



August 2, 2017

## Apple Versus the Lithium Metal Benders

Since we're in the dog days of summer, let's take some time to step back and take a long-term view of some investment ideas. Last quarter our advice was to "accentuate the positive" and rise above the squalid food fights in Washington. Despite the Trump induced turmoil, things are definitely getting better both domestically and globally. From our higher ground vantage point we can see well past the distracting thrashing and splashing of the swamp drainers. On the horizon are massive swells of technological innovation that are already starting to wash over and radically transform both our economy and our culture. There is no doubt that these waves are far more powerful than any party or politician in Washington and will not be stopped. Whether we will like the changes, or not, is not the question. Rather, it's our task to determine how to prudently invest ahead of these changes. Since 2011, our "**Cloud Computing**" holdings have positioned us ahead of the first part of these transformative waves. This has worked out very well with **Cisco** and **Microsoft** (up over 100% and 200% respectively over this time period). We have also supplemented these holdings with the more aggressive Internet ETF (**PNQI** – up 175% over the past 5 years) which has given up more direct exposure to the sexier internet plays like the **FANG** stocks (**Facebook**,

**Amazon, Netflix, and Google.** With the global economy now showing signs of sustainable growth, it's time to start shifting focus from lower risk "**Cloud Cartel**" plays to growth opportunities in specific industry sectors which are in transition.

The past 5 years has been all about the Cloud transforming the distribution of virtually every industry. Now, America's sudden obsession with electric cars and autonomous driving signals a different sort of radical economic shift which is not about "distribution", but about the potential radical adoption of new technologies to stodgy old industries: Autos & Energy. Just last week the UK announced it would end the use of internal combustion engines (**ICE**) in autos by 2040. Folks, the sudden shift away from the ICB combined with autonomous driving is **RADICAL**. History has shown such sudden shifts create bottlenecks and opportunities.

Control of the automobile cockpit will be the key to controlling massive amounts of consumer interactions and data. The "**Connected E-car**" gold rush has already started. On the "**E-car**" part of the equation, major US, German and Japanese auto manufacturers are already facing competition from **Tesla**, and will also face new competition from a slew of Chinese manufacturers. Already, China can claim the e-car lead by having put 500,000 electric vehicles on the road last year versus under 100,000 in the US. Perhaps more interesting is the "connected" part of the equation with powerful new entrants like **Apple, Amazon, Google and Microsoft** jostling for positions to provide the autonomous driving software and operating systems. **Amazon** could become a player right off the bat with its own fleet of commercial delivery trucks to service its **Amazon Prime** customers and its mushrooming network of distribution centers. Already 40% of American consumers live within 20 miles of an **Amazon** distribution center. What does America do with 500,000 unemployed truck drivers?

**Google** will likely follow the model of its Android phone operating system for self-driving cars and license this out to fleet operators around the world. **Microsoft** is currently devoting big bucks to developing their own

autonomous car operating system, which if combined with its **Azure** Cloud centers can provide a one-stop global presence. They are likely to license out the car operating system bundled with the use of Azure's massive data storage and processing capabilities. We'd envision partnerships with major auto manufacturers like **BMW** or **Daimler**.

Of the possible new entrants, **Apple** is the most intriguing. **Apple** watchers say that there is an internal directive to prove the feasibility of an autonomous car operating system by the end of 2017, which is just 6 months away! Tim Cook has also said that creating an operating system for a self-driving car is "**THE essential core technology for the future**" and has called the auto operating system "**The mother of all Artificial Intelligence projects**". *The Financial Times* recently reported that **Apple's** top secret "**Titan**" project has already hired over 1,000 automotive design engineers, including top defectors from **Tesla**. Other sources have said that **Apple** has secretly leased 850,000 square feet of manufacturing space which is zoned for automobile manufacturing. While **Apple's** operating system will no doubt be first class, we're betting that they have a strategy for an even more truly distinctive "**WOW!**" offering which could set them apart from the rest of the pack. While our dot connecting is highly speculative, please follow along!

Setting aside the super sophisticated **Autonomous Driving** operating system, manufacturing an electric car is less complex than today's ICE automobile. Why? An E-car has far fewer moving parts and you aren't containing a zillion explosions a minute. First, you can ditch the massive 6 cylinder engine, the entire transmission and its 700 moving parts and replace them with smaller electric motors controlled by software, not gears. You also eliminate the complex fuel delivery, exhaust, pollution, noise and vibration abatement systems. These savings are partially offset by the bulky batteries which comprise about 50% of both the weight and cost of current electric cars. **Tesla's** 85 Kw battery pack weighs 1,500 pounds and provides a driving range of about 250 miles. Largely because of the cost of batteries, E-cars are only competitive with ICE cars after receiving generous government energy tax credits. But, basing an entire industry's viability on the continued largesse whims of Washington is a high risk proposition. This is why Elon Musk is

betting his ***Giga-Battery plant*** can radically reduce the cost of batteries by 50% or more. Only with lower price batteries can electric cars be competitive with gasoline powered engines. However, even if the cost per KW is reduced, the size and weight of lithium batteries still poses serious design constraints for an electric car.

But, what if there is an ***alternative technology to lithium batteries?*** Over the past 20 years a ***“hydrogen fuel cell”*** powered car has been touted as the ultimate “green” alternative by producing only clean water as its exhaust. ***Toyota and Honda*** are the leaders here and are selling cars in California which get the equivalent of 70 MPG. But, they have been using ***pressurized hydrogen*** to get the driving range up to over 250 miles per fill up. This in turn has created a “chicken or the egg “situation of needing a whole new network of specialized refueling stations at \$1.5 million per pop. It has also created the perception of highways full of potential ***Hindenburg’s*** which could explode at any minute. For any number of reasons, the early lofty expectations of hydrogen fuels cells have not been fulfilled and the formerly high flying stocks have all crashed.

However, major advances in the use of ***metal hydroxides*** to greatly increase the storage capacity of tanks with ***non-pressurized hydrogen*** could be a game changer. ***Suzuki*** is using this technology for electric motor scooters that get about a 45 mile range with a 5 minute fill from a refillable canister. Non-pressurized hydrogen is also being used in fleets of forklifts by ***Amazon, Walmart*** and others. If metal hydroxide can be made scalable to autos, a volume of 12 gallons of hydrogen weighing about 150 pounds could replace a 1,500 pounds lithium-ion battery and provide a range of 350 miles. Also, it would only take about 5 minutes to refill the tanks versus 4 hours to fully re-change lithium batteries. From a practical perspective, non-pressurized hydrogen would also eliminate the need for specialized refueling stations making a roll out much quicker. If we take this one step further, modular non-pressurized tanks could be sold at any commercial outlet willing to set up an exchange program not unlike the propane tank exchanges for your gas grill. Going on a long trip? Pop a 5 gallon module in the trunk and you’re good for another 150 miles.

***Let's start connecting the dots.*** We all know that **Apple** has always been obsessive about developing its own in-house technology to totally control its lineup of proprietary self-branded products. Last year, **Apple** spent about \$10.5 billion on R&D. To put this into perspective, last year **Apple** spent more on R&D than **Coca Cola** had in world-wide sales! As part of this effort **Apple** has quietly filed several patents related to using low pressure hydrogen in both consumer and commercial applications. And, last year **Apple** acquired the exclusive technology rights of a UK startup company called **Intelligent Energy (ADR- INGY)** which has developed hydrogen fuel cell powered I-phone and Laptop prototypes. A one minute squirt from a hydrogen canister similar to a butane lighter refill will keep you web surfing, texting and talking for up to 2 weeks. **Apple** is still keeping this top secret, but **IE** posted the prototype on its website without **Apple's** permission. Ooops! Now, envision if **Apple** launched an entire product lineup free of the tyranny of charging cables and batteries to include cell phones, lap tops, and perhaps even .... hydrogen powered e-cars. Talk about product differentiation!

Elon Musk is on the record as an avowed hydrogen skeptic and with his Giga Battery strategy he has effectively bet the entire future of **Tesla** on lithium ion batteries. The first Giga plant started delivering batteries in June, and Musk has now announced 4 more Plants. **Tesla's** cash is already tight, and they would not survive a "re-tool" to hydrogen. In other words, for **Tesla**, there is no turning back. For now, everyone seems to be following **Tesla's** lithium lead and are scrambling to catch up. **Volvo** has declared it will be all electric by the end of 2019. To reach this goal means they have already made huge design, R&D, and capex commitments towards lithium battery technology. It's another "bet the company" commitment to lithium.

An **Apple H-car** would give a powerful and distinctive product differentiation from **Tesla** and the rest of the "me too" lithium battery metal benders. Timing is everything here, and there is no need to for **Apple** to rush to be first to market. **Apple** wasn't the first to the PC or cell phone markets either, were they? Maximum tactical leverage could be achieved if market pressures force GM, Ford, Daimler, Tesla, Volvo and others to financially commit to lithium batteries prior to an **Apple** entrance. A deferred hydrogen products launch

could provide **Apple** with a sustainable marketing advantage for years to come. If the metal hydroxide technology is solid, providing a refueling infrastructure would be the next major challenge. But for Apple this is much less of a challenge than for others. With over \$250 billion in the bank, **Apple** has the cash to establish its own hydrogen fueling station network, or retrofit existing service stations. Even at \$1,500,000 per station, a \$7-\$10 billion expenditure for 5,000 stations is a very small price to pay in order to claim a nationwide franchise for decades to come. This could disrupt the oligopoly of **Exxon Mobil, BP** and **Shell**.

Another issue that would need to be resolved is getting hydrogen fuel cell production brought up to the massive scale an **Apple** product would need. Consider this: it took **McDonald's** 8 years to sell 1 billion hamburgers at 15 cents a bite. It took **Apple** just 9 years to sell over **1 billion I-phones** at about \$500 dollars each. Now, think about the incredible logistics chain for all the components necessary to build and deliver these phones.

Building the logistics chain must also be done covertly and isn't something that could be readily "subbed out to China". Last year, the R&D budget for the entire hydrogen fuel cell industry was likely under \$100 million, or less than 1% of **Apple's** current annual R&D spending. With an increased allocation to manufacturing related R&D, **Apple** will resolve this bottleneck.

Only somewhat cynically, because the public stocks in hydrogen fuel cell sector are extremely beaten down, **Apple** could actually buy the entire publically traded hydrogen fuel cell industry, AND all its IT. The cost would be little more than a rounding error in its current \$250 billion cash stash. Wouldn't this be a very small price to pay to dominate both the auto industry and refueling industries for a decade or longer?

Early profits will not likely come from the auto manufacturers themselves, but from potential supply bottlenecks when demand surges. Since the existing manufacturers have already committed, and **Apple** is on the sidelines, the initial bottleneck will be in the lithium battery industry supply chain. Our thoughts are to invest ahead of this potential seismic change in both the automobile and fossil fuel industries.

To play this scenario we will be adding a new position in the **Global X Lithium and Battery Technology Fund (LIT)** which is split about 50% to the chemical and materials side of the battery industry, 35% to technology, and 15% towards consumer sales. Top holdings include **FMC**, which produces lithium derivatives chemicals, and **SQM**, which is the chemical and mining company of Chile. With **Tesla**, China and Germany all announcing massive new battery factories, increased output means there should be a further squeeze on the chemical side of the equation.

Our conjecture is that **Apple** will take several years to position and commit to hydrogen. That means now is the time to start building a small speculative position in the area of hydrogen fuel cells. **Apple** could be the catalyst to reignite the entire industry. Since there is no Hydrogen Fuel Cell EFT and none of the current players clearly stand above the others, we'll take small positions in a handful of them. The few publically traded stocks available are now just selling at between 5% and 33% of their prior peak prices. Here is a quick look:

**Ballard (BLDP)** was the early fuel cell high flier and reached \$90 a share in 2000 but now trades at \$2.75. However, they are still the global leader providing fuel cells for municipal bus fleets. In 2015 **Ballard** sold its automotive IP to **Volkswagen** for \$80 million and has entered into a long term service agreement with them. BTW - **VW** is now the largest auto maker in the world which would make them a good partner to have. **BLDP** is also providing fuel cells to propel military drones. The advantages? Electric motors are stealth silent, vibration free, and can patrol for 24 hours on a single fueling. The risk with **Ballard** is that they have previously sold tons of stock to raise cash in order to stay afloat. The upside? Because of their extensive patent library, they should also be a prime acquisition target. The risk/return? If **Ballard** just reaches ½ its prior peak, this would represent a 1,500 % return.

**Plug Power (PLUG)** is the major player in non-pressurized hydrogen fuel cells. **PLUG** is down 95% from its peak despite a 300% increase in revenues over the past 5 years. Of particular interest to us is that **Amazon** has just committed to purchasing \$60 million of fuel cells and “services” from **PLUG**

over the next several years. In addition, and not to be outdone, in the past week, **Wal-Mart** has also announced a similar \$60 million commitment. We sure like these dynamics! It's trading at about \$2.00 a share.

**Intelligent Energy (IYGG)** is valued at under \$50 million. **IE** is a tiny company with very interesting prospects. In addition to its technology licensing agreement with **Apple** (previously mentioned), **IE** is already positioning itself in Europe to supply consumer hydrogen fuel cells on a retail level for PC's and phones. To position for a wider distribution of refill canisters **IE** has recently acquired **BIC** (of the butane lighter fame). Most importantly, **IE** has an **automotive division** which already provides the fuel cell technology for **Suzuki's e-scooters and London Taxi**. The fuel cell powered cabs require only a 5 minute fill-up rather than a 4 hour recharge which saves garage space necessary for recharging. Most importantly, **IE** has another "**secret**" automotive client whose identity it won't divulge. You don't need to buy a vowel to solve this puzzle. Wanna bet the first letter is an "A"? This start up is tiny and bleeding right now, but with a big brother like **Apple** the upside is excellent. Did we mention that it's also rumored **Apple** has an option to acquire the company?

**Hydrogenis (HYGS)** is another leader in non-pressurized hydrogen fuel cell technology and also sells hydrogen refueling stations. With a market cap of \$150 million it is also is a very small company. Last month, it received an equity investment of \$21 million from a Chinese company related to fuel cell technology for bus fleets.

Another less speculative play will be to add a position in **Hertz (HTZ)** where **Apple** or any other non-traditional player will need to acquire a global network of e-car service locations. We also see car rental fleets offering an excellent way to test out new products.

At this time we see allocating just 5% to 10% of most portfolios to the lithium and hydrogen fuel cell opportunities.



## ***Further off into the Future:***

While we're on the topic of hydrogen and the future, the frequency of important announcements in the area of ***nuclear fusion*** is increasing. As a rough benchmark, nuclear fusion becomes economically viable (and the world as we know it will change) when a reaction of ***180 million degrees Fahrenheit*** can be sustained for 5 minutes. At this point, reactors produce more energy than they consume and at these levels a fusion reactor will produce 10X the energy it consumes. Over the past 6 months, there have been at least a half dozen important announcements from private companies in the UK, Germany, the governments of China and South Korea as well as universities such as MIT about reaching significant milestones toward this goal. Most of these report reaching temperatures between of 25 million and 50 million degrees for various periods of time. While still quite far away from the ultimate goal, the race is on! Over the past decade there have been very rapid advances in the science of electro magnetics which have advanced much faster than Moore's law in computer chip technology. But, if we were to apply the predicted rate of change of Moore's law to magnetics a net energy positive reaction could be viable in the next several years. Several small ventures predict a commercially viable reactor the size of a pickup truck could be available in less than 5 years. We can't get our heads around the business model here yet, but it sure will be disruptive. The price of fossil fuels would plunge. What about utility stocks?

Right now, research is being funded by very smart and very rich guys like Paul Allen and Jeff Bezos who are funding in increments of \$10 to \$20 million. This is chump change in a world where the payroll of the New York Yankees is over \$200 million and social media startups are valued in the billions. As the science fiction dream moves closer to becoming a reality how to monetize the technology will come into sharper focus. The only public play is ***Lockheed Martin (LMT*** – up 12.5% YTD) where we have started building positions. At current market values we are getting the stock of a solid defense contractor with a lottery ticket for its nuclear fusion research thrown in for free.

Now, imagine a world with noise and pollution free E-cars, some powered by lithium batteries and others by hydrogen fuel cells. Even if these just capture 25% of the market, imagine the crash in oil prices and the disruption in the energy and automotive industries. Much more speculative, and further down the road, is a world with nuclear fusion providing virtually free energy that would transform world power and economic structures. While it's hardly the time to bet the ranch, we're building some small initial positions now. Ten years will go by in the blink of an eye. Remember that the I-phone is just 10 years old and there are now over 2 billion in use!

While we wait for the world to transform, our **"Fortress America"** strategy has produced excellent returns for the first six months of the year, with most accounts showing returns between 6% and 8%. Top performers have been **Toll Brothers (TOL** - up 25.9%) and **C&S Global Infrastructure (UTF**- up 26.3%). Our Internet ETF position (**PNQI** – up 21.6%) gave up more exposure to the hot **"Cloud Cartel"** stocks like **Alphabet, Amazon, Facebook** and **Netflix**.

We'll return after the summer to readdress some of the other major forces potentially impacting markets such as China, Trump, Interest Rates and the Dollar. Until then, we'll continue to accentuate the positive!



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