

March 5, 2026

California Air Resources Board  
1001 I Street  
P.O. Box 2815  
Sacramento, CA 95812

Submitted via Drive Forward Medium- and Heavy-duty Vehicle [comment docket](#)

Re: December 3, 2025, workshop on the Drive Forward Medium- and Heavy-duty Vehicle Regulation

Dear Chair Sanchez, members of the Board and Staff:

The Strong Plug-in Hybrid Electric Vehicle (PHEV) Coalition's advocacy team appreciates this opportunity to comment on the Drive Forward Medium and Heavy-duty regulation workshop on December 3. Established in July 2019, the Strong PHEV Coalition represents an independent group of over forty electric transportation experts with many years of collective professional experience. We possess expertise throughout the EV industry including research and academia, vehicle manufacturing and deployment, policymaking, utilities, NGO advocacy, consumer education, EV fleet management, and charging infrastructure development.

Our coalition has provided information to CARB during the last six years as we have consistently supported regulations enabling light-duty PHEVs with a minimum of 50 miles or greater all-electric range (AER) based on USEPA's label and called for regulations that support commercialization of medium and heavy-duty PHEVs and ePTOs (electric power take-off systems). Please see [www.sphev.org](http://www.sphev.org) for our previous education and advocacy efforts including letters to CARB staff and our April 2023 [overview](#) of strong PHEVs. Today there are about 27 million light duty PHEVs and 91 million light-duty BEVs globally<sup>1</sup> and the strong trend is toward longer-range versions for both technologies. This light-duty vehicle trend bodes well for medium- and heavy-duty PHEVs which are in an earlier stage of adoption and commercialization. Medium- and heavy-duty PHEVs and ePTOs have applications where they can make a difference in meeting CARB's goals and should be supported by CARB.<sup>2</sup>

We define PHEV very broadly. To be a PHEV it must be able to plug into an outlet or charging station. We support PHEV as a term for a type of dual- or tri-fuel vehicle that includes series, parallel and power split designs with many possible all-electric ranges, powertrain energy management schemes, type of transmission (or none), type of liquid or gaseous fuel, charging technology or engine.<sup>3</sup> However, they all must be able to plug into an outlet or charging station. EREV (extended range EV) is a marketing term for a type of PHEV that behaves consistently whether the engine is operating or not and typically

provides a high AER. EREVs may or may not use a series-hybrid design. In addition, we include ePTOs as a type of PHEV that can be used on a PHEV or ICEV.<sup>4</sup> And we also include retrofits of gasoline or diesel tractors with electrified trailers (e-trailers) as a type of PHEV.<sup>5</sup>

**Summary of why PHEV trucks are needed.** We believe that regulations and incentives have not tried hard enough to encourage Strong plug-in hybrid MHD vehicles, especially those that can achieve 80 percent to nearly 100 percent of their annual miles using electricity. We believe that Strong PHEVs including e-trailers, and ePTOs in combination with battery electric vehicles (BEVs) and fuel cell EVs (FCEVs) are better in the near- and long-term than a scenario with FCEVs and BEVs with no Strong PHEVs or other PHEVs.

Advantages of including Strong PHEV (and other PHEVs) in the rule include:

- A combined strategy (strong PHEVs + PHEVs + BEVs + fuel cell EVs) is a faster path for the world to adopt vehicles with zero greenhouse gasses<sup>6</sup> As mentioned above, the 27 million light-duty PHEVs and 91 million light duty BEVs today in the world, illustrate this potential to do the same for heavy duty vehicles. Electrified trailers and ePTOs will further accelerate the path to zero greenhouse gas emissions
- Strong PHE trucks are a better solution (because they are dual fuel) to survive long-term catastrophes and daily emergencies (e.g., wildfires, earthquakes, windstorms, hurricanes, tsunamis, power outages, riots, vandalism, tornadoes, floods, and public service power shutoffs) and can provide power export using the engine and/or the battery during these situations
- Strong PHE trucks can support the grid and exert a downward pressure on electricity rates for all utility users with existing managed charging programs and upcoming bi-directional charging programs which pay the driver or truck owner for grid services
- Strong PHE trucks are a better solution for owners of used trucks who are often low-income independent contractors
- Strong PHE trucks have much less cost impact on the grid and have a lower demand charge part of their electricity bill and help mitigate scale-up concerns of building a network of away-from-home heavy-duty vehicle DC fast chargers and heavy-duty hydrogen infrastructure in a timely manner
- Drivers in rural areas often drive longer distances than others and in areas with little access to charging. As a result, strong PHE trucks are a better option for the portion of the world that covers small and mid-size towns where trip distances (when needed) exceed those in urban megacity regions
- Strong PHEV trucks are a better option in regions with extreme cold weather for the same reason or those who typically drive high annual miles
- Strong PHE trucks are particularly useful in cold weather regions and for fleets that need to tow trailers, boats and campers for work
- Strong PHEV trucks are a better option for as the hub for a mobile emergency command and control center that can provide significant vehicle power export to support critical communications, lighting equipment, and portable battery recharging

- Strong PHE trucks are particularly suited to large vehicles due to their much smaller batteries (compared to battery EVs)
- Strong PHE trucks are attractive to late adopters and drivers who are skeptical of or opposed to battery EVs or fuel cell EV., and these buyers are needed to reach the last 30 to 40% of the market as noted above
- Strong PHE trucks can equal the GHG reduction benefits of a comparable long-range BEV when battery manufacturing emissions, renewable diesel or E-85, control of high-power cold start emissions, and other factors are considered and thus are likely a long-term solution for some drivers and a transition-to battery EVs for others
- Strong PHE trucks use substantially less critical minerals (due to their smaller batteries compared to battery EVs), and thus reduce pressure on the need to rapidly scale supply chains for these minerals and hedge against supply chain disruptions<sup>7</sup>
- Strong PHE trucks compared to battery electric trucks can weigh less resulting in fleets not having to purchase larger BEVs (e.g., Class 4 instead of Class 3) in order to have the same payload
- Strong PHE trucks will have important long-term adopters globally regardless of their cost and many, but not all, car and/or truck makers will want to serve this market
- Strong PHE trucks offer air quality benefits that are very similar to BEVs
- Strong PHE trucks are a better solution for commercial fleets that are renters and change business locations relatively often.

### Summary of our recommendations

- 1) Two more guiding principles should be added to the six principles on slide 26:
  - a. *Support innovation and technology advancement.* CARB has a long history of technology forcing regulations
  - b. *Seek high volumes of adoption with regulation that appeals to as many Section 177 states as possible* (e.g., 50 percent of the US market). Volume is key to engaging the business model of legacy truck and trailer and PTO manufacturers but also helps PHEV start-ups. Conversely, trying to launch an industry with the current Advanced Clean Fleet (ACF) regulation on public fleets is erroneously based on too small of a market to attract dependable manufacturers that fleets typically seek.
- 2) Include ePTOs in the upcoming regulation. CARB has not regulated this market yet but has regulated many smaller markets. Over 150,000 PTOs are sold annually in US, and ePTOs have been available for 15 years.<sup>8</sup> We understand that only a few thousand ePTOs have been sold to date in the US and no state has nurtured this market with a regulatory push. In some applications they can reduce overall NOx (miles driven plus PTO hours) by 90%, and the upcoming regulations should mandate them as a vehicle plus PTO system and not in separate regulations for PTOs and vehicles. See Appendix A for details on ePTOs.
- 3) Include electrified trailers in the upcoming regulation by encouraging or requiring retrofits of the existing on-road fleet. The ability to reduce emissions from the existing fleet is a very

worthwhile and attractive aspect of this type of PHEV. See Range Energy and Revoy products on the market.<sup>9,10</sup>

- 4) Design the upcoming regulations to encourage or require a greater volume of PHEVs than was expected in the Advanced Clean Truck (ACT) and the original version of ACF and include PHEVs and ICEVs with ePTOs, and electrified trailers (new and retrofits) that propel gasoline, natural gas, and diesel tractors.
- 5) Reward PHEVs (broadly defined above) in the early-action provisions in the upcoming rulemaking for PHEVs prior to model year 2031.
- 6) Create manufacturer and fleet rules at the same time in the upcoming rulemaking
  - a. Also create separate rules for class 2b to 3 (~one million vehicles in California) and for classes 4-8 in the upcoming rulemaking in order to recognize the commercialization/ large-scale adoption ramps of ZEVs and PHEVs (new and retrofits) in these three vehicle classes will be different.
- 7) Engage with the start-up and legacy OEMs who make PHEVs, electrified trailers and ePTOs to learn more about their technology, business models and products including these companies:
  - a. Harbinger Motors' recreational vehicle and class 5-6 trucks (PHEVs)<sup>11</sup>
  - b. Range Energy's electrified trailer<sup>12</sup>
  - c. Revoy's electrified trailer<sup>13</sup>
  - d. VE motion's electrified trailer<sup>14</sup>
  - e. Mack's PHEV truck pilot (US Defense department)<sup>15</sup>
  - f. Scania's PHEV truck pilot (Europe)<sup>16</sup>
  - g. Ford's super duty PHEV truck class 2b<sup>17</sup> (upcoming)
  - h. Hylion PHEV<sup>18</sup>
  - i. Evotech's recreational vehicle (PHEV)<sup>19</sup> (upcoming)
  - j. Mammoet's hybrid crane<sup>20</sup>
  - k. Elgin sweepers (PHEVs)<sup>21</sup>
  - l. Global sweepers (PHEVs)<sup>22</sup>
  - m. Fire truck pilot (PHEV)<sup>23</sup>
  - n. ePTOs for use on PHEVs, conventional ICEVs, BEVs and other alt fuel vehicles (e.g. manufacturers including Odyne Systems, Parker Hannifin Corporation, Muncie Power Products, Bezares, OMFb, Hydrocar, Interpump Hydraulics, Eaton Corporation, ZF Friedrichshafen, Hyva Global, Chelsea Products Division (Parker Hannifin), Weichai Power Co, Sunfab Hydraulics, Kozmaksan Hydraulic, Qingdao Jining Hydraulic Co., Hydreco Hydraulics, Binotto, Pacbrake Company, OMSI Trasmissioni, Ryder System, and Tuthill Corporation).<sup>24</sup>
- 8) Inform stakeholders more about the pros and cons of different regulatory frameworks that CARB is considering. We do not know enough to have an opinion at this time regarding the frameworks discussed at the December workshop.
- 9) Other recommendations for the upcoming regulations on fleets and manufacturers:
  - a. Require ePTOs on public fleet vehicles in the current Advanced Clean Fleet

- b. Update test procedures for traditional PHEVs (average per year approach) so that they are effective and streamlined. Similarly, CARB should create new test procedures for electrified trailers and ePTOs when combined with ICEVs, PHEVs and BEVs
- c. When designing the PHEV portion of the upcoming regulation, use a sliding scale approach to reward PHEVs with longer all-electric use (e.g., range or hours) compared to shorter all-electric use
  - i. Develop utility factor curves for PHEVs and ePTOs to form the basis of a sliding scale credit system rather than using a linear sliding scale. Also note that ePTOs should be measured in hours per year, not miles per year. And utility factors, due to lack of data need to make assumptions especially about long all-electric use and should be refined later with more data. In addition, vehicle manufacturers should be allowed to develop their own utility factors with true-up provisions to correct inaccuracies between expected and actual emissions.
- d. Adopt other ePTO provisions recommended by Odyne Systems to USEPA
  - i. Provide a greater regulatory benefit for the use of ePTO systems
  - ii. Ensure delegated assembly can be used to transfer credits to truck chassis OEMs by intermediate or final stage manufacturers that install emissions reduction components and systems, such as PHEV and ePTO systems
  - iii. Increase credits for ePTO systems that reduce GHG and NOx emissions over a wide variety of use cases and duty cycles
- e. Find a balance between helping California-based start-ups (PHEVs, electrified trailers, ePTOs) achieve volume sales and attracting large scale, legacy OEMs to the market
- f. Research more on the best applications for PHEVs (broadly defined) besides first responders, emergency mutual aid, long-haul trucking, retrofitting diesel and gasoline tractors and ePTOs. In addition, CARB should research their GHG and NOx reduction potential. For example, Eaton Corp states that an urban vocational PHEV can cost-effectively reduce CO<sub>2</sub> by 52% and NOx to 10 mg / bhp-hr.<sup>25</sup> We expect PHEVs should have many cost-effective applications in MHDVs, based on the global trend for light duty PHEVs with long AERs being in class 2a but not class 1 vehicles
- g. When designing the PHEV portions of the upcoming regulation, consider, as explained in detail in our letter on the light duty Drive Forward, the benefits of PHEVs having a smaller battery and less GHG from mining and battery manufacturing
- h. Consider including ZEV assurance and educational programs to support implementation of the upcoming rulemaking
- i. Consider, in the upcoming rulemaking, requiring long-range or very long-range PHEVs that use spark-ignited engines to be flexible fuel vehicles (FFVs) capable of using E-85 (to have access to California's 500 E-85 stations). See Appendix B
- j. The upcoming rulemaking should incentivize PHEVs with bidirectional charging. See Appendix C

- k. Similarly, early action credits for PHEVs (broadly defined above) sold prior to MY 2031 should, at minimum, reward technologies that do not exist today or that are just emerging such as:
  - i. PHEVs with long AERs and more for very long AERs
  - ii. PHEVs with bidirectional charging
  - iii. PHEVs with flex fuel vehicle ability so they can use California's many E-85 stations
- l. Consider, in the upcoming rulemaking, requiring conformance testing of connectors, cybersecurity, communications and bi-directional charging standards and protocols (e.g., EV-charging station-grid). For example, see CARB's June 2024 workshop which covered some of this
- m. Consider conducting a comparative analysis regarding PHEV and BEV costs with stakeholder input or a working group and fully explore ways to reduce the costs of PHEVs. This analysis should also look at the price to the end -user including innovative business models especially with electrified trailers (e.g., leasing a service, swapping of e-trailers). This analysis should also consider advances in battery and other technology which reduces the cost of the vehicle and battery, increases fast charging, and reduces weight.
- n. Due to the growth of artificial intelligence, recommend that CARB and the California Energy Commission initiate a detailed analysis of AI growth and how AI technology advances would harm or benefit EV and PHEV growth in the future
- o. CARB should also help the California Energy Commission in its load growth analysis of transportation and other electrification per AB 2700 (Chaptered 2022) as well as AI data center growth.

Achieving 100% of sales of new battery EVs, fuel cell EVs and long-range PHEVs for medium- and heavy-duty vehicles and PTOs, including getting the last 40% of the market to be electrified, will be much harder than most thought one or two years ago. Accelerating adoption of these technologies will require the upcoming regulations to include short- and long-range PHEVs, ePTOs and electrified trailers. PHEVs with long all-electric range are particularly promising. While more research is needed, a long all-electric range (AER) PHEV is likely equivalent in environmental performance to a long-range BEV when considering all types of emissions (including mining and battery manufacturing). other environmental issues (e.g., water, impact on animals, waste, etc.) and the percentage of total miles from off-board electricity (utility factor curve).

Regarding the emissions from battery mining and manufacturing, we note that UC Davis, Argonne National Lab and European researchers have separately made a lot of progress on understanding these impacts, based on presentations at the 2025 UC Davis conference at Asilomar. It appears that these and other researchers are close to being able to show how much GHG comes from various types and sizes of batteries and including their mining and manufacturing practices. We strongly recommend

that CARB should join in these efforts and use the information to inform policy and education in this rulemaking (e.g., regulations, incentives, window stickers, QR codes for the vehicle). We are not asking for penalties on battery EVs, but for long-range and very long-range PHEVs to receive more PHEV-specific and therefore more accurate treatment in the Drive Forward Light-duty Vehicle regulation. We continue to recommend several near-term studies that should include CARB participation with the National Renewable Energy Lab, SAE International, Argonne National Lab, USEPA, UC Davis, Colorado State University Ft Collins, University of Texas Austin, and automotive manufacturers. The purpose would be to examine the benefits of long-range PHEVs based on a PHEV's percentage of electric mileage driven, use of E-85, and cradle-to-grave greenhouse gas reductions. Details regarding our recommendations and justifications for them are in Appendix D in this letter.

Our primary goal has always been to advocate for improvements to PHEVs to increase their environmental benefits and attractiveness to consumers, and to educate on the benefits of long-range PHEVs which have additional strong attributes such as further reducing criteria pollutants. Our research, as of March 2026, has found 68 light-duty PHEVs models (existing and near-term pending) with over 80-mile all-electric range (estimated USEPA label) worldwide but none in the US, and 29 PHEV models with over 120-mile AER worldwide.<sup>26</sup> See Appendix E. To catch up, we believe CARB needs to adjust its incentives and regulations for light-, medium- and heavy-duty PHEVs. In 2024, CARB staff projected that light-duty PHEVs as only making up 5-10% of future vehicle sales (BEVs, FCEVs and PHEVs),<sup>27</sup> but given what is happening with PHEVs in the rest of the world, and the many benefits of strong PHEVs, we believe CARB should seek to have much higher percentages of long- and very long-range PHEVs by including new regulatory incentives and requirements in the upcoming Drive Forward medium and heavy-duty vehicle regulations.

Given today's marketplace environment and cancellation of announced ZEVs, PHEVs (broadly defined above) need to be supported and encouraged. CARB has the experience to lead and should encourage these PHEVs with long- and very long AERs in this rulemaking.

In this letter and our previous conversations with CARB and EPA staff, the Strong PHEV Coalition sought to share our data-driven approach to understanding the future of PHEVs. We seek to be a resource to CARB and to EPA to connect policy making to the resources and expertise that we have available in our diverse team. We look forward to more dialogue with staff so that we might collectively improve the sustainability, justice, and economy of transportation for all stakeholders.

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas Bradley". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

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*Robert L. Graham*

Robert L. Graham

Co-Chair, Strong PHEV Coalition, and Retired (EPRI, Southern California Edison, US Dept of Energy)

## Appendix A

Trucks operating at worksites often use engines to power truck-mounted equipment, such as cranes, bucket trucks, and other applications. Depending on the application, diesel trucks can be in Power Take-Off (PTO) mode for many hours daily.

**Very-high unregulated GHG and NOx emissions in the PTO operating mode:** GHG and NOx emissions from trucks are often very high when operating PTOs. Odyne Systems has worked with the U.S. Department of Energy on various projects that show 50% or more of daily fuel can be consumed in some applications due to PTO operations. DOE studies also show very high NOx emissions since PTO operation does not allow the diesel after-treatment system to work correctly. Very high NOx output results from a low average load on the engine during many PTO applications, causing the exhaust to be too cold to enable the emissions system to work properly. As a result, 90% of full-day NOx emissions in some applications can be attributed to PTO use per DOE studies.

Some examples of trucks with PTOs are shown below and listed in California Regulation 1432.<sup>28</sup> PTO examples: “boom truck (block boom), bulk feed truck, car carrier with a hydraulic winch, carpet cleaning van, cement mixer, cement pumper, distribution truck (hot asphalt), dump trailer, dump truck, fire truck, garbage truck (automated side loader, manual side loader, single drive front end loader, dual drive front end loader, single drive rear end loader, dual drive rear end loader, roll-off truck, lugger truck, recycling truck (compaction and non-compaction), one-pass truck, and container delivery truck), leaf truck, lime spreader, line trucks with digger, derrick or aerial lift, log trucks with self-loader, mobile crane, pneumatic tank truck, refrigeration truck, salt spreader (dump with spreader), seeder truck, semi-wrecker, service trucks with a jackhammer or pneumatic drill, sewer cleaning truck, snow plow, spray truck, super suckers (port-o-let trucks), sweeper truck, tank transport, tank truck, truck with a hydraulic winch, transfer trailer, and wrecker.”



We encourage CARB to engage with ePTO industry experts such as Odyne Systems who have provided CARB and USEPA with industry data on NOx and GHG reductions as well as regulation design recommendations.

## Appendix B

**In this rulemaking, CARB should seriously consider requiring PHEVs that have spark-ignited engines (not ePTOs or electrified trailers) to have flex fuel vehicle (FFV) technology** so they can use E85, renewable gasoline, and other renewable fuels. California and section 177 states will need fueling stations and infrastructure for PHEVs long-term and a signal should be sent that these stations are needed. Unless new FFV models are available to consumers, the number of FFVs on the road in California will gradually decline, as will E85 sales. While gasoline stations will go extinct, we need E85 stations for PHEVs. Today, there are 500 stations in California that sell E85. Requiring FFVs for PHEVs with spark-ignited engines in the upcoming regulations to replace ACC II, ACF and ACT will help bring FFVs and E-85 back and support the existing E85 stations in CA and other ZEV states. In addition, the cost of E85 today is about \$2 to \$2.50 less than gasoline and has substantial GHG benefits and some benefits for other air pollutants.<sup>29</sup> Making PHEVs an FFV increases their overall environmental benefit as many PHEVs will use E85. Finally, today FFVs are not priced more than non-FFVs, and GM says they cost \$70 more.<sup>30</sup> In addition, we understand the slightly poorer fuel economy of E85 makes a very small impact on the substantial GHG benefits of E85 compared to gasoline.

We believe there is enough feedstock to support a FFV requirement for long-range or very long-range PHEVs, but welcome new studies to verify this. Some biomass feedstocks used in gasoline cannot or will not be used in diesel or jet fuel powered transportation. This should result in large amounts of unused feedstocks because biomass feedstocks for spark-ignited engines may not be needed in the long run (e.g., 2050) for transportation or industrial uses. CARB staff should also use data from the many low carbon liquid biofuels that can be blended with gasoline and are certified in the Low Carbon Fuel Standard on a well-to-wheels basis.

## Appendix C

**We recommend that CARB should consider adding a small bonus credit in the Drive Forward medium- and heavy- duty Vehicle regulation for vehicles that have on-board AC bidirectional chargers or are integrated with multiple DC off-board chargers.** Alternatively, at minimum, CARB should conduct an analysis on how it can advance bi-directional charging in the future. *Justification:* The promise of bi-directional charging (AC or DC) to address air pollution, GHG and electric grid issues is very significant with BEVs and PHEVs in light-, medium- and heavy-duty vehicles, or off-road equipment. For example, a recent May 2022 presentation by the World Resources Institute using Bloomberg NEF and Energy Information Administration data found the power capacity in 2030 for EVs to be 10 to 20 times more than the 2030 power capacity of stationary storage.<sup>31</sup> CARB can and should play a role in helping to unlock this potential especially with DC bi-directional charging:

- For example, the internal combustion engine in a PHEV has a much lower emission signature than a stand-alone, backup generator. A PHEV backup generator function can be extremely valuable in emergency response scenarios or with increasing grid failures.
- Bidirectional charging, like battery stationary energy storage, can reduce GHG and traditional pollutants from fossil fueled power plants by shifting electricity use to renewable energy in the cleanest hours of the day and reducing the need for high-emitting plants (such as traditional peaker power plants).
- Bidirectional charging can also provide many types of grid services including ancillary services, providing resource adequacy, and helping with the evening transition from renewables to other generation resources. Because the batteries are already paid for by car and truck owners, utilities can gain a low-cost resource compared to battery stationary storage.
- The potential value is significant and can contribute to lower operating costs for BEVs and PHEVs.<sup>32</sup>
- Fleet vehicles used in single-shift operations are promising candidates for bi-directional charging with their large battery packs and typically 16 hours at home base connected to the grid.

We believe a small bonus credit in the final regulation for a few years is justified and needed to unlock this technology because of the large emission reduction benefits and other benefits enabled by bidirectional charging.

## Appendix D

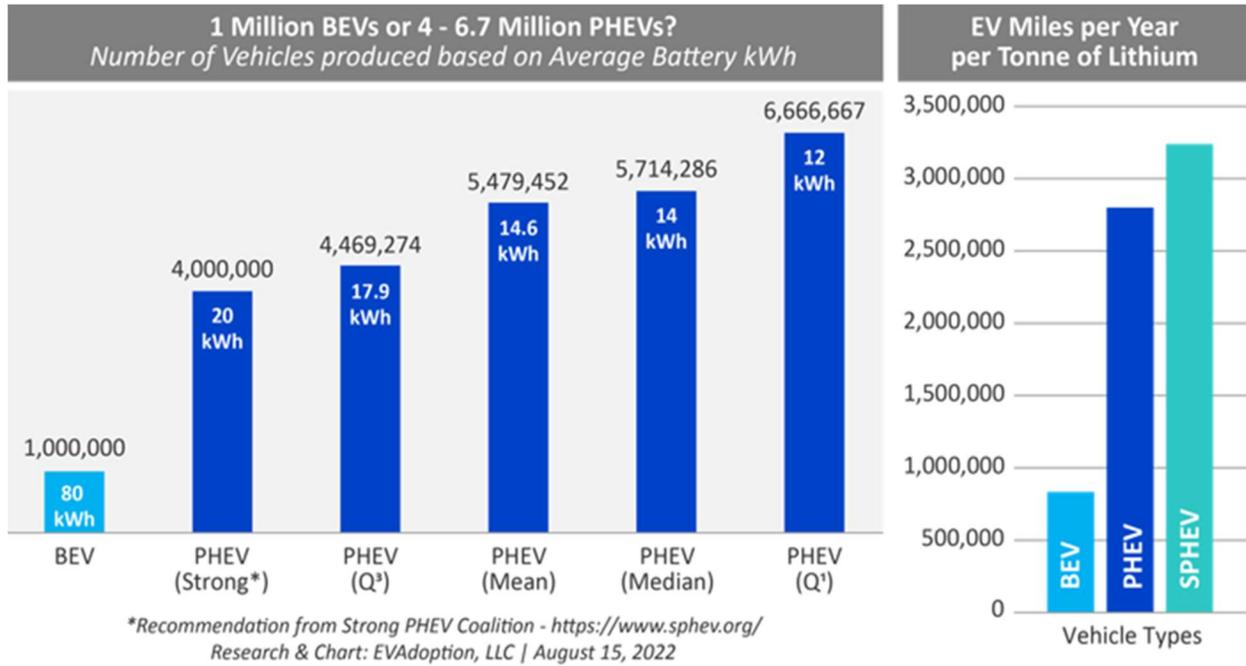
**Emissions from battery mining and manufacturing:** The Drive Forward Medium- and Heavy-duty Vehicle regulation needs to consider issues that traditionally have not received enough attention in order to avoid unintended consequences. Specifically, concerns regarding supply of critical minerals, supply chain ramp-up and the GHG and other emissions from mining and battery manufacturing need

to factor into policy making. While PHEVs have gasoline miles, they have substantial benefits regarding these issues which essentially mitigate the GHG from the gasoline miles (including refinery emissions) and reduce reliance on critical minerals – especially from outside the US. This is especially true for PHEV 60s, 90s and 120s. Using regulatory incentives in this rulemaking to encourage automakers to make PHEV 60s, 90s and 120s is a small no-regrets action that should be adopted in this rulemaking.

CARB needs to take the issue of mineral for batteries much more seriously including environmental impacts, supply chain impacts, vulnerabilities due to disruption. While it may be too hard to design a regulation based on well-to-wheel impacts, these factors should be considered in design of the PHEV part of the Drive Forward regulation. We believe it is possible to include this issue without making these emissions apply to the BEV and fuel cell EV parts of the regulation. For example, the percentage cap on the number of PHEVs an truck maker can make could be different for a PHEV 50, 70, 90, 110, 130, 150 and so on.

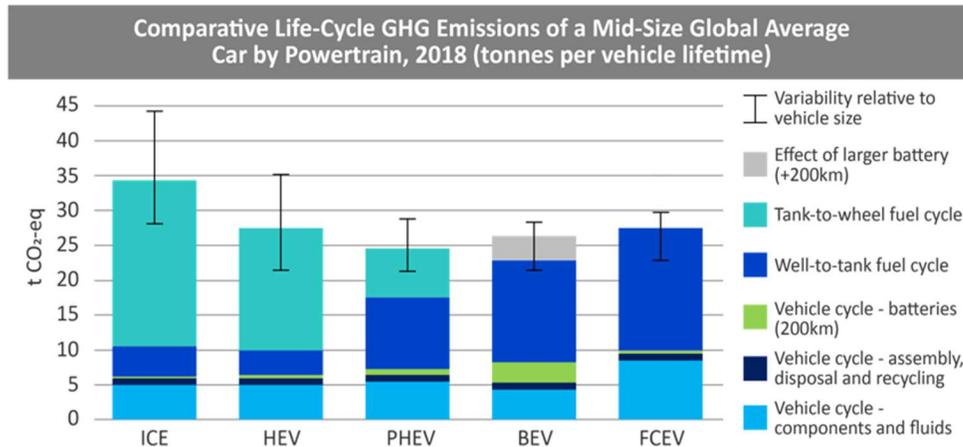
CARB should work with the UC Davis, Argonne National Lab<sup>33</sup> and European researchers that presented at the 2025 UC Davis conference at Asilomar (STEPS+ pre-conference workshop) as was as other experts such as the University of Michigan, Massachusetts Institute of Technology, Yale University, McKinsey and Company and the International Energy Agency to study this issue in order to determine how many years' worth of driving a each type of long-range PHEV can save in GHG emissions from battery mining and manufacturing compared to a long-range BEV. Based on analyses by Argonne's GREET R&D model and McKinsey & Company, the savings from a PHEV compared to a BEV appears to be about 11 to 20 percent of a comparable gasoline vehicle's lifetime miles which is significant because it offsets the very low amount of gasoline used in a long-range light-duty PHEV using E85.<sup>34</sup> (See Appendix B and below.) Recently the University of Michigan has published a study on this topic.<sup>35</sup> and the Massachusetts Institute of Technology,<sup>36</sup> Yale University,<sup>37</sup> USEPA<sup>38</sup> and McKinsey & Company<sup>39</sup> have also researched it. To give an example, the chart below shows an International Energy Agency analysis on well-to-wheel GHG of conventional vehicles, hybrid EVs, PHEVs, BEVs and fuel cell EVs that is close to a cradle-to-grave analysis as it includes mining, battery manufacturing and refinery emissions and shows very favorable results for long-range PHEVs compared to BEVs.

Because of this IEA analysis and the other studies, we do not believe that long-range, strong PHEVs come at the expense of BEVs, but support a more in-depth analysis by CARB, USEPA and the stakeholder community in order to determine how to treat long-range and very long-range PHEVs in this rulemaking. Ideally, this research should include power plant, battery manufacturing, mining, oil extraction, and refinery emissions.



## GHG Reductions of Strong PHEVs Compared to Large BEVs With Battery Manufacturing

- Strong PHEVs (PHEVs with 35 mi range) are indistinguishable from BEVs in lifecycle GHG emissions
- Significant difference between BEV 100 and BEV 500 in GHG emissions



The charts above for light-duty PHEVs and BEVs show the benefit of PHEVs in reducing the use of critical minerals and accounts for the difference in electric miles between BEVs and different types of PHEVs. While these charts are not for medium- and heavy-duty BEVs and PHEVs, they are illustrative and directional for them. Strong PHEV battery utilization maximizes the value of battery manufacturing and materials capacities and helps address the need for fast scale up of battery manufacturing and mineral extraction by better utilizing resources. PHEV trucks, especially strong PHEV trucks, can electrify most daily commuting miles while occasionally using some gasoline, while

BEVs have a lot of battery capacity that only gets "used" on very long trips. We assert that this could be considered wasted or underutilized lithium and other battery minerals. Thus, because PHEVs use their batteries more, the US gets more EV miles per ton of lithium by driving PHEVs and Strong PHEVs as shown in the chart above. PHEV's smaller batteries reduce the lifecycle environmental burdens associated with battery materials, production, and end-of-life.<sup>40</sup>

## Appendix E

**Light-duty, Long-Range PHEV Table 1** Not available in US Black font = sold in China. Blue font = sold in Europe & China, Green font = sold in China and other countries.

Note that Chinese PHEVs exports are increasing and the media reports a tidal wave of new models for EU, UK, Australia, South Asia, and Latin America. Shorter range PHEVs not included. Also note that a PHEV's all-electric range (AER) is based on USEPA estimates calculated by converting CLTC and WLTP ranges.<sup>41</sup>

	Make	Model	Approx. price converted to US\$ <sup>42</sup>	pack size (gross) in kWh	Est Miles AER USEPA label <sup>43</sup>
1	AITO	M9 <sup>44</sup> EREV	\$65,250	52	122-133
2	AITO	M7 <sup>45</sup> EREV	\$34,695	42	81
3	AITO	M8 <sup>46</sup> EREV	\$63,200	53.4	143
4	AITO	M8 base <sup>47</sup> EREV	\$50,800	37	93
5	AITO	M5 <sup>48</sup> EREV	\$34,500 to \$38,600	42	107
6	Arcfox (part of BAIC group)	Alpha T5 <sup>49</sup> EREV	\$17,300 to \$22,800		97
7	Audi	A3 sport back TFSIe <sup>50</sup>	\$51,700		73
8	Audi	Q3 e-hybrid <sup>51</sup>	\$57,000	25.7	61
9	Buick	Electra L7 <sup>52</sup> EREV	\$41,800	40.2	139
10	BYD	Atto 8 <sup>53</sup>	\$30,200 to \$38,600	35.6	69
11	BYD	Seal 06 DM i <sup>54</sup>	\$15,232	18.7	71
12	BYD	Sealion 6 ER <sup>55</sup>	\$31,013	26.6	62
13	BYD	Sealion 07 <sup>56</sup>	\$31,800		256

14	BYD	Song DM <sup>57</sup>	\$18,500	26.6	66
15	BYD	Tang <sup>58</sup>	\$24,600 to \$27,400	21.5	99
16	BYD	Seal U <sup>59</sup>	\$20,600		64
17	BYD	Song Plus DM	\$25,600	26.6	71
18	Changan	Deepal S07 <sup>60</sup> EREV	\$20,820	31.7	106
19	Changan	Deepal S07 <sup>61</sup>	\$25,200	39	138
20	Changan	Deepal G318 <sup>62</sup> EREV	\$24,431	35	63
21	Changan	Hunter pickup <sup>63</sup> EREV	\$19,500 to \$31,100	31.8	83
22	Changan	Deepal S09 <sup>64</sup> EREV	\$48,000	40.2	83
23	Changan	Nevo AO6 <sup>65</sup> EREV	less than \$20,000	28.4	92
24	Chery	Fulwin A9L <sup>66</sup>	\$20,700 to \$27,600.	33.7	124
25	Chery	Fulwin A8 <sup>67</sup>	\$16,700 to \$19,000		67
26	Chery Exceed	Exlantix ET5 <sup>68</sup>	\$22,500	32.7	94
27	Chery Exceed	Exlantix ET7 <sup>69</sup>	N/A	39.8	93
28	Chery	Fulwin 11 <sup>70</sup>	\$28,000 to \$37,000	40	101
29	Chery	Tiggo 9 <sup>71</sup>	\$56,470	34.5	74
30	Cupra (part of VW)	Formentor <sup>72</sup>	\$33,800 to \$44,200	25.8	60
31	Cupra (part of VW)	TerraMar <sup>73</sup>	\$50,700	25.8	61
32	Cupra (part of VW)	Leon <sup>74</sup>	\$52,300 to \$56,300	25.8	63
33	DENZA (part of BYD)	Z9 <sup>75</sup>	\$46,300	38.5	93
34	DENZA (part of BYD)	N9 <sup>76</sup>	\$54,000 and \$62,000	47	93
35	Dongfeng	M-Hero M817 <sup>77</sup>	\$46,000 to \$50,500	50.4	134
36	Dongfeng	Aeolus L8 <sup>78</sup> EREV	\$21,000	30.3	114

37	Ford (China)	Bronco <sup>79</sup> EREV	\$32,300 to \$39,800	44	<b>111</b>
38	<b>GAC</b>	Hyptec HL EREV <sup>80</sup>	\$37,500 to \$42,000	60.3	<b>157</b>
39	GAC	Trumpchi S7 PHEV <sup>81</sup>	\$34,500	36.3	<b>94</b>
40	Geely	Starshine 8 <sup>82</sup>	\$23,600	18.4	60
41	Geely	Galaxy M9 <sup>83</sup>	\$29,000	41.5	<b>106</b>
42	<b>GWM</b>	WEY 05 <sup>84</sup>	\$69,400 to \$73,900	39.7	74
43	<b>GWM</b>	WEY 03 <sup>85</sup>	\$53,000	34	70
44	<b>GWM</b>	Haval H6 GT <sup>86</sup>	\$36,600	35.4	<b>92</b>
45	<b>Hozon Auto</b>	Neta S EREV <sup>87</sup>	\$29,600	44	<b>116</b>
46	IM Motors	LS6 Pro EREV <sup>88</sup>	\$34,200	52	<b>170</b>
47	IM Motors	LS6 Ultra EREV <sup>89</sup>	\$41,000	66	<b>207</b>
48	Jetour (part of Chery)	Shanghai L7 Plus <sup>90</sup>	\$19,500 to \$25,400	32.7	<b>101</b>
49	Leapmotor	C11 EREV <sup>91</sup>	\$20,900	43.7	<b>138</b>
50	<b>Leapmotor</b>	C10 EREV <sup>92</sup>	\$47,817	28.4	74
51	Leapmotor	D19 <sup>93</sup>	\$35,000 to \$42,000	80.3	<b>230</b>
52	<b>Li</b>	L9 EREV <sup>94</sup>	\$56,917	44.5	<b>96</b>
53	Li	L8 EREV <sup>95</sup>	\$50,500	52.3	<b>143</b>
54	Li	L7 EREV <sup>96</sup>	\$47,700	52.3	<b>143</b>
55	Li	L6 EREV <sup>97</sup>	\$34,695	36.8	<b>93</b>
56	Lotus	Eletre <sup>98</sup>	Not yet on sale	50	<b>Over 100</b>
57	Lotus	Eletre <sup>99</sup>	Not yet on sale	70	<b>Over 100</b>
58	Luxeed (Chery/Huawei JV)	V9 <sup>100</sup>	\$57,400	37	<b>80</b>
59	Luxeed	V9 <sup>101</sup>		37	<b>107</b>
60	Luxeed	V9 <sup>102</sup>	\$64,500	53.4	<b>114</b>
61	<b>Lynk &amp; Co (part of Geely)</b>	O8 <sup>103</sup>	\$60,000 to 65,000	39.6	<b>98</b>
62	Lynk & Co (part of Geely)	900 <sup>104</sup>	\$42,500	44.9	<b>129</b>
63	Maextro (part of Huawei and JAC)	S800 EREV dual <sup>105</sup>	\$141,600		<b>184</b>
64	Maextro (part of Huawei and JAC)	S800 EREV tri <sup>106</sup>	\$98,700		<b>168</b>

65	Mazda	EZ 60 <sup>107</sup>	\$17,000 to \$22,600	31.4	73
66	Mazda	Vision X-coupe <sup>108</sup>	\$22,000 to \$26,000		61
67	Mercedes	GLC 300de <sup>109</sup>	\$80,100 to \$92,800		64
68	MG (part of SAIC)	eHS <sup>110</sup>	\$ 43,400		61
69	Nissan (China)	N6	About \$15,000	21.1	83
70	Omoda (part of Chery)	9 <sup>111</sup>	\$43,300 to \$58,952	34.5	76
71	Renault	EREV <sup>112</sup>	not yet on sale		102
72	SAIC	Roewe M7 <sup>113</sup>	\$13,700 to \$16,100	19.7	73
73	Smart (part of Mercedes / Geely)	#5 EHD <sup>114</sup>	\$32,000	41.5	116
74	Smart (part of Mercedes / Geely)	#6 EHD <sup>115</sup>	Not yet on sale	Similar to #5	131
75	Skoda (part of VW)	Superb iV <sup>116</sup>	\$55,600 to \$65,000		69
76	Skoda (part of VW)	Kodiaq iV <sup>117</sup>	\$56,300 to \$60,000+		61
77	Volvo (part of Geely)	XC 70 EREV <sup>118</sup> (China)	\$57,300 to \$68,400	39.6	98
78	Volvo (part of Geely)	XC 90 EREV <sup>119</sup>	New version not yet on sale		about 100
79	Voyah (part of Dongfeng)	FREE EREV <sup>120</sup>	\$31,792	43	119
80	Voyah (part of Dongfeng)	Passion EREV <sup>121</sup>	\$44,800	43	121
81	Voyah (part of Dongfeng)	Passion L EREV <sup>122</sup>	\$39,600 to \$43,800	63	185
82	Voyah	Dream	\$63,700	62.5	161
83	Voyah	Dream – base <sup>123</sup>	\$46,700	43.5	104
84	VW	eGolf PHEV <sup>124</sup>	\$ 51,700	19.7	72
85	VW	Passat eHybrid <sup>125</sup>	\$59,000 to \$68,600	22	66

86	VW	Tiguan eHybrid <sup>126</sup>	\$56,900	19.7	63
87	VW	ID Era 9X <sup>127</sup>	Not yet on sale	51	123
88	VW	ID Era 9X <sup>128</sup>	Not yet on sale	65.2	156
89	Xpeng	G7 EREV <sup>129</sup>	about \$30,000	55.8	150
90	Xpeng	G6 EREV <sup>130</sup>	\$43,550	63.3	208
91	Xpeng	X9 MPV EREV <sup>131</sup>	\$43,500		207
92	Xpeng	P7+ EREV <sup>132</sup>	\$29,600		184
93	Yangwang (part of BYD)	U8L Dingshi EREV <sup>133</sup>	\$179,000		92
94	Zeeker (part of Geely)	9X EREV <sup>134</sup>	\$68,000 to \$136,000 est		174
95	Zeeker (part of Geely)	8X <sup>135</sup>	\$61,500	70	151
96	Zeeker (part of Geely)	8X <sup>136</sup>	\$57,300	55	118
97	Zhengzhou Nissan	GE PHEV pickup <sup>137</sup>	\$ 30,500	33	63

<sup>1</sup> Global electric car sales, 2014-2024, *International Energy Agency*, <https://www.iea.org/data-and-statistics/charts/global-electric-car-sales-2014-2024>, accessed 2025-10-07. 2025 estimate based on Global EV sales over 9 million in first half of 2025, growing by 28%, Rho Motion, <https://rhomotion.com/news/global-ev-sales-up-28-in-2025-2/>, accessed 2025-10-07.

<sup>2</sup> <https://dataintelo.com/report/electric-power-take-off-systems-for-trucks-market> 2023

<sup>3</sup> **Relationship of battery and engine sizes:** Long-range PHEVs have larger batteries that provide more energy and power, and this allows for smaller engines and more efficient engine designs.

**Type of fuel and engine:** gasoline, blend of 85% ethanol/15% gasoline (E85), or natural gas for spark ignited engines; hydrogen for fuel cells; and diesel for compression ignition engines.

**Type of charging:** Typical is level 1 or 2 AC, but many long-range PHEVs have DC fast charging. Wireless charging could emerge for luxury models.

**Size of vehicle:** Mostly light duty PHEVs today, but medium and heavy-duty PHEVs are in the market, and several additional versions will be commercially available soon.

**Powertrain energy management:** Long-range PHEVs provide more electric capability in terms of power and all-electric miles. Many short-range PHEVs have less electric capability so they must engage the engine more often.

<sup>4</sup> Also, can be used on a BEV or FCEV too.

<sup>5</sup> *Bosch presents electromobility for semitrailers*, August 28, 2018. <https://www.bosch-presse.de/pressportal/de/en/bosch-presents-electromobility-for-semitrailers168963.html> and *HDT Truckinginfo: How Trailers Are Harnessing 'Free' Energy*, October 8, 2020. <https://www.truckinginfo.com/10127672/harnessing-energy-in-trailers> and *Technology & Maintenance Council: Future Truck Position Paper: 2022-2 — Trailer Energy Harvesting: Regenerative Braking Systems for Trailer Applications*, February 11, 2022.

<https://tmc.trucking.org/blog/future-truck-position-paper-2022-2---trailer-energy-harvestingregenerative-braking-systems> and *SAF-Holland Working on Trailer e-Axles for North America*, March 6, 2022.

<https://www.truckinginfo.com/10162828/saf-holland-reports-on-its-trakr-e-axles-for-north-america> and *NACFE: Consider Trailer Technologies and Practices to Improve Efficiency Efforts*, last accessed May 26, 2023.

<https://nacfe.org/research/trailer-general/#powered-axle> and *Trailer Dynamics & Mars Logistics to deploy 500*

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*eTrailers*, June 9, 2023. <https://www.electrive.com/2023/06/09/trailer-dynamics-mars-logistics-to-deploy-500-etrailers/> and *Green innovation in land transport: Using eTrailers as a game changer for decarbonizing long hauls*, October 25, 2022. <https://www.dbschenker.com/de-en/insights/news-and-stories/press-releases/using-etrailers-as-a-gamechanger-for-decarbonizing-long-hauls-946138>

<sup>6</sup> Long-range PHEV trucks with 80-90 percent of annual miles electric and 10-20 percent existing miles on biofuels are likely a long-term solution.

<sup>7</sup> For example, see <https://insideevs.com/news/589228/stellantis-plans-combat-battery-shortage-recession/>

<sup>8</sup> Please contact Steve Latin-Kasper, Senior Director of Market Data and Research at NTEA – The Association for the Work Truck Industry, for estimates of annual PTO installations on new medium and heavy-duty vehicles, (248) 479-8193, [stevelk@ntea.com](mailto:stevelk@ntea.com)

<sup>9</sup> Range's product adds a battery and an electric motor e-axle to a semi-truck trailer, instead of to the tractor itself, which means that a fleet can add electric capabilities without having to buy new tractors. Initial customer deliveries of Range's eTrailer System are expected to begin in 2025, and the company currently has pre-production units deployed in customer pilots across North America. ZF is helping. Range's eTrailer System is delivering projected savings of over \$30,000 per trailer per year in early tests, and up to 70 percent reduction in emissions, all while using existing equipment and infrastructure. Since December 2023, Ryder has been testing three dollies on a 250-mile Memphis-to-Laredo route, swapping at stations in Prescott, Arkansas and Dallas.

<sup>10</sup> Revoy's electrified trailer dolly, powered by a 575-kWh lithium-iron-phosphate battery, connects via a standard fifth-wheel hitch and drives an electric axle to propel the rig. It gets 6-8 miles per gallon to 20-35 mpg, cutting emissions by 70-90%. A 250-mile diesel trip costing \$140 at \$4 per gallon drops to half the fuel with Revoy, saving fleets thousands per year per truck, even with the per-mile leasing fee.

Revoy owns and maintains the units, so no upfront costs for operators.

<sup>11</sup> <https://harbingermotors.com/our-company/>

<sup>12</sup> <https://www.range.energy/>

<sup>13</sup> <https://www.revoy.com/>

<sup>14</sup> <https://electrek.co/2026/02/13/ve-motion-electric-trailer-axles-cut-truckers-diesel-fuel-bills-in-half/>

<sup>15</sup> <https://www.macktrucks.com/mack-news/2025/mack-defense-wins-prototype-phase-of-medium-tactical-truck-development-for-us-marine-corps> and <https://electrek.co/2025/05/30/mack-trucks-selected-to-develop-next-gen-marine-corp-mtt-erev-maybe/>

<sup>16</sup> <https://group.dhl.com/en/media-relations/press-releases/2025/100-day-dhl-test-new-scania-e-truck-with-fuel-powered-backup-generator-saved-90-percent-co2-emissions.html>

<sup>17</sup> <https://www.ford-trucks.com/articles/ford-super-duty-erev-reportedly-in-the-works-with-700-miles-of-range/>

<sup>18</sup> <https://www.fleetmaintenance.com/equipment/powertrain/article/21256763/hyliion-hyliion-deploys-hybrid-and-full-electric-drive-solutions-to-the-class-8-electrification-market>

<sup>19</sup> <https://techcrunch.com/2025/11/06/anker-backed-hybrid-rv-startup-evotrex-comes-out-of-stealth/>

<sup>20</sup> <https://electrek.co/2025/12/20/mammoet-expands-electric-vehicle-fleet-with-massive-xcmg-hybrid-crane/>

<sup>21</sup> [https://www.elginsweeper.com/hubfs/Pelican%20Plug-in%20Hybrid%20Electric%20Spec%20Sheet\\_4%2023.pdf](https://www.elginsweeper.com/hubfs/Pelican%20Plug-in%20Hybrid%20Electric%20Spec%20Sheet_4%2023.pdf)

and <https://vimarequipment.com/brands/elgin-sweepers/hybrid-sweepers/>

<sup>22</sup> <https://globalsweeper.com/products/mechanical/m4phev-plug-in-hybrid>

<sup>23</sup> <https://www.firerescue1.com/fire-products/fire-apparatus/articles/yesterdays-crazy-is-todays-obvious-electric-apparatus-in-the-fire-service-2185qDLEvE2k5NNV/>

<sup>24</sup> <https://dataintel.com/report/electric-power-take-off-systems-for-trucks-market>

<sup>25</sup> See Eaton comments to USEPA on the HDV GHG rule in 2023

<sup>26</sup> For PHEVs with 50-to-59-mile all-electric range we found 19 PHEVs worldwide but only 3 in the US. For example, outside the US we found models such as Renault's Rafale e-Tech, Mercedes GLE 400e and C3002, Land Rover's Range Rover, Geely's Galaxy L7 and A7 Emi, Chery's Tiggo 8, Changan's Nevo AO5 and CS 55plus, BYD's Qin L DMi and Seal 05 DMi, BMW's X5, 3 series 330e, and 5 series PHEV, and Audi's A5, A6 and Q5

<sup>27</sup> See Slide 32 in the June 26, 2024, workshop by CARB on amendments to ACC II.

<sup>28</sup> <https://www.cdtfa.ca.gov/lawguides/vol3/dftr/dftr-reg1432.html>

<sup>29</sup> Renewable Fuels Association letter to CARB on the November 2023 workshop on ACC II, Jan. 15, 2024

<sup>30</sup> Ibid

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- <sup>31</sup> See slide 5 at <https://www.slideshare.net/emmaline742/building-resiliency-with-v2g-in-residential-homes-by-camron-gorguinpour>
- <sup>32</sup> California Energy Commission, March 2019, [Distribution System Constrained Vehicle-to-Grid Services for Improved Grid Stability and Reliability](#), Figure 42
- <sup>33</sup> [https://greet.anl.gov/publication-c2g\\_lca\\_us\\_ldv](https://greet.anl.gov/publication-c2g_lca_us_ldv)
- <sup>34</sup> <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-race-to-decarbonize-electric-vehicle-batteries>
- <sup>35</sup> <https://news.umich.edu/evs-reduce-climate-pollution-but-by-how-much-new-u-m-research-has-the-answer/>
- <sup>36</sup> <https://climate.mit.edu/ask-mit/how-much-co2-emitted-manufacturing-batteries>
- <sup>37</sup> <https://environment.yale.edu/news/article/yse-study-finds-electric-vehicles-provide-lower-carbon-emissions-through-additional>
- <sup>38</sup> See <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-multi-pollutant-emissions-standards-model> published April 18, 2024. This rule package mentions the critical minerals issue over 190 times.
- <sup>39</sup> <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-race-to-decarbonize-electric-vehicle-batteries>
- <sup>40</sup> Two studies. 1) Dunn, J.B., Gaines, L., Kelly, J.C., Gallagher, K.G. (2016). Life cycle analysis summary for automotive lithium-ion battery production and recycling. In: REWAS 2016: Towards Materials Resource Sustainability, R.E. Kirchain, B. Blanpain, C. Meskers, E. Olivetti, D. Apelian, J. Howarter, A. Kvithyld, B. Mishra, N.R. Neelameggham, and J. Spangenberg, eds. (Springer) pp. 73-79, [https://doi.org/10.1007/978-3-319-48768-7\\_11](https://doi.org/10.1007/978-3-319-48768-7_11)
- <sup>41</sup> <https://insideevs.com/features/343231/heres-how-to-calculate-conflicting-ev-range-test-cycles-epa-wltp-nedc/>
- <sup>42</sup> Most prices converted in September 2025, some in early 2026
- <sup>43</sup> <https://insideevs.com/features/343231/heres-how-to-calculate-conflicting-ev-range-test-cycles-epa-wltp-nedc/>
- <sup>44</sup> <https://www.motortrend.com/news/first-look-aito-5-7-and-9-range-extended-evs?id=applenews>
- <sup>45</sup> Ibid
- <sup>46</sup> [https://en.wikipedia.org/wiki/AITO\\_M8](https://en.wikipedia.org/wiki/AITO_M8)
- <sup>47</sup> Ibid
- <sup>48</sup> <https://www.arenaev.com/erev-or-extended-range-electric-vehicle-explained-news-1103.php>
- <sup>49</sup> <https://interestingengineering.com/transportation/chinas-new-extended-range-ev> and <https://carnewschina.com/2025/10/14/baics-arcfox-alpha-t5-starts-pre-sale-with-erev-lineup-starting-from-17300-usd/>
- <sup>50</sup> <https://www.topgear.com/car-news/first-look/new-audi-a3-plug-hybrid-now-gets-88-miles-all-electric-range>
- <sup>51</sup> <https://www.thecooldown.com/green-business/audi-q3-plug-in-hybrid-electric-car-ev-range/>
- <sup>52</sup> <https://gmauthority.com/blog/2025/07/2026-buick-electra-l7-erev-powertrain-details-revealed/>
- <sup>53</sup> <https://www.thecooldown.com/green-business/byd-atto-8-suv-china-premium/>
- <sup>54</sup> <https://insideevs.com/news/721338/byd-phev-1300-miles-seal/> and <https://www.irishexaminer.com/motoring/arid-41741931.html>
- <sup>55</sup> [https://en.wikipedia.org/wiki/List\\_of\\_BYD\\_Auto\\_vehicles](https://en.wikipedia.org/wiki/List_of_BYD_Auto_vehicles)
- <sup>56</sup> <https://interestingengineering.com/transportation/china-byd-hybrid-ev-drone-landing-pad>
- <sup>57</sup> <https://www.arenaev.com/erev-or-extended-range-electric-vehicle-explained-news-1103.php>
- <sup>58</sup> Ibid
- <sup>59</sup> <https://www.arenaev.com/erev-or-extended-range-electric-vehicle-explained-news-1103.php>
- <sup>60</sup> <https://cnevpost.com/2025/09/19/changan-deepal-launches-updated-s07-suv/>
- <sup>61</sup> Ibid
- <sup>62</sup> <https://interestingengineering.com/transportation/chinese-electric-suv-offers-high-range>
- <sup>63</sup> <https://www.autocango.com/news-detail/Changan-Hunter--The-world%E2%80%99s-First-EREV-Pickup-Truck-Hit-the-Market>
- <sup>64</sup> <https://carnewschina.com/2025/02/09/changans-deepal-s09-officially-released-in-china-as-erev-rival-of-aito-m9/>
- <sup>65</sup> <https://interestingengineering.com/transportation/china-changan-ev-offers-fast-charge>
- <sup>66</sup> <https://www.thecooldown.com/green-tech/chery-hybrid-vehicle-electric-sedan/>
- <sup>67</sup> <https://www.thecooldown.com/green-tech/chery-fulwin-a8-hybrid-car-range/>

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- <sup>68</sup> <https://interestingengineering.com/transportation/china-chery-hybrid-ev-808-mile-range> and <https://thecarhq.com/article/exeed-exlantix-et5-presale-starts-at-22500-with-1310-km-range-and-lidar-adas>
- <sup>69</sup> <https://thedailypiston.com/chery-exeed-exlantix-et7-ev-innovation/>
- <sup>70</sup> <https://www.thecooldown.com/green-tech/chery-fulwin-electric-suv/> and <https://www.dailyrevs.com/cars/2026-chery-automobiles-fulwin-t11-erev>
- <sup>71</sup> <https://www.topgear.com/car-news/first-look/tiggo-9-a-seven-seat-plug-hybrid-offering-91-miles-ev-range> and <https://www.irishexaminer.com/motoring/arid-41741931.html>
- <sup>72</sup> <https://www.auto-data.net/en/cupra-formentor-facelift-2024-1.5-tsi-272hp-e-hybrid-dsg-53217>
- <sup>73</sup> <https://www.auto-data.net/en/cupra-terramar-1.5-tsi-272hp-e-hybrid-dsg-52623>
- <sup>74</sup> <https://www.auto-data.net/en/cupra-leon-facelift-2024-1.5-tsi-272hp-e-hybrid-dsg-53237>
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- <sup>76</sup> <https://interestingengineering.com/transportation/byd-hybrid-suv-800-mile-range-autonomous-driving>
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