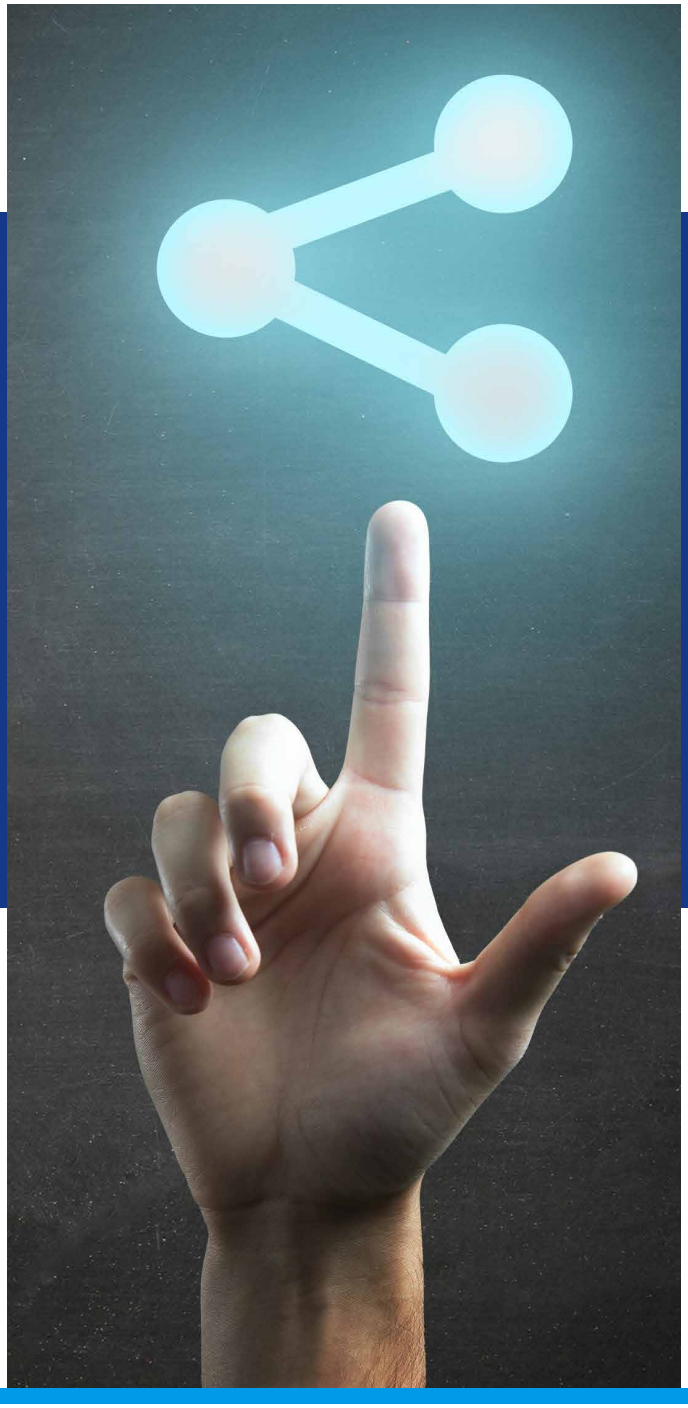
Omega
Global Resource Solutions



THE FIVE TECHNOLOGIES DESTINED TO SHAPE OUR FUTURE:

FROM BATTERY TECH, TO ARTIFICIAL INTELLIGENCE, WE LOOK AT THE LATEST ADVANCES IN TECHNOLOGY

Guide Overview:

We live in an era where technology is advancing at an unprecedented rate. In just over 10 years, we've seen the rise of the smartphone, the Cloud and of course, the smart world of connected devices.

Our daily lives have been transformed and influenced by new technology, but what's next? In our latest guide, Omega Resource Group look at five technologies that will no doubt shape our future.

Included in this guide:

- **The Latest in Battery Technology**
- **Home Energy Storage Technology**
- **The Introduction of the Smart Grid**
- **Advances in Artificial Intelligence**
- **The Future of Electric Transport**
- **Recruiting in the Electric Market**

The Five Technologies Destined to Shape our Future: Introduction

We live in a time where technology is advancing at an unprecedented rate. In just over 10 years, we have seen the rise in the Smartphone, the Cloud and connected devices, not including the many advances in medical technology.

Our daily lives have been transformed by advances in technology, but what is next? In this guide from Omega Resource Group, we look at five technologies that will no dount, shape our future.

1: Battery technology

The launch of new batteries will push the electric future further and will form the foundation of a new era of technology.

2: The Micro-Grid

Home energy storage systems are likely to become common ground in the future as battery technology advances and prices fall due to mass production.

3: The Smart-Grid

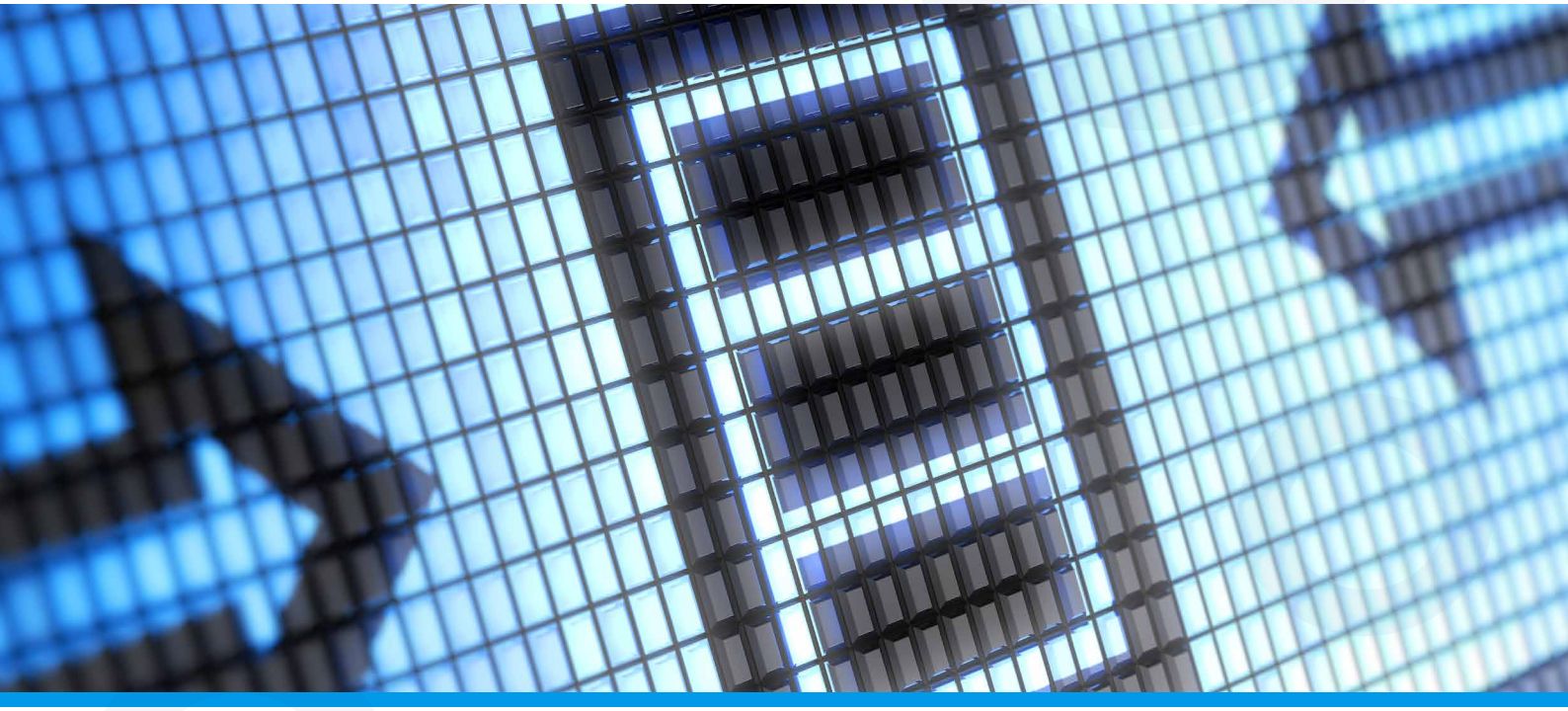
The smart-grid has the potential to solve many of the UK's future energy problems by matching supply and demand.

4: Artificial Intelligence (AI)

AI is now advancing that can simulate reasoning, develop knowledge, and allow computers to set and achieve goals, moving closer to mimicking the human thought process.

5: Electric transport

Previous experience of introducing new technologies into the automotive market shows that having a broad range of both models and body styles is key to ensuring strong uptake of new power-trains.



1 Battery Technology: The Battery is Key

The success of new technology is reliant on the battery.

With the coming era of the electric car and more advanced robotics, a need to swap to renewable energy, and an ever-increasing (and more mobile gadget-hungry) global population and humanity's capability of storing energy is going to become critical.

Lithium-ion:

The idea for using Lithium-ion rechargeable battery cells was first proposed by a British chemist in the early 1970s. Over the past years, Lithium-ion batteries have become increasingly popular compared to lead-acid batteries due to offering more energy compactness, better resistance to self-discharge and their ability to hold a charge for longer periods.

Unlike other types of battery, Lithium-ion has no memory and does not need exercising (deliberate full discharge) to keep it in good shape. Self-discharge is less than half that of nickel-based systems and this helps the fuel gauge applications. The nominal cell voltage of 3.60V can directly power mobile phones, tablets and digital cameras, offering simplifications and cost reductions over multi-cell designs.

The falling cost to manufacture Lithium-ion batteries combined with high capacity and rapid charging have made Lithium-ion the current battery of choice for powering Battery Electric Vehicles or BEVs.

Battery Technology: The Next Generation

The search for a better battery.

As with all technology, the search for the next generation of battery that will power future electronic devices and Battery Electric Vehicles that yield more power, faster charging and discharging, is underway.

With the race now on, to develop and manufacture the next generation of battery, there are many ideas in development which promise to solve the shortfalls in current Lithium-ion batteries. A few of these technologies are:

Gold nanowire batteries:

This technology could lead to batteries that never need to be replaced in most applications. The gold nanowires are strengthened by a manganese dioxide shell encased in an Plexiglas-like gel, electrolyte.

Solid state lithium batteries:

A paper, published by Toyota scientists, offers insight into their tests of a solid state battery which uses sulfide superionic conductors. The result is a battery that can operate at super capacitor levels to completely charge or discharge in just seven minutes - making it ideal for cars.

Graphene batteries:

Graphene can improve battery attributes such as energy density and shape in various ways. Li-ion batteries can be enhanced by introducing graphene to the battery's anode and capitalising on the material's conductivity and large surface area traits to achieve morphological optimisation and performance.

What is Graphene?

Graphene is an atomic-scale honeycomb lattice made of carbon atoms.

Battery Technology: The Next Generation

Laser-made micro-supercapacitors:

Scientists at Rice University have made a breakthrough in micro-supercapacitors. Currently, they are expensive to make, but using lasers, that could soon change.

By using lasers to burn electrode patterns into sheets of plastic manufacturing, costs and effort drop massively. The result is a battery that can charge 50 times faster than current batteries and discharge even slower than current super-capacitors.

Foam batteries:

Prieto believes the future of batteries is 3D. The company has managed to crack this with its battery that uses a copper foam substrate.

This means that these batteries will not only be safer, thanks to no flammable electrolyte, but they will also offer longer life, faster charging, five times higher density, be cheaper to make and be smaller than current offerings.

Prieto aims to place its batteries into small items first, like wearables. But it says the batteries can be upscaled so we could see them in phones and maybe even cars in the future.

Summary:

Which ever technology or combination of technologies hits the mainstream, we can be assured that the world will be powered by a new generation of batteries that offer increased performance, faster charging and greater flexibility.

The launch of new batteries will push the electric future on further and will form the foundation of a new era of technology.

2 Home Energy Storage: Battery Packs

Home energy storage technology.

Home energy storage systems are likely to play a huge role in meeting the increasing demand for electricity as we move away from fossil fuels.

The latest generation of home energy storage systems utilise the same Lithium-ion battery technology that are found in laptop computers and battery electric vehicles that can be simply wall mounted.

Home energy storage systems are likely to become a common phenomenon in the future as battery technology advances and prices fall due to mass production.

Facts about AC/DC current

Household electricity is delivered from the grid in AC (Alternating Current), however a battery outputs in DC (Direct Current), meaning that the power output needs to be converted into AC current.

The majority of today's electronics either do or can run on DC current, and must be converted from AC, which comes out of wall-outlets.

Home Energy Storage: The Micro Grid

Home energy storage and power feed back.

Home energy storage is not just for the preserve of people living off-grid anymore. Technological developments and the growth of domestic renewable energy have made this an area with big growth potential.

With grid-tied solar and wind systems, excess power is sent back to the grid to be used by someone else. Adding an energy storage system enables the storage of excess power for consumption later when the power generation drops, such as at night.

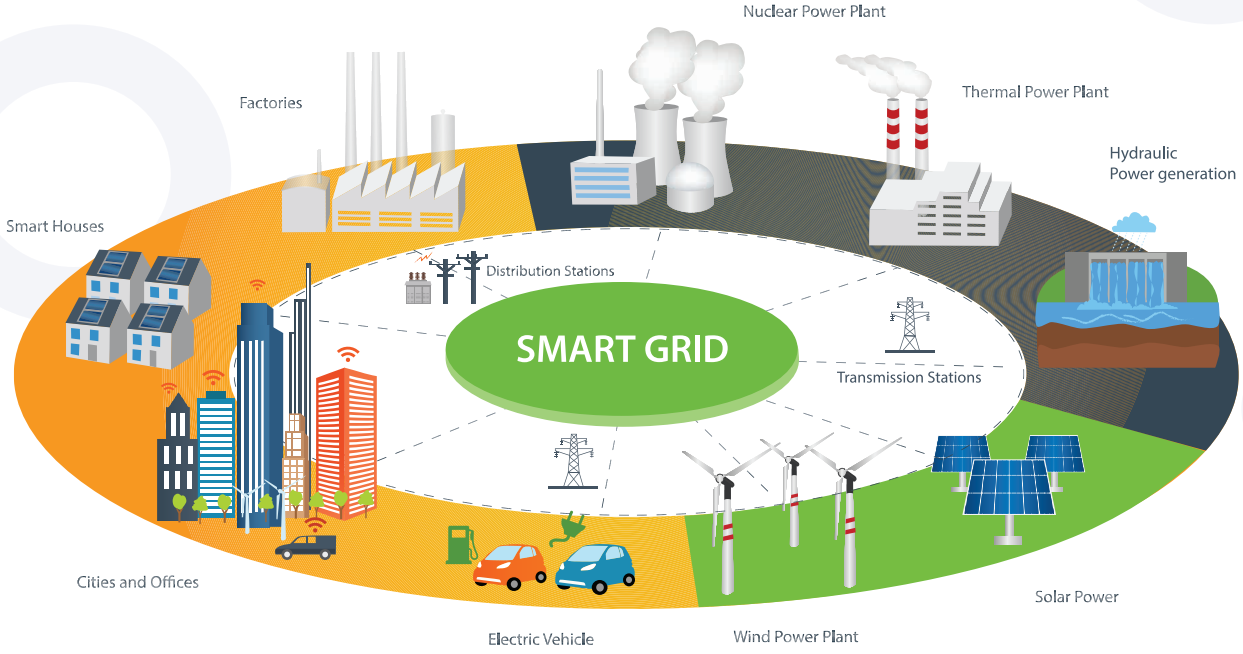
Storage also ties in very well to the idea of the 'smart home'. Many smart storage systems allow you to keep track of your energy, use online and charge the batteries with low rate electricity from the grid if you're on a tariff that is cheaper at certain times of day.

Storage may also lead to households playing a role in smart energy management at grid level. This might mean allowing their energy storage device to be used to store excess electricity – in return for preferential rates.

3 The Smart Grid: Meeting Our Future Power Needs

What is a smart-grid?

A smart-grid monitors and responds to power demands in real time. Often referred to as the "internet of energy", the smart-grid has the potential to solve many of the UK's future energy problems by matching supply and demand.



Connected homes, devices and transport

Smart meters are the first step towards this, however this is just the start. By connecting home-storage, smart homes/appliances and plug-in vehicles power supply and demand becomes much more efficient. For example, your car is charged from your home storage rather than the grid or your dishwasher turns on at night automatically when there is surplus power in the network.

"Home-storage and connected devices have the potential to solve future energy problems at a local level"

4

Artificial Intelligence: Advances in Learning and Automony

Types of Artificial Intelligence

Cognitive analytics

Cognitive analytics, where machines learn from experience and build associations, help develop technology systems that evolve hypothesis, draw conclusions and codify instincts and experience.

Face-reading machines

Face-reading machines decipher micro facial expressions to build meaningful information on the emotional state of the user, improving human-computer interaction in areas of e-learning and e-therapy.

Parallel information processing

Parallel information processing, aided through chips custom designed for AI applications, help parallel processing of vast amounts of data.

Deep learning

Deep learning approaches allow processing of raw data including images, speech and natural language; thus providing deeper insights.

Smarter gets redefined

Smarter gets redefined with the advances in sensor, cloud and machine learning technology, and pushes the boundary of smarter homes, cars, infrastructure and just about everything.

Intelligent automation

Intelligent automation combines automation with artificial intelligence that allows knowledge workers, from physicians to investment analysts to plant supervisors, to process, understand and use ballooning volumes of information.

AI is set to change more about our daily lives than we imagine, including our work, home and daily activities. In fact, it is likely that many future decisions made about us will be by AI.

When combined with other advanced technologies such as robotics, cloud technologies and future battery technology the possibilities are endless.

Artificial Intelligence: Advances in Learning and Automony

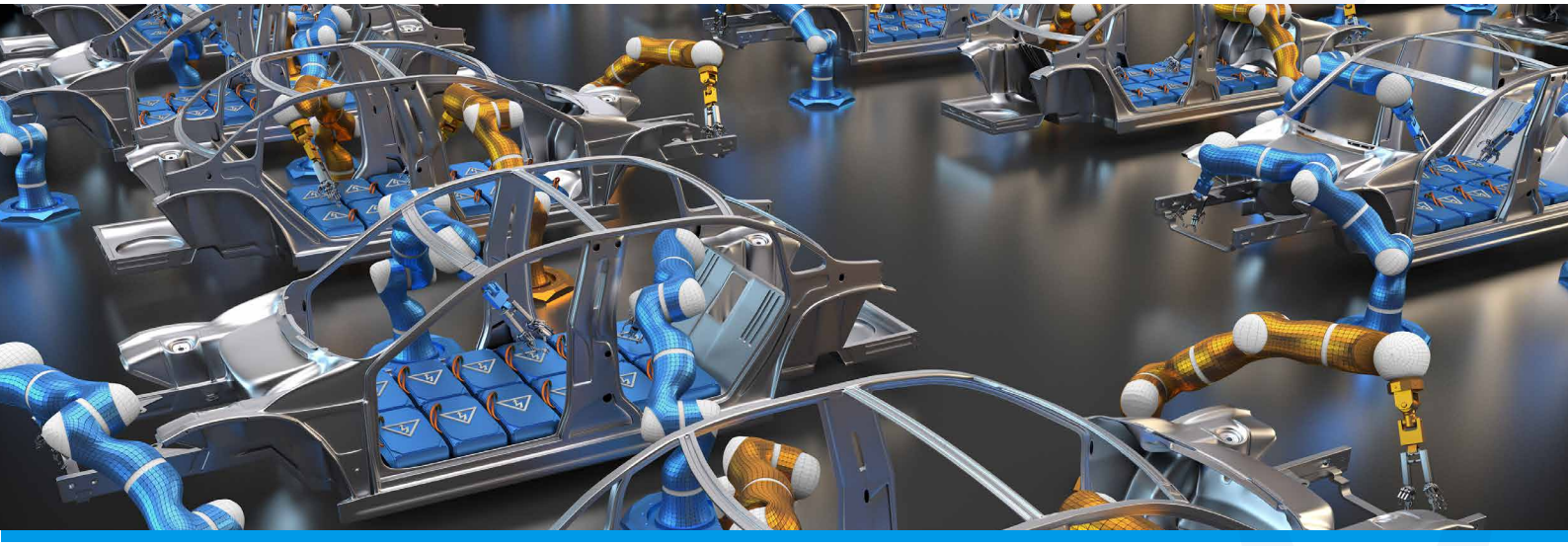
What is Artificial Intelligence?

Artificial intelligence (AI) has been emerging in consumer goods for years and the fact is that most of us are much closer to this technology that we thought. Take SIRI on your iPhone or Alexa on your Echo, both of which are conversational AI that let you have natural(ish) interactions.]

There is more, however, to AI then just finding out the weather or arranging a next day delivery. Conversational AI has enabled this technology into our homes and lives and we have been happy to adopt this threat free companion.

AI is now advancing that can simulate reasoning, develop knowledge, and allow computers to set and achieve goals, moving closer to mimicking the human thought process. These intelligent systemsimprove accuracy of predictions, accelerate problem solving and automate administrative tasks bringing in an era of automation.

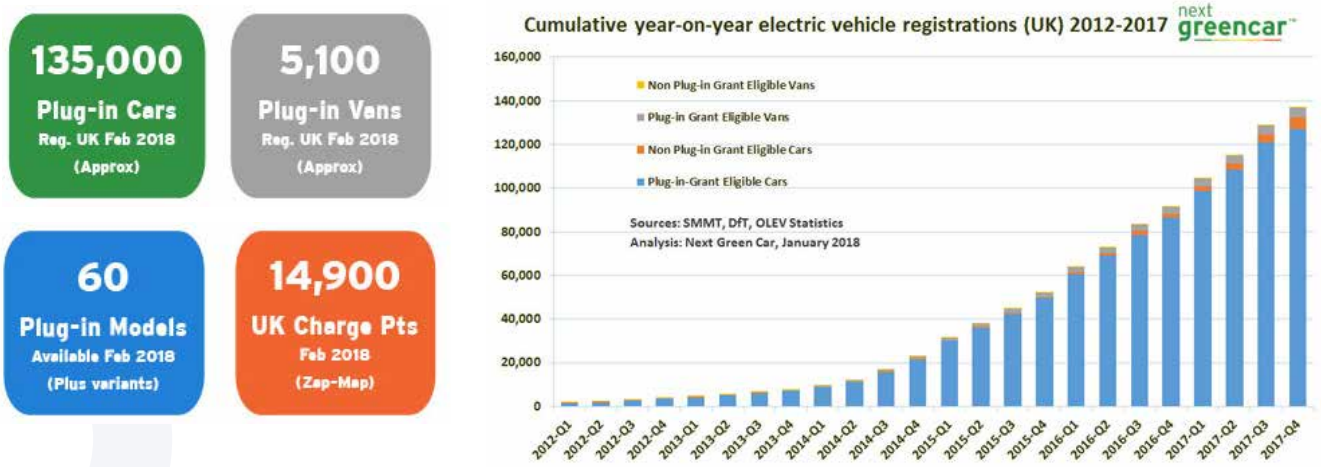
> "We have allowed AI into our homes and lives as a perceived threat free companion"



5 Electric Transport: Where will the Future Take Us?

Figures published by the Society of Motor Manufacturers and Traders (SMMT) each month show that electric car sales in the UK have risen dramatically over the past few years. While only around 500 electric cars were registered per month during the first half of 2014, this has now risen to an average of almost 4,000 per month during 2017.

At the end of 2017, more than 47,000 plug-in cars had been registered over the course of the year - a new record. This significantly improved upon the previous record, set in 2016, improving it by more than 10,000 units. By the end of the year, plug-in cars as a proportion of total UK registrations reached 2.9%, and averaged over 2017, electric cars now represent 1.9 per cent of the total new car market in the UK.

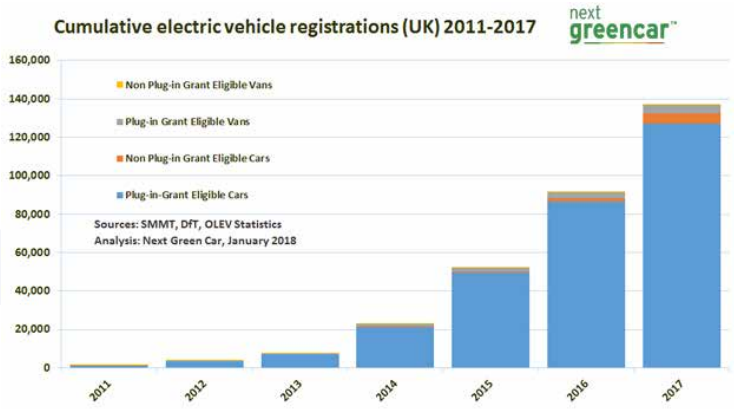


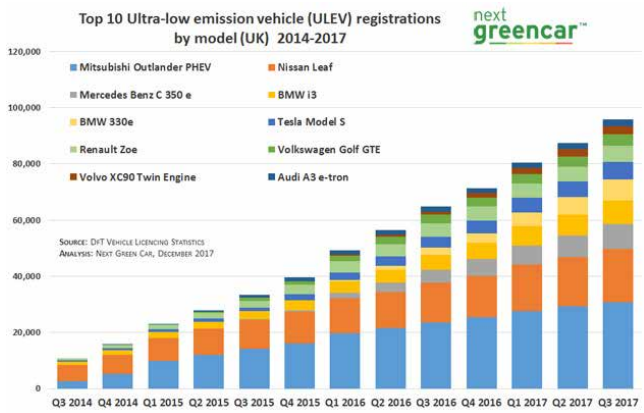
Source: SMMT, OLEV, DfT Statistics; Analysis: Next Green Car, January 2018.

Electric Transport: Where will the Future Take Us?

A key indicator as to the strength of the UK market for electric vehicles is the number of segments covered by the electric models currently available. While the main nine electric cars available in 2011 covered four body styles - city cars, small family cars, small vans and sports coupés - the more than 70 plug-in cars and vans available in 2017 now include superminis, large family cars, hatchbacks, estates, SUVs, executive models, and medium-sized vans.

Previous experience of introducing new technologies into the automotive market shows that having a broad range of both models and body styles is key to ensuring strong uptake of new power-trains. With the large number of brands and classes now available, the EV market has a strong base on which to continue to grow.





Source: SMMT, OLEV, DfT Statistics; Analysis: Next Green Car, January 2018.

Recruiting in the Electric Technology Market

Whilst we can only expect the demand for EVs to rise, the Institute of the Motor Industry (IMI) has growing concerns over the lack of skills required for vehicle technicians and operators to work on plug-in vehicles.

According to a survey conducted by the IMI, only 1% of all vehicle technicians have been trained to operate on EVs, with almost all of them employed by franchised dealers. This issue is amplified by the UK's general candidate shortage and war for talent, making it increasingly difficult to find quality candidates, let alone in the Electric Technology market.

Omega Resource Group work closely with a number of automotive employers, many of which specialise in Electric Technology. Our involvement in the industry has provided us with a comprehensive talent pool of trained technicians in the service and repair of EVs, together with consultancy expertise and experience to source candidates with the relevant skill-sets.

SPEAK TO A CONSULTANT