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The battery powering the 2023 Mini Cooper SE, currently the EV with the smallest battery pack available in the US, has a total or gross capacity of 32.6 kWh, but its usable capacity is 28.9...

Prices are dropping and Bloomberg (December 2017) says that the average EV battery costs now $209 per kWh. This includes housings, wiring, BMS and plumbing, housekeeping that adds 20 percent to 40 percent to cell costs. Experts predict that the EV battery will drop below $100 per kWh by 2025.

Battery Capacity: The size of the EV battery can impact the range it can travel on a single charge. Typically, a larger battery capacity can provide a longer range. Temperature: Cold temperatures can reduce an EV"s range by requiring more energy to heat the cabin and the battery.

Transformation from the horse-drawn carriage to horseless transportation took its time when new technology arrived. The architecture and seating arrangements stayed the same for a while on early cars; only the horse was replaced with a motor. Figure 1 illustrates proud and well-to-do travelers on a horseless carriage, well elevated from the danger of horse"s hoofs and the grit from the street.

In the early 1900s, the electric vehicle was reserved for dignitaries the likes of Thomas Edison, John D. Rockefeller, Jr. and Clara Ford, the wife of Henry Ford. They chose this transportation for its quiet ride over the vibrating and polluting internal combustion engine. Environmentally conscious drivers are rediscovering the EV with a choice of many attractive products.

The EV culture is developing distinct philosophies, each satisfying a unique user group. This is visible with vehicle sizes and the associated batteries. The subcompact EV comes with a battery that has 12-18kWh, the mid-sized family sedan has a 22-32kWh pack, and the luxury models by Tesla stand alone with an oversized battery boasting 60-100kWh to provide extended driving range and achieve high performance.

The makers of Nissan Leaf, BMW i3 and other EVs use the proven lithium-manganese (LMO)battery with a NMC blend, packaged in a prismatic cell. (NMC stands for nickel, manganese, cobalt.) Tesla uses NCA (nickel, cobalt, aluminum) in the 18650 cell that delivers an impressive specific energy of 3.4Ah per cell or 248Wh/kg. To protect the delicate Li-ion from over-loading at highway speed, Tesla over-sizes the pack by a magnitude of three to four fold compared to other EVs.

The large 90kWh battery of the Tesla S Model (2015) provides an unparalleled driving range of 424km (265 miles), but the battery weighs 540kg (1,200 lb), and this increases the energy consumption to 238Wh/km (380Wh/mile), one of the highest among EVs(See BU-1005: Fuel Cell Vehicle)

In comparison, the BMW i3 is one of the lightest EVs and has a low energy consumption of 160Wh/km

(260Wh/mile). The car uses an LMO/NMC battery that offers a moderate specific energy of 120Wh/kg but is very rugged. The mid-sized 22kWh pack provides a driving range of 130-160km (80-100 miles). To compensate for the shorter range, the i3 offers REX, an optional gasoline engine that is fitted on the back. Table 3 compares the battery size and energy consumption of common EVs. The range is under normal non-optimized driving conditions.

Clarification: The driving ranges in Tables 2 and 3 differ. This is less of an error than applying different driving conditions. Discrepancies also occur in topping charge, depth of discharge and fuel-gauging.

The cost of automotive lithium-ion batterers has fallen from about $1,000/kWh to a bit more than $100/kWh today. These cost reductions are attributed to incremental improvements in battery design and manufacturing efficiency, but few are credited to better battery chemistry. To further reduce cost, better battery chemistries are needed, but nothing is in the foreseeable future for the EV at time of writing.

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