

## Electrification is the Future!

**Electrification and autonomous vehicles are dominating the transportation landscape. Fuelled by advancements in technology, environmental awareness and consumer behaviour the switch from the Internal Combustion Engine to Electric Vehicles (EV) is**



**accelerating at a rapid pace. Electric Cars though are not an invention of modern times; they have a long and storied history. Whilst back in the early 1800's horse and buggies were the primary mode of transportation, innovators in Hungary, the Netherlands and the U.S. looked forward and started to create some of the first small-scale electric cars.**

## From Humble beginnings

The true inventor of the electric car is still debated today. However, if you want to trace the electric car back to its humblest origins, it would be Hungarian inventor Anycos Jedlik who in 1828 created a type of electric motor that he used to power a small model carriage.



*Robert Anderson Rudimentary Electric Carriage 1839*

Whilst the exact year remains unknown, it is believed that at some point between 1832 and 1839, the first electric carriage

capable of carrying people was invented. It is Scotsman Robert Anderson who is widely credited as having invented the first rudimentary electric carriage with crude non-rechargeable batteries, however Anderson wasn't the only inventor with an EV vision though and between 1834 and 1835, American Thomas Davenport along with scientists from Holland and Hungary invented their version of an electric carriage. It wasn't until the 1870s or later though that electric cars become practical.

## Rise of the electric car

The first electric carriage to enter series production made its debut around 1890 and was created by William Morrison of Des Moines, Iowa, USA. It wasn't more than an electrified wagon, but it ignited interest in electric vehicles. Morrison built a number of electric car prototypes, but it wasn't until 1891 when he signed a contract with the American Battery Company to both manufacture and

promote his invention that things would begin to take off. These vehicles quickly became popular with urban residents, especially women as they were quiet, easy to drive and didn't emit smelly pollutants, unlike some of the gas and steam powered automobiles of the time.

The specifications of the 'Morrison Electric' were mostly poor by today's standards: its electric motor developed just 4bhp, the batteries took 10 hours to recharge, and top speed was between 6 and 12mph. However, a range of 100 miles was said to be achievable, which is actually very impressive given that many of the electric cars of today can barely manage more, and some still offer less.



*William Morrison Electric Carriage 1890*

Electric cars started to gain popularity and by the turn of the 20<sup>th</sup> Century electric vehicles were all the rage in the U.S., accounting for around a third of all vehicles on the road. Inventors, realising the high demand explored ways to improve the technology and following on from his first patent application in 1878 for "The Improvement In Electric Lights" Thomas Edison began working on building better battery systems. The late 1800's saw Ferdinand Porsche, founder of the sports car

by the same name create the Löhner-Porsche Mixte, the world's first hybrid electric car. The vehicle was powered by electricity stored in a battery and a gasoline engine. It was powered by a 3bhp motor, had a top speed of 22mph and a range of up to 50 miles. And while such figures seems paltry compared with those of the Taycan electric car, which Porsche will launch in 2020. back in the day they were still enough to give the P1 victory in a 25-mile electric car race; it finished 18 minutes ahead of the second-place car. While the Löhner-Porsche technology was reliable, it was not competitive with conventional petrol-engined cars and production of hybrid cars ceased in 1906 although Löhner continued to produce Löhner-Stoll trolley buses for several more years.



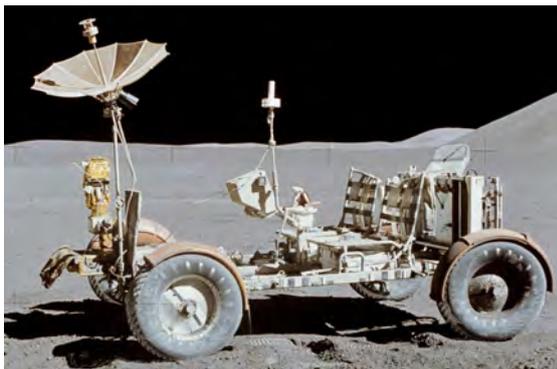
*Ford Model T*

## The start of the industrial revolution

In the early 1900s Ford and their mass-produced Model T brought down the price of petrol-powered cars, making them significantly cheaper than electric alternatives and more widely available and affordable. The industrial revolution dealt a blow to electric vehicles and inevitable started their decline. By 1935 with the creation of better roads and the discovery of cheap Texas crude oil, electric vehicles had all but disappeared and over the next

30 years or so, cheap, abundant gasoline and continued improvement in the internal combustion engine created little need for alternative fuel vehicles.

But in the 1960s and 1970s, gas prices soared through the roof, re-igniting interest in electric vehicles again. The profile was raised higher when in 1971 NASA's first manned electric Lunar Roving Vehicle (LRV) was driven on the moon. The ensuing years had lots of interest and many new designs of all shapes and sizes but there was one main drawback, limited performance and range ultimately causing interest in electric cars to fade again.



*Apollo 15 Lunar Rover*

## The environment fights back

It wasn't until new emissions regulations in the late 1990's and the prominence of the environmental impact of transport that scientists and engineers began to work on improving electric vehicles and their batteries. The Toyota Prius was the world's first mass-produced petrol-electric hybrid vehicle. Its domestic launch in late 1997 marked the culmination of a concerted, five-year effort by Toyota Motor Corporation to develop and bring to market a practical, low-emission family vehicle. The Prius was

released worldwide in 2000 and became an instant success with celebrities, increasing its (and the electric vehicle's) profile.



*Early Nissan Leaf (2011)*

The attitude towards electric vehicles truly turned. Battery prices began to fall, and major vehicle manufacturers realised there was a growing market. In 2011 Nissan produced the first model of the Nissan LEAF, which became the first ever full electric vehicle to sell over 400,000 units. The latest model of the Nissan LEAF has a range of 150 miles, utilising its new 40 kWh battery. Other OEMs such as BMW, Renault, Ford and more have all added electric vehicle models to their line ups, with the majority of major manufacturers committing to delivering a larger choice of electric vehicles in their up and coming product launches.

## The future starts here

Electric vehicles hold a lot of potential for helping the world create a more sustainable future, reducing our dependence on oil and lowering the carbon pollution from the transportation sector. We have a long way still to go and not just the automotive sector.

Motorsport has already taken up the mantle and have hybrid powertrains in their Formula 1 series and even an all-electric race series (Formula E). Other motorsport series are following suit. Commercial and off-highway sectors as well as the Aerospace sectors are also investigating ways of incorporating electric motors into their powertrain infrastructures to reduce or totally eliminate fossil fuel reliance.

In response to anticipated growth in electric propulsion, a dynamic e-Drive Systems group was formed by Integral Powertrain Ltd in 2008 and in 2009 the company was awarded the business to design and manufacture a 130kW motor for a prestigious hybrid supercar. The production run of 550 units was successfully completed in 2015.



*Volkswagen Electric ID Vehicles 2020*

In 2013 the company was commissioned to design and manufacture a series of premium machines with global leadership in speed and power density. At the other end of the spectrum it developed a range of low-voltage interior permanent magnet (IPM) machines with integrated inverters suitable for high-volume manufacture. Today it supplies some of the world's leading brands, most notably the Volkswagen ID R All-Electric

Race Car which has broken 3 world records and won many awards in the past 12 months.



*Volkswagen Motorsport's record breaking ID. R race car*

Manufacturers are using electric motors to propel themselves into the future with bespoke Hybrid and All-Electric vehicle concepts. We can only wait and see how the boundaries of electric vehicle propulsion will be challenged in the coming years. Companies such as Aston Martin lead the charge with their first All-Electric car, the Rapide E, due for release later in 2019 from its purpose built manufacturing plant in St Athans, Wales, UK. Others such as Tesla, Porsche, Audi, Mercedes, BMW, Rimac Automobili, Pininfarina, Lotus, McLaren and many more are all developing electric vehicles to rival their competition.

Commercial success for EVs will however require installing a readily accessible, easy to use, and relatively inexpensive charging infrastructure, whether at home or in public locations. What form this infrastructure will take is still uncertain, but organisations and governments around the world are understanding these challenges and opportunities and will for sure work together to make this revolution

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in motion remain benefit all future generations.

### How can Integral Powertrain help?

Integral Powertrain's team of engineers have a wealth of experience in automotive, motorsport and aerospace and develop, validate and manufacture

world leading electric motors and inverters. Designed to perfectly match client specifications these products have broken records and won many awards. To learn more take a tour of their [website](#) or call 01908 278600 to discuss your requirements with one of the Engineering Team.