SUSTAINABILITY

TIPS

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EVs: Why go electric, and why I did.

One of the most visible efforts to combat climate change is the adoption of electric vehicles (EVs). They're a big part of our local tech industry, not to mention a big part of our own neighborhoods here in Portola Valley. We're told that the adoption of EVs is an essential component of decreasing greenhouse gas (GHG) emissions, but others cite facts to the contrary, leaving many of us who are interested in fighting climate change not knowing which direction to take. In writing this, I hope to summarize the best information on EVs while also discussing myths, advantages and their potential drawbacks.

Are internal combustion engine (ICE) cars a problem?
Yes. The EPA estimates between 25 and 30% of all US GHG emissions are from personal transportation, the majority of which is from personal vehicles. This is the biggest single contributor to all US emissions, bigger than heating and cooling, agriculture and electricity generation. Any effective solution to the problem of climate change needs to address ICE cars and trucks.

Don't EV's just offset emissions by generating power elsewhere instead of burning gasoline in an ICE car?
Yes and no. It is certainly true that EV's are directly responsible for the emissions that result from the electricity they use, just as ICE vehicles are responsible for their emissions from gas. However, there are two major differences between electricity and gas that result in a great disparity of emissions between the two.

First, burning gas in an ICE car is much less efficient. A gallon of gas moves a vehicle about 25 miles on average in the US, and this results in about 20 pounds of CO2 production, **but about 80% of that energy is lost to heat and other factors.** So, for every $5 we spend on gas, only $1 is moving our car forward, the other $4 is lost to low efficiency. Alternatively, EV's technology is up to 90% efficient, using almost all energy created for propulsion. This is due to multiple factors including a power plant's ability to capture and utilize more heat resulting in greater efficiency as well as regenerative braking in EVs. So, even in the worst-case scenario where all

of an EV's electricity comes from 100% coal, an EV is far more efficient and results in fewer GHG emissions than an ICE vehicle.

Second, because electricity will get cleaner over time, EVs will also get cleaner over time, while ICE cars will not. This is because our power grid is constantly moving toward renewable, lower carbon sources. On a typical day in the summer here in California, the majority of our power may come from solar. In our own town, we can opt in to 100% carbon-free, renewable energy from Peninsula Clean Energy. And even outside of our state and community the national grid is getting cleaner every day. As Al Gore recently pointed out, The Coal Museum in Kentucky now has solar panels on the roof! Gas-powered engines have had over a century to work on efficiency. Any additional gains they make will be very modest. Finally, obtaining oil that is refined into gasoline will always require drilling, a process frequently associated with severe environmental consequences.

What about the battery? Doesn't battery production produce a lot of GHG emissions?
Yes. It is completely true that the production of an EV is responsible for more GHGs than an ICE vehicle, and much of this is due to the battery. EV battery power is generally measured in kilowatt-hours (kW-h), and they can range from 16 kW-h (Smart EQ) all the way up to 200 kW-h (GMC Hummer EV). These batteries require an average of from 100 to 200 pounds of CO2 per kW-h for production, so we can see there is a huge range of additional emissions to account for here: as low as 1,600 pounds for the Smart Car and as high as 40,000 pounds for the Hummer!

How do we interpret these numbers? We can look at three factors: the electricity we purchase, how much we drive and what we would be driving otherwise.

First, our grid. The cleaner the grid, the more quickly we offset the carbon required for battery production. With 100% clean energy, that Smart Car will offset its battery production emissions after only 2000 miles, or 2 months of average driving. That's pretty quick, and every mile after that is a huge net reduction of emissions over and ICE vehicle. With a more average US grid this will take longer, but still probably in the 10k-20k mile range.

The next factor is how much we drive. What if we get that Hummer EV, keep it in the garage and only drive it to Robert's on Sundays? What will happen is that the battery production emissions will essentially *never* be offset. The life of the vehicle will probably end long before you've had a chance to drive enough to offset the energy used for manufacturing. To apply a concept I use with my kids all the time, an EV is a tool, not a toy. The more we drive them, the more they offset emissions.

But, what if you currently have an *ICE* Hummer and you drive it every day for your business? In this case there are two advantages to moving over to the EV Hummer. First, you're driving frequently so your emissions will be more quickly offset. Second, the vehicle you were driving to begin with (ICE Hummer) was incredibly inefficient. Transitioning from an inefficient ICE car to an inefficient EV still has a big carbon advantage. If you were driving an ICE Honda Civic

(small car) and you want to move to an EV Hummer instead (big car), there may be no advantage at all, depending on your grid mix. Sorry to pick on the Hummer. ☺

There are other issues with battery production including local environmental pollution, labor practices in the manufacturing and recyclability. There's not yet a good argument to refute these concerns. However, when deciding on an EV vs an ICE vehicle we might not just consider if there are concerns with EVs but also how they compare to known concerns with ICE vehicles and their fuel source, examination of which yields a plethora of questionable practices in all respects.

What about range anxiety? Is range anxiety going to be an issue? I may have range anxiety.

Concern about ability to charge on the road is a prevalent among new and potential EV owners. But talk to long-time users, and you may find that concern waning. It's going to be while before we can charge as quickly and in as many places as we fill up with gas, but several factors are helping EVs catch up and even surpass the convenience of the gas station.

First, with an EV, you can start every day with a full tank. Most homes will accommodate a level 2 charger (similar capacity to a 240v dryer outlet) without modifying the electrical panel. For a fraction of the cost of equivalent range in an ICE vehicle, your car can be full every morning. EV owners who habitually charge nightly never have to worry about being surprised by a low range reading on the way to work. It's always ready to go, and in this respect and EV is more convenient than an ICE car (and cheaper to drive)

The next consideration regarding range is the network of charging stations. This basically breaks down into Tesla and non-Tesla compatible stations. Tesla has had a big advantage in this area for years, establishing a high speed, ubiquitous network where you can be almost anywhere in the country and charge your car fully in 40 minutes or so. The non-Tesla charging networks are rapidly catching up though. Plus, Tesla has recently announced that they'll be adding adapters to their network, allowing other vehicle models to charge. Additionally, a few other auto manufacturers have announced they will be using the Tesla charge port in their future vehicles. This is huge, but the reality is that it's still not as convenient as a gas station. I'm planning a trip with old friends this summer, and we're modifying our route somewhat to accommodate charging (non-Tesla). We consider this to be a minor penalty and one we gladly make in exchange for the advantages of driving an EV.

What about towing a trailer?

Yep, this is an issue. Towing a heavy load in an EV can cut range in half (similar to what it can do to an ICE truck). If you're going a long distance, this range reduction without the ability to fill up the tank quickly can be a deal-breaker. Right now, the highest range EV trucks are about 300 miles, with 400 mile and possibly higher coming in the next year or two. Even so, towing is an area where gasoline trucks certainly have the edge in convenience, though many anticipate this changing as charging networks expand and battery technology continues to improve.

Summary

As long as you'll actually drive it, moving to an EV will result in fewer emissions, lower cost of ownership and increased daily convenience. If you're considering a new vehicle soon, please consider an electric one. Most EV owners, myself included, are happy to share their honest experiences. Please feel free to reach out to me if I can help you in your journey.

Thanks for reading.

Jay Saleh
(driver of a Tesla and a non-Tesla)