OLLI-UA GREEN VALLEY ELECTRIC VEHICLE BASICS CLASS (GV EVBC)

NEWSLETTER # 1, FEBRUARY 21, 2024 SESSION; EV LINGO/TERMINOLOGY

Hello Bill, Steve, Hugh, Jackie, and hopefully Patrick 😊

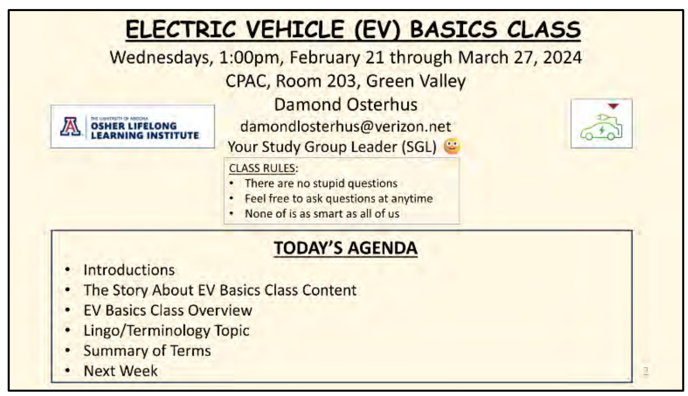
Welcome to the first GV EVBC Newsletter. Newsletters cover:

- What was presented and discussed during the subject class session, including
  - Questions asked that were not answered or not answered completely,
  - Responses to comments about issues/concerns related to Electric Vehicles
  - Expanded explanations on a topic area that weren't covered in class
- Additional reference materials
- Announcements of local EV Events

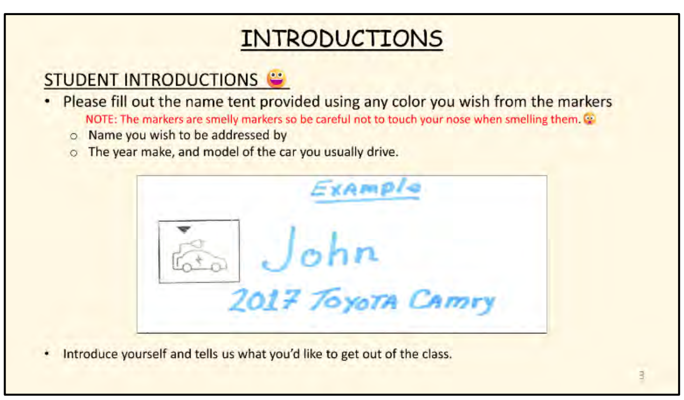
WHAT WAS PRESENTED AND DISCUSSED

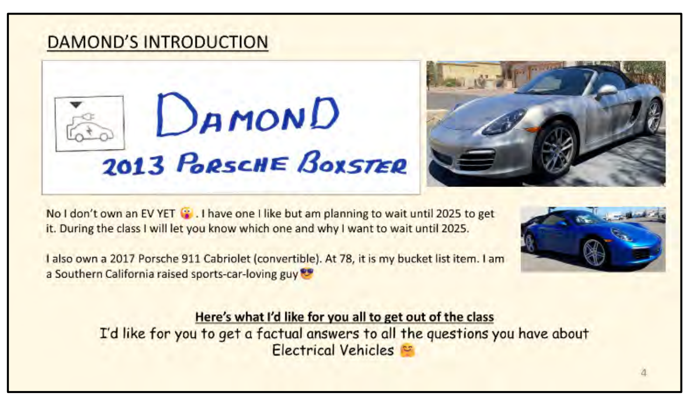
This part of the Newsletter uses less than full sizes of the PowerPoint slides presented during the session in the order that they were presented. It provides an organized way to talk about what was presented and discussed. Also, there will be *Damond's Additional Comments* that address things not covered in class.

Should you desire a full size of a specific or all the slides, the pdf of the PowerPoint slide file that is also attached to the transmittal email can be used to view or print out any or all slides.



INTRODUCTIONS





As requested, everyone created a name tent that included a name they wished to be addressed by and the year, make and model of the car each normally drives. I also asked that they mention what they would like to get out of the class. Here's what I recollect being said (memory is good just short! 🙁)

Bill noted he drives a 2023 Honda CR-V Hybrid, and mentioned that he had driven it 16,000 miles in the last 11 months. He said he was interested in knowing if an EV would work for him. (My recollection)

Steve mentioned he was from Minnesota, but unfortunately, I draw a blank on the car he drives. He also noted driving long distances in the car he drives back to Minnesota. Steve also noted that he was interested in finding out if an EV would work for him.

Hugh noted he drives a Subaru Cross-trek, and comes from Green Bay Packer country, Wisconsin.

Jackie drives a Tesla Model 3 in addition to her pickup truck. She lives in Green Valley.

I noted that I drive a 2013 Porsche Boxster (and also own a 2017 911). I am not yet an EV owner YET. I have one I like but won't be buying it until 2025. I plan to tell which one and why the wait during the class.

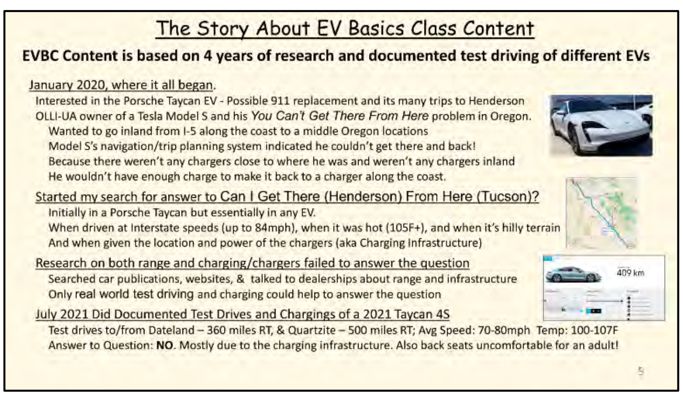
I also noted that it was my desire to provide factual answers to your questions about EVs.

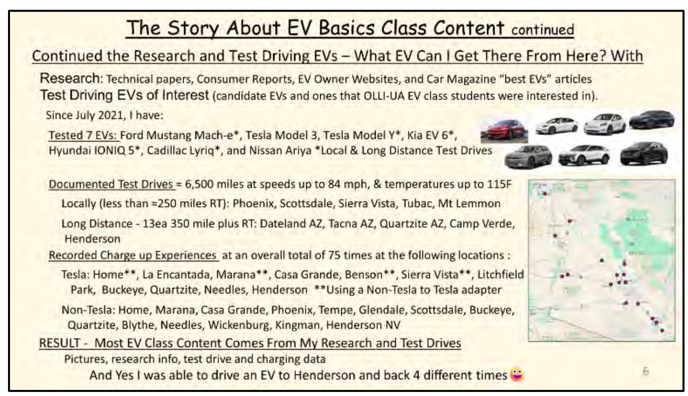
Damond's Additional Comments. As mentioned in the transmittal email, as a result of the introductory conversations, it was apparent to me that Bill, Steve, and Hugh drive to other "residences" from Green Valley, and probably drive mostly locally (under 180 miles round trip) around Arizona while residing here.

Because we are a small group, I want to take the opportunity to address your individual specific questions about the advantages and disadvantages of owning an EV given your driving and residential situations.

To do this, I will need some details associated with your current driving and residential situations here and elsewhere. I plan to ask for these details as part of the Charging At Home/Not At Home – The Details session this Wednesday, Feb 28th.

THE STORY ABOUT EV BASICS CLASS CONTENT





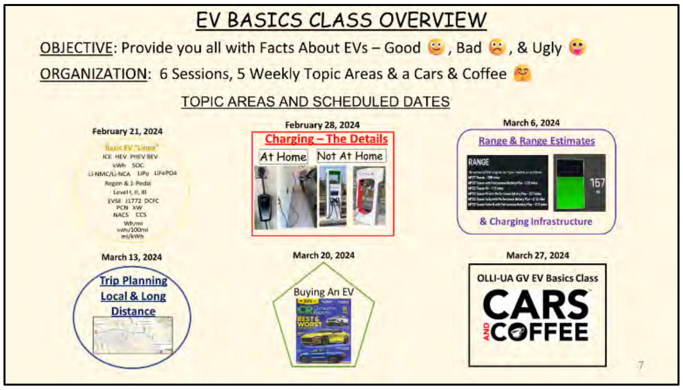
These two slides address that the source of most of the material for the class comes from my personal experience in researching and test driving 8 different EVs; from a 2021 Porsche Taycan 4S, to the 2023 Kia EV 6. The research involved 4 years of literature searches. It involved 6,500 miles of documented test drives that included 13 each 350-mile plus round trip.

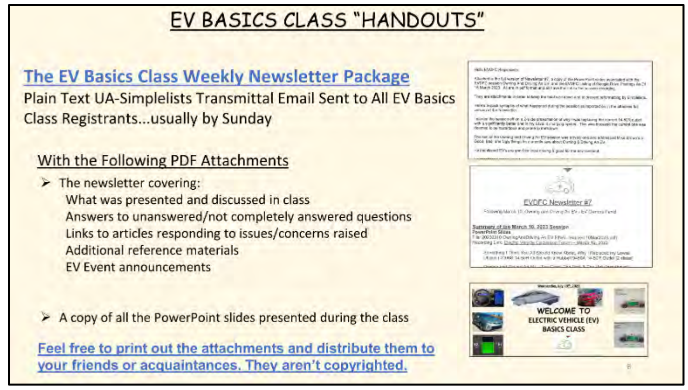
The overall quest was to answer the question "Can I Get There From Here in an EV when driven at Interstate speeds and when it was over 105F?". The "there" was Henderson NV and the "here" was Tucson. I was able to answer the question YES since 4 of the test drives were from Tucson to Henderson NV and back.

Most of the data results and a majority of the pictures used during the class come from this research and test drives.

I wanted to provide this background since it is an example of how both the range of the EV combined with the status of the charging infrastructure are important in discovering ones EV of choice particularly when considering it for long distance travel.

EV BASICS CLASS OVERVIEW & EV BASICS CLASS HANDOUTS





These slides provide the stated objective of the class, its organization, the topic areas & scheduled dates, and the class handouts.

<u>EV Basics Class Overview Slide.</u>

The objective is to provide all participants with the Good, Bad, and Ugly facts about Electric Vehicles. It is organized around 6 sessions; 5 weekly topic areas and a Cars & Coffee as follows:

- Basic EV Lingo/Terminology. The terms, and abbreviations used associated with the EV experience. Their understanding helps when talking about EVs to EV owners about what its like to own and drive an EV. (February 21)
- Charging – The Details; At Home and Not At Home. This topic goes into the details about being able to charge an EV at home via Level I & Level II charging equipment; and the Level I, II, and III charging experience when away from home. I will demonstrate how the PlugShare app can be used to see where all the chargers are. 🤗 I will address the most common issues and concerns. (February 28)

  Damond's Additional Comments. For this GV EVBC, I want to address the specific issues and concerns that each non-EV owning participant has when considering EV ownership. This includes addressing:

  > *Hugh's Estes Park Family Members EV Charging Issue*. It appears to being only able to use a 120VAC Level I charging system when driving an EV to work in the city (Denver?) on a daily basis. It is barely adequate to provide the charge necessary to make it to work and back.

- Range & Range Estimates. This will take on the most common "elephant in the room" when talking about EVs; range and range anxiety. We will take a look at the factors that affect range, what range estimates are the best to use when shopping for an EV, and when actually driving an EV. (March 6th)
- Trip Planning, Local and Long Distance. This topic area will involve demonstrating the various trip planning methods available to an EV owner when driving around town, and on a long distance adventure. I plan to demonstrate both the PlugShare app Trip Planning feature, and A Better Route Planner app (ABRP). I also will be id'ing what apps are not so good at trip planning. (March 13th)

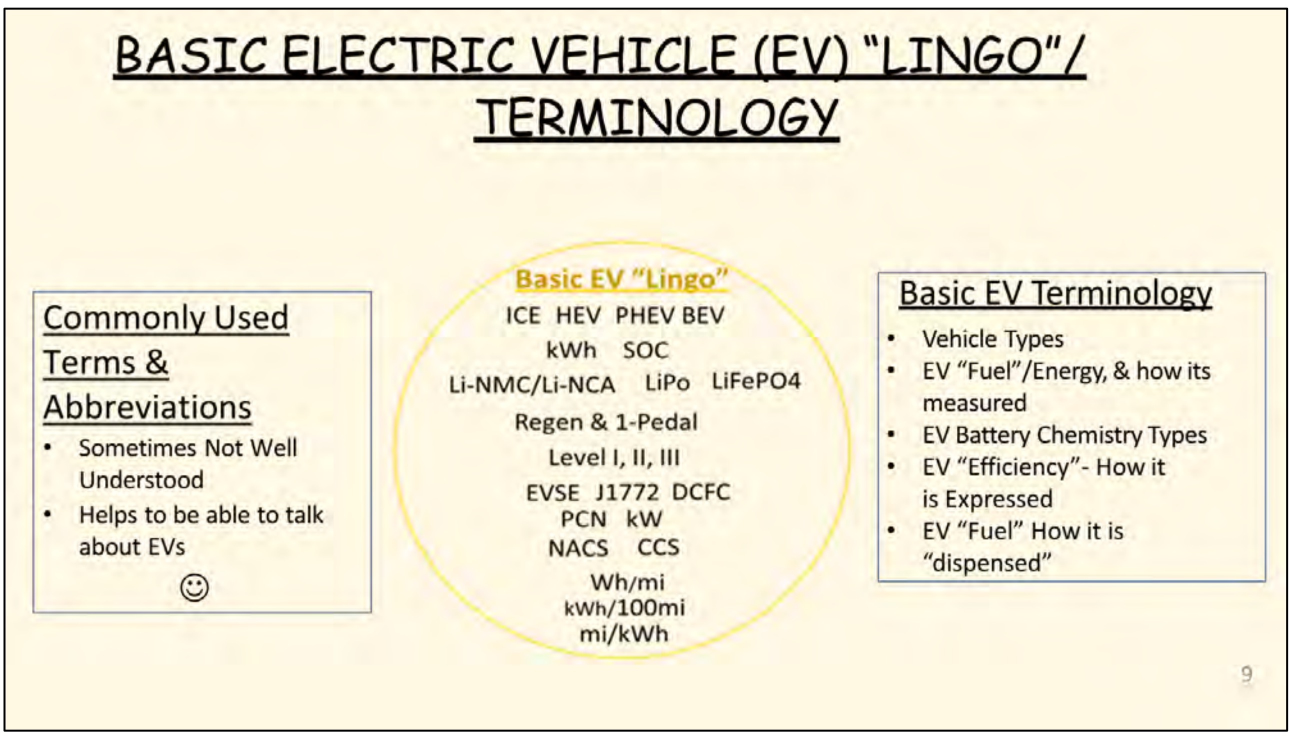
- Buying An EV. I plan to discuss some of the issues often associated with the EV buying experience and show several sources of EV buying guidance and data. Finally, I will talk about the Federal Government's $7,500 "rebate" for selected EVs.
- GV EVBC Cars & Coffee. I plan to have several EVs and EV owners available with their EVs to chat with GV EVBC participants and possibly other GV OLLI-UA members. I plan to advertise the Cars & Coffee on the Green Valley OLLI-UA bulletin board.

  Currently I plan to have Jackie & her Tesla Model 3, my friend Teri & her 2024 Kia Niro EV, and a TURO rented Ford Mustang Mach-e or a Kia EV 6 all available to look at and to ask questions about. The whole class period will be available to just talk about EVs. 🤩

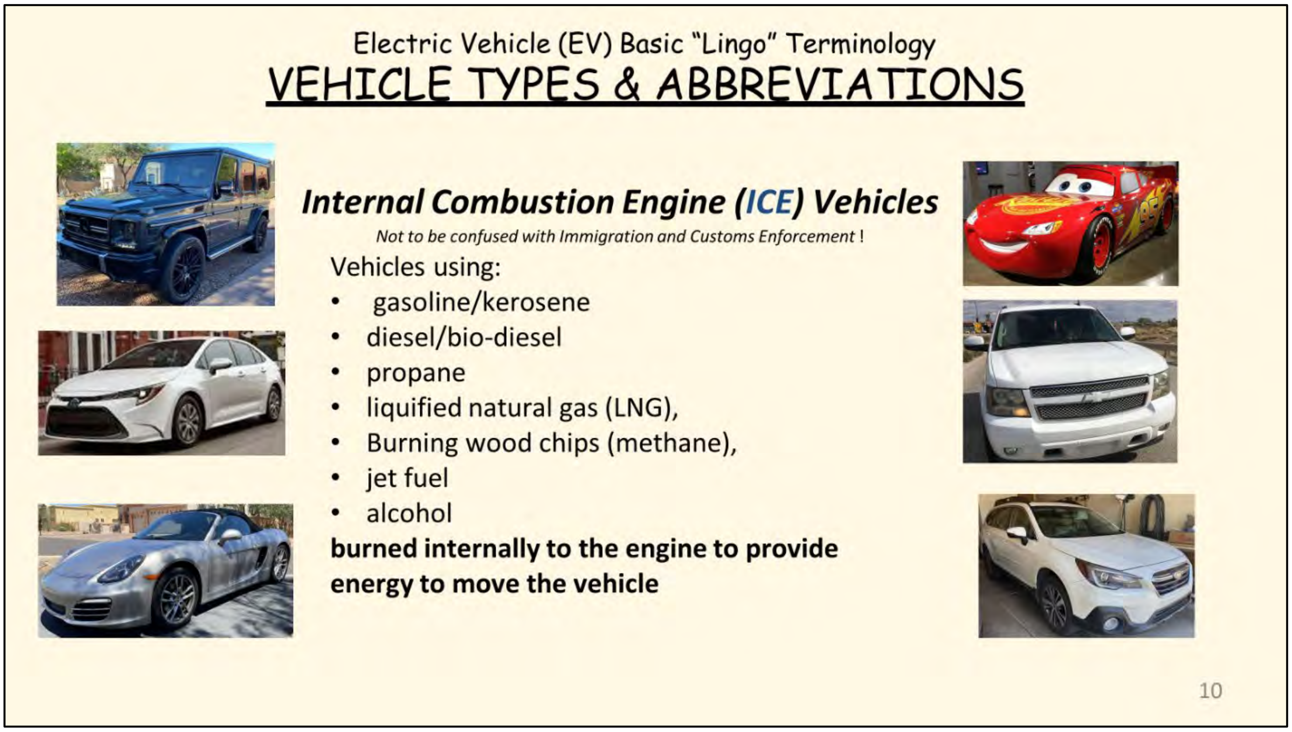
EV Basics Class "Handouts" Slide

The slide just shows that for each class session, except for Cars & Coffee, I will be sending out via an OLLI-UA Simplelists transmittal email a Newsletter, like this one, and a copy of the PowerPoint slides; both in pdf format.

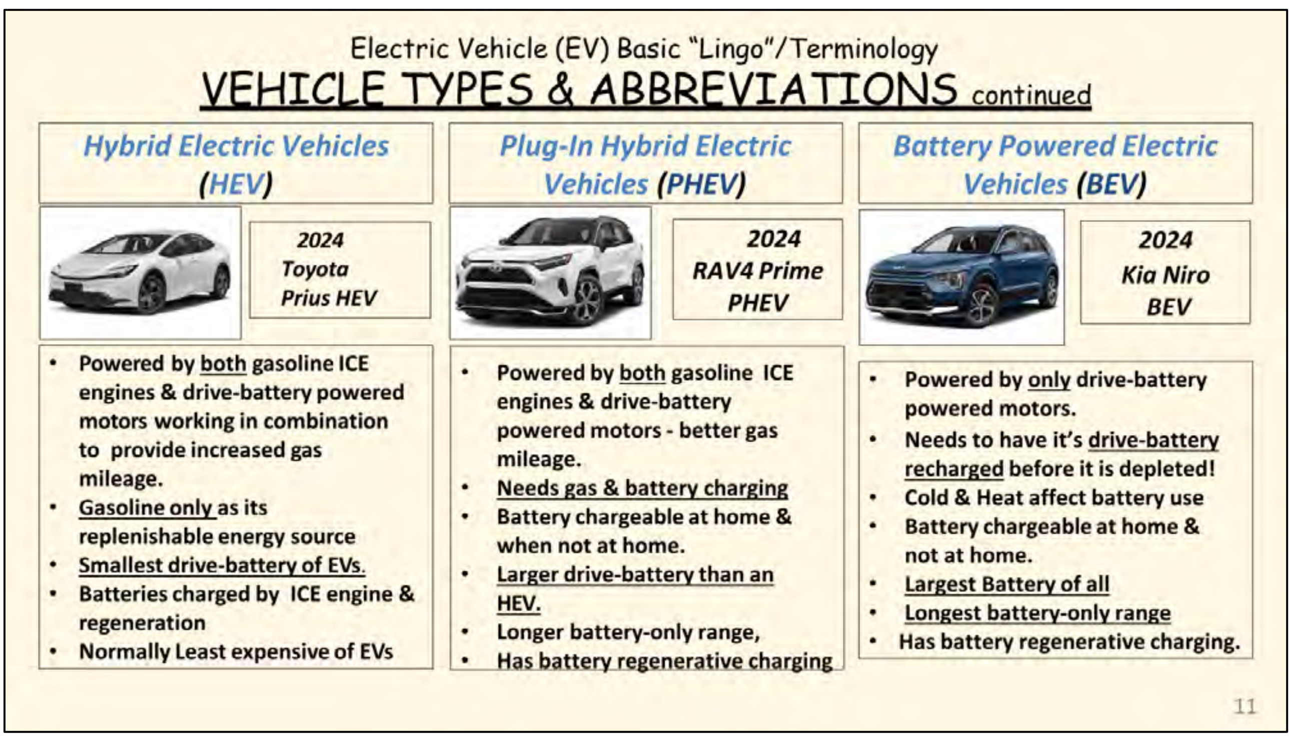
Both the Newsletter and the PowerPoint slides are yours to do with as you wish. You may provide them in either digital form or hard copy printouts to your friends or acquaintances who might find them useful when wanting to know about Electric Vehicles. They are not copyrighted.



This slide begins the topic for this first class. The following slides address the subtopics listed on the left that in turn will talk about all the abbreviations listed in the Basic EV "Lingo" circle shown in the slide.

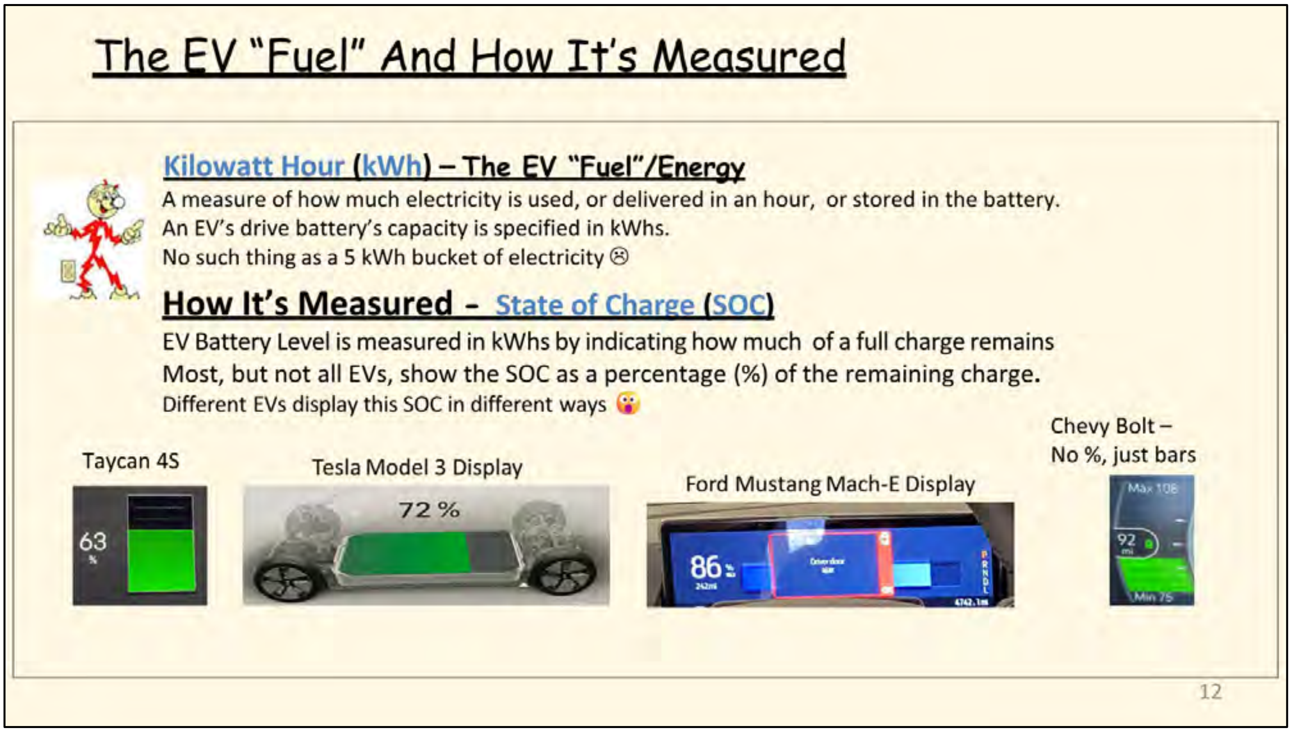


As stated in the ICE abbreviation applies to any vehicle that burns a fuel internally to provide the energy to move the vehicle. It is most commonly used as an identifier of vehicles burning fossil fuels such as gasoline, diesel, propane, and LNG internally that result in the emission of carbon dioxide, water vapor, and nitrogen based products. Not sure something like a Stanley steamer qualifies since the fuel is burned externally to heat the water and the steam is used internally to provide the energy to move the vehicle.



The important differences between an HEV, PHEV, and a BEV as shown above in this slide are that the HEV & PHEV require both ICE and battery power. They both need fossil fuel and battery energy. They do get better gas mileage than a ICE vehicle, but still need the maintenance/servicing of a ICE based vehicle. Both HEV and PHEV are less efficient than a BEV in their use of the stored energy in the "fuels" that they use (gasoline and battery stored energy). A BEV on the other hand is totally dependent on replenishing the energy that is used by the drive batteries.

This class will focus mostly on PHEVs and BEVs and their electrical fuel/energy.

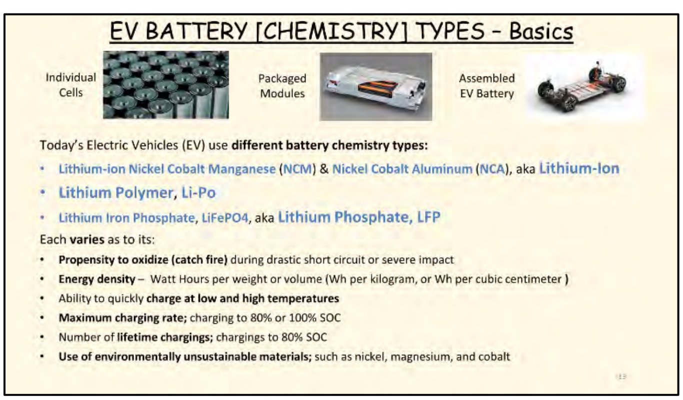


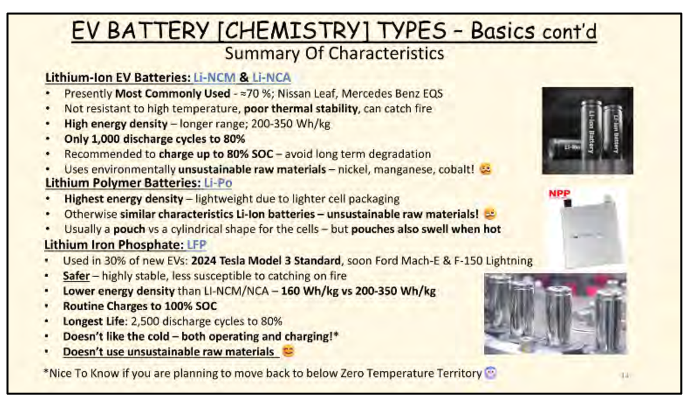
This slide reflects that the kilowatt hour (kWh) is the measure of the energy used, replenished, and stored in a PHEV and BEV. It can be conceptually thought of similar to a gallon of fossil fuel for an ICE vehicle.

> *Damond Additional Comment.* During class I said a gallon of gasoline was equal in energy to 36,000 kilowatts. I was off by a factor of 1000. If a gallon of gasoline was completely burned with 100% efficiency it would produce 33.7 kWh of energy. Unfortunately, an ICE vehicle only converts of a gallon of gasoline's energy into a 11-17% Wheel to Wheel (WTW) efficiency. (Source: Princeton University)

The slide also shows that EVs display the amount of energy remaining in its drive battery is expressed as a percentage of the battery's full capacity – State of Charge (SOC). Similar to a gas gauge in an ICE vehicle where a ¼ tank could be expressed as 25% full, ½ tank could be expressed as 50% full, etc. Maybe more precise but also with the same accuracy. The way SOC is measured in an EV it can be plus or minus 10% accurate! 🙁

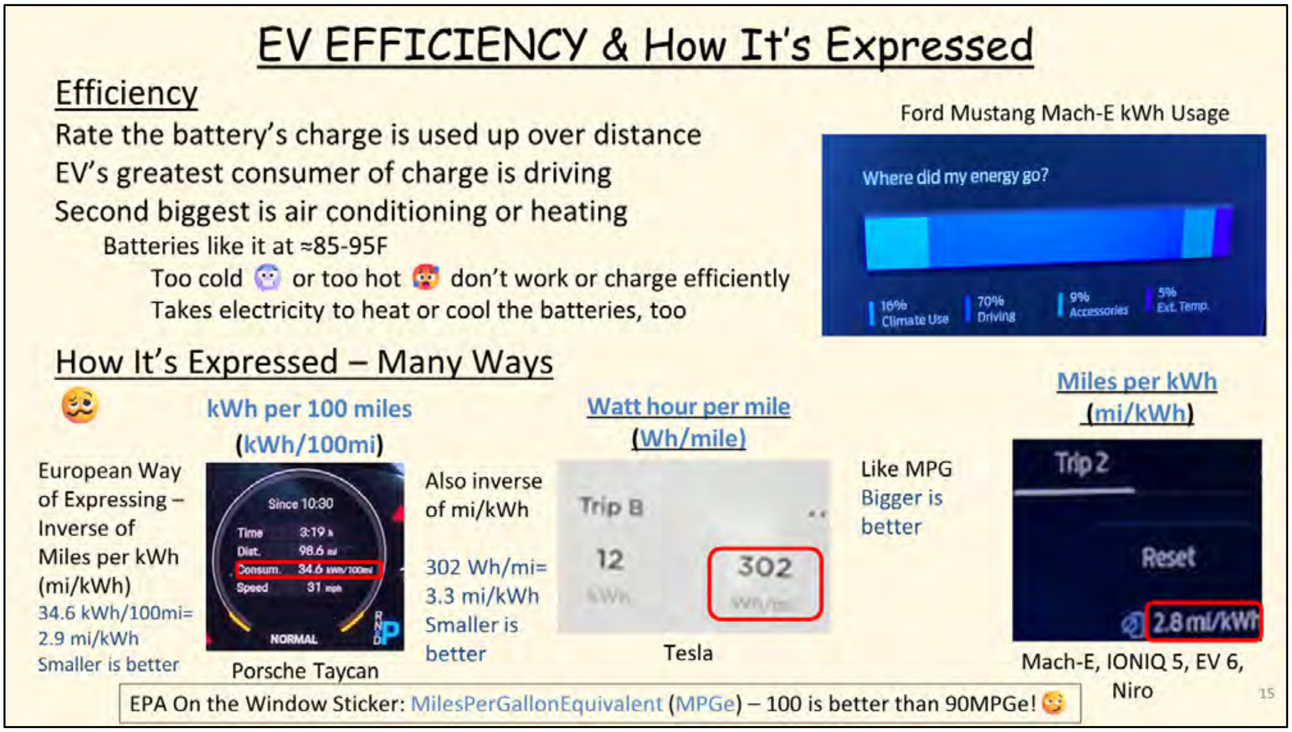
EV BATTERY [CHEMISTRY] TYPES





These two slides have been added to this topic area because of recent news articles about EV battery fires and changes that EV manufacturers such as Tesla are making because the Lithium Iron Phosphate (LFP) drive battery types are replacing Lithium-Ion NMC batteries.

This is being done for several reasons, primarily because LFP is less expensive to manufacture, they do not require unsustainable raw materials (nickel, manganese, & cobalt), and they are less susceptible to catching fire. They also can be routinely charged to 100% SOC without degradation. (more about degradation in the Charging – The Details class next Wednesday, February 28th).



Unlike ICE cars that in the US express efficiency in miles per gallon (mpg), EV manufacturers and even the EPA express how much drive battery energy in different ways. As shown driving is the biggest user of battery energy. Heating and cooling is second by significantly less. Meaning if you are stopped in traffic the only thing using battery energy is probably keeping the cabin temperature comfortable.

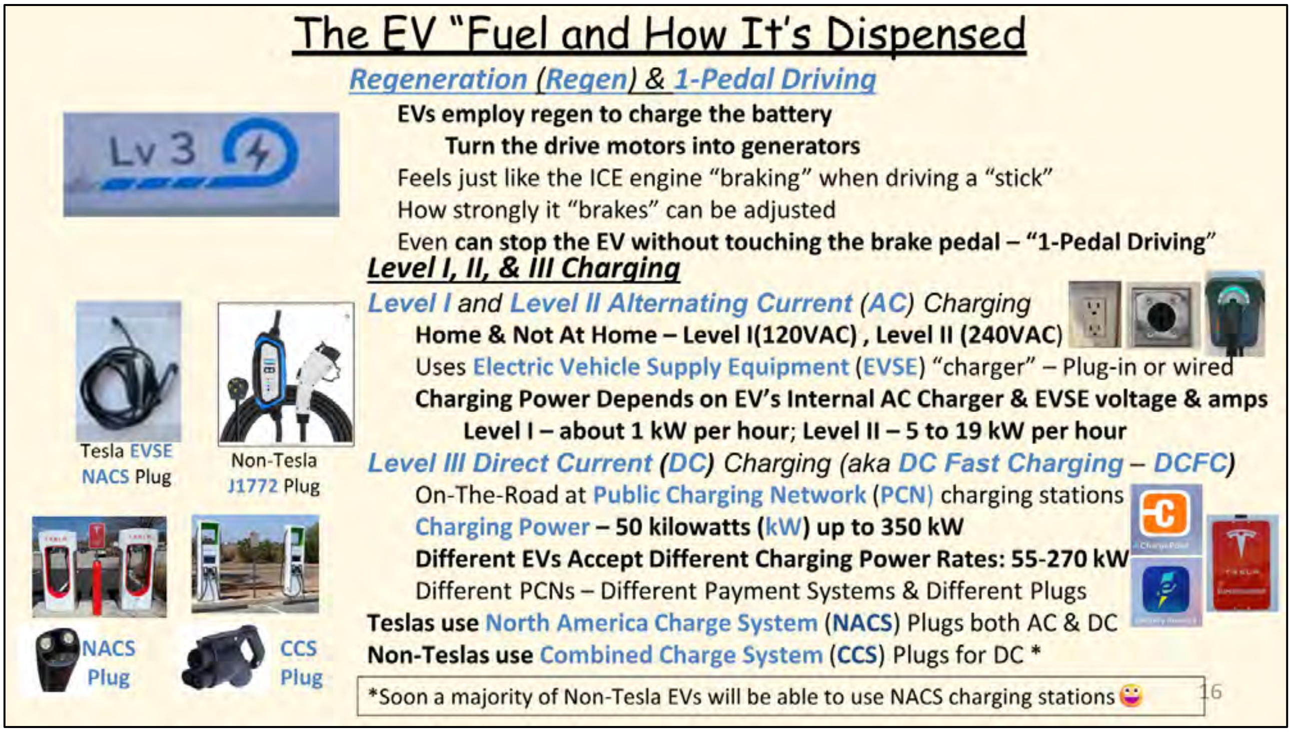
> *Damond's Additional Comments.* For example, an EV travelling at 65 mph can use around 21.7 kWh each hour (at 3 mi/kWh) due to driving. During that time, the Heating/Cooling system uses 3-4 kWh depending on how hot or cold it is. If stopped in traffic for an hour, one can use maybe 5% SOC (77kWh battery) just using the heating and cooling system. Not what happens in an ICE vehicle that keeps its engine running in order to heat or cool the cabin.

The German-made Porsche Taycan and other European EV manufacturers use kilowatts per 100 miles (kWh/100mi). The smaller this number is the more efficient the EV uses its stored energy. To convert it into a measure more like mpg; that is into miles per kilowatt hour (mi/kWh), you have to divide the kWh/100mi number into 100; i.e., mathematically invert it. For example, the 34.6 kWh/100 mi shown for the Porsche Taycan converts to 2.9 mi/kWh by dividing 100 by 34.6.

Tesla also uses a unique measure of efficiency: Watt hour per Mile (Wh/mi). Again, the smaller the number, the more efficient the EV is using its stored energy. To convert it into miles per kilowatt hour (mi/kWh), one has to divide the Wh/mile number into 1000. For example, the Tesla 302 Wh/mi figure shown results in a 3.3 mi/kWh figure, by dividing 302 into 1000. The 1000 is used because the Tesla number is only based on Watts (W) and not kilowatts (1000 watts).

Finally, EVs made in the US, Japan, and Korea, display efficiency in miles per kilowatt hour (mi/kWh). This measure makes it easier to calculate how far one can go until empty when one knows the SOC and the size of the battery. This "distance to empty" or "miles remaining" estimate is usually already calculated and displayed in an EV just the same as it is in most newer ICE vehicles.

EPA's Miles Per Gallon equivalent. (MPGe). The MPGe is shown on every new EV window sticker. It is related to the 33.7 kWhs of energy that a gallon of gasoline would produce if it was 100% used efficiently. The result is an attempt to compare EVs with almost 100% efficiency. Simply stated when comparing EVs the larger the MPGe the more efficient that EV is over a lesser MPGe under the same conditions 🫣



This is a busy slide. You will find some of my slides are designed to be like a page from a text book. When reviewed read later they are complete and require no notes to be taken while they are presented and discussed. I often bold phrases that contain things that are important. Such as in this slide:

<u>Regen & 1-Pedal Driving</u>. As mentioned in the HEV, PHEV, and BEV slide, all these EVs use regeneration as a means of charging up the drive batteries. For an HEV, and a PHEV, it is used in addition to the ICE to charge the drive batteries. For the PHEV, and BEV they use it to extend the distance it can go before having to charge the drive batteries. For all of these EVs, when driving at speed on highways for a long time without having to brake for anything, the regen does little to charge the drive batteries, and so for the HEV and PHEVs the gas mileage often is less than when driving in conditions requiring recurring braking. The BEV also suffers from lower efficiency, mi/kWh, when driving on highways with little or no braking.

> *Damond's Additional Comments.* I remember Bill mentioning that he got poorer gas mileage than he expected when driving long distances on roadways at constant speed/little or no need for braking in his Honda CR-V hybrid.
>
> Also, the below comments are expanded explanations about Level I, II, and III charging that may help clarify the differences portrayed in the slide. The main purpose of the slide was to familiarize you with the terminology. The class session next Wednesday February 28th is to provide all the details associated with these different levels of charging. The expanded explanations below are provided to help differentiate them.

Level I, II, & III Charging.

The key difference between the Levels of Charging is the **power** that is provided during charging. **Power is measured in kilowatts (kW)** and for EVs is the hourly rate at which energy is delivered. **Drive battery energy in kilowatt hours (kWh) is the result of power delivered over time;** i.e., kW (per hour) times the time in hours it is delivered.

Level I AC charging only delivers power at steady 1 kW (per hour) which means it can only charge a drive battery at 1 kWh per hour of charging. If you need a 10 kWhs of charge (energy) to bring your State of Charge (SOC) up to 80%, then you will need 10 hours of Level I AC charging to do it.

Level II AC charging is also a steady rate, and can deliver from 5 to 19 kW per hour of charging depending on the Electric Vehicle Supply Equipment and your EVs internal charging system.. This means that if you needed the 10 kWhs of charge to bring the SOC up to 80%, it would take only 2 hours at 5 kW and only 31.6 minutes at 19 kW.

Level III DC charging can deliver up to 350kW per hour of charging. That being said, there are many factors that govern how much power is actually delivered at any moment of time during charging. Among those factors are:

- The maximum power level the EV is designed to accept; e.g. a Chevy Bolt can only accept a charging power of 55 kW per hour; while a Porsche Taycan can accept a maximum charging power of 270 kW per hour
- The current SOC of the battery. If the SOC is over 80%, the maximum charging power can be significantly less that the maximum power level that the EV was designed to accept. A simple explanation is that the drive battery “pushes back” as the SOC increases particularly after 80% SOC up to 100%. Somewhat like blowing up a balloon and how much harder it is to blow it up as it gets full. More about that in next Wednesday’s class.
- Weather conditions at the time one is charging; hot and cold weather affect the charging power.
- The state of the charger itself. It is not uncommon for a charger to not be able to deliver its maximum power. It can be commanded to not deliver full power, or is not capable of doing so.

Consequently, the time to charge from a specific SOC to 80% or 100% is determined by an everchanging charging power governed by the factors above. When all is working well at a charger it is possible to charge from a 10% SOC to an 80% SOC in less than 20 minutes.

I have had a Kia EV 6 hooked up to a 350 kW charger with a 35% SOC and charged to 80% in 12 minutes. It started out at the Kia EV 6’s maximum charging rate of 235 kW. I barely had time to go to the bathroom! 😲

Finally, currently there are differences in the plugs used to charge EVs based on whether or not they are Teslas or not. It is important to know in the future if your non-Tesla EV can use a Tesla Supercharger, and if so, can it use it with or without an adapter.

The comments associated with the slide above, and the slide below reflect what terms are important to remember for next week.

Key Terms/Abbreviations To Remember for Next Week

Plug-in Hybrid Electric Vehicle (PHEV)
- Has both a gas engine and battery powered drive.
- Can drive up 30-50 miles on batteries alone
- Batteries ultimately require charging via a plug-in charger, Level I, II, or III

Battery Electric Vehicle (BEV)
- Uses only battery supplied energy to move
- Requires charging of the drive batteries

Kilowatt Hours (kWh)
- EV's fuel/energy
- Stored in the drive batteries that have a spec'd useable capacity

State of Charge (SOC)
- The amount of kWh energy remaining in the drive battery expressed as a percentage (%) of the full charge

Level I Charging using a NACS plug for Teslas and a J1772 plug for Non-Tesla EVs
- Alternate Current (AC) charging using a standard 120 volt outlet and a plug-in Level I EVSE ("Charger")
- A "trickle charger" that supplies only 1 kilowatt (kW) power per hour of charging; only 1 kWh in an hour

Level II Charging using a NACS plug for Teslas and a J1772 plug for Non-Tesla EVs
- AC charging using a 240 volt outlet & plug-in EVSE ("Charger") or a hard-wired 240 volt EVSE ("Charger")
- Primarily used as a home EV charging system supplying a 5 – 19 kW power per hour of charging; 5-19 kWh in an hour
- Also, available when Not At Home at shopping centers, hotels, shops, etc.

Level III Charging using a NACS plug for Teslas and a Combined Charging System (CCS) plug for Non-Tesla EVs
- High voltage Direct Current Fast Charging (DCFC) provided by Public Charging Networks (PCN) away from home
- Charging charging power in kilowatts (kW), ranges from 50 to 350 kW; a 20 minute charging 10-80% SOC possible

OPEN ITEMS

At the end of this class session, Hugh mentioned the concern about where all the electricity was going to come from when there would be all the EVs.

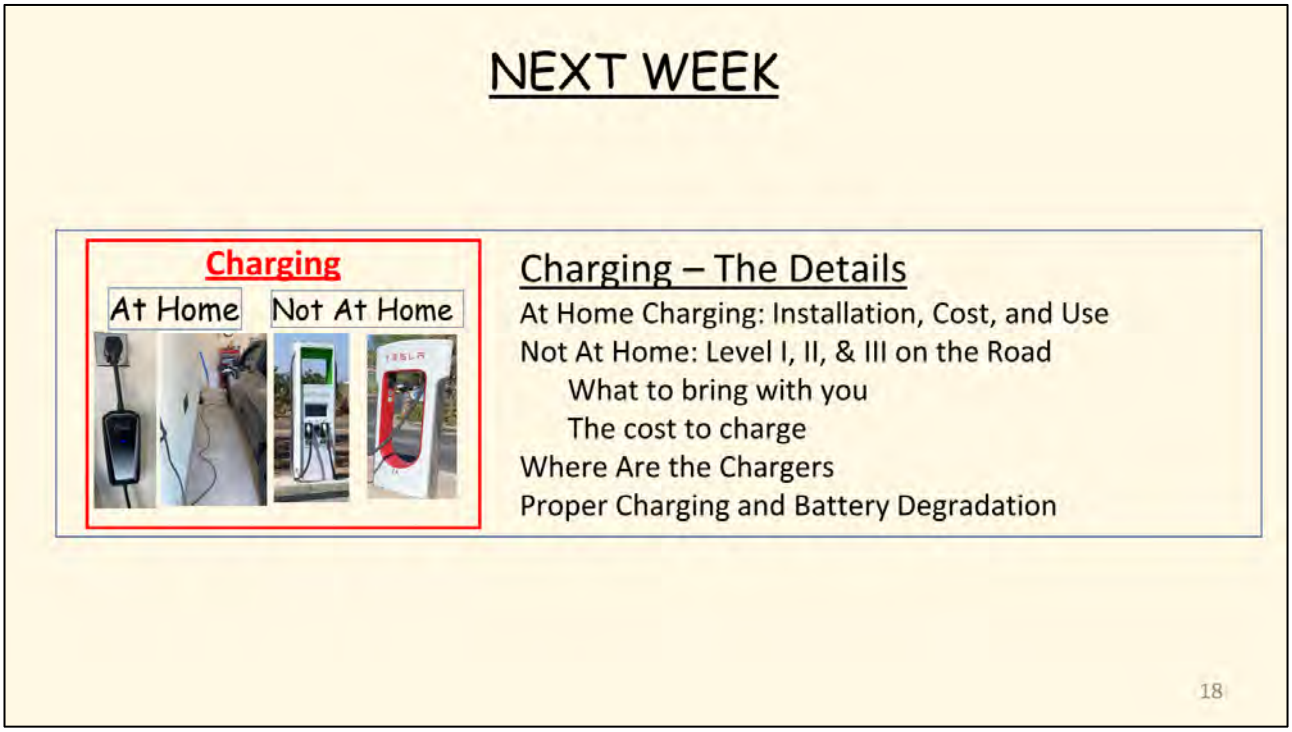
I promised him that I would research this issue and get back to him.

I am currently obtaining several articles on that subject. I am attempting to find articles both supporting the claim that the "electric grid" won't be able to support all the EVs in the future, along with articles also claiming that there will be no problem with the grid supporting not only the EVs but also the shift away from fossil fuel use to all electricity use.

I will attempt to have available for Hugh and any of the GV EVBC participants articles to read by the next Newsletter.

I plan to ask you all at the next class, who would like the articles I obtain, and if you would like them distributed via the Newsletter or in hard copies.

I will also make time in a future class session to discuss this topic. It will not be in next week's class, however.



Next week's class session will focus in on the details associated with charging.

As mentioned at the beginning of the Newsletter, I want to engage Bill, Steve, and Hugh in discussions on their specific driving and residence situations and how they would see an EV fitting in with their situations.

I would also like to address Hugh's family in Estes Park CO EV charging situation to see what, if anything, can be done to improve the EV charging situation there.

FINAL NOTES

Your Feedback Please on the Newsletter Style and the Ability to Eliminate Sending Out a Copy of the Slides.

I would like your feedback on the usefulness of this particular style of Newsletter relative to also providing you a pdf copy of the PowerPoint slide file. The style of this Newsletter is such that all the slides are shown, albeit some are in a reduced size that may make it hard for them to be read easily. I am attempting to have the Newsletter as the only "handout" you get. You will notice that for the most part you do not have to have a pdf copy of the PowerPoint slides.

Let me know, if it would be better to just include a reduced, but still readable copy of each slide in the Newsletter, and eliminate sending you all a copy of the PowerPoints. It will make the Newsletter longer page wise.

I am also attempting to make the Newsletter along with the additional comments and expanded explanations a document one can find useful, even when one has to make a class session.

I'd appreciate your feedback on this. Even though it means having to at least scan a somewhat lengthy document.

My Contact Information

You can always contact me about the class content, questions, comments, or suggestions at damondlosterhus@verizon.net, or phone/text at 520.449-1893 (cell). If you do email me, please include GV EVBC in the subject line. I have Outlook rules set up to put class related emails in the GV EVBC folder.

Thanks for listening,

Damond