Washington Advanced Energy Stakeholder Meeting

Critical Infrastructure, Resilience and Microgrids

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Projected growth of BEV and PHEV Models through 2023

Established OEMs are expected to launch around 400 new electric-vehicle models through 2023.

Existing and newly launched BEV[1] and PHEV[2] models by vehicle segment, number of model launches

[1]Battery electric vehicle. [2]Plug-in hybrid electric vehicle. [3]Cars actually produced in 2018. All subsequent year numbers are estimates by segment.

Source: IHS Markit; McKinsey analysis

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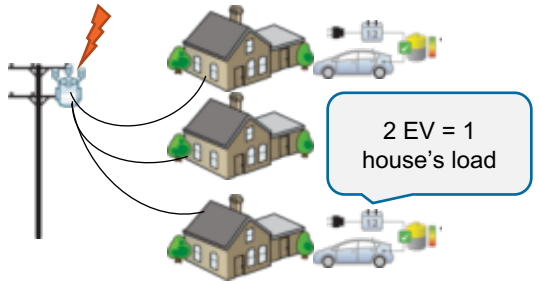
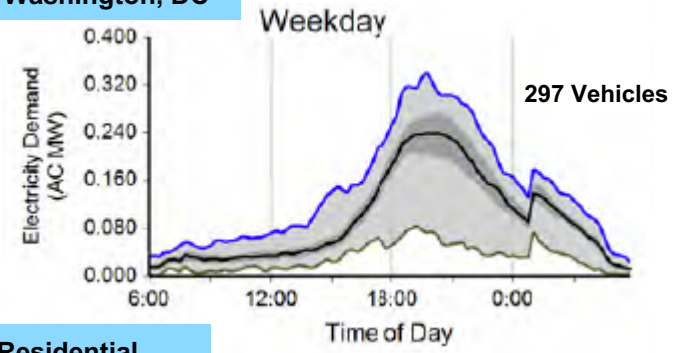
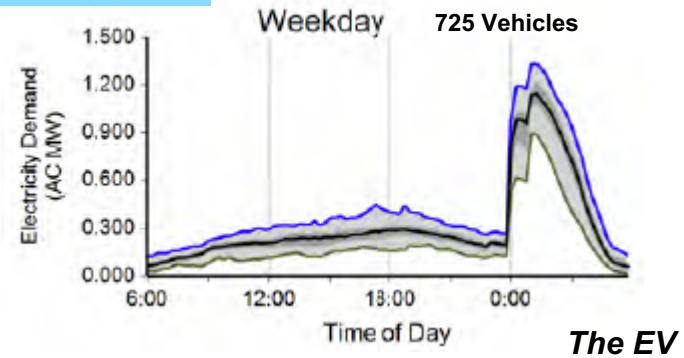
Unmanaged EV charging can create reliability problems for utilities…..



Residential Washington, DC[1]



Residential San Diego, CA[1]



Local Distribution System Impact

- EV load is equivalent to ½ of full home load, so adding EVs may overload local transformers
- Older, more established neighborhoods with higher concentrations of EVs will be particularly at risk (e.g., Montgomery County and Prince Georges's County Suburbs)

Local Peak Load Increase

- Most drivers will return home and plug in between 4-8 PM, resulting in an increase to the normal afternoon peak
- Uncontrolled charging will create the need for additional Infrastructure and result in longer and higher peak demand
- Potential for Impact to Distribution System reliability

Operational Needs

- Metering EVSE as separate load for Innovative Rates
- Back-office integration of EVSE for control, billing
- Remote diagnostics for lower maintenance costs
- Ability to manage charging in pockets to prevent stress on the Distribution System
- Need to validate the accuracy of on-board metering in EVSE in order to eliminate the need for a second AMI meter

The EV Project Report, Q1 2013, US DOE[1]

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U.S. ELECTRIC BUS MARKET

CAGR 23.9% (2019–2024)

2024 $1,554.5 MILLION

2018 $445.7 MILLION

U.S. electric bus market is forecasted witness fastest growth in coming years

DRIVERS

- Environmental benefits
- Stricter regulatory measures to reduce emissions
- Long-term economic benefits to transit agencies
- Availability of local, state, and federal funding toward zero-emission buses
- Falling battery costs and improving operational efficiencies

Market Players

Proterra Inc., BYD Motors Inc. | and NFI Group Inc.
Furthermore | GILLIG LLC and NFI Group Inc

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Where knowledge inspires strategy

Electric Bus Charging creates a new Infrastructure challenge

- Electric Bus charging can be overnight, on route or both
- Initial chargers are 100KW to 150KW, future 350KW to 450KW
- 10 Electric Buses, centrally charged creates a peak load of 1.5MW
- Could require as much as 5MWh of energy
- Charging could be offset to reduce peak loads, MWh would remain the same
- Loads can be provided by Electric Distribution system with possible upgrades
- Energy Storage could shave peak, but 1.5MW / 5MWh would only satisfy one day's usage
- Solar is possible but requires 1 acre per 1MW
- Gas fired generation is least cost, but carbon based

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Problem Statement:

As the District of Columbia considers mass transit electrification, how do you best address the charging needs of a fleet of electric buses during a long-term (multi-day) storm related outage to prevent further disruption in the daily lives of Washingtonians?

Organization	Definition
Federal Energy Regulatory Commission (FERC)	*The ability to* ***withstand and reduce the magnitude and/or duration of disruptive events,*** *which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event*
Department of Energy (DOE)	***The ability to prepare for and adapt to changing conditions and withstand and recover*** *rapidly* ***from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.***