ABOUT ME

• Native West Virginian currently living in Martinsburg
• Day job in information technology
• Married with two feline overlords
• Current president of the West Virginia Electric Auto Association
• Advisory Board Member for Solar United Neighbors WV
BACKGROUND WITH EVS & SOLAR

- Interested in efficient vehicles for many years due to longer commutes
- First EV, 2015 Nissan LEAF
- Installed 11.3kW rooftop solar array in late 2017
- Installed Level 2 home EVSE in 2017
- $5/month electric bill since March 2018 for all-electric home and EV
BACKGROUND WITH EVS

- Second EV, 2018 Model 3 Long Range Dual Motor
- Won 2022 National Drive Electric City Captain Award from Plug In America
- Teaching a six week EV Lifelong Learning course at Shepherd U
- Presented to classes at WVU, other state schools, state legislators, and the Expo last year
Annual Totals

Solar Gen kWh: 13,082
Home Use kWh: 9,341
EV Use kWh: 2,773

Annual Electric Cost: $60

2020 West Virginia Solar Production vs Home and EV Usage in kWh

Annual Electric Cost: $60

2020 TOTALS
Solar Production: 14,169 kWh
Home Usage: 9,171 kWh
EV Usage: 1,802 kWh
Net Result: 3,196 kWh Credit
WHY DRIVE AN EV?

• Be a good steward of the planet
  – Use limited fossil fuel resources wisely; minimize air pollution and CO₂ generation.

• National security concerns
  – Global petroleum markets can fund unfriendly countries and oil is at least partly responsible for costly, both in lives and dollars, foreign conflicts.

• Greater personal independence
  – Gasoline cannot be made at home, but electricity can be. If I can make my own energy, then I have control over the source and cost of my energy.
WHY DRIVE AN EV?

• Latest technology and performance
  – Auto or technology enthusiasts (or both) prefer vehicles with the highest safety, performance, efficiency, and latest technology. EVs can get better over time with updates that add new features.

• American made vehicles and “fuel”
  – The most American-made vehicles are EVs. Electricity isn't imported like oil, it’s generated and used locally, supporting local jobs, whether it comes from solar, wind, hydro, natural gas, or coal.

• Others: Quiet, home charging, etc.
AGENDA

- Snapshot of Electric Vehicle (EV) market
- EV charging overview
- Charging infrastructure highlights
- Questions
EV MARKET SNAPSHOTS
WHERE DO WE STAND AND WHAT’S COMING?
 Derived registration counts by the National Renewable Energy Laboratory, Experian Information Solutions
WV PEV REG STATS: 2021 BY COUNTY

Derived registration counts by the National Renewable Energy Laboratory, Experian Information Solutions
US PEV SALES & SHARE FORECAST 2021-2030

Source: evadoption.com. Historical sales data: GoodCarBadCar.net, InsideEVs, IHS Markit/Auto Manufacturers Alliance, Advanced Technology Sales Dashboard, Research & Chart: Loren McDonald/EVAdoption
FOLLOW THE MONEY…

Volkswagen doubles down on its EV strategy with a nearly $200B investment

Volkswagen says last generation of combustion engines to be launched in 2026

Hyundai Motor to invest $80 billion in future electrification with 17 new BEVs and a new modular platform

Audi is converting all factories to produce EVs as it phases out gas cars

Ford boosts EV spending to $50 billion, sets up new Model e unit

Ford to invest $11.4B, 11,000 jobs in Tenn., Hardin County for electric vehicles

GM Will Boost EV and AV Investments to $35 Billion Through 2025

Buick is rebranding as an electric-only automaker

Cadillac is going electric – every new vehicle will be all-electric starting now
AUTOMAKERS TARGET $515 BILLION
$1.2 TRILLION FOR EVs AND BATTERIES

“...does not include the tens of billions of dollars being invested in additional production capacity by the world's largest battery companies...”

Source: Reuters - Exclusive: Global carmakers now target $515 billion for EVs, batteries

Panasonic Picks Kansas for $4 Billion Battery-Production Site

Stellantis, Samsung to build $2.5B battery plant in Indiana
GLOBAL EV SALES BY YEAR

Global BEV & PHEV sales ('000s)

- Battery Electric Vehicles
- Plug-In Hybrids
- EV Market Share

Source: Global EV Sales for 2022
EV CHARGING
LEVEL 1, LEVEL 2, DCFC, OH MY!
### AC Level 1, 2 & DC Fast Charge (DCFC)

**AC Level 1**
- **Voltage**: 120V 1-Phase AC
- **Amps**: 12 – 16 Amps
- **Charging Loads**: 1.4 to 1.9 kW
- **Charge time for vehicle**: 3 – 5 miles of range per hour

**AC Level 2**
- **Voltage**: 208V or 240V 1-Phase AC
- **Amps**: 12 – 80 Amps (Typ. 32 Amps)
- **Charging Loads**: 2.5 to 19.2 kW (Typ. 7kW)
- **Charge time for vehicle**: 10 – 20 miles of range per hour

**DC Fast Charge**
- **Voltage**: 208V or 480V 3-Phase AC
- **Amps**: <125 Amps (Typ. 60 Amps)
- **Charging Loads**: <90 kW (Typ. 50kW)
- **Charge time for vehicle**: 80% Charge in 20 – 30 minutes

Source: bateselectric.com – Commercial DC EV Charging Stations

**150-350kW is common for interstate DCFC stalls.**
CHARGE CONNECTORS: STANDARDS...

• AC Level 1 and 2: J1772 or Tesla (Destination)
• DCFC: Tesla (Supercharger), CCS 1, CHAdeMO (phasing out)

Source: enelx.com – The Different EV Charging Connector Types
USE CASES

• Dwell time: How long will typical users be onsite to charge?

• Longer dwell times are suitable for AC charging (home, work, hotels, airport parking, conf centers)

• Short dwell times at convenience stores, for example, use 150-350kW DCFC

• In between, there is “slow” DCFC with <50kW charging power. 24-50 kW is common at auto dealerships.

Source: UCLA Luskin School of Public Affairs: Electric Vehicle Charging at Work
According to the US Department of Energy, 80% of EV charging happens at home.

Level 2 AC chargers are $200 plus depending on features.

Level 2 installation cost could be free if you have a 240V outlet, or $500 plus depending on the complexity.

Some users can operate on Level 1 (120V) charging, but it may not be as convenient depending on your situation.
Tesla Supercharger Network Accounted for 74.1% of New DCFC Ports Deployed in the US in 2022

The Tesla Supercharger and EVgo DCFC networks had the highest YOY growth in number of ports at 35.7% and 35.1% respectively.

Tesla ADDED more DCFC ports in 2022, than the #2 network (Electrify America) has in total.

Data: Alternative Fuels Data Centers (AFDC) — Dec 31, 2021, Dec 31, 2022
Chart: EVAduction, LLC | February 6, 2023
TESLA SUPERCHARGER/MAGIC DOCK

- Tesla has the largest, most reliable DC fast charging network in the country and the largest DC fast charging network in West Virginia since 2014.
- Magic Dock enables non-Tesla vehicles to use Tesla Superchargers.
- No current Magic Dock sites in West Virginia, but new Superchargers coming to Marmet, Ripley, and Lewisburg could be the first.
- Tesla Superchargers typically offer eight charging stalls at speeds of 150-250kW in WV.
OTHER FAST CHARGING

- **National Electric Vehicle Infrastructure** coming soon
- **TravelCenters of America (TA)** plans to open 1,000 electric vehicle charging station at 200 locations
- **Shell Recharge** is growing a US fast charging network
- **Kroger** partners with **Volta** to deploy EV charging
- **7-Eleven Announces New EV Fast Charging Network**; to “build one of the largest EV fast charging networks of any retailer in North America.”
- **GM, Pilot** to develop EV charging network
- Other than NEVI, it’s unclear when or if these will arrive in West Virginia
14 DC FAST CHARGING (>50kW) SITES

- All installed DC fast chargers are 150-250kW Tesla Superchargers except for one new CCS 62kW station in South Charleston.
OVER 100 AC LEVEL 2 SITES
If you’re looking for an EV charger in the state, PlugShare is a good, free app and website to find Level 1/2 and DC fast chargers in the state. Check reviews of EV chargers ahead of time if you’re concerned about being able to charge at a particular destination. Find out what amenities are provided or nearby. Understand the fees for most chargers. See other chargers in the area that could be used if needed as a backup.
CHARGING CHALLENGES

• J.D. Power’s Electric Vehicle Experience Public Charging Study alleges that over 20 percent of all charging attempts failed in 2022.

• Downtime is becoming a serious issue for EV charging stations.

• Satisfaction with Level 2/3 chargers hit its lowest point in 2022 Q3 since J.D. Power began its EV public charging study in 2021.

• Tesla’s Supercharger network is the most consistent by a wide margin.

Source: J.D. Power Survey Suggests Public EV Charging Getting Worse, TheTruthAboutCars.com
Alternative Fuels Data Center

- Multi-Unit Dwellings
- Workplace Charging
- Public Charging
- Operation and Maintenance
- Signage
- Laws & Incentives

See https://afdc.energy.gov/
VEHICLE TO LOAD (V2L)

For those that are interested. We have had no power for 2 days 3 nights. The V2L system has been running our fridge, deep freeze, lights, charging appliances, internet wifi and the odd appliance like toaster and coffee machine. Car was charged to 100% and now sits at 90%. So at this rate we will be OK for max 20 days on the basics. Yet to test if it will handle the water pump up to the top tank as we are gravity fed from there and haven’t run it dry yet. Our V2L cable arrived literally the day before the storm! So lucky.
ELECTRIFICATION IS COMING TO ALL TRANSPORT

“...contract to build seven battery-powered ferries for Fjord, Norwegian transport conglomerate. The news comes after the operators of the first all-electric ferry in Norway, the Ampere, reported impressive statistics after operating the ship for over 2 years. They claim that the all-electric ferry cuts emissions by 95% and costs by 80%.”

Caterpillar Electric Mining Truck

Wabtec Electric Locomotive

Pipistrel Velis Electro Serial production Battery Electric Aircraft
QUESTIONS?