



GEOTAB[®]
management by measurement

EV Data Access Requirements

Prepared for GENIVI - March 2020

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Background;

GENIVI has requested Geotab propose EV signals required based on their Commercial Fleet management business. Sarah Kerr (Geotab) Presented the Slide Deck, [Fleet EV & Electrical Utility EV Load Use Cases](#) to GENIVI recently.

GENIVI has requested Geotab recommend the data access that EV OEM's should provide to enable fulfillment of use cases Geotab has solved for in the Commercial Vehicle space. This also includes data used for 'public good', e.g. Power Utility load balancing, attribution of vehicle 'tail pipe emissions' - now emitted by the Power Utility, and range/destination monitoring.

EV Data Access Requirements;

1) Vehicle Charging data; * (see note)-

How much electrical energy and power is delivered to the vehicle during charging.(including time and location/GPS)

Charging:

- Where: GPS coordinates or alternative location representation
- When: date and time
- Power:
 - Captured at very short intervals through the charging
 - Unit: kW typically is the human-readable unit for an individual vehicle
- Energy:
 - Derived from power and time
 - Unit: kWh typically is the human-readable unit for an individual vehicle

2) Vehicle Discharge data -

How much energy and power is discharged from the vehicle (including time, and location/GPS)

Driving and Operating Energy:

- Where: GPS coordinates of the travel route, including Z for altitude change
- When: date and time
- Energy (kWh) leaving the HV battery for propulsion and auxiliary loads
- Energy (kWh) being added back into the HV during operation from regenerative braking

USE CASES

Virtually all EV specific use cases can be solved with manipulation of this basic set of EV charge/discharge data. Some of the use cases are of direct and essential benefit to the public and rely

on access to these EV signals. I.e. Power Utility load balancing, CO2 and other emission attribution to EV, power utility receiving and providing credits based on vehicle GHG emissions.

All EV's

GHG emission reduction resulting from EV adoption

EV energy consumption

Km/KWh efficiency

Real world range versus published range

How much charging energy am I consuming? What are my costs?

How much energy consumed by EV was used for propulsion versus other EV loads?

PHEV's - optimize/maximize EV part of vehicle use.

Relative battery degradation among EV's (requires an algorithm comparing vehicle charging and discharge data over time.)

Absolute battery degradation compared to range required for vehicle purpose/needs

Battery degradation as input to calculate vehicle residual value.

Commercial Fleets;

Comparison of cost/benefit for converting a specific ICE vehicle to EV

prioritize which EV's need as charge - which EV has enough to complete planned route

Do I have enough building capacity? Do I have enough local transformer capacity?

Do I need to manage coincident power levels given (local) capacity limitations?

Do I need to manage coincident power levels given grid limitations?

Can I use my fleet vehicles to provide energy for my operations in case of emergency?

Power Utilities

Predicting Power Utility (generation, transmission, distribution) requirements based on adoption rates for EV

An EV on average adds ~ 4000 kWh to household load annually (based on Geotab's consumer vehicle data averages).

NA average is ~ 11,000 kWh (US src; Can src).

UK average is ~ 4000 kWh (src).

Current grid generation and assets sized for pre-EV load

Manage EV Load (Demand.Response) and Load Shaping - Peak Demand and Balance high demand versus lower demand times of day.

*** note: Vehicle Charging data - details**

Two types of EV charging stations

AC energy enters the vehicle, is converted to DC in the vehicle, then pushed into battery. Geotab currently measures DC energy pushed into the battery and does not include losses converting AC power to DC, nor in-vehicle line losses enroute the battery.

DC energy enters the vehicle during charging and flows to charge the battery.

Ideally - OEM EV charging data would include total energy flowing into the vehicle from the charging station (what the vehicle owner pays for) versus the electrical energy flowing into the battery that does not include losses from charging station to battery. DC (fast charge) stations do not have this electricity ac/dc conversion loss