

**Comments on Air Resources Board Item 09-5-4 at May 28, 2009 Hearings  
by Ron Gremban, CalCars Technical Lead**

First, as always, I wish to express appreciation for the Board and staff's great efforts toward enabling a nascent vehicle electrification industry while designing rules to ensure continued compliance with criteria emissions requirements. Though the Board is not yet authorized to deal with vehicular GHG emissions, authorization is clearly coming, and climate change may well be the challenge of the century. We believe that HEV-to-PHEV conversions can continue to advance public awareness, pressure auto manufacturers to continue to move rapidly forward, and provide battery field data both earlier and on a larger field of battery technologies and products than from new PHEVs. Additionally, they and the Board's rules can presage the coming ICE-to-PHEV conversions that, though beyond the scope of today's session, we believe have the potential to provide significant petroleum displacement and GHG reductions within the AB32 timespan, long before new plug-in vehicles – due to the time to replace existing vehicles and the energy cost of new vehicle manufacture – can make an important impact.

Today I will be offering a new way of assuring continued criteria emissions of HEV-to-PHEV conversions, one that we believe is both more certain and simpler. The staff's current proposal depends upon dynamometer testing of conversions. However, what has been determined from testing of existing conversions at Argonne Labs and elsewhere is that there are just two ways in which conversions may increase criteria emissions, and two additional concerns:

1. By allowing engine warm-up under load either because it wasn't warmed up upon vehicle activation or because the catalytic converter (CAT) was allowed to cool below operating temperature during EV operation.
2. By purging the evaporative emissions canister too seldom, so it may become saturated.
3. Unless the OBD system is kept intact and extended as necessary, the system can deteriorate over time without alerting the driver that repairs are necessary.
4. Batteries do wear out and fail, and, because few PHEVs (all conversions) have been on the road long enough to develop battery field experience, reliability and longevity are unknowns despite best-effort laboratory testing. Though conversions can help provide this field experience, there must also be a mechanism to avoid excess criteria emissions due to battery deterioration or failure.

All four of these issues have known solutions that can be fully verified without dynamometer testing. In fact, because of the rigidity of standardized testing cycles, various potentially problematic cases – easily verified both via verification of design documents and by checking operation upon forcing of specific unusual but possible conditions – may not be discovered by such dynamometer testing.

Our proposal, detailed in our submitted comments and addendum, is to replace dynamometer testing with verification – on paper for Tier 1 and 2, and via physical verification as well for Tier 3 – of implementation of accepted solutions – or of new solutions accompanied by solid documentation and test results assuring efficacy. A concurrent additional requirement is to instrument a representative sample of e.g. 10% of Tier 1 vehicles, 5% of Tier 2 vehicles, and 1% of Tier 3 vehicles with a certified CAN logging and transmission system such as offered by V2Green. The data are to be periodically and automatically transmitted to a central database available to Board staff to check through to ensure continued legal operation. An additional advantage of this approach is a recommended additional requirement that anonymized data be posted publicly for use by the automotive and conversion industries as well as by researchers and policy makers who do not yet have data from actual field use of PHEVs.

A final point concerns both conversion battery warranties and durability testing, both of which are potentially huge problems for small conversion companies, and could cause the delay of conversions by many years, if viability remains at all. Our suggestions are as follows:

1. Conversion companies must demonstrate that their systems either maintain acceptable criteria emissions or set an OBD emissions control error upon battery degradation or failure.
2. The required conversion warranty should require only continued emissions compliance (which in some cases may remain even with a dead conversion battery), not any particular PHEV performance. PHEV performance warranties for customer protection that fit the price and developing track record of various batteries and chemistries will come about from competitive market pressures: once one company offers such protection, others will have difficulty attracting customers without also offering appropriate protections.

Thank you.