



P E R S P E C T I V E S



by **Rinaldo S. Brutoco**

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Electric Cars – Look What's Coming *Cars Without Fossil Fuels or Batteries!*

Tesla led the world in electric vehicle (“EV”) sales during 2020 with a total of 499,511 (pure electric vehicles) followed by Volkswagen at 424,729 (if you count plug-in electrics) sold. The three closest competitors after that, all legacy car manufacturers, were in the low 200,000 to 250,000 range of units sold. In the US, the numbers are even more intriguing. Here, Tesla sold 201,769 units while the mighty GM sold a humble 20,807, followed by Volkswagen, Toyota, and Hyundai. Taken together, however, those global and domestic electric totals represent only four percent of the global market, and an even smaller two percent of the US market.

You can safely conclude three things from these numbers and the acceleration curve we've seen in EV sales: a) at only four percent globally today, future EV sales have enormous upside market potential and will see dramatic, compounding growth starting in 2021 and stretching to 2035 as we convert off of fossil fuel Internal Combustion Engines (“ICE” engines); b) the race to sell the most EVs is heating up and the legacy manufacturers will take an increasingly larger share of new EV sales; and c) even the press is unaware of how to properly analyze the rapidly evolving EV market, let alone tell us what we need to know about it.

For starters, look at the fact that plug-in hybrids are counted as EVs. That is surprising because, as GM discovered with its technically superior and very popular “Volt,” the market is moving away from all ICE engines. Counting Volkswagen plug-in hybrids as an EV is like counting the declining sales of horse-drawn buggies as part of the alternative vehicle fleet—they're not. Plug-in hybrids will not have a meaningful share of the future car market, so from now on, let's all agree the term EV means electric propulsion vehicles without any fossil fuel assist. Volkswagen is acutely aware of this and is pinning its hopes on its ability to mass-produce the “D” Series of all electric vehicles it has developed and will be bringing to market in upcoming model years.

Now that we're clear on the horizon for EVs, there is an even more important factor to consider: there are presently only two viable ways to create electricity to power our electric car fleet. Almost all observers assume that the tens of millions of EVs that will be produced in years to come will be battery-powered (“BEV”s). That is one way to get “juice” to the engine. The other is by using electricity from fuel cells powered by hydrogen. Should you care which technology wins out? “Yes,” for collective social reasons. And “Yes,” for individual financial gain.

Lithium is the main ingredient in present-day batteries. It is a very “dirty” mineral to mine which takes as much as 500,000 gallons of water per ton of lithium extracted. Unfortunately, most of today's lithium comes from areas where water is scarce and indigenous communities are fearful for continued access to clean water when lithium is mined so aggressively.

Lithium is also toxic to humans if released from its containment vessel (e.g., like a car crash can do). Making matters worse, lithium mining in the developing world releases about 15 tons of CO₂ for every ton of lithium recovered. A recent Forbes article predicted that the amount of lithium required by 2025 to service the battery market will increase five-fold to 1.3 million metric tonnes (1 metric “tonne” = 2,205 pounds).

Fortunately, there are several promising new technologies to extract and refine lithium from geothermal sources, as well as proposed new PEM stack type filtration systems, and equally promising on-going research into solid state batteries that won't use concentrated lithium. Unfortunately, no one knows if and how these new approaches will work, and no one yet knows how we're going to avoid massive environmental damage in the meantime from the burgeoning lithium mining industry. Making matters worse, end-of-life disposal of highly toxic lithium creates its own environmental disaster which will grow

exponentially as more and more batteries are removed from primary and secondary service.

There are several other drawbacks to battery electric vehicles (“BEV”s) including 1) the limited range which averages about 200+ miles across the fleet, and drops precipitously if the vehicle has to climb a hill or mountain; 2) the number of charging stations that will have to be built in the millions, and for which you’ll have to get in line as the vehicle production outstrips charging stations; 3) the amount of time even a rapid charge takes that still takes a minimum of 40 minutes; and 4) the certainty that we do not have enough extra grid capacity to provide electricity to charge that vastly increasing fleet of BEVs (MIT estimates the grid would need to carry 25 percent more electricity).

By contrast, a Fuel Cell EV (“FCEV”) which is an electric car powered by a fuel cell consuming gaseous hydrogen, is superior to a BEV because: 1) range is already in excess of 350 miles and could go higher by simply adding a larger fuel tank; 2) charging stations are not required as an FCEV fuels up at a hydrogen gas station the same way your ICE vehicle does; 3) it only takes about five minutes or less to re-fuel an FCEV; and 4) we don’t need to pull more electricity through an already strained electrical grid which is vulnerable to all sorts of dangers including terrorism—in fact FCEVs can be used to add power to your home as a mobile power plant that can power your house at night instead of draining power.

Best of all, there are ZERO negative aspects from creating green hydrogen (it is made from renewable resources), ZERO negative aspects from consuming hydrogen in a fuel cell (no lithium to mine or figure out how to discard at end of life). H₂O, pure water vapor, is the only byproduct.

Having driven the hydrogen-powered Toyota Mirai for more than three years, I can personally attest to its reliability, functionality, ease of use, and being able to effortlessly create a pleasant way to “do my part” for my carbon footprint. Honda has a great hydrogen car, but I believe we’ll all see a surge in recently re-tooled Toyota Mirai sales by the last half of this year. If you haven’t had a test drive, you’re missing out on the financially superior, smoothest riding, environmentally “correct” car of the 22nd Century. Stay tuned to this space for several updates on the amazing, rapidly emerging, Hydrogen Economy.