Opportunities in electric vehicle charging and infrastructure

Insights from WMG’s ‘Ready for Electrification’ event series

The UK electricity grid is changing and barriers to electric vehicle ownership are breaking down.

Dr Stuart Bradley, Principal Engineer at WMG explains the trends and opportunities for UK manufacturers:

On average, UK grid capacity is currently 80GW and the carbon intensity is 170g CO₂ per kilowatt hour over a year. This capacity mainly consists of coal and gas generation (60GW), with offshore wind, nuclear and biomass accounting for around 20GW.

In 2030 however, it is predicted that the grid intensity will drop down to 50-100 CO₂ per kilowatt hour and the grid capacity will rise to 150GW. This huge change will be due to an increase in offshore wind and other renewable resources. The grid in the UK will also change to distributed power stations and we will have interconnections with other countries enabling power to be bought and sold. All of this is great news for electrification.

In terms of charging rate and range, there have been some significant developments since electric vehicles (EVs) were first introduced. DC charging has increased from 50kW in 2014 to 150kW in 2020.

Electric vehicle energy consumption is about 5 miles per kW hour for a small electric vehicle (EV), and with today’s grid carbon intensity, this equates to 360 miles per gallon (mpg). For larger cars their electrical consumption equates to around 170 mpg, which is a huge increase in carbon efficiency compared to using petrol at about 25 mpg. Furthermore, as the grid de-carbonises, then by 2030 the equivalent mpg will be over 1000, and transport carbon emissions will be much lower than today’s 65 million tonnes.

There is a significant increase in people buying pure EVs and an associated demand for charging and infrastructure, with business opportunities in:

**Vehicle Power Electronics & Operation**
- On-board Chargers
- Motor inverters
- DC/DC converters
- Sensors and control systems
- Communications
  - Smart Charging
  - Grid operation data
  - User preferences

**Vehicle Charging**
- Charge points (electronics, enclosures, fixings, mouldings and castings)
- Cables and connectors
- Control and Sensors for ground and vehicle assemblies
- Manufacturing processes, quality assurance and defect detection
- Installation services
- Condition monitoring, maintenance and repair
Electric vehicle ecosystems

Tom Callow from bp Pulse, a charge point provider and network operator, gives his insights:

The most fundamental difference in ‘charging’ compared to ‘fuelling’ cars is that stations will not be the only place people use. Different locations for charging include: the home (currently 80% of charging), the workplace, destination charging (pubs, shops etc.) and increasingly public rapid charging points.

We are not going to see a convergence of charging around one type of speed there will be different speeds for different needs:

- Slow charger 3kW (Up to 2 miles in 10 minutes)
- ‘Fast’ charger 7kW (Up to 5 miles in 10 minutes)
- Existing rapid charger 50kW (Up to 33 miles in 10 minutes)
- Ultra-fast forecourt charger 150kW (Up to 100 miles in 10 minutes)

This diversity of charging will aid the adoption of EVs and will also create less strain on the grid.

It is predicted, however, that the future dynamics of charging will shift; with home charging declining from 70-80% to 40% (due, in part, to people who do not have access to off-street parking buying EVs), workplaces becoming more significant and public charging increasing due to a shift towards rapid charging.

UK charging infrastructure

Melanie Shufflebotham, co-founder and COO of Zap-Map gives her insights:

There has been a four-fold increase in charging points over the last four years.

Government funding in certain areas have created regional centres of excellence, but the main growth has been delivered by commercial companies.

More than 80% of EV drivers have a home charger, accounting for an estimated 80% of all charging. This is a game changer as most people charge overnight and this meets daily commute needs. However, there is a challenge in that 40% of UK households do not have off-street parking. There has recently been an increase in on-street charging (with charging units being installed on residential streets as either stander alone chargers or in lamp posts) which is beginning to address this issue. However, a Field Dynamics / Zap-Map study showed that despite this there is still a lack of provision, and 90% of households without OSP across 63 cities, are not within five minutes walking distance from peoples home. This is clearly an area which needs investment from local authorities to stimulate growth.

Destination charging is used to describe places such as pubs, restaurants and shops, which have charging facilities to allow customers to top-up. Increasingly businesses are seeing this as an opportunity to attract customers. Over 60% of EV drivers choose parking based on whether or not they can charge their vehicle.

On-route charging is similar to a petrol station, where people charge part way through a journey using rapid charging units.
Future developments in charging will be likely to include:

1. Increased charging speeds up to 350kW (for capable electric vehicles)
2. Charging hubs with up to 40 charging units in one location with facilities and showrooms
3. Solutions for home charging and embedded infrastructure for street parking
4. Simple payment options across networks
5. Dynamic pricing, with offers available at different times of day

Melanie concludes: “electric vehicles are a fantastic innovation, zero emission at point of use and a great way to drive. Only 1% of zap-map users would go back to a petrol or diesel car.”

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If you would like to find out more about the opportunities in electric vehicle charging and infrastructure please contact wmgbusiness@warwick.ac.uk.