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Harbinger Motors EPIC 5 Research Concept Proposal

Additional submitted attachment is included below.

Electric Program Investment Charge 2026–2030 (EPIC 5)
Research Concept Proposal Form

The California Energy Commission (CEC) is currently soliciting research concept ideas and other input for the Electric Program Investment Charge 2026–2030 (EPIC 5) Investment Plan. For those who would like to submit an idea for consideration, please complete this form and submit it to the CEC by **August 8, 2025**. More information about EPIC 5 is available below.

To submit the form, please visit the e-commenting link: https://efiling.energy.ca.gov/EComment/ECommentSelectProceeding.aspx and select the Docket **25-EPIC-01**. Enter your contact information and then use the "choose file" button at the bottom of the page to upload and submit the completed form. Thank you in advance for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

The primary contact for this research concept is Chris Brown, who can be reached at chris.brown@harbingermotors.com or (813) 245-6680. This contact will be available for any follow-up questions the California Energy Commission (CEC) may have regarding the proposal.

2. Please provide the name of the contact person's organization or affiliation:

The proposing organization is Harbinger Motors, which is leading this concept. Harbinger Motors is a developer of medium-duty zero emission vehicles (ZEVs), and the project will leverage the company's expertise and facilities in California to advance clean transportation solutions.

3. Please provide a brief description of the proposed concept that you would like the CEC to consider as part of the EPIC 5 Investment Plan. What is the purpose of the concept, and what would it seek to do? Why are EPIC funds needed to support the concept?

Proposed Concept: Harbinger Motors plans to reconfigure and expand its facilities to accelerate medium-duty electric vehicle innovation. The company plans to move its vehicle assembly operations to a new, larger facility and either repurpose its current facility, or secure another local facility to focus on battery research & development (R&D) and the custom development of specialty zero-emission medium-duty vehicles for unique fleet applications. This dual-facility

approach enables Harbinger to simultaneously improve battery technology and develop new specialized electric vehicles tailored to complex duty cycles while allowing for separate mass production of vehicles that have already been fully designed and homologated.

Purpose and Objectives: The concept's purpose is to overcome key technology and market gaps in medium-duty ZEVs. By expanding in-house battery R&D and manufacturing capacity, Harbinger aims to advance medium-duty battery technology for greater efficiency and energy density, which will directly help reduce the production cost and ownership cost of electric trucks, as well as off road, energy storage, and auxiliary power applications. In parallel, the project will allow for the design and prototyping of medium-duty ZEVs for niche public and private fleet needs (for example, utility service trucks, municipal vehicles, and other vocational trucks with unique duty cycles). The primary objectives of the concept include:

- **Advance Battery Technology:** Develop higher-performance, cost-efficient battery packs optimized for medium-duty vehicles, addressing the fact that battery packs currently make up roughly 70% of the cost premium in heavy-duty ZEVs[1]. This will improve vehicle range and efficiency, making electrification more practical for demanding routes.
- **Reduce ZEV Costs:** Streamline manufacturing and integrate new battery tech to lower the upfront cost and total cost of ownership of medium-duty ZEVs. Many medium/heavy-duty electric vehicles today have much higher purchase prices than diesel equivalents[2]. Harbinger's unique approach to battery pack design and its vertically integrated business helps reduce the delta between its trucks and the equivalent diesel vehicle; however, continued cost cutting is essential to truly reach cost parity across the industry, especially to prepare a secondary market to be successful when it begins to emerge in the medium-duty and heavy-duty ZEV space. Harbinger's scaled production in the new assembly facility and improved battery designs will drive down costs, supporting wider adoption.

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[1] https://calstart.org/wp-content/uploads/2022/10/component_costs_analysis_october_2022.pdf#:~:text=crucial%20factor%20related%20to%20ZE,Interact%20Analysis%2C%202021

[2] https://www.rff.org/publications/reports/medium-and-heavy-duty-vehicle-electrification-challenges-policy-solutions-and-open-research-questions/#:~:text=Costs%20to%20fleets,MHDEVs%E2%80%94factors%20that%20are%20currently%20unknown

- **Develop Scalable Specialty EVs:** Design and build specialized medium-duty electric vehicles for diverse fleet duty cycles (e.g. maintenance trucks with power take-off equipment, delivery vehicles with high stop-start usage, etc.), which can then be produced at scale in the new assembly plant. This addresses gaps in the market where certain vehicle configurations are not yet available as ZEVs. (Notably, CARB estimates that ~3% of medium/heavy-duty fleet vehicles are of specialized types with no current ZEV offerings.[3] By demonstrating electric trucks that meet complex operational requirements, the concept will enable fleet operators in public works and private industries to replace diesel vehicles even for challenging duty cycles.

Need for EPIC Funding: EPIC funds are crucial for this concept because it involves significant up-front investment in R&D infrastructure and technology development that the private sector alone may not undertake. The total projected budget is estimated at $50 million, which will cover facility upgrades, advanced equipment for battery prototyping and pilot manufacturing, and vehicle development efforts. EPIC support is needed to bridge the funding gap for this high-impact research and to ensure the project delivers broad public benefits (lower emissions, cleaner air, and cost savings for ratepayers) that might not be realized through market forces alone. In summary, EPIC funding will accelerate a technological leap that aligns with California's clean energy and transportation goals, by de-risking the upfront R&D and enabling a state-of-the-art medium-duty ZEV innovation hub.

4. In accordance with Senate Bill 96[i], please describe how the proposed concept will "lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals." For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technology or innovation? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, provide more information on what data and information gaps the proposed concept would help fill, and which specific parties or end users would benefit from the results, and for what purpose(s)?

[3] https://www.rizontruck.com/blogarticle/carb-advanced-clean-fleets/#:~:text=not%20available%20as%20ZEVs

This concept directly targets technological and market barriers that currently hinder California's statutory clean energy and emission-reduction goals, and it proposes breakthroughs to overcome them:

- **Barrier 1 – High Cost of Medium-Duty ZEVs:** The affordability problem is the most significant hurdle to medium- and heavy-duty EV adoption[4,5]. Batteries and electric powertrains add substantial cost, making the purchase price of most medium-duty electric trucks much higher than its diesel counterpart. This high upfront cost translates into a higher total cost of ownership (TCO) for fleets unless mitigated by incentives or cheaper energy.

  Breakthrough Approach: Harbinger's expanded battery R&D aims to drive down battery costs and increase performance, hitting specific targets that make medium-duty EVs economically viable. A key technical target is to approach the Department of Energy's goal of battery packs <$75 per kWh by 2030[6], which would drastically lower vehicle costs. The project will experiment with advanced pack designs to improve energy density (more kWh per kg) and simplify pack assembly, thus reducing cost per kWh. The project can also reduce supply chain costs and improve economies of scale. In addition, moving assembly to a dedicated facility allows for more efficient production processes for the vehicles. Together, these innovations will target a reduction in ZEV upfront cost, and this concept directly addresses that with technology innovation and scaling.

- **Barrier 2 – Limited Model Availability for Specialized Duty Cycles:** Many specialized or demanding fleet applications currently lack suitable zero-emission vehicle options. Medium-duty fleets in public works and other sectors often require custom configurations (e.g. utility bucket trucks, emergency response vehicles, vocational trucks with specific onboard equipment or range needs). If a required truck configuration "is not available" as a ZEV, fleets have no choice but to continue using

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[4] https://calstart.org/wp-content/uploads/2022/10/component_costs_analysis_october_2022.pdf#:~:text=crucial%20factor%20related%20to%20ZE,Interact%20Analysis%2C%202021

[5] https://www.rff.org/publications/reports/medium-and-heavy-duty-vehicle-electrification-challenges-policy-solutions-and-open-research-questions/#:~:text=Costs%20to%20fleets,MHDEVs%E2%80%94factors%20that%20are%20currently%20unknown

[6] https://www.energy.gov/eere/vehicles/batteries-charging-and-electric-vehicles#:~:text=VTO%27s%20Batteries%2C%20Charging%2C%20and%20Electric,and%20cell%20technologies%20that%20can

combustion vehicles, an issue recognized by regulators (CARB provides exemptions when no ZEV exists for a needed configuration). Additionally, today's medium-duty EVs have limitations in range and performance that may not meet certain duty cycles with many electric trucks have ranges under ~200 miles per charge versus 300+ miles (or more) often needed, and they can face payload penalties due to heavier batteries.

Breakthrough Approach: Harbinger will leverage its current facility to function as an innovation lab for specialty EV design. The team will work directly with fleet operators (municipal and private) to understand complex duty-cycle requirements (such as extended daily range, high power auxiliary functions, or rapid turn-around between shifts) and will engineer bespoke medium-duty ZEV solutions for these uses. Examples might include developing a Class 4-6 electric truck platform with a PTO (power take-off) system for utility bucket use, or an electric delivery truck optimized for multi-stop urban routes with fast charging capabilities. By focusing R&D on these niche needs, the concept will produce breakthrough vehicle prototypes that prove ZEVs can handle the same jobs as legacy diesel trucks. Improvements in battery energy density and thermal management will extend range and operational hours, addressing performance gaps. The expected outcome is that previously "hard-to-electrify" vehicle segments will have viable electric models – helping overcome the market barrier of limited model availability. This directly enables increased adoption of clean vehicles in sectors that have been slower to electrify.

- **Barrier 3 – Production Scale and Market Uncertainty:** Today's medium/heavy ZEV market is still nascent, with relatively low production volumes and few manufacturers, which keeps prices high and slows innovation. Manufacturers face high costs to retool for each new technology iteration, and they are cautious due to uncertain demand, while fleets are hesitant because of uncertainty about manufacturers' longevity.

  Breakthrough Approach: The concept tackles this by making a bold investment in scalable manufacturing capacity and flexible production processes. By establishing a new assembly facility designed for high-mix, high-volume production, Harbinger can rapidly scale up successful designs from the R&D phase to commercial production. The assembly plant will be equipped to accommodate evolving battery designs and different vehicle configurations, mitigating the need for complete retooling with each advancement. This proactive scaling reduces the risk that limited manufacturing capacity or market power keeps prices elevated.

Additionally, Harbinger's commitment (with support from EPIC funding) signals confidence to the market, encouraging suppliers and fleets to engage. The concept aligns with California's broader strategy of fostering competition and diversity in the zero-emission truck market – more manufacturers and models will dilute market power that currently lets a small number of producers set high prices. Overall, by overcoming production and scale barriers, the project will help create a more robust market where increased supply and competition drive costs down and innovation up.

By addressing these barriers, the proposed concept will help achieve technological breakthroughs necessary for California's statutory energy and climate goals. In particular, it supports the mandate that 100% of new medium- and heavy-duty vehicle sales be zero-emission in the coming years (for example, CARB's Advanced Clean Fleets rule requires all new MHD vehicles sold to fleets be ZEV by 2036[7]). The concept accelerates progress toward these targets by removing key obstacles such as high cost and limited technology applicability that currently prevent full adoption of clean trucks. End users benefitting from this research include fleet operators across California who will gain access to more affordable and fit-for-purpose ZEVs and ratepayers/the public who will benefit from cleaner air and lower system costs as ZEV adoption grows. In summary, the concept delivers the advancements needed to overcome current barriers and significantly increase the adoption of clean medium-duty vehicles, in line with SB 96's directive for technological breakthroughs to meet state energy and climate goals.

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology or ratepayer costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the innovation at scale? How will the innovation lead to ratepayer benefits in alignment with EPIC's guiding principles to improve safety,[ii] reliability,[iii] affordability,[iv] environmental sustainability,[v] and equity?[vi]

If this research concept is successful (even partially), it will yield several important outcomes that enhance the value proposition of medium-duty electric vehicles and deliver benefits to California ratepayers:

a. Reduced Costs and Improved Value: A primary outcome will be a significant reduction in the cost of medium-duty ZEVs. By lowering battery and

[7] https://ww2.arb.ca.gov/news/1-6-new-trucks-buses-and-vans-california-are-zero-emission#:~:text=,any%20other%20entity%20challenges%20California%E2%80%99s

manufacturing costs, the project can help bring the purchase price and TCO of electric trucks closer to (or below) that of diesel trucks. This directly reduces technology costs for fleets and, ultimately, for ratepayers who rely on services provided by these vehicles (such as goods delivery, public services, etc.). Studies indicate that with policy support, electric trucks' TCO can drop below diesel within this decade.[8] This project's innovations, such as cheaper battery packs and efficient production will accelerate that trend. The value proposition of medium-duty EVs will improve through better performance (longer range, faster charging) combined with lower cost, making the switch to ZEVs an economically sound choice for fleet operators. At scale, these cost reductions also benefit California ratepayers broadly by exerting downward pressure on goods movement costs and by reducing reliance on fossil fuels (shielding against fuel price volatility). Importantly, more affordable electric trucks mean incentive programs (like HVIP vouchers) can achieve more with less funding, optimizing the use of public funds.

b. Enhanced Performance and Reliability: The concept aims to produce medium-duty EV technologies that increase performance metrics such as vehicle range, battery longevity, and charging speed. A successful outcome would be battery systems that enable, for example, 20–30% more range than current models for a given vehicle class, and that can charge faster without degrading the battery. This improves the operational reliability and utility of ZEVs and fleets will be able to deploy them on longer or more demanding routes with confidence. The innovation in battery chemistry and thermal management will also enhance safety and reliability: more robust batteries reduce the risk of failures or thermal events, and electric drivetrains which have fewer moving parts can improve vehicle uptime and reduce maintenance needs. An efficient electric truck fleet can improve the reliability of services (e.g., delivery schedules or utility repairs) due to fewer breakdowns and more predictable charging costs. In terms of grid reliability, the project's focus on battery efficiency could reduce charging energy demands for a given mileage, helping mitigate grid impacts as electrification scales up. Overall, California ratepayers would benefit from more reliable and better-performing fleet services as medium-duty EV technology matures.

c. Environmental Sustainability: A core outcome is greater emissions reductions from the medium-duty transportation sector. By enabling more medium-duty ZEVs on the road through cost and technology improvements, the concept will help cut greenhouse gas and air pollutant emissions. Medium and heavy-duty vehicles are currently a disproportionate source of emissions, and in California they account for about 25% of on-road greenhouse gases and over

[8] https://energyinnovation.org/wp-content/uploads/Fast-Falling-Battery-Prices-Boost-Economic-Benefits-Expected-from-Heavy-Duty-Vehicle-Electrification.pdf#:~:text=provisions,%E2%80%9D46%2C47

35% of NOx emissions, despite being only ~6% of vehicles[9]. Successful deployment of the project's innovations at scale could substantially lower these numbers. For example, each diesel truck replaced by an electric one eliminates tailpipe CO_2 and NOx; on a larger scale, the improved battery tech could make thousands of such replacements feasible. This translates to improved air quality and public health: reduced diesel exhaust will lower exposure to toxic pollutants that cause respiratory and cardiovascular harm. Diesel truck pollution is estimated to cause thousands of premature deaths in the U.S. annually,[10] so reducing it has real health benefits. In turn, this lowers healthcare costs and brings cleaner air, especially to communities near highways and freight corridors. From a climate perspective, the innovation supports California's path to carbon neutrality by cutting transportation emissions, and medium-duty trucks electrified with cleaner electricity will drastically reduce per-vehicle CO_2 emissions. This outcome aligns with EPIC's environmental sustainability and climate goals, contributing to safer, cleaner environments for ratepayers.

d. Equity and Community Benefits: The project's outcomes also promote equity in the clean energy transition. By focusing on cost reduction, the concept will make medium-duty EVs more accessible not just to large companies but also to small fleet operators and public agencies that often face budget constraints. High upfront cost has been a top barrier especially for small fleets;[11] lowering that barrier enables broader participation in electrification, including in disadvantaged communities. Furthermore, the development of specialty EVs means that services critical to low-income or underserved communities such as municipal services, public buses or utility repairs in those areas can transition to zero-emission without sacrificing functionality. Communities located near freight and transportation hubs which are often low-income communities of color will particularly benefit from the localized air pollution reductions as diesel trucks are replaced[12,13]. This contributes to environmental justice by improving air quality and health outcomes in overburdened areas. In addition, the project has an economic equity benefit: it involves expanding manufacturing in California, which

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[9] https://ww2.arb.ca.gov/news/1-6-new-trucks-buses-and-vans-california-are-zero-emission#:~:text=of%20color%2C%20have%20some%20of,road%20greenhouse%20gas%20emissions

[10] https://energyinnovation.org/wp-content/uploads/Fast-Falling-Battery-Prices-Boost-Economic-Benefits-Expected-from-Heavy-Duty-Vehicle-Electrification.pdf#:~:text=The%20health%20and%20air%20quality,51

[11] https://calstart.org/wp-content/uploads/2025/01/January2025_ZIO-ZET_MarketUpdate_Final.pdf#:~:text=CALSTART%20,8%20trucks%2C%20the%20latter%20of

[12] https://ww2.arb.ca.gov/news/1-6-new-trucks-buses-and-vans-california-are-zero-emission#:~:text=,road%20greenhouse%20gas%20emissions

[13] https://ww2.arb.ca.gov/news/1-6-new-trucks-buses-and-vans-california-are-zero-emission#:~:text=of%20color%2C%20have%20some%20of,road%20greenhouse%20gas%20emissions

will create well-paying clean energy jobs and workforce development opportunities. For example, when the CEC funded a battery production facility in Brisbane, CA, it was noted that the project would bring "well-paid clean energy jobs" and support community revitalization[14]. Similarly, Harbinger's concept will generate skilled jobs (engineers, technicians, assembly workers) and prioritize training local workers, including those from disadvantaged communities, thus spreading the economic benefits of the clean transportation transition.
In summary, the anticipated outcomes include lower costs, better performance, and accelerated adoption of medium-duty electric vehicles, along with multi-faceted benefits aligned with EPIC's guiding principles. The innovation will improve affordability through cheaper vehicles and operation, reliability and safety with durable technology and less pollution, environmental sustainability through emissions reduction, and equity with broader access, health benefits, and workforce development. These outcomes have the potential to scale significantly. At full scale, Harbinger's new facility could produce thousands of advanced battery packs and vehicles annually, multiplying the cost savings and emissions reductions across California's fleets. The potential at scale is a transformation of the medium-duty sector. A scenario where specialized electric trucks are readily available for any duty cycle, and fleet turnover to ZEVs is rapid because the business case is positive. This would directly support California's climate targets and yield sustained ratepayer benefits through cleaner air, healthier communities, and more efficient transportation services.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

To evaluate the impacts of the proposed research concept, Harbinger Motors will track a combination of quantitative metrics and qualitative indicators. These metrics will measure progress toward the project's goals of cost reduction, technology performance, and market readiness. Key metrics include:

- **Battery Cost per kWh:** A core metric is the reduction in battery pack cost achieved by the project. For example, the project will measure the battery pack cost in $/kWh before and after R&D improvements. The goal is to approach the DOE target of <$75/kWh by 2030, from a current industry baseline that is roughly ~$150–$200/kWh. A specific success indicator could be achieving a XX% reduction in $/kWh (e.g., a drop from ~$180 to

[14] https://ample.com/2023/02/28/ample-receives-15m-grant-from-the-california-energy-commission/#:~:text=manufacturing%20facility%20in%20Brisbane%20will,charging%20are%20still%20reluctant%20to

$100 per kWh for prototype packs), which would validate progress toward making medium-duty EVs more affordable.

- **Vehicle Production Cost and Sale Price:** Harbinger will estimate the per-vehicle production cost for the new medium-duty EV models including battery, drivetrain, and assembly costs, and compare it to baseline diesel truck costs. A metric of success would be a significant reduction in the cost premium of the ZEV over a diesel equivalent – for instance, cutting the incremental cost by half. If currently a medium-duty electric truck can be twice the cost of a diesel, the project might target bringing that factor down to e.g. 1.2× or lower. The sale price or projected market price of the prototype vehicles will also be tracked to see if it can be brought within an acceptable range for fleet customers, possibly through economies of scale in the new facility. These cost metrics directly relate to the project's objective of cost reduction and will indicate how close we are to price parity that can drive mass adoption.
- **Performance Metrics (Range and Efficiency):** The project will evaluate vehicle performance improvements quantitatively. Key metrics include vehicle range per charge (in miles) under typical duty cycles, and energy efficiency (e.g. kWh per mile). For example, if baseline medium-duty EV range is 120 miles, the project might target >180 miles range for a given battery size, or if energy consumption is 1.5 kWh/mile, target reducing that to 1.2 kWh/mile through weight reduction or drivetrain efficiency. Achieving longer range and better efficiency will be measured via controlled tests and pilot deployments. Another related metric is charging time: how quickly can the new battery systems recharge to 80%? The goal might be to demonstrate, say, a 50% reduction in charge time (such as going from 4 hours to 2 hours for an 85% charge), which would improve operational uptime.
- **Prototype Vehicle Deployments:** A qualitative-yet-trackable indicator is the number of specialty vehicle prototypes developed and field-tested. The project will count how many distinct medium-duty EV configurations (e.g., an electric bucket truck, an electric step van, etc.) are produced and tested with partner fleets. The aim is to produce multiple (X number of) prototype vehicle types that address previously unmet fleet needs. Each prototype will go through performance validation in real-world duty cycles. A successful outcome could be, for instance, three new vehicle types

demonstrated in pilot programs with at least Y hours of operation or Z miles driven in each pilot. This indicates the concept's breadth in addressing diverse duty cycles.

- **Duty Cycle Fit and Fleet Feedback: Qualitative metrics** will be gathered from fleet operators who test the specialty EVs. This includes surveys or interviews capturing the suitability of the EV for the intended duty cycle (e.g., "Did the electric truck meet your daily range and operational needs?"). We will look for qualitative indicators like operator satisfaction, ease of integration into fleet operations, and any performance issues encountered. Success here would be positive feedback that the EV met all critical duty requirements, for example, a utility fleet reporting that the EV bucket truck was able to perform an 8-hour shift with all equipment usage on a single charge. We may also track uptime vs. downtime in the pilot comparing to their diesel trucks as a reliability indicator.
- **Scale of Manufacturing & Economic Metrics:** As the new assembly facility comes online, metrics such as battery packs per month and vehicle assembly rate will be measured. For instance, a goal might be that by the end of the project the facility can produce XX battery packs or YY vehicles per year on a pilot basis. These metrics demonstrate scalability. Additionally, the project will track jobs created and workers trained, and the percentage of local content in the supply chain to see how manufacturing benefits California's economy.
- **Environmental Impact Metrics:** To connect with broader impacts, the project can estimate emissions reductions achieved in the pilot deployments. For example, tracking diesel fuel displaced by the electric prototypes, and the corresponding reduction in CO_2 (tons) and NOx/PM emissions. If, say, 5 prototype vehicles operate for a year, how many tons of CO_2 did we avoid? This can be extrapolated to potential scale (e.g., if 500 such vehicles were deployed). Meeting certain emissions reduction benchmarks (like X tons CO_2 avoided per $ spent) can be a metric of environmental performance.

These metrics cover both quantitative indicators such as cost figures, range, production volume, emissions data, and qualitative outcomes like user satisfaction, and operational fit. They will be used to rigorously evaluate the concept's impact. For each metric, the project will set baseline values and target values. Success will be measured by improvement against those targets – for

instance, a decrease in battery $/kWh by a certain percentage, or achieving a specific minimum range. We will report these metrics to the CEC and stakeholders to demonstrate how the project is delivering results. By using a mix of technical performance metrics and market/adoption indicators, we ensure that the concept is evaluated not just in the lab, but in its real-world effectiveness at overcoming barriers and providing benefits. Ultimately, the most telling metric will be increased readiness of medium-duty ZEV technology – if by the project's end, more fleets are willing to adopt medium-duty EVs because they are proven to be cost-effective and capable, that will be the clearest indicator of success.

7. Please provide references to any information provided in the form that supports the research concept's merits. This can include references to cost targets, technical potential, market barriers, equity benefits, etc.

This proposal is grounded in publicly available data and analysis that underscore the merit and urgency of the research concept. Key references and benchmarks supporting the concept include:

- **High Battery Cost as a Barrier:** Analyses by CALSTART and others have shown that the battery is the single largest cost driver in electric medium/heavy-duty vehicles. In fact, battery packs have recently accounted for nearly 70% of the incremental cost of heavy-duty ZEVs compared to diesel[15]. This emphasizes why our focus on battery R&D (to reduce cost per kWh) is so important. Furthermore, Resources for the Future (RFF) reports that medium- and heavy-duty EV purchase prices are much higher than diesel equivalents, making TCO less competitive without intervention.[16] These data points validate the need to invest in cost reduction and our concept directly responds to this by targeting cheaper, more efficient batteries and scaled production.
- **Need for Cost/Performance Targets:** To be broadly adopted, medium-duty EVs must hit specific cost and performance targets. The U.S. Department of Energy has set a goal to reduce EV battery pack costs to

[15] https://calstart.org/wp-content/uploads/2022/10/component_costs_analysis_october_2022.pdf#:~:text=crucial%20factor%20related%20to%20ZE,Interact%20Analysis%2C%202021

[16] https://www.rff.org/publications/reports/medium-and-heavy-duty-vehicle-electrification-challenges-policy-solutions-and-open-research-questions/#:~:text=Costs%20to%20fleets,MHDEVs%E2%80%94factors%20that%20are%20currently%20unknown

<$75/kWh by 2030 while still providing long driving range.[17] We use this as a guiding benchmark for our R&D efforts. Additionally, studies and policy analyses indicate that achieving price parity or better TCO for electric trucks by the mid-2020s to 2030 is feasible with technology improvements and incentives.[18] Our project's targets, such as doubling vehicle range and significantly lowering cost are aligned with these industry benchmarks and will help realize them sooner. These references underscore that the concept's goals are ambitious yet attainable, and more importantly, necessary for mass adoption.

- **Market and Adoption Barriers:** CARB regulations and reports highlight current market gaps that our concept addresses. CARB's Advanced Clean Fleets rule anticipates that certain specialty vehicle configurations are not yet available as ZEVs, and provides exemptions in those cases.[19] CARB officials have noted that only about 3% of MHD vehicles are the kind of specialty types likely to qualify for such exemptions, but those still represent important fleet roles (e.g., emergency vehicles, vocational trucks). This reference supports the notion that a niche remains where ZEV technology hasn't reached the niche our specialty vehicle development will fill. Moreover, RFF's research on MHDEV challenges points out that limited model availability and few manufacturers in certain truck segments give existing manufacturers outsized market power to keep prices high.[20] By introducing new models and expanding production in California, our project intends to mitigate that issue. These sources confirm the existence of the barriers we described regarding affordability and duty-cycle suitability, and lend weight to our strategy to overcome them.

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[17] https://www.energy.gov/eere/vehicles/batteries-charging-and-electric-vehicles#:~:text=VTO%27s%20Batteries%2C%20Charging%2C%20and%20Electric,and%20cell%20technologies%20that%20can

[18] https://energyinnovation.org/wp-content/uploads/Fast-Falling-Battery-Prices-Boost-Economic-Benefits-Expected-from-Heavy-Duty-Vehicle-Electrification.pdf#:~:text=provisions,%E2%80%9D46%2C47

[19] https://www.rizontruck.com/blogarticle/carb-advanced-clean-fleets/#:~:text=In%20addition%2C%20while%20it%E2%80%99s%20unlikely,a%20fleet%20is%20not%20available

[20] https://www.rff.org/publications/reports/medium-and-heavy-duty-vehicle-electrification-challenges-policy-solutions-and-open-research-questions/#:~:text=necessitates%20new%20equipment%20and%20vehicle,critical%20minerals%20may%20be%20restrictive

- **Statutory Goals and Policy Alignment:** The concept is informed by California's statutory energy and climate goals, as documented by CARB and CEC. Under the Advanced Clean Trucks (ACT) regulation and related policies, California has mandated a transition to 100% zero-emission new truck sales for medium- and heavy-duty vehicles in the 2035–2045 timeframe.[21] Specifically, starting in 2036 all new MHD vehicles sold to California fleets must be zero-emission. This is a statutory-backed goal aimed at achieving the state's climate commitments. We cite these rules to demonstrate that our project is not an abstract research exercise – it directly supports real and pressing policy goals. The CEC EPIC guiding principles also call for innovations that improve affordability, reliability, sustainability, and equity. We have referenced data on emissions and health to show the stakes: trucks are only ~5–6% of vehicles but contribute ~25% of transport GHGs, and a large share of toxic diesel pollution, which causes thousands of deaths annually in the U.S. Transitioning these vehicles to zero-emission yields outsized benefits in emissions reduction and public health, especially in overburdened communities. These references justify why EPIC investment in medium-duty electrification will have high impact. The project's alignment with CARB's regulations and the state's climate targets is firmly supported by these documented goals and statistics.
- **Equity and Economic Benefits:** We have also drawn on sources that illustrate the equity and economic rationale for this concept. The CARB press release from June 2024 notes that communities near trucking corridors that are often low-income communities of color, suffer from some of the worst air quality,[22] due to diesel truck pollution. This contextual data reinforces why our focus on zero-emission solutions for all duty cycles including those serving such areas will yield equity benefits. On the economic side, an example from a CEC-funded initiative is instructive: Ample's battery swapping facility received nearly $15 million from CEC to build a new production line in California, and local officials praised it for bringing clean energy jobs and community revitalization. In a more robust investment Proterra conducted a corporate expansion of $76 million to

[21] https://ww2.arb.ca.gov/news/1-6-new-trucks-buses-and-vans-california-are-zero-emission#:~:text=,any%20other%20entity%20challenges%20California%E2%80%99s
[22] https://ww2.arb.ca.gov/news/1-6-new-trucks-buses-and-vans-california-are-zero-emission#:~:text=,road%20greenhouse%20gas%20emissions

open a new battery system production plant in Greer, SC.[23] This expansion will supply batteries for electric trucks, buses, and equipment, directly supporting the transition to zero-emission fleets.[24] The project is expected to create over 200 well-paying jobs locally. State leaders praised it as proof that clean transportation technology can spur economic growth, calling it an opportunity to "create clean energy jobs" and strengthen U.S. climate leadership.[25] As a promising but young business, Harbinger does not have the resources to make a capex investment of this magnitude without the CEC's support. In short, external references confirm that investing in clean transportation infrastructure not only addresses technology gaps but also creates economic opportunities and health benefits, which are key merits of our concept.

All the above sources, from CALSTART's cost analyses to CARB's regulatory announcements and DOE's targets converge on the point that medium-duty vehicle electrification is both critical and challenging, requiring concerted innovation. This proposal is built on those findings. By referencing these data, we demonstrate that the concept stands on solid evidence as it targets documented barriers with solutions that meet or exceed industry benchmarks. The mix of technical data regarding costs, and performance targets, market analysis such as adoption barriers and policy requirements, and societal impact of improved health and equity considerations shows a comprehensive case for the research concept's merit. In summary, publicly available research and reports strongly support the need for and the approach of Harbinger's EPIC 5 concept.

8. The EPIC 5 Investment Plan must support at least one of five Strategic Goals:[vii]
    a. Transportation Electrification
    b. Distributed Energy Resource Integration
    c. Building Decarbonization
    d. Achieving 100 Percent Net-Zero Carbon Emissions and the Coordinated Role of Gas
    e. Climate Adaptation

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[23] https://www.govtech.com/fs/ev-manufacturer-announces-76m-operation-expansion#:~:text=,in%20the%20South%20Carolina%20Upstate

[24] https://www.govtech.com/fs/ev-manufacturer-announces-76m-operation-expansion#:~:text=and%20technology%20for%20such%20vehicles%2C,new%20jobs%20in%20Spartanburg%20County

[25] https://www.govtech.com/fs/ev-manufacturer-announces-76m-operation-expansion#:~:text=The%20Republican%20McMaster%20lauded%20the,company%E2%80%99s%20efforts%20in%20the%20Upstate

Please describe in as much detail as possible how your proposed concept would support these goals.

The proposed concept primarily supports the EPIC 5 strategic goal of Transportation Electrification, and it also contributes to the state's broader climate objectives by aligning with achieving 100% net-zero emissions. Below is how the concept aligns with these goals:

- **Transportation Electrification:** This project squarely advances transportation electrification by focusing on medium-duty trucks, a segment that is crucial to decarbonize. By developing better batteries and scalable electric truck designs, the concept will accelerate the replacement of diesel medium-duty vehicles with electric versions. This aligns with California's strategy to electrify the transportation sector, as seen in mandates like the Advanced Clean Fleets rule for 2036. The outcome will be more zero-emission miles driven in California for services like delivery, utilities, and public fleets. Additionally, by lowering costs and expanding the range of available EV models, the concept helps electrify transportation in a way that is affordable and practical for fleet operators, thereby speeding up adoption. Transportation electrification is not only about vehicles but also about supporting infrastructure and manufacturing. Our project contributes here by establishing a battery manufacturing line and assembly capacity in-state, creating an ecosystem that can support many more EVs on the road. In essence, the concept will help electrify a portion of the medium-duty sector that has lagged, bringing California closer to its goal of widespread vehicle electrification across all vehicle classes.
- **Achieving 100% Net-Zero Carbon Emissions:** Medium- and heavy-duty vehicles are a major source of greenhouse gas emissions; electrifying them is essential for California to reach its climate neutrality goals by 2045. By enabling more medium-duty ZEV deployment, our project reduces reliance on diesel and cuts carbon emissions from the transportation sector. This supports the strategic goal of a net-zero carbon energy system. Every diesel truck converted to electric, especially when powered by California's increasingly renewable electricity mix represents a substantial reduction in carbon emissions. Moreover, the battery innovations from this project could have spillover benefits for other clean

energy areas (e.g., stationary storage, off road, and auxiliary equipment, further helping to decarbonize the energy system. The concept also complements efforts to coordinate with the electric grid in achieving net-zero: for example, improved battery performance might enable future vehicle-to-grid services or better load management for charging. In summary, by decarbonizing a challenging segment of transportation, the concept moves the needle toward California's 100% clean energy and net-zero emissions trajectory.

The Harbinger concept clearly advances EPIC's strategic priorities. It will help electrify transportation in a critical vehicle class, thereby reducing emissions and supporting California's path to a clean, resilient, and equitable energy future. The project's success would demonstrate how EPIC investments can overcome barriers and drive progress in one of the hardest-to-electrify sectors, underscoring the alignment with strategic statewide goals for clean transportation and climate leadership.

About EPIC

The CEC is one of four EPIC administrators, funding research, development, and demonstrations of clean energy technologies and approaches that will benefit electricity ratepayers of California's three largest investor-owned electric utilities.

EPIC is funded by California utility customers under the auspices of the California Public Utilities Commission.

To learn more about EPIC, visit: https://www.energy.ca.gov/programs-and-topics/programs/electric-program-investment-charge-epic-program

EPIC 5 documents and event notices will be posted to: https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5

Subscribe to the EPIC mailing list to stay informed about future opportunities to inform the development of EPIC 5: https://public.govdelivery.com/accounts/CNRA/signup/31897

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i See section (a) (1) of Public Resources Code 25711.5 at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC&sectionNum=25711.5.

ii EPIC innovations should improve the safety of operation of California's electric system in the face of climate change, wildfire, and emerging challenges.

iii EPIC innovations should increase the reliability of California's electric system while continuing to decarbonize California's electric power supply.

iv EPIC innovations should fund electric sector technologies and approaches that lower California electric rates and ratepayer costs and help enable the equitable adoption of clean energy technologies.

v EPIC innovations should continue to reduce greenhouse house gas emissions, criteria pollutant emissions, and the overall environmental impacts of California's electric system, including land and water use.

vi EPIC innovations should increasingly support, benefit, and engage disadvantaged vulnerable California communities (DVC). (D.20-08-046, Ordering Paragraph 1.) DVCs consist of communities in the 25 percent highest scoring census tracts according to the most recent version of the California Communities Environmental Health Screening Tool (CalEnviroScreen), as well as all California tribal lands, census tracts with median household incomes less than 60 percent of state median income, and census tracts that score in the highest 5 percent of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.

vii In 2024 the CPUC adopted five Strategic Goals to guide development of the EPIC 5 Investment Plan. A description of the goals can be seen in Appendix A of CPUC Decision 24-03-007 available at: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M527/K228/527228647.PDF