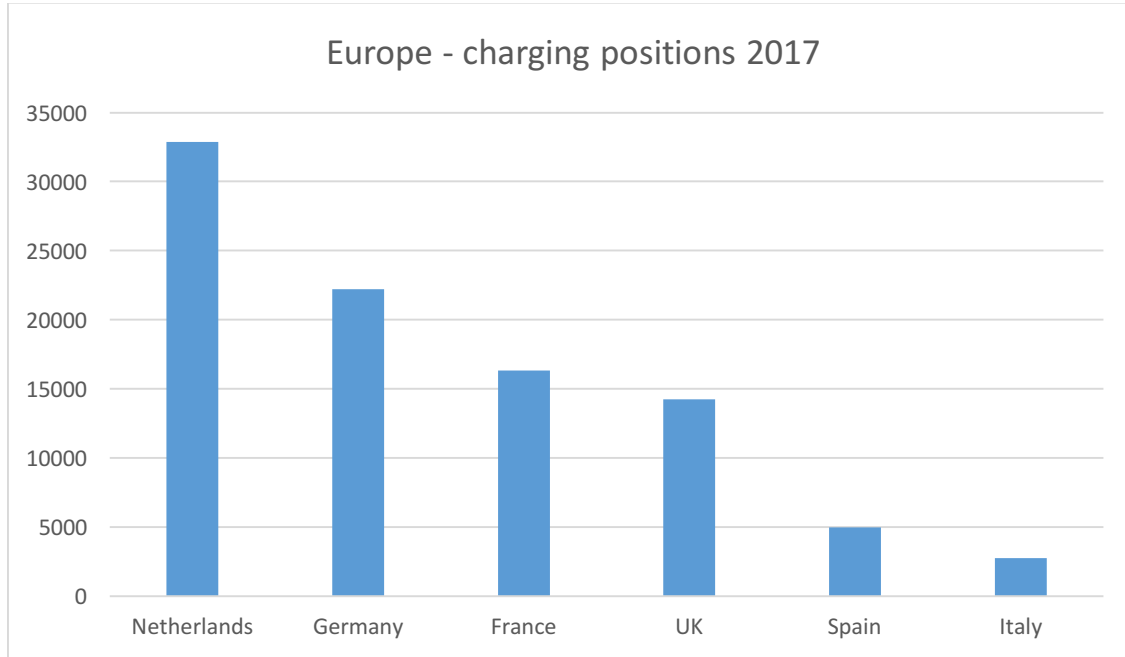
'On the go' charging

Away from the depot, investment is gathering pace for the development of charging stations. At present the major investments have come in Europe, USA and China. The key difference between domestic charging and public points is the speed of charge. Rapid charge points can charge an electric vehicle battery in 20-30 minutes. This will be essential for the fast-moving parcels sector where time is a critical commodity.

Europe

Many believe that a huge increase in charging points is needed in Europe if the infrastructure is to support the forecast number of electric vehicles. The bank Morgan Stanley estimates that 1-3 million public charging points will be required in Western Europe by 2030 compared to the present number of around 120,000.

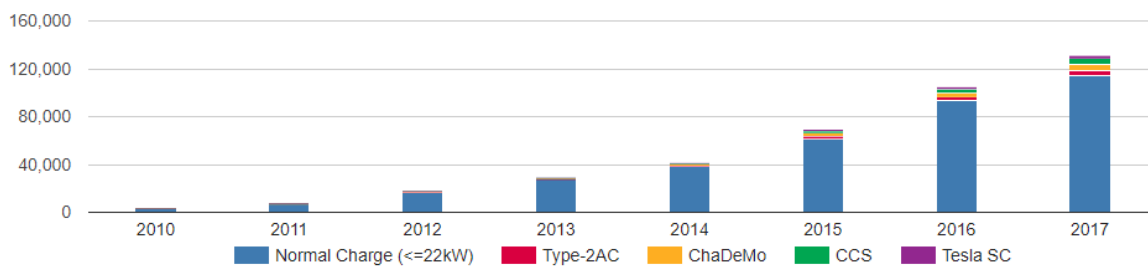
Although most parcels companies will be rolling out fleets of electric vehicles in urban areas where ‘on-the-go’ charging is not so much a problem, it will mean, eventually, that with the improvement in battery technologies, fleets may go fully electric rather than a mix of both diesel and electric.



Source: Eurostat

The chart above includes all charging positions, the majority of which are under 22kW – it is estimated that only 6% are ‘fast’. The new ‘Type-2’ charging connections are much faster, but much fewer in number. ‘Type-2’ has been adopted by the European Commission as the standard and will become ubiquitous over time.

Charging positions by type



Source: Eurostat

These points are being supported by both public sector subsidy and regulation as well as private sector investment.

Recent European initiatives include:

- In November 2017, Shell formed a partnership with IONITY (a group consisting of BMW, Ford, Volkswagen and other vehicle manufacturers) to develop a High-Power Charging network across Europe.
- BP has invested \$5 million in FreeWire Technologies, a US manufacturer of charging systems for electric vehicles. FreeWire's EV charging systems will be added to filling stations in the UK capable of fully charging an EV in 30 minutes.
- Not to be out-done in terms of diversification from its core energy business, Shell has acquired NewMotion, a company that specializes in building fast charging public EV stations. As with BP, they have started rolling out charging points in the UK with plans to expand in other locations in Europe. This will operate alongside Shell's network of points at its forecourts. With access to more than 64,000 public charge points, NewMotion has the largest charge network in Europe covering Belgium, Germany, The United Kingdom, France and The Netherlands.
- Another collaboration between US ChargePoint and French company Engie is also planning to build a pan-European networks of high-voltage fast-charging stations.
- Chargepoint is part owned by BMW, Daimler and Siemens and it has entered into a partnership with French-based TSG (previously owned by Tokheim) which provides maintenance services to filling stations in France, Germany, Ireland, Netherlands and UK.

UK

UK government legislation will prove important to the development of a national network by eventually making electric charging points compulsory at all petrol stations.

In the UK the National Grid is investing up to £1 billion in a network which will mean cars/vans are never more than 50 miles away from a re-charging station. Another issue is the speed of re-charging. National Grid say that their re-charging points will enable batteries to be re-charged within five minutes, obviously of key importance to commercial vehicles.

Another major player, Chargemaster believes that around 70,000 charging points will be in place in the UK by 2020 (it presently operates 6,500) and over 500,000 have been forecast by 2030. It plans to invest £50m in the expansion of its POLAR charging network in the next two years.

There has also been a partnership between MFG, which owns and manages filling stations across the country and Chargepoint, along with InstaVolt which has raised £12 million to install 3,000 charging points across Britain by 2020. Chargepoint has also formed partnerships with facilities solution provider ABM and utility service provider Fulcrum.

Germany

At the end of 2017, Germany had about 10,700 public charging points for standard charging at 4,730 charging stations, including 530 fast charging stations. The rest are in semi-private locations.

The National Platform for Electric Mobility forecasts that by 2020 there will be:

- 1.02 million private AC charging points in domestic garages, parking spaces, and employee parking lots
- 103,000 semi-private AC and 7,100 DC charging points, e.g. in customer car parks, truck stops or filling stations
- 70,000 public AC charging points in central locations and residential areas

German utilities company, E.ON, has acquired a Danish tech company, CLEVER, which runs charging networks in Denmark, Sweden and Germany, although it doesn't make its own equipment. It is looking to expand into France, UK and Italy with the support of E.ON.

France

Although, behind Germany and the UK in terms of the number of charging points in the country, France is rapidly catching up. It installed more than any other country in 2017, around 12,000, more than Germany and the UK combined.

- French utilities company Engie has acquired one of Europe's largest manufacturers of charging stations, EV-Box, a Dutch-based company.
- EDF operates 4,000 public charging points through its subsidiary Sodetrel. It has a fast-charging network, Corri-Door, which covers many of the main arterial routes. Currently it has 200 fast-charging 50 kilovolt stations costing €10m.
- French oil company, Total, is planning to roll out charging points at its filling stations throughout the country in conjunction with automotive manufacturer, PSA. Initially 300 filling stations will be targeted.

Netherlands

As can be seen from the chart above, the Netherlands has a large number of charging stations compared to its size. Consequently, its expertise has been sought after by investors looking to scale up across the region (c.f. acquisition of EV-Box)

- Fastned owns 63 EV charging stations and is looking to raise €100m to expand into Belgium, UK and France.

United States

The US Electric Vehicle Charging Association (EVCA) calculates that there are 50,991 charging stations across the US, both public and private. This is an increase from around 5,000 in 2011 and up from 45,000 in 2016. One of the key factors in the growth has been the 'Electrify America' initiative, funded by VW Group. A \$2 billion investment resulted from a settlement of VW's law suit relating to the falsification of nitrogen oxide results, \$800m of which will be invested in Zero Emission Vehicle (ZEV) infrastructure in California.

- Electrify America selected seventeen metro areas including Boston, Chicago, Denver, Fresno, Houston, Los Angeles, Miami, New York City, Philadelphia, Portland, Raleigh, Sacramento, San Diego, San Francisco, San Jose, Seattle, and Washington, D.C.
- Community-based charging station sites will be built in workplaces, retail (shopping centres, restaurants, etc.), multifamily residential locations and municipal lots and garages, as well as high-speed community depots that will feature fast EV charging at speeds of up 150kW compared with today's peak of 50kW.

- Highway sites will be located along high-traffic corridors between metropolitan areas, including two cross-country routes, and will include between four and ten 150kW and 350kW individual DC fast chargers at each location before June 2019.
- These sites will be located no more than ~120 miles apart and on average just 70 miles apart. Many shorter range EVs will benefit from 50kW DC fast charging on the Electrify America highway network.

Source: *Electrify America*

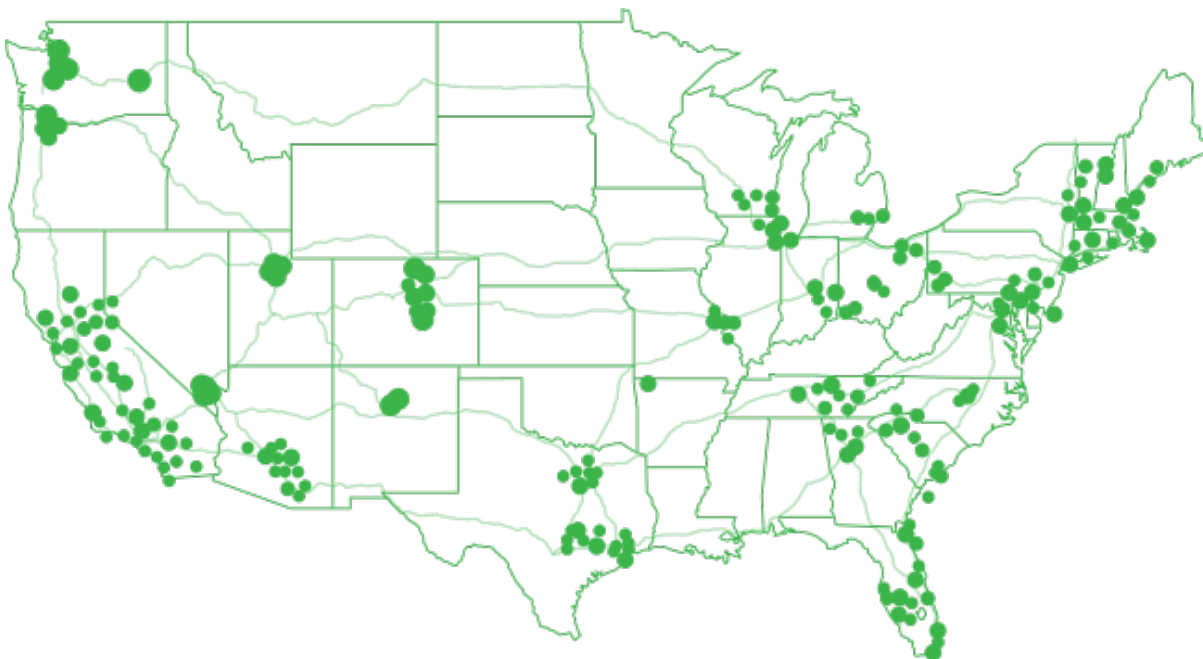
As part of its plans, VW Group also intends to partner with Walmart to install 2,000 chargers at around 500 charging stations across the country by June 2019.

In order to provide a network of fast-charging ‘on-the-go’, it is estimated that most of the US could be covered by 400 stations, situated 75 miles apart.

The four market leaders in the US are ChargePoint, EV Connect, EVgo, and SemaConnect which operate around a half of all public and private charging stations.

- The EVgo network, with over 1,000 fast charging points, grew by 20% in 2017, making it the fastest growing in the country. It claims to be the largest fast-charging network in the US. In 2017, in conjunction with engineering company ABB, it launched a 150kW service in California.

EVGo’s Fast-charging Network



Source: *EVGo*

- Chargepoint has added 10,000 charging locations in the last year, bringing its total to 49,000 charging points across the country. Of this, 767 are fast-charging. It has global ambitions and has partnered with many companies from various backgrounds in order to enter key markets around the world.

- EV Connect has raised \$5.9m in six funding rounds to finance its growth. It has won contracts from Electrify America to acquire, install and manage at least 630 charging ports at multi-unit dwelling and workplace sites within the greater New York City, Los Angeles, San Jose and Raleigh markets. It manages about 2,000 ports but has another 8,000 in the pipeline.
- SemaConnect claims to be the leading provider of electric vehicle amenities to the North American commercial and residential property market but it has also entered into partnership with utilities companies such as Pacific Gas & Electric.

The UK's National Grid is planning to roll out charging stations in Massachusetts (1,200 stations), New York (300-400 stations) and Rhode Island. It has already installed 150 stations to date.

China

In 2017 the number of public EV charging points grew by 51% to 214,000, according to the Chinese government. The target is to have in place around 500,000 by 2020 and China's government plans to invest \$19 billion in charging points – aiming to develop 4.8m in total. Despite these ambitious targets there are questions over the quality of the infrastructure being built. Charging times can be long and the number of providers makes payment and technology inconsistent. Chargers can be incompatible due to a lack of standards and the large numbers of manufacturers building EVs in the market.

The difficulty which consumers have in charging their vehicles during the day is likely to make home-charging at night the preferred option – but that will then place pressure on the grid during peak periods.

The solution would be to focus on building a network involving a fewer number but faster-charging stations.

This lack of coordination has not stopped investment in the sector. Didi Chuxing, a competitor to Uber, has launched a joint-venture with Beijing-based Global Energy Interconnection Development and Cooperation Organization (GEIDCO) to build a nationwide network.

Conclusion

Investment is pouring into the Electric Vehicle Charging Station sector. Government regulations and incentives will encourage consumers and freight operators to adopt EVs over a relatively short time frame and the infrastructure will need to be in place to support this growth.

Amongst the parties involved are:

- Oil companies looking to diversity from fossil-fuel dependence
- Power distribution companies seeing the market as a major opportunity
- Automotive companies who need dense re-charging networks in place in order to encourage consumers to buy EVs
- The technology hardware and software companies developing the charging stations
- Facilities management, retailers, filling station forecourt owners etc looking to leverage the location of their assets
- Governments and local authorities developing public policy for climate change and public health.

Despite the rush to build large numbers of charging stations, a more focused response would be to develop fewer, but faster-charging points. This would encourage consumers and companies to charge during the day rather than at peak times, such as the evening.



Smart technologies which ‘grid-balance’ will become important, especially in parcels depots, to decide on the best time to re-charge vans.

About Ti Insight

For further information about this article please contact John Manners-Bell at jmannersbell@ti-insight.com or visit the Ti website at www.ti-insight.com.

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