5.2 Electric vehicle technologies

21st APEC workshop on energy statistics: data collection on new energy products and technologies, Tokyo

Energy Statistics and Training Office (ESTO), Asia Pacific Energy Research Centre
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Day 3	14 September 2023
Session 5*: Reporting the energy consumption of EVs, PHEVs and FCEVs to be moderated by *Mr Glen Sweetnam	
9:30-9:55	***Special presentation*** • Modelling electric vehicle energy consumption for sustainable electric mobility ***Mr Morgan Watkins, Chair, Land Expert Group APEC TWG***
9:55-10:15	***APERC presentation*** • Electric vehicle technologies ***Mr Finbar Maunsell, Assistant Researcher, APERC***
10:15-10:35	***EGEDA secretariat report*** • Electricity consumption in the road transport sector ***Ms Risa Pancho, Researcher, APERC/EGEDA secretariat***
10:35-10:50	**Morning break**
10:50-11:30 (20 mins each)	***Economy presentations*** • Electricity consumption data of battery electric vehicles (BEVs) ***Mr Jen-Yi Hou, Vice President, TRI Chinese Taipei*** • Electric Vehicle Program in Thailand ***Ms Narumon Fromhold, Chief, Energy Information Development Group***
11:30-12:30	**Roundtable discussion (All members)** 1) What are your economy's plans to electrify road transport? 2) How and who will collect the data?
12:30-13:30	Lunch break

Electric Vehicle Technologies

- Outline:
  - Estimating EV energy use
  - Separating EV energy use from buildings energy use
  - Projecting energy use
  - Charging statistics
  - Hybrids
  - FCEVs

The most important value

- Stocks (registered vehicles) - if you know this, you can estimate any other value.
- Breaking stocks into vehicle types (e.g. car/truck/van/bus) is the next most useful thing.
- This applies to all engine types, not just EVs.

Estimating EV energy use

- Mileage: the amount of km that the average vehicle drives per year
- Efficiency: energy use per km travelled

(These factors can be found online, or I am happy to provide what I use for your economies.)

Mileage*Stocks = km travelled per year

Efficiency*km = Energy

Separating EV energy use from buildings energy use

- Charging in homes and at charging depots can easily be accidentally recorded in residential or services categories.
- Unless you know/estimate public charger use, it is difficult to understand how much EV use to take away from these categories.
- An EV could use around 200-150kwh monthly. That would make up about 17% of an average US households current energy use.
    - This is why the time of charging is so important. Shift it later into the night, or during the day, and you spread the peak out a lot.

Projecting energy use

- If you base your projections off stocks, you will want:
  - Sales shares (the proportion of new vehicles sold that are EV's)
    - Most economies already have targets for these so they can provide a reference point
  - Turnover rates
    - 3% works, but it can differ based on the average age of vehicle stocks.
  - Additional stocks per year:
    - After stocks to replace the turnover of stocks, there are the new vehicles to satisfy new demand. Historic trends in the change in total vehicles stocks per year can tell you how many additional sales there are per year.
    - Our model calculates this using passenger/freight km and its growth.
- So:
  - New EV's = (Additional stocks per year + turnover) * sales share of EV's.

Charging statistics

- Charger to stock ratios
  - Studies show economies seem to require around 1 charging point per 10 EVs. This can change based off:
    - the number of fast/slow chargers (faster charging means less chargers needed).
    - private charging availability
    - average battery capacity
    - Driving patterns
- Finer detail: Kw charger to kwh of battery ratios
  - Even better.

Hybrids

- Studies still being done, but its important to know how people use electricity vs fuel in their hybrids.
  - Current estimates are 50%, or less (link in notes at the end)
- Should only track plug in hybrid electricity use. Non-plug-in hybrid electricity use comes from fuel consumption.

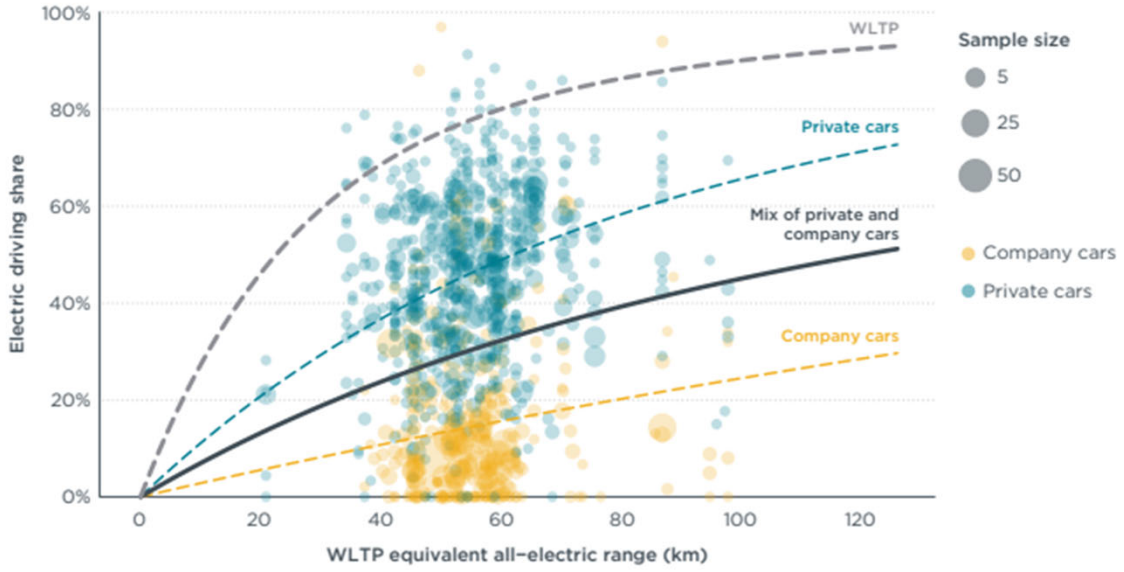

Chart from ICCT - Real-world usage of plug-in hybrid vehicles in Europe

FCEV's

- Fuel cell electric vehicles
  - These convert hydrogen into electricity. Therefore, energy use is recorded as hydrogen energy use.
  - Energy can be estimated using stocks.

Wrap up and key takeaways

- Stocks are the most important metric to track. Once you have that, the rest is easy.
- Difficult to separate charging from buildings energy use, unless you know public charging statistics.
- Separate hybrids by their type. Non-plug-in hybrids can be treated like they only use fuel.

Appendix

- Hybrid electricity usage share - https://theicct.org/wp-content/uploads/2022/06/real-world-phev-use-jun22-1.pdf
- Useful pages on how different EV technologies work https://afdc.energy.gov/vehicles/how-do-hybrid-electric-cars-work
- IEA trends in charging infrastructure - https://www.iea.org/reports/global-ev-outlook-2022/trends-in-charging-infrastructure
- ICCT report on charging (very informative) - https://theicct.org/wp-content/uploads/2021/06/EV_charging_guide_03162020.pdf
- Detailed breakdown of EV lifecycle emissions https://www.iea.org/data-and-statistics/charts/comparative-life-cycle-greenhouse-gas-emissions-of-a-mid-size-bev-and-ice-vehicle
- I will supply a workbook containing factors for mileage/efficiency and more. Plus some other data.

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