

Cal Poly Rapid Battery Exchange (RBX) Team



As an alternative to the time-consuming process required to fully recharge an electric vehicle, battery exchange methods for electric vehicles have been around since before 1900 in both manual and semi-automatic embodiments. However, making them actually work and practical for daily use remain significant engineering challenges. In Prof. Art MacCarley's course EE/BRAE 434 "Alternative Energy Vehicles" and in the related "Electric Vehicle Engineering Club" that he advises, the mechanization of automated rapid battery exchange (RBX) systems have been recurring engineering class projects since the early 1990's. An ongoing innovation challenge that evolves with every new project built (6 since 1995). Work leading to a commercial version is now in progress following two recent successful demonstrations of student-built systems:

<https://www.youtube.com/watch?v=DZvteZl77do> video of the 2014 student project apparatus in operation, or

<https://www.youtube.com/watch?v=yi7NDjSNVZ0> video of the 2016 student project apparatus at a public demonstration.

The 2014 apparatus required 1 minute 25 seconds, while the 2016 apparatus performs the exchange in 60 seconds; both faster and more convenient than either the 90 second exchanger demonstrated by Tesla Motors in 2016, or the three minutes required by a battery exchange apparatus plus vehicle demonstrated in 2019 by the Chinese company Nio Systems, that is receiving extensive publicity.

The object for the class projects has been the design and construction of a fully automated system that will "refuel" a campus escort van at a regular passenger stop in less time than required for the passengers to board the vehicle, and without the driver ever leaving the vehicle. The exchange and charging apparatus is installed flush with the pavement, inconspicuous to the public. The recent RBX teams are particularly proud to note that these multidisciplinary projects were built within budget limitation of \$5000 using GMC vans originally donated by PG&E.