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BYD E6 and the EV Range Solution

Clean Technology Breath on the Wind Monday, August 15, 2011

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Build Your Dreams E6

BYD Co Ltd (Build Your Dreams 002594.SZ) is on schedule to enter the growing EV market with the E6 crossover in Q2 of 2012, reports senior vice president Stella Li to Alysha Webb of Plug-in Cars.

It is an interesting time in EV marketing as each manufacturer tries to present their technological solution and win EV popularity. Tesla first gave us the sexiest electric vehicle. Nissan is trying to give us the mass-produced EV. GM is telling us not to be afraid. While all the manufacturers are happy to point out how clean these vehicles are to operate, an ever present undercurrent is the vehicle range and vehicle cost. With the BYD E6, we can focus on range issues.

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Battery Capacity

A battery manufacturer that has started building vehicles, BYD could be expected to do something special with the battery. At 60 kWh, the E6 battery is almost 4 times the size of the battery in the GM Volt or Mitsubishi I, and it is more than twice the size of the Nissan Leaf battery. At 53 kWh, only the Tesla Roadster battery pack comes close in size. The capacity of the battery, combined with the way in which the car is driven, the efficiency of the vehicle, and the weight of the vehicle, will determine the vehicle range.



Vehicle Efficiency

Most vehicles on the roads today operate using gasoline or diesel. Not only are we dependent upon petrochemicals, but we use these in essentially only one engine design, the Internal Combustion Engine (ICE). Cars with an internal combustion engine require transmissions, due to no torque at 0 RPM. We have to first bring the engine up to speed and then slip the clutch or use a torque converter to slowly transfer power.

Gasoline is a very energy dense fuel, but by the time we measure how much energy reaches the wheels, we find that it is only about 15% efficient. The balance is wasted. Electric motors are far more efficient. Electric motors have great starting torque and an EV will typically have only one fixed gear with a direct connection. The electric car can be over 90% efficient from battery to wheels.

Vehicle Weight

Efficiency is different from fuel economy. Efficiency only tells us how well we are moving the vehicle load with the energy it has available. A heavier vehicle has more work to do than a lighter one. Therefore, it will not get the same fuel economy as a lighter vehicle with the same efficiency. In an effort to increase range, manufacturers try to use lighter vehicles, make them as efficient as possible and then play a bit with "driving modes" that adapt acceleration and regenerative braking.

The E6 is a "crossover," an SUV built on a car and not a truck chassis. At 4453 pounds, it is a big car. The Tesla roadster, with a similarly sized battery, is only 2723 pounds and is rated at 245 miles on a charge. The E6 does not yet have an EPA sticker but the company is saying it will travel "150 miles using the AC."

Battery Chemistry

Battery chemistry is important to how long the battery will last, how quickly it can charge, the cost, weight and size. The E6 uses a Lithium Iron Phosphate battery (LiFePO or LFP). These tend to have more life cycles (the number of times the battery can be charged and discharged) than the more standard lithium cobalt oxide batteries (LiCoO₂) that are used in consumer electronics. Energy density is, however, lower, which means a heavier and larger battery pack.

A vote of confidence for this chemistry is that GM has just joined with A123 systems, an MIT spin-off that makes batteries with a similar chemistry. The E6 batteries can achieve a 50% charge in 10 minutes and will take one hour for a complete charge. While this sounds great, in order to transfer 60 kWh of energy in an hour, a 240-volt charger would have to be operating at a minimum of 250 amps (most residences have no more than a 200 amp service). If you had 320-watt solar panels on the roof, you would need over 200 of them to provide the needed power in one hour. This is far beyond the rating of present level II charging you might have installed in your home. Tesla also has a high-capacity, level III charger for its vehicle, which charges the vehicle in 4 hours.

->> Page 2: Supplying Needed Power, 3 Potential Solutions

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