

Electric Vehicles but Not as We Know Them

By Dr Peter Harrop, Chairman, IDTechEx

Electric vehicles use electricity wholly or partly for traction – making them go along. That encompasses an increasingly large variety of modes of travel by land, sea and air. Add to that fresh water. Electric vehicle manufacturers and those supplying their components vary from ones that are so large, well funded and ambitious that they go for the biggest opportunity, which is hybrid cars for the next decade.

At the other extreme, small niche players with astute marketing are dominating niches. Sadly, in between, there are a lot of underfunded, delusional vehicle and parts manufacturers that go for the largest markets without much thought about how they could have more chance of success in niches, let alone create such niches. Yet those smaller market sectors often involve premium pricing, specialist technologies and components and power trains both much larger and much smaller than those for cars.

The truth is that an electric power train offers a huge number of benefits from quietness, reliability, manoeuvrability and acceleration to environmental credentials and, in the military, little or no heat signature for missiles to home in on. A hybrid vehicle can even act as a power supply for military or civil work carried out at destination.

Here are just a few of the increasing variety of applications of electric vehicle technology.

Year of introduction of new types of electric vehicle

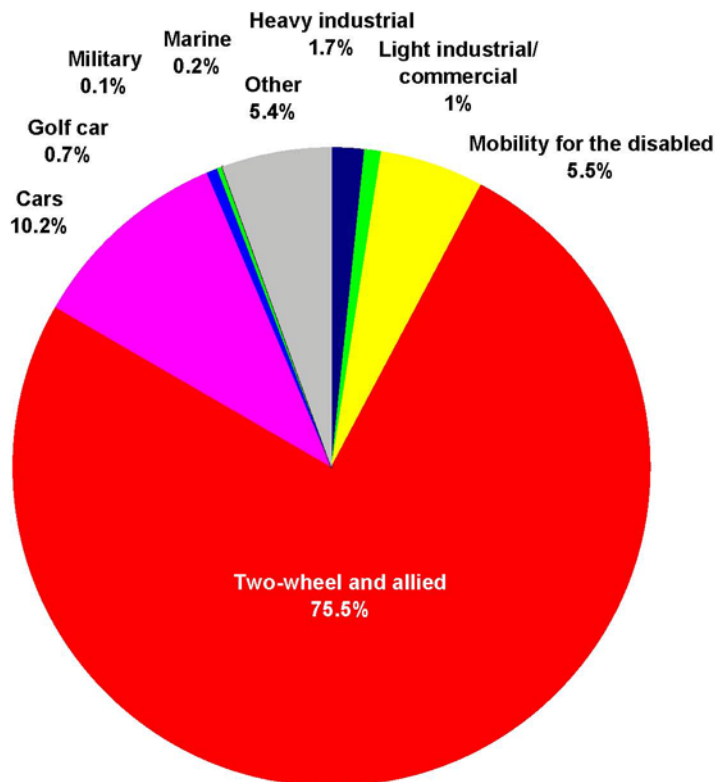
Year	Vehicle becoming electric	Leading player today
1834	Pure electric car (Thomas Davenport UK)	Ingersoll Rand USA (golf cars)
1898	Light delivery truck	Smiths Electric Vehicles UK
1899	Hybrid Car (Ferdinand Porsche at Lohner Electric Works Austria)	Toyota Japan
1980 approx	Forklift	Linde Germany
1930 approx	Underwater craft	Kongsberg Norway
1999	Bicycles	Suzhou Small Antelope China
2005	Gyro two wheelers	Segway USA
2000 approx	Aircraft	AeroVironment USA
2007	Performance sports car	Tesla USA
2011	Sea going motor yachts and motor boats	Bénéteau France
2012	Jellyfish	NAVSEA USA
2014	Light rail using automotive hybrid electric technology	European work
2015	Bat	US Army USA

Source IDTechEx

Micro hybrids are just off the radar. This is a tongue in cheek term for conventional vehicles that automatically switch off the engine when the vehicle comes to a halt and automatically switch it on when the accelerator is next pressed. They tend to use larger batteries and/ or regenerative braking to manage this. Many vehicle manufacturers are caught wrong footed with no electric vehicles in their range, so calling stop start conventional vehicles “micro hybrids” buys them time while helping to meet tighter pollution laws such as those recently introduced in Europe.

Forecasting the future markets for real electric vehicles is tricky because so many new sectors are emerging. For example, over 37 million will be sold in 2015 but the variety will be formidable.

Choose carefully. Number of electric vehicles as percentage global market share in



2015

Source IDTechEx

Let us look at some of the niches, many of which have hefty funding and can lead to billion dollar activities.

Military innovation

Military traction batteries need to be very reliable, even bullet proof, and, when they are in hybrids, sharply reduce fuel consumption to create operational flexibility. For example, in 2010, Quantum Fuel Systems Technologies Worldwide, Inc., announced its Clandestine Electric Reconnaissance Vehicle (CERV), an all-wheel-drive diesel hybrid electric vehicle designed by Quantum and TARDEC's National Automotive Center (NAC) with funding support from the US Special Operations Command (USSOCOM). The unit can maintain speeds of 80 miles per hour and climb 60 percent grades - all while reducing fuel consumption by up to 25 percent compared with conventional vehicles of comparable size. QT has developed a land-based V22 hybrid reconnaissance surveillance and targeting vehicle "RSTV", a hybrid FMTV truck and a hybrid line hauler. The development budget granted by the US military for the projects was \$43 million.

New marine markets

Battery driven surface craft help to meet pollution regulations from India to the USA. Indeed, on some inland lakes, the internal combustion engine is banned so even fast boats pulling water skiers are pure electric. Out at sea, the Autonomous Underwater Vehicle AUV has considerable funding because its uses are widening rapidly. They already include sea condition monitoring, meteorology, oil rig maintenance, research, mine and submarine detection and countermeasures, search and rescue and mineral prospecting. Some stay at sea for years, so their batteries, energy harvesting and control electronics have to be highly sophisticated. These are not toy traction batteries either. AUVs may look like torpedoes but their traction batteries are typically 60kWh in capacity and some being developed to take 300kWh batteries, much bigger than those in an electric car and pressure resistant. The market for existing types of AUV alone is worth \$2.3bn over the next decade with 1,400 new AUVs built particularly for military, scientific and oil and gas sectors according to the IET. AUV traction

battery packs can be 20% of the cost and some AUVs cost \$5 million each. Read about the Gulf of Mexico and realise that many more AUV types are needed.

AUV developed by Central Mechanical Engineering Research Institute (CMERI) in India for search and rescue and military missions



Source CMERI

Yachts become electric vehicles

A particularly brilliant example of creation of a new market for traction batteries happened this year. In February, Valence Technology signed a deal worth up to \$45 million to supply the largest yacht maker in the world, Bénéteau Group of France with traction batteries for a new concept of fully integrated hybrid yachts, sailboats and motor boats. The global leisure boat market is at least \$20 billion – some niche.

"This is a revolution, not an evolution, in marine propulsion, energy generation, storage and management," said Robert L. Kanode, president and CEO, Valence Technology. "Bénéteau is setting a new blue water standard for cleaner sailing yachts. Ports and harbors around the world will be cleaner, quieter and safer thanks to Valence Technology's safe, dynamic energy systems and the forward thinking of companies like Bénéteau Group, and ZF Marine, a pioneer in electric pod drives."

"The teams from the Bénéteau Group and Valence Technology have been working closely together for many months now, with the combination of their expertise paving the way for this major technological breakthrough," said Dieter Gust, Management Board Member, Bénéteau Group.

In a major departure from the way boats and yachts have been manufactured for decades, new hybrid-electric sea-going vessels yield low to zero-emissions, reduce fuel consumption and require less maintenance than traditional diesel marine propulsion systems. Valence Technology dynamic energy storage systems can power both propulsion and auxiliary power systems without affecting the vessel's performance or functionality. One of the most innovative features of the new hybrid drive system is the capability to recharge the advanced battery packs without the use of noisy, polluting diesel generators.

Electric aircraft get serious

Electric aircraft are ceasing to be one offs. Many organisations are involved including AeroVironment, Aurora Flight Sciences, Electric Aircraft Corporation, GE Aviation Systems, Yuneec International, Sonex Aircraft, Earthstar Aircraft, DARPA, ACV Electroservices, Electravia, NASA and a host of universities and research centers. There is even APAME in France, which translates as the Association for the Promotion of Electrical Engine Aircraft. This is getting to be quite an industry.

Based in Cambridge, UK, IDTechEx is a company involved in global analysis, strategic advice and market intelligence of printed electronics, RFID, energy harvesting and their applications.