EXECUTIVE SUMMARY

TAKING COMMERCIAL FLEET ELECTRIFICATION TO SCALE:
FINANCING BARRIERS AND SOLUTIONS

April 2021

Numerous barriers and risks impede zero-emission commercial vehicles (ZECV) from reaching meaningful scale despite strong and growing policy momentum toward their adoption. While some of these barriers and risks are technological in nature, like the suitability of battery range to fleets' duty cycles, others relate to the financing conditions for truck and bus electrification projects, namely uncertainty regarding residual value and the total cost of ownership. "Taking Commercial Fleet Electrification to Scale" offers structured guidance on how public and private levers can catalyze ZECV markets to target the most prominent barriers to adoption, and in so doing unlocking the needed capital to finance fleet electrification at scale.

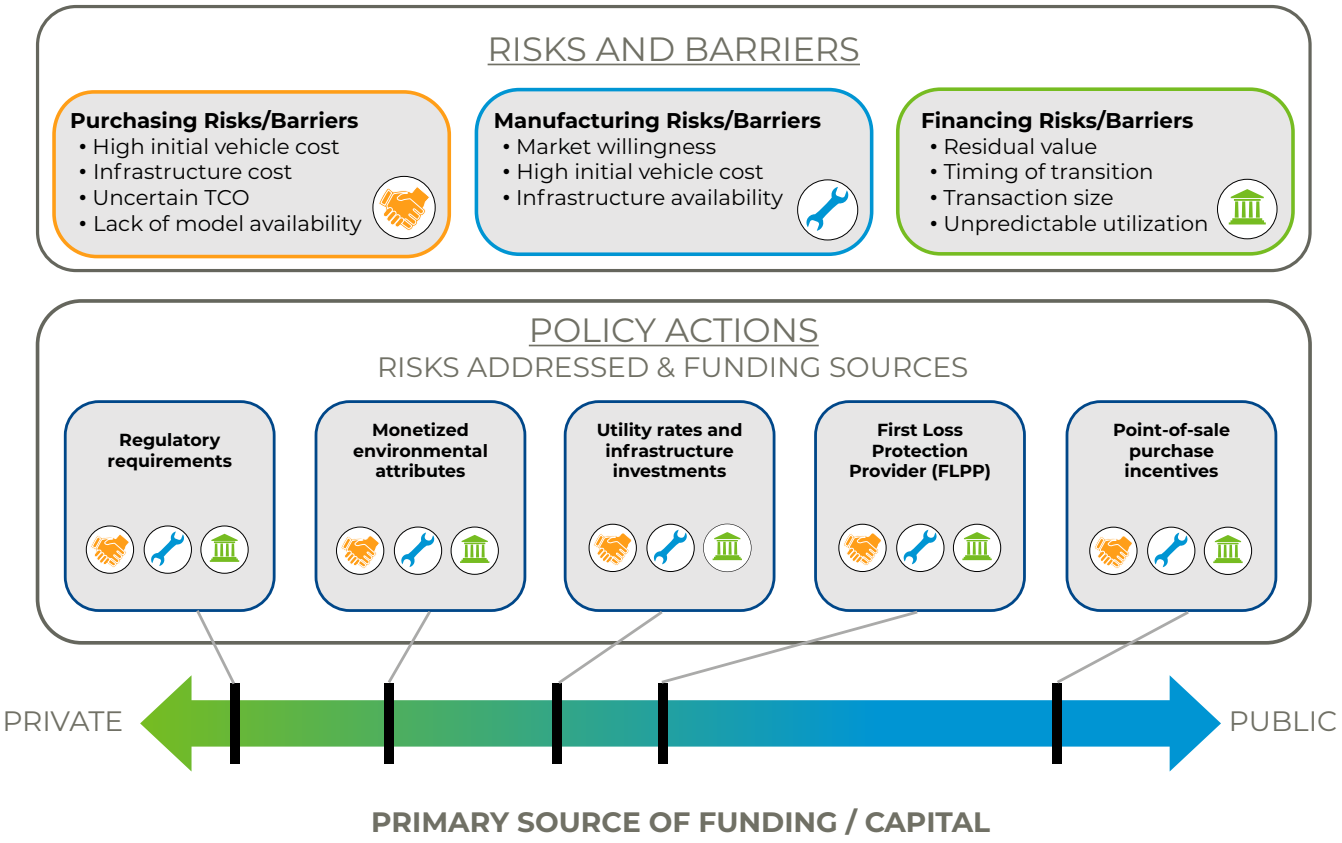
The public sector can marshal greater involvement of private capital in financing the ZECV transition and eventually obviate an active government role in both capital provision and risk mitigation capacities. To begin, government agencies, working in concert with financial market stakeholders, should serve as "First-Loss Protection Providers" (FLPPs) to target the most oft-cited financing barrier for ZECV projects—residual value risk, or the concern over how well ZECVs will retain value at the end of their fleet service time. Such a function would mitigate project risk by absorbing the first amount of residual value downside risk and would in turn ease financing of ZECV projects by traditional financial intermediaries. The FLPP role could be fulfilled at the state level by Green Banks or at the federal level through the U.S. Department of Energy's Loan Programs Office, as examples.

With an FLPP in place to shore up ZECV financing prospects, government leadership can remove other near-term market barriers to ZECV adoption **(Figure ES-1)**. Strong and clear regulations on

manufacturers and fleets, together with point-of-sale purchase incentives and supportive utility infrastructure investment programs would be powerful tools to drive accelerated deployment of ZECVs to meet climate timelines and community health needs.

- Regulations for sales and purchases of zero-emission trucks and buses send clear market signals that products meeting these requirements will be stable investments.
- Point-of-sale incentives are critical to reducing the near-term risks for manufacturers to build and for fleets to purchase ZECVs and create an early market.
- Utility infrastructure programs (and supportive rate design) are vital components of the ZECV ecosystem because they make the infrastructure procurement and commissioning process—which is novel to most fleets—eminently more manageable while activating a ready source of capital from regulated utilities.
- Monetizing environmental attributes where applicable, such as allowing fleets to borrow against future revenues from market mechanisms like a low-carbon fuel standard, would further accelerate cost parity between zero-emission technologies and internal combustion engines.

Figure ES-1. Government policy action to address various financial barriers to ZECV adoption



In the early years of ZECV market development, these policy tools can work in conjunction with each other. Once early ZECV markets take hold, mechanisms to encourage private capital markets to fund the next stages of growth can help focus and scale back public funding while providing a clear direction for private investment. This transition from public funding to private capital should become

self-perpetuating as zero-emission vehicle and infrastructure technologies become less expensive, project economics improve, and perceived uncertainties resolve—but public sector actions are key to seeding these trajectories in the immediate term. FLPP mechanisms fulfilled by public agencies will serve to reduce the riskiest elements of early stage ZECV deployment by protecting investors against current unknowns, such as residual value risk. In time, the FLPP role can and should transfer to private intermediaries as a standard credit enhancement offering once the market has taken shape more fully. The other policy tools—namely regulations and the incentives and infrastructure support to attain regulatory targets—will more quickly bring private capital to the market, in time reducing per-vehicle public funding support. An added benefit will be the emergence of a robust secondary market (i.e., used vehicles) that can mainstream ZECVs by making the technology available to fleets that do not normally procure new vehicles, including many small truck fleets.

These are the summary results of "Taking Commercial Fleet Electrification to Scale: Financing Barriers and Solutions." The market and technological context for ZECVs, as well as key issues, findings and a summary of policy and financial recommendations are outlined below.

CONTEXT FOR ZERO EMISSION COMMERCIAL VEHICLES

Zero-emission commercial vehicles (ZECVs) are now technically ready for market launch across multiple applications and are being produced in a growing variety of model types in North America, Asia, and Europe. The number of commercially available ZECV models in the United States and Canada should roughly double by 2023 relative to the end of 2019.[1] The first products in the market are primarily battery-electric and are focused on public transit as well as urban and regional goods movement and services. Before 2025, long range vehicles will also become commercially available utilizing both battery electric and fuel cell electric powertrains.

The operational benefits of ZECVs are receiving greater recognition, most notably the potential for significantly lower operating costs from lower-cost fuel, higher-efficiency powertrains and greatly reduced maintenance needs. Many, if not most, ZECVs show a positive business case over their life as measured by the total cost of ownership (TCO). By 2030, all ZECVs could reach TCO parity with their diesel counterparts, with urban vans reaching cost parity by 2026.[2] Strong near-term financial incentives can help accelerate attainment of cost parity.

Moreover, ZECVs represent a significant strategy to reduce smog-forming air pollution in at-risk communities and driving down greenhouse gas emissions to levels that can meet global targets for transportation by 2030 and 2050. As a result, zero-emission trucks and buses have received increasing policy support as states consider adopting California's manufacturer and fleet regulations for trucks and buses and an increasing number of jurisdictions seek to accelerate ZECV markets with point-of-sale purchase incentive pilots or longer-term programs.

1 CALSTART (2021). ZETI Analytics. Retrieved from: https://globaldrivetozero.org/tools/zeti-analytics

2 CALSTART and FIER Automotive & Mobility (2020). Moving Zero-Emission Freight Toward Commercialization. Retrieved from: https://globaldrivetozero.org/publication/moving-zero-emission-freight-toward-commercialization

KEY ISSUES INHIBITING FLEET ADOPTION

Nonetheless, risks and barriers to ZECV adoption remain meaningful. These include, in the near term, much higher initial purchase cost, the need for new fueling infrastructure that can be expensive and complex, developing a new business case, and understanding how the new technology can work in current operations.

While well-capitalized and larger fleets have been able to make initial deployment inroads, getting to scale with these fleets and reaching smaller and owner-operator enterprises will require entirely new approaches. Business model innovations and novel financial strategies that can de-risk ZECV adoption will be imperative to unlocking needed levels of deployment growth. Reducing the initial ZECV purchase price, funding and planning for infrastructure, and bringing forward the financial benefits of lower operating costs in the business case are critical strategies to de-risk ZECV investments.

FINANCIAL INDUSTRY RISKS AND BARRIERS

Just as there is operational risk that may discourage vehicle operators from adopting ZECVs, significant financial risks have kept most financial institutions out of the market until this point. Addressing these risks is critical to unleashing the scale of private market capital required to transform the market over the next critical years.

Current and potential financiers of ZECVs – including commercial banks, finance companies, green banks, green bonds, microlenders, and equity investors – view this emerging and rapidly growing sector with great interest. They view ZECVs' rapid growth, positive economics, and value toward addressing climate change as a natural extension of both the renewables and/or transport sector in which they are already deeply invested.

Nevertheless, these investors report significant perceived risk in investing in ZECVs and their supporting infrastructure, on top of structural impediments to financing such as small transaction size **(Table ES-1)**. As a byproduct, transactions at scale are currently scarce. The residual value of these advanced vehicles is their top concern, because of the relative newness of the market and a lack of data around the value of ZECVs as they age. Other key barriers cited include higher up-front costs, a perceived lack of model availability, fear of rapid obsolescence, a lack of cooperation from local utilities, and utility rates that are unsupportive of ZECV charging requirements.

Table ES-1. A comparison of relevant financing parties

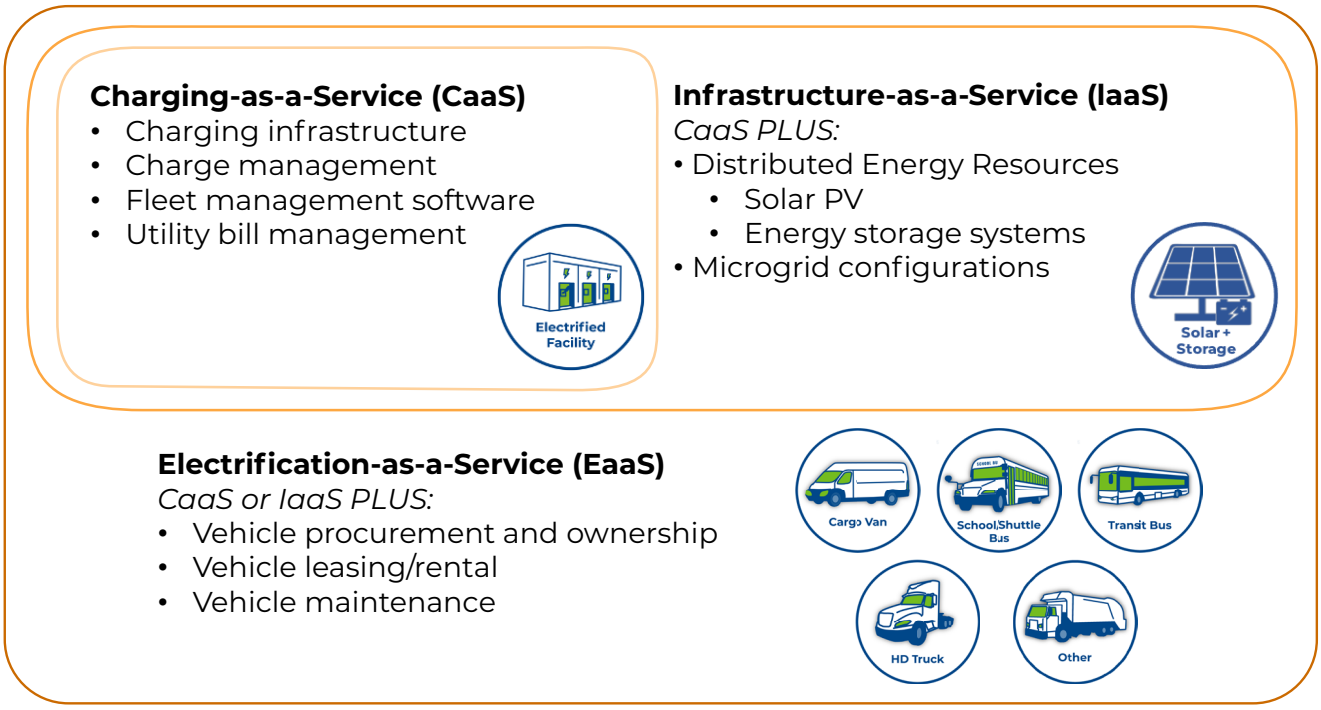
TYPE OF INSTITUTION	FINANCIAL INSTRUMENT	TRANSACTION SIZE	RISK TOLERANCE	TARGET RETURN
Commercial Banks	Debt	●●●	●	●
FinCos	Debt	●	●●	●●
Green Banks	Debt	●	●	●●
Green Bonds	Bonds	●●●	●	●
Microlenders	Debt	●	●●	●●
Equity Investors	Equity	●●●	●●●	●●●

KEY					
●	<$10 million	●	Low	●	LIBOR + 200-300bp
●●	$10-$50 million	●●	Moderate	●●	LIBOR + 301-500bp
●●●	>$50 million	●●●	Flexible	●●●	>10% IRR

OPPORTUNITIES FOR THE FINANCIAL INDUSTRY TO ACCELERATE TRANSFORMATION

Based on an in-depth canvassing of the finance industry, this report identifies several promising financial tools that could directly address these risks and barriers. These tools range from more traditional bundled vehicle and infrastructure lease packages to full-service, inclusive structures such as "Charging-as-a-Service" (CaaS) and "Electrification-as-a-Service" (EaaS) **(Figure ES-2)**. Innovative service structures offer the ability for vehicle operators to pay fixed ongoing fees (e.g., $/month, $/kWh, $/mile) over a service period – generally periods of eight to ten years or longer – at rates competitive with or lower than the cost of operating a conventional vehicle. These structures can mitigate operator adoption risks by blending the operational cost savings of vehicles that have regular and predictable routes and operations with their higher upfront costs (vehicle and/or infrastructure) to create an attractive business case at a reasonable payment rate. Several vehicle manufacturers, as well as infrastructure and power providers, are exploring some versions of these tools, in addition to independent service providers whose entire business is offering such services.

Figure ES-2. Relationships and Definitions of "As a Service" Models



The ability to attract private capital and financing to the ZECV marketplace could have revolutionary impacts on the ability to deploy vehicles faster by overcoming critical initial market barriers. Similar financial models helped the solar and wind energy industries reach scale, and nascent innovations in ZECV financing models signal that a similar inflection point for vehicle fleets is approaching.

EMERGING FINANCIAL SOLUTIONS

A number of financial and commercial solutions are emerging that could mitigate perceived risk for financiers by:

- Lowering residual value risks;
- Increasing transaction size by packaging charging infrastructure with vehicle ownership;
- Lowering risk by lending against future low-carbon fuel standard (LCFS) credits or other environmental attributes; and
- Advancing commercial fleet electrification specifically through new tailored financial products, for instance by green banks.

In addition, vehicle and battery manufacturers as well as project developers are working to insulate fleet operators from the above risk types through:

- New financial tools or business models to fund battery costs;
- The development of a growing body of data around residual values through a secondary vehicle

market;

- New business models that aggregate vehicle sales;
- An improved business case via scaled-up production and early-stage research and development (R&D); and
- Expanding partnerships throughout the supply chain.

Technological advancements will continue to drive growth across all aspects of electrification, sending a strong signal to manufacturers to invest more into R&D. Those investments will drive ever greater technological innovation and improvements, leading to a virtuous cycle of vehicle proliferation, improved performance, and declining costs.

POLICY RECOMMENDATIONS

Public policy support for vehicle electrification is generally strong. However, deeper private capital investment will require policies and mechanisms that specifically address the key risks acknowledged by financiers, and in particular that of residual value risk. Uncertain residual values put payback of investment at risk because the underlying asset(s) may have lost more value than was anticipated in the original transaction underwriting. In conjunction with state- and federal-level policies that require and incentivize the transition to ZECVs, enacting complementary supporting policies to de-risk capital investment would make ZECVs far more financeable.

Key recommendations for policymakers are as follows:

- Mitigate residual value risk through first loss protection mechanisms, specifically by working with financial market practitioners to establish **First Loss Protection Provider (FLPP)** programs, funded via state or federal Green Banks or other aligned intermediary sources. FLPPs would research and price residual value risk, and provide this protection (possibly for a fee) to financing entities providing qualifying ZECV sales and lease agreements.
- Provide clean market signals and directions by adopting **strong regulations** requiring a time-certain adoption schedule for manufacturers and fleet users, such as the California Advanced Clean Trucks (ACT) regulation and the forthcoming Advanced Clean Fleets rulemaking. Importantly, because of the lengthy (multi-year) lead-times between rule proposal and enactment and between enactment and full implementation, signaling an intention to introduce or explore regulations early in this process can provide a decisive direction for market actors and financiers, contextualizing other policy actions within a clearer policy landscape.
- Create and fund direct, multi-year **point-of-sale incentive programs** to support ZECV purchase and adoption in the near-term and ensure those funds are primarily directed small-to-medium sized businesses and/or low-to-moderate income communities, and prioritize deployments within the communities with poorest air quality. These programs may necessitate creation of new aligned funding streams, such as cap-and-invest auction revenues or clean fuel standard credits.
- Relatedly, and where applicable, develop structures that allow fleets to **monetize environmental attributes** associated with zero-emission fleets. For instance, California's Low Carbon Fuel Standard (LCFS) creates a steady stream of income for zero-emission fleets, potentially worth up to $150,000 over a ten-year vehicle life, depending on the battery size and duty cycle of the vehicle. An LCFS

loan program would enable fleet owners in participating jurisdictions to borrow against their future LCFS credit value to meet upfront capital needs for electrification investments. Bringing the term value of environmental attributes forward in this way could dramatically lower up-front costs for ZECVs wherever LCFS programs (or similar) are under consideration.

- Reinforce ZECV deployment readiness with **infrastructure investments** such as utility make-ready programs for fleets, as well as setting competitive rate structures for electricity and hydrogen; provide **grant funding that supports innovation**, pilot scale deployment experience and manufacturing and workforce training assistance.

Taken together as a holistic approach, these policy tools can not only catalyze mainstream adoption of ZECVs by a wide range of vehicle fleets, including small operators, but can chart a course to a self-sustaining market by erasing barriers to private capital deployment as the need for an active role by government entities fades from view.