VOUCHER INCENTIVE PROGRAMS: A TOOL FOR ZERO-EMISSION COMMERCIAL VEHICLE DEPLOYMENT

A CALSTART Report

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Cover photo: ZEV Showcase and Policy Summit, February 2023, Sacramento, CA. Zero-emission truck and bus showcase events inviting dealers and manufacturers to bring their vehicles for fleets to see and drive, packaged with training sessions, have been highly successful as part of a total outreach and support strategy. Photo credit: Uplifted visuals.

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About CALSTART

CALSTART is a nonprofit organization working nationally and internationally with businesses and governments to develop clean, efficient transportation solutions. CALSTART is a network that connects companies and government agencies and helps them do their jobs better. From technology firms to transit operators and from vehicle manufacturers to

research institutions, we connect every element of the clean energy sector, offering customized services, information, and programming.

Drawing on more than 30 years of experience and expertise, CALSTART provides services and consulting to spur advanced transportation technologies, fuels, systems, and the companies that make them. Our clients range from companies working on emerging technologies to transit agencies piloting potential clean energy solutions. See our staff directory to find the expert you need. CALSTART's 300+ member firms and agencies include manufacturers, suppliers, fleets, technology firms, academic institutions, government agencies, NGOs, power companies, fuel providers, banks, and other businesses interested in the future of transportation.

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List of Acronyms

Acronym	Definition
AB	Assembly Bill
ACT	Advanced Clean Trucks regulation
AQIP	Air Quality Improvement Program
BEV	Battery-electric vehicle
BMP	Beneficiary mitigation plans
CARB	California Air Resources Board
CEC	California Energy Commission
CHE	Cargo-handling equipment
CMAQ	Congestion Mitigation and Air Quality Improvement
CNG	Compressed natural gas
CORE	Clean Off-Road Equipment Voucher Incentive Project
DAC	Disadvantaged community
DOER	Department of Energy Resources
DPF	Diesel particulate filter
EnergIIZE	Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles Project
EPA	U.S. Environmental Protection Agency
ePTO	Electric power takeoff

Acronym	Definition
FCEV	Fuel cell electric vehicle
FHWA	Federal Highway Administration
GHG	Greenhouse gas
Global MOU	Global Memorandum of Understanding for Zero-Emission Medium- and Heavy-Duty Vehicles
GVWR	Gross vehicle weight rating
HVIP	Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
IIJA	Infrastructure Investment and Jobs Act
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
ISEF	Innovative Small E-Fleet
lbs.	Pounds
MHDV	Medium- and heavy-duty vehicle
MOR-EV	Massachusetts Offers Rebates for Electric Vehicles
NAAQS	National Ambient Air Quality Standards
NHPP	National Highway Performance Program
NJ-ZIP	New Jersey Zero-Emission Incentive Program
NJEDA	New Jersey Economic Development Authority
NOx	Nitrogen oxide
NYCDOT	New York City Department of Transportation
NYSDEC	New York State Department of Environmental Conservation

Acronym	Definition
NYSDOT	New York Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
NYTVIP	New York Truck Voucher Incentive Program
RGGI	Regional Greenhouse Gas Initiative
STBG	Surface Transportation Block Grant
TCI	Transportation and Climate Initiative
TCO	Total cost of ownership
TIP	Transportation Improvement Plan
VIP	Voucher incentive program
VPC	Voucher processing center

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Executive Summary

Overview

Climate change has accelerated in impact, and the time left to act grows shorter each day (IPCC, 2023). Alternative fuel solutions once thought sufficient to reduce greenhouse gas (GHG) emissions from transportation no longer achieve the necessary results. The world must now focus on transportation electrification (IPCC, 2023).

Fortunately, investments and innovations in zero-emission buses and trucks are progressing at a rapid pace in the United States and across the world. Nonetheless, fleet adoption during this critical ramp-up period has been slowed by the comparatively high costs of these new vehicles in the early, low-volume market, as well as planning and paying for infrastructure.

Policymakers, manufacturers, and end users have experimented with a number of policy tools to promote first clean and now primarily zero-emission vehicle adoption. An expanding number of states and regions have adopted a now well-proven policy tool to efficiently deploy zero-emission commercial vehicles—and now infrastructure—faster using an innovative and flexible point-of-sale incentive: the voucher incentive program (VIP).

The VIP tool has proven highly effective in reducing the risk to faster fleet adoption of zero-emission and other clean vehicles. By directly reducing the cost at the time of purchase, this style of incentive changes purchase decisions for commercial vehicle operators. VIP programs also leverage meaningful co-investment funds of as much as 3-to-1 that not only expand the impact of the public investment dollars but can drive a growing, clean tech economy (HVIP, n.d.).

The first region to use this VIP tool, California, funded the program with state resources, but follow-on states have found ways to tap regional and federal dollars to fund their programs. Now, with the advent of significantly increased federal funding to states via the Infrastructure Investment and Jobs Act (IIJA, also known as the Bipartisan Infrastructure Law or BIL) and given the flexibility provided to states in using this funding, the time is ripe for more states and regions to accelerate local adoption by creating regional VIPs.

A New Incentive Needed for Clean Commercial Vehicles

More than ever, as governments and industry work to speed up the penetration of zero-emission technology at the pace now required, a tool to ease and accelerate adoption is needed. High incremental vehicle cost, followed by infrastructure costs and timing, are the primary barriers cited by fleet purchasers as preventing more rapid zero-emission vehicle purchases. Incentives for the purchase of commercial medium- and heavy-duty vehicles (MHDVs) are needed to help spur and create a robust, sustainable market.

While tax credits have been valuable in advancing consumer light-duty passenger car uptake, rebates that reduce the upfront purchase price have been shown to be more effective. However, in the commercial MHDV segment, tax credits—while useful—have not been nearly as successful in promoting the uptake of commercial zero-emission vehicles. To enable the faster adoption of clean trucks, buses, and other commercial vehicles, CALSTART, with industry and the California Air Resources Board (CARB), developed the voucher incentive model to provide direct and upfront reductions in the price of new vehicles. The urgency around the need for incentives and the issues involved in different incentive designs are presented in Section I.

The VIP Model

A VIP is designed to reduce the high cost of new technology right at the time of purchase. By doing so, it changes the business case for users and directly influences the purchase decision. It is a well-structured, highly transparent tool that government agencies can use to attract industry participants, engage fleets, and distribute public funding efficiently, equitably, and directly to clean and zero-emission vehicle deployments.

While regional program priorities and funding sources may vary, there are several common principles of a successful VIP. These commonalities demonstrate the core strengths of the VIP design and should be preserved in any proposed new program.

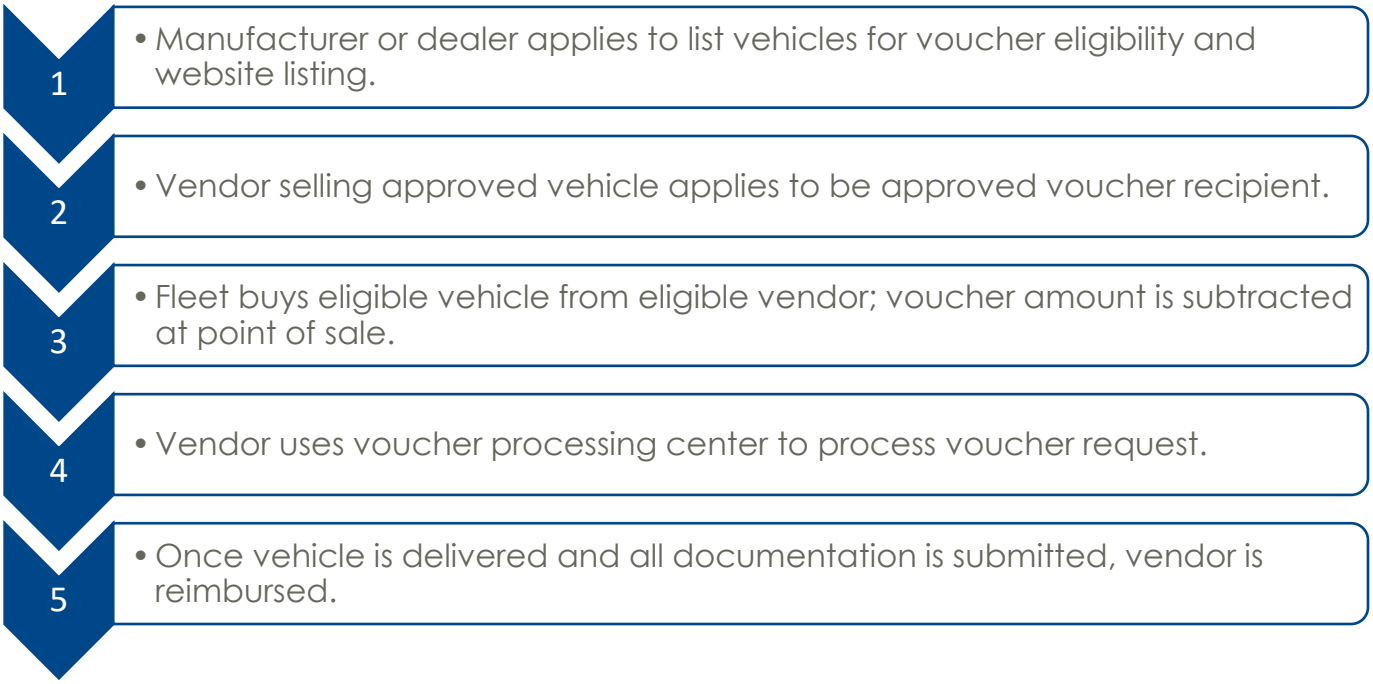
- Simplicity of Design: The prime strategy of all VIPs is to reduce the cost of purchase at the time of sale. While each program brings constraints and priorities attached to funding sources and regional needs, these requirements can be integrated into the VIP structures. Such designs make it easy for fleets to understand the amounts available and how to manage them while reducing the administrative burden on sponsoring agencies.
- Transparency and Certainty of Outcome: The clearly outlined and transparent approval structure shared among all programs provides a funding guarantee in

advance of purchase if all rules are followed. This creates certainty of outcomes for manufacturers, vendors, and fleets, in addition to state and/or local sponsors.

- Flexibility/Adaptability: Design choices can tailor the basic VIP structure to accommodate funding requirements or other local priorities, as well as adjust to meet changing needs and dynamics in the evolving vehicle market and give states the ability to meet policy goals.

Most importantly, VIPs make fleet acquisition of zero-emission trucks, buses, and other commercial vehicles easier and more affordable. In a VIP, public funds are used to reduce the incremental cost difference between a conventionally fueled vehicle and a comparable zero-emission vehicle. Caps for each category of vehicle may set an upper limit of public funds for each vehicle. Dealer networks help fleets navigate the VIP process and take on the responsibility of completing voucher redemptions. As a result, fleets see a lower purchase cost, while dealers receive the full price—public funds make up the difference between the invoice price and the voucher-reduced price the user pays. The basic steps in a VIP are laid out in Figure ES-1 and discussed in greater detail in Section II.

Figure ES-1. Major Stages of Voucher Application and Processing in a VIP



VIP Successes Across the United States

The VIP model has been implemented successfully in several locations around the United States. Established initially in 2009, California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) was an immediate success that validated the VIP design. In its first year of operation, HVIP disbursed its funds faster than any program in CARB history and was recognized as the number-one emerging state energy project by the American Council for an Energy Efficient Economy (ACEEE, 2010).

The HVIP program alone has provided or reserved funding for more than 11,000 all-electric and hybrid vehicles and low nitrogen oxide (NOx) engines since inception (as of January 31, 2023) (Table ES-1).[1] More than 6,000 of these vouchers have been for zero-emission vehicles. HVIP—and all VIP programs nationally—are now focused almost exclusively on zero-emission vehicles. HVIP cumulative voucher investments as of January 2023 total close to $1 billion dollars: $959 million (Table ES-1). It has also spurred a highly successful off-road program, the Clean Off-Road Equipment Voucher Incentive Project (CORE) and a parallel infrastructure program, Energy Infrastructure Incentives for Zero-Emission (EnergIIZE) Commercial Vehicles.

Ensuing programs in New York State and Chicago initially used federal Congestion Mitigation and Air Quality Improvement (CMAQ) funding with innovative program designs tailored to each jurisdiction's particular regional needs. New York has now further expanded its funding via Volkswagen Settlement funds. Similarly, new programs in New Jersey and Massachusetts have tailored their programs to their unique funding sources and regional policy goals. Total funding amounts, per-vehicle incentive levels, and priorities for deployment differ slightly between these programs, but each provides a simple, streamlined purchase incentive that reduces upfront costs for zero-emission trucks and buses.

The most impressive aspect of these programs is their combined impact. As of the end of January 2023, these programs and their ongoing investments have together spurred the purchase of over 15,000 clean vehicles and equipment—more than 9,000 of which (60 percent) were zero-emission (Table ES-1). Based on a documented ability to leverage $3 in additional investment for every $1 of voucher funds, CALSTART estimates these programs have also driven more than $5.2 billion in economic activity (HVIP, n.d.). When currently

[1] CALSTART compiled funding and voucher data from each of the VIPs through discussions with program staff, publicly posted information, and other sources.

available funds are included, these programs are on track to push forward more than $9.6 billion in clean tech activity once all currently available funding is reserved (Table ES-1).

Table ES-1. Impact: Regional VIP Voucher Funds Reserved or Awarded, Available Funding, and Vehicle Sales (as of Jan 2023)

VIP Program	Voucher Funding to Date	Funding Available	Total Vehicles & Equip. to Date	Zero-Emission Vehicles & Equip.	Hybrid Vehicles	E-PTOs	Natural Gas & LPG[2] Vehicles	DPFs[3]
California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)	$959 M	$738 M	11,379	6,026	2,580	304	2,469	-
New York Truck Voucher Incentive Program (NYTVIP)	$54.9 M	$25.9 M	814	239	319	-	132	124
New Jersey Zero-Emission Incentive Program (NJ-ZIP)	$44.25 M	$45 M	400	400	-	-	-	-
Drive Clean Chicago	$11.3 M	$0	288	49	221	18	-	-
Massachusetts Offers Rebates for Electric Vehicles – Trucks (MOR-EV Trucks)	$10 M	TBD	221	221	-	-	-	-
Clean Off-Road Equipment Voucher Incentive Project (CORE)	$239 M	$273 M	2,297	2,297	-	-	-	-
Totals	**$1,318.5 M**	**$1,082 M**	**15,399**	**9,225**	**3,120**	**322**	**2,601**	**124**

[2] Only currently offered in NYTVIP.

[3] No longer offered by any VIPs.

Flexible to Funding Source Requirements

VIP designs can be highly customized to allow program planners to express preferences for clean air goals, invest in targeted communities, and evolve to add new technologies. The VIP model can flexibly accommodate a wide range of policy objectives, such as:

- Promoting or excluding solutions based on their GHG or criteria pollutant impacts;
- Adjusting funding caps by gross vehicle weight or by technology type to emphasize development and deployment of particular classes of vehicles or technologies; or
- Reserving incentives or adding additional incentives for vehicles domiciled in or predominantly serving areas that are identified as environmentally or socially disadvantaged.

To promote the greatest flexibility to meet any jurisdiction's clean transportation goals, VIPs can be designed for zero-emission technologies only or can be expanded to include multi-fuel and multi-technology solutions as needed. The design flexibility of a VIP can also be extended to meet the requirements set forth by different sources of publicly available funding. Funding for VIPs has been allocated from various state and federal programs (including new federal sources now available), as well as from Appendix D of the Volkswagen Settlement (the Mitigation Trust). Sometimes local sources of funding can be added to augment a program. In each case, the regional VIP was configured to accommodate requirements or goals from each funding source:

- In California, the original VIP—**HVIP**—is funded by CARB primarily from various state-based sources (HVIP, n.d.a). However, HVIP has also been augmented by accepting funds from other agencies, including the Ports of Los Angeles and Long Beach. Port funding allows vehicles within that specific jurisdictional area to receive increased funding provided for zero-emission drayage trucks. In this case, regional funding was designed to accelerate fleet acceptance even further in a region beset with serious air quality challenges.
- The New York Truck Voucher Incentive Program (**NYTVIP**) managed by the New York State Energy Research and Development Authority (NYSERDA) launched using federal funding, as did the now-completed **Drive Clean Chicago** program from the City of Chicago (NYSERDA, n.d.; CDOT, 2020). The federal dollars were distributed through the CMAQ program of the Federal Highway Administration (FHWA). Vehicles deployed needed to be compliant with waivers for the federal Buy America requirement for vehicle purchases. However, Buy America guidelines and waiver guidance have been in review and delayed since 2018, creating issues for using the

funds. While new guidance is expected in 2023, Chicago has decided to focus its future CMAQ funds on infrastructure (FHWA, 2023).

- The New York program has now also incorporated funding from the Volkswagen Settlement, which requires scrapping 2009 or older vehicles as a prerequisite for earning incentives on new, clean vehicles. The VIP model for New York was revised to make use of a network of scrapyards throughout the state and to establish a clear process for scrapping vehicles before voucher reimbursements are issued.
- The relatively recent New Jersey Zero-Emission Incentive Program (**NJ-ZIP**), operated by the New Jersey Economic Development Authority (NJEDA), is funded from regional sources (NJEDA, n.d.). It uses proceeds from the Regional Greenhouse Gas Initiative (RGGI) to enable its program, which has provided significant flexibility of action. NJ-ZIP is focused on zero-emission trucks and buses only. Its first phase targeted primarily urban centers suffering from the worst air pollution, but its second phase starting in 2023 is open to the entire state.
- Massachusetts Offers Rebates for Electric Vehicles – Trucks (**MOR-EV Trucks**) is funded by the Massachusetts Department of Energy Resources (DOER) (DOER, n.d.). Initially designed as a rebate program for passenger cars, it has been expanded and modified to meet the specific needs of commercial vehicle operators by allowing fleets to reserve funds before a purchase.

As shown, the VIP design is highly effective and flexible. In each jurisdiction where the voucher incentive model has been implemented, funding requirements have been seamlessly integrated to produce a simple, successful program. These considerations are explored in Sections III and IV.

New and Expanded Sources of Federal Funding for State VIPs

With the passage in 2021 and 2022 of two significant pieces of federal funding legislation, states now have much greater access to dollars that can be used to structure and run their own VIP and other incentive programs. IIJA is the primary source bringing new and expanded funding to programs. However, the Inflation Reduction Act (IRA) also contains important incentive provisions for vehicle and infrastructure deployment that states can expand upon and extend with their own programs.

Within IIJA's massive $1.3 trillion overall scope, roughly $35 billion has been set aside specifically for investments that reduce transportation emissions (Garcia Coyne, 2022).

There is also significant additional funding available that has the flexibility to be used for transportation emissions reductions, but it is not earmarked solely for this purpose.

The bulk of the funding will be distributed to states and local governments via formula funding and competitive grants. A Georgetown Climate Center assessment found that states have great flexibility to allocate funds from multiple other federal highway programs into the programs listed below and will be able to use the funding for incentives or other allowed purposes (Levandowski, 2023).

Based on CALSTART research, four IIJA programs stand out as the best new or augmented federal funding sources for VIP-style state and regional vehicle incentive programs (Garcia Coyne, 2022). These funding programs and their allocations are (White House, 2022):

- Carbon Reduction Program—$6.4 billion over five years;
- CMAQ—$13.2 billion over five years;
- National Highway Freight Program—$7.1 billion over five years; and
- Tribal Transportation Program—$2.9 billion over five years.

VIPs are just one critical part of what comprises a larger transition to clean commercial vehicles. VIPs work well in concert with complementary efforts to help fund infrastructure installation, fleet planning assistance, and workforce development. The following IIJA programs appear best suited for vehicle and infrastructure incentive programs (Table ES-2). The assessment and workforce programs are listed not to fund incentives but because they can be used in parallel with incentive funding as part of a total transportation transformation strategy.

Table ES-2. State Actions Compatibility with IIJA Programs

State Actions	ATTIMD	CARP	CMAQ	CORP	DGPCFI	IRAGP	NEVI	NHFP	RSTGP	SIB	STBGP	TTP
1. **Point-of-sale Voucher Incentives**		**X**	**X**					**X**				**X**
2. Needs Assessments and Project Implementation Grants	X	X	X	X				X				X
3. Depot Charging Incentives		X	X					X	X			X
4. Publicly Accessible Corridor Charging and Refueling Incentives	X	X	X		X	X	X	X	X		X	X
5. Publicly Accessible Urban Hub Charging and Refueling Incentives	X	X	X		X	X	X	X	X		X	X
6. Workforce Development Programs		X	X		X		X		**X**		X	X
7. Fleet Assessment Services		X	X					X				X

Chart adapted from *Investment Strategies to Accelerate Clean Transportation in the Northeast*, a CALSTART white paper published May 31, 2022.

Funding compatibility accurate as of May 10, 2022, based on eligible projects and use of funds descriptions stated in the U.S. Code. (U.S. Congress, 2021; 23 U.S. Code §129, §133, §149, §167, §503, §202, §173, §117, §151, §175, §610; 49 U.S. Code §5339, §5302; U.S. DOT, 2022a; U.S. Congressional Research Service, 2022.)

Key	
ATTIMD - Advanced Transportation and Technologies and Innovative Mobility Deployment CARP - Carbon Reduction Program CMAQ - Congestion Mitigation & Air Quality Improvement Program CORP - Congestion Relief Program DGPCFI - Discretionary Grant Program for Charging and Fueling Infrastructure IRAGP - Infrastructure for Rebuilding America Grant Program	NEVI - National Electric Vehicle Infrastructure (NEVI) Formula Program NHFP - National Highway Freight Program RSTGP - Rural Surface Transportation Grant Program SIB - State Infrastructure Banks STBGP - Surface Transportation Block Grant Program TTP - Tribal Transportation Program

The IIJA programs represent once-in-a-generation increases in funding available to state and local jurisdictions. Nonetheless, to meet the scale of emissions reductions required and to comply with IIJA match funding requirements, governments will need to bring their own sources of funding to the table as well. This can take the form of state and regional cap-and-trade funding (such as California's Assembly Bill 32 program or RGGI), programs such as the Low Carbon Fuel Standard, bond funding, general fund revenues, and potentially private sector contributions via match for vehicle purchase.

The use of these federal funds can also bring challenges, which this white paper details in Section III. For instance, FHWA's CMAQ program has provided flexible funds suited for vehicle VIPs that two regions (New York and Chicago/Illinois) have used to fund VIPs. However, since 2018, delays in both providing clear Buy America guidance for using the funds (to purchase vehicles) and in providing waivers to the requirement have limited their use and frustrated state authorities, though this issue may be rectified in 2023. Buy America guidance for use of CMAQ funds for infrastructure has been issued and at least one region, Chicago, plans to create an infrastructure incentive program with its funds.

Separately, it is also important to note that IRA is providing funding for two important national tax credits to support zero-emission MHDV deployment. One is a 30 percent tax credit for zero-emission commercial vehicles themselves (capped at $40,000 for vehicles from 14,000 pounds gross vehicle weight rating (GVWR) and higher, and $7,500 for vehicles under that weight), and the other is a 30 percent tax credit for MHDV infrastructure, with a cap of $100,000 (Internal Revenue Service, 2023; EV Connect, 2022).

As this white paper outlines, tax credits alone are not the preferred tool for speeding commercial vehicle transformation. The primary reasons are: 1) not all fleets—particularly small fleets—can make use of the credit because it requires having sufficient tax liability; 2) tax credits do not directly reduce the vehicle price at the time of sale and therefore do not change commercial purchase decisions; and 3) tax credits are further discounted based on the tax rate of the entity involved.

Nonetheless, a tax credit that is combined with a regional direct incentive (VIP) would be highly effective together and might allow the regional incentive to be smaller than if operating alone. With states now able to program new federal funds to create their own regional incentive programs, states have the ability to enhance the tax credit's effectiveness by using their allocated federal funds to directly reduce the vehicle's base cost via a VIP. The two tools working together make for a very powerful incentive strategy. These issues are further discussed in Section II.

Lessons Learned and Recommendations

A VIP lays the groundwork for a regional zero-emission and clean vehicle economy. The impact of these investments is felt beyond the simple deployment of zero-emission trucks or buses; these vehicles all require manufacturing and shipping, as well as new infrastructure and systems of fueling, servicing, and operating the vehicles. The investment made through a VIP is accompanied by a growth in related manufacturing and services. With continued investments, a regional and national zero-emission and clean vehicle economy can grow and mature into a sustainable, thriving industry.

Important lessons have been learned through the years in terms of establishing, funding, and operating a successful VIP program. These considerations are discussed fully in Section V. The most important issues to address are listed below:

- **Outreach is needed to realize program benefits.** A program administrator or partner should reach out on an ongoing basis to market participants to provide information and education about the technology, application segment opportunities, and total cost of ownership (TCO) improvements of zero-emission vehicles, including providing access to TCO calculators and pricing information.
- **Infrastructure planning and funding is critical to success.** The largest and fastest growing need is for fleets to plan their infrastructure installation in advance of their vehicle purchase, and for funding assistance to be provided to help fleets make the transition. All VIP programs need to provide clear guidance to fleets about how to plan adequately for infrastructure, whether for electric charging equipment and utility connections or for hydrogen fueling systems. These installations have lead times that can be longer than the build time for the vehicles.
- **Hands-on assistance is needed for fleets.** The transition to zero-emission technology, while providing multiple benefits to operations and business case, is still a paradigm shift that can be daunting to fleets, particularly smaller fleets and owner-operators. Fleets need extra hands-on assistance to go from the fuels and maintenance practices they know to entirely new vehicles.
- **Experiencing zero-emission vehicles in person breaks down myths.** Most fleets have yet to touch, feel, and drive these vehicles. Such an experience can be transformative. Zero-emission truck and bus showcase events inviting dealers and manufacturers to bring their vehicles for fleets to see and drive, packaged with training sessions, have been highly successful.

- **Longer-term funding certainty creates opportunity for growth.** Vouchers that are available over a long period create predictability and cost certainty for fleet adoption. Additional certainty could be provided if the funding sources were allocated for several years at a time rather than single-year allocations.
- **Train users on requirements in a clear, concise manner.** While simple in design, all these programs also designate clear and ongoing requirements for participants. Engaging with vendors and fleets early—before their order is made—to clearly review and demonstrate understanding of program requirements will help participants and administrators with compliance and efficient voucher applications.
- **Requirements drive interest.** Incentive programs do not function in a vacuum. Having clear state and federal goals and regulations setting the pace and timing for the transition to zero-emission commercial vehicles establishes the need and the urgency that incentives can help address.
- **Incentives are needed in more than one state**. There is a clear need to expand voucher programs to new states to build overall national vehicle volumes and fleet user experience and knowledge to match the pace of vehicle adoption climate change will require.

A broader network of incentives will increase the size and scope of the early market, leading directly to additional air quality and petroleum reduction benefits. It also leads to increased vehicle sales, creating and retaining jobs in this industry. Perhaps most importantly, a broader network of incentives will help boost volumes and drive down costs through economies of scale, creating a virtuous cycle that will increase deployment and further drive down costs.

In the short term, a VIP helps immediately reduce the upfront cost and technological acquisition barriers of zero-emission commercial vehicle adoption. In the longer term, VIPs can help create innovative, self-sustaining centers of excellence that enable industry to meet the growing needs for zero-emission trucks and buses.

I. Introduction: Why Vouchers?

Investments and innovations in zero-emission and clean buses and trucks are progressing at a rapid pace in the United States and across the world. These accelerated changes are driven by a combination of factors, the most critical being the accelerating urgency of making immediate greenhouse gas (GHG) reductions. The March 2023 synthesis report from the United Nation's Intergovernmental Panel on Climate Change (IPCC) makes clear that reductions must begin immediately to avoid the most damaging impacts from climate change temperature increases (IPCC, 2023). There are other important drivers as well, including more rigorous fuel economy and carbon requirements for commercial trucks and buses, volatility in fossil fuel prices, state and city efforts to reduce criteria pollutants and promote environmental justice, corporate sustainability and climate commitments, and concerns over energy security and fuel diversity. Accelerating the deployment of zero-emission buses and trucks is a recognized reduction strategy; with this solution, cities and states can meet climate and air quality policy goals on the urgent timeline required (IPCC, 2023).

Yet fleet adoption of zero-emission vehicles has been slowed by the comparatively high costs of the new technologies. Policymakers, manufacturers, and end users have experimented with a number of policy tools to promote zero-emission and clean vehicle adoption, and in several locations these groups have come together to efficiently deploy vehicles through a highly innovative, flexible, and successful tool—the voucher incentive program (VIP).

This white paper provides an overview of motivations for and the mechanics of a VIP, a proven incentive model that has been successfully implemented in leading regions throughout North America. In the following sections, this brief will:

1. Explain the need for purchase incentives and the merits of a VIP;
2. Review program design elements;
3. Demonstrate VIP flexibility to meet a range of funding sources and highlight new sources of federal funds that states can use to create their own programs;
4. Highlight the jurisdictions that have instituted VIPs and the clean vehicle successes in each location; and

5. Review lessons learned from existing VIPs, provide recommendations for program design, and suggest next steps for interested stakeholders.

The Need for New Incentives

High incremental cost is cited by fleet purchasers as the prime barrier preventing zero-emission and vehicle purchases (Van Amburg, 2010). While these higher costs should diminish as production volume increases, they persist as an impediment to early market growth and necessitate effective incentive structures that can mitigate these upfront cost disparities in the near term.

Traditionally, incentives have taken the form of tax credits because these were the most politically viable incentive structures at the federal level and generally required no direct funding. Rather than appropriating funds, a tax credit simply reduces future government revenue. Tax credits have been valuable in advancing consumer light-duty vehicle uptake, though rebates that reduce the upfront purchase price have been shown to be more effective than incentives distributed through tax credits (Electrification Coalition, 2018; Descant, 2018). In the commercial medium- and heavy-duty vehicle (MHDV) segment, however, tax credits have not been as successful in promoting uptake of clean vehicles for many reasons: primarily, a tax credit has no immediate financial impact at the time of a purchase decision and thus fails to address the issue of greater capital outlay for fleets. Additionally, many fleets are unable to benefit from tax credits, either because they lack sufficient tax liability or because the credit is monetized elsewhere in the company and does not flow down to the fleet manager's budget or is discounted by the company's tax rate. In other cases, fleets may be tax-exempt public or municipal fleets that are ineligible for tax credits.

The Voucher System Solution

Most fleets factor in upfront purchase price as a critical factor in their business case assessment and therefore their purchase decision. The tax credit approach does not sufficiently change that equation. To remedy these shortcomings, a team of fleet, government, and industry representatives designed an alternative approach that more directly addresses the barrier of high upfront cost—the **point-of-purchase voucher**. When surveyed, both fleet users and manufacturers identified streamlined vouchers that directly reduce vehicle purchase cost as the most effective tool on the list of incentives and support policies for advanced truck technologies. Point-of-sale incentives ranked above research and development investments, tax credits for vehicle purchases, and oil surcharges to create price signals (Van Amburg, 2010).

Since their implementation, vouchers have become the preferred incentive for purchasers of zero-emission and clean vehicles to reach early scale (CALSTART, 2012). In a voucher program, public funds are used to reduce technology costs at the point of purchase. Fleets see a lower purchase cost, while dealers receive full price for the vehicles or retrofits because public funds make up the difference between the original price and the reduced voucher price.

Vouchers are preferable to tax credits, grants, loans, accelerated depreciation, and other purchase incentives because they are simple, direct, and immediate:

- Vouchers directly lower the incremental price of the advanced technology at the point of purchase, which is a valuable approach for fleet managers that are working with fixed budgets and may never see the benefits of tax credits.
- The administrative burden for agency staff is small with minimal delay and involves no grant writing and no delays for grant review and selection. Trained vehicle dealers handle all documentation, reducing the burden on the fleet customer.
- Vouchers currently support zero-emission vehicles but can include a range of clean and alternative fuel technologies.
- The purchasing organization does not need to have tax liability to take advantage of a voucher. Tax-exempt entities, such as government fleets, can take advantage of vouchers, whereas they cannot take advantage of tax credits.
- There is no question as to whether a fleet will receive a voucher based on subjective judgment of their project or grant proposal. Designed properly, vouchers have clear rules and pre-set amounts for vehicle types, so the voucher provides certainty of outcome for requesters who follow eligibility guidelines.

The result is a lower purchase price for fleets and an increase in sales for manufacturers and suppliers, leading to reduced GHG emissions, improved air quality, and support for a regional clean commercial economy.

Growing Markets Locally and Globally with Incentives

By helping to spur a network of zero-emission vehicles within a particular city or state, a VIP lays the groundwork for a regional clean vehicle economy. The impact of clean vehicle investments is felt beyond the simple deployment of discrete zero-emission trucks or buses; these vehicles all require manufacturing and shipping, as well as new methods and systems of fueling, servicing, and operating. The zero-emission and clean vehicle investment made through a VIP is accompanied by a growth in related manufacturing and services. With continued clean vehicle investments, a regional clean vehicle economy will grow and mature into a sustainable, thriving industry.

The strategy of investing in targeted, first-mover regions is critical to the success of the early zero-emission vehicle market. It is a core focus of the Global Commercial Vehicle Drive to Zero™ (Drive to Zero) program led by CALSTART and a coalition of worldwide industry and governmental stakeholders. A region may be defined as a national or subnational clean vehicle market and may range from a large city or a state to a connected series of cities and states or a full nation. Drive to Zero partners and signatories commit to a strategy that will "significantly reduce criteria pollutants and greenhouse gases by enabling and expanding the use of zero-emission technology in targeted segments ("beachheads") of the medium- and heavy-duty vehicle market on a worldwide basis." (Welch, 2019)

As of January 2023, 27 countries have further committed to a Global Memorandum of Understanding for Zero-Emission Medium- and Heavy-Duty Vehicles (Global MOU) (CALSTART, n.d.). This Global MOU commits signatories to meet 30 percent zero-emission sales by 2030 and 100 percent by 2040. To achieve this goal requires accelerating adoption of zero-emission commercial vehicles in all segments possible, via regulations, policies, investments, and incentives. By coordinating these actions and focusing on similar zero-emission vehicle segments ready for deployment, the signatories and other supporters—including regions with their own VIP programs—contribute to the creation of a global supply chain for common components, adding to increased production volumes and lower prices in future years (CALSTART, n.d.a).

II. How Do Voucher Incentives Work?

Zero-emission commercial vehicles have advanced far past the preliminary test and demonstration stage. They now have established commercial availability and viability and are ready to emerge at increasing scale. Jurisdictions seeking to promote this technology to advance clean air and climate goals need effective policy tools to quickly and efficiently support the uptake of these vehicles. Vouchers play a critical role in accelerating these on-the-cusp markets for established but low-volume technologies.

The earliest state model to demonstrate the function, flexibility, and effectiveness of a voucher-based incentive program for commercial vehicles was California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP). HVIP was developed and is funded by the California Air Resources Board (CARB) and is administered by CALSTART on its behalf. The project officially opened its doors in February 2010, using state funds from license fees specifically dedicated to support advanced vehicle and fuel demonstration and deployment. In the intervening years, HVIP has been funded by multiple sources, including auction proceeds from California's statewide GHG cap-and-trade program (designed pursuant to California Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006), as well as state general fund and other dollars. HVIP has been a key component of CARB's Low Carbon Transportation Investments and Air Quality Improvement Program (AQIP), which is focused on supporting development and deployment of the advanced technologies needed to meet California's longer-term, post-2020 air quality goals. Its success as a powerful tool for rapid deployment has encouraged regional adaptations of the voucher model in other states.

The VIP model expanded in 2013 to New York and in 2015 to Chicago, following the same basic principles that made HVIP so successful while adapting to meet local policy goals and funding requirements. Where HVIP has been funded by dedicated state funding streams, the New York Truck Voucher Incentive Program (NYTVIP) and the now-completed Drive Clean Chicago have utilized federal funding programs to develop simple and effective MHDV deployment programs. Since then, both New Jersey and Massachusetts have also launched variants of the VIP model using their own unique funding sources. The launch and subsequent success of these programs demonstrates the effectiveness of the VIP model and its robustness to new jurisdictional needs, and their challenges are also instructive. Details on each of these programs are provided in Section IV.

Basic VIP Framework

The VIP method is effective because it reduces the upfront cost of vehicles and does so in a streamlined way for users. In response to industry research by CALSTART and the feedback of fleets and manufacturers, HVIP was originally designed to directly reduce the incremental purchase cost of eligible hybrid and zero-emission MHDVs. HVIP initially set voucher amounts at half of the incremental cost for first hybrid and then zero-emission vehicles—funding deemed critical by fleets and manufacturers to assist the early market. Importantly, CARB retains flexibility to adjust incentive levels as needed to continue to meet market dynamics and provide adequate market demand. Responding to market needs, HVIP zero-emission voucher amounts now target full incremental cost. In other jurisdictions, the incentives for each vehicle have been set following a similar rationale, with a distinct cap based on gross vehicle weight rating (GVWR). At any level of compensation, reducing upfront vehicle costs for fleets meets a crucially important need identified by stakeholders.

VIPs are designed to be as clear and easy as possible for all involved parties by providing simple rule structures and transparency about available funds and use limits. The program provides clarity on which vehicle technologies are eligible and if any other restrictions apply, such as geographic boundaries or, in some cases, any scrappage requirements. Once the program parameters have been established, the process of facilitating zero-emission and clean vehicle adoptions and voucher incentives begins in earnest.

As an example, in all VIPs administered by CALSTART, a voucher processing center (VPC) guides participants through the voucher request and redemption process and tracks documentation. VIP participants fit into three categories: manufacturers, vendors, and fleets. Manufacturers are the original equipment manufacturers or equipment modifiers that produce eligible vehicles and submit vehicle information for listing on program websites. Vendors connect manufacturers and fleets to coordinate sales and usher parties through the voucher application and documentation processes. Frequently, vehicle dealers or manufacturers serve the role of the vendor, which is the party that works most closely with the program administrator and VPC to complete the voucher process. These parties work to deliver clean vehicles to fleets, who are the end users that operate the vehicles according to the terms set forth by the program administrator and agency sponsor (e.g., term of ownership or lease, geographic boundaries for domicile and/or operation).

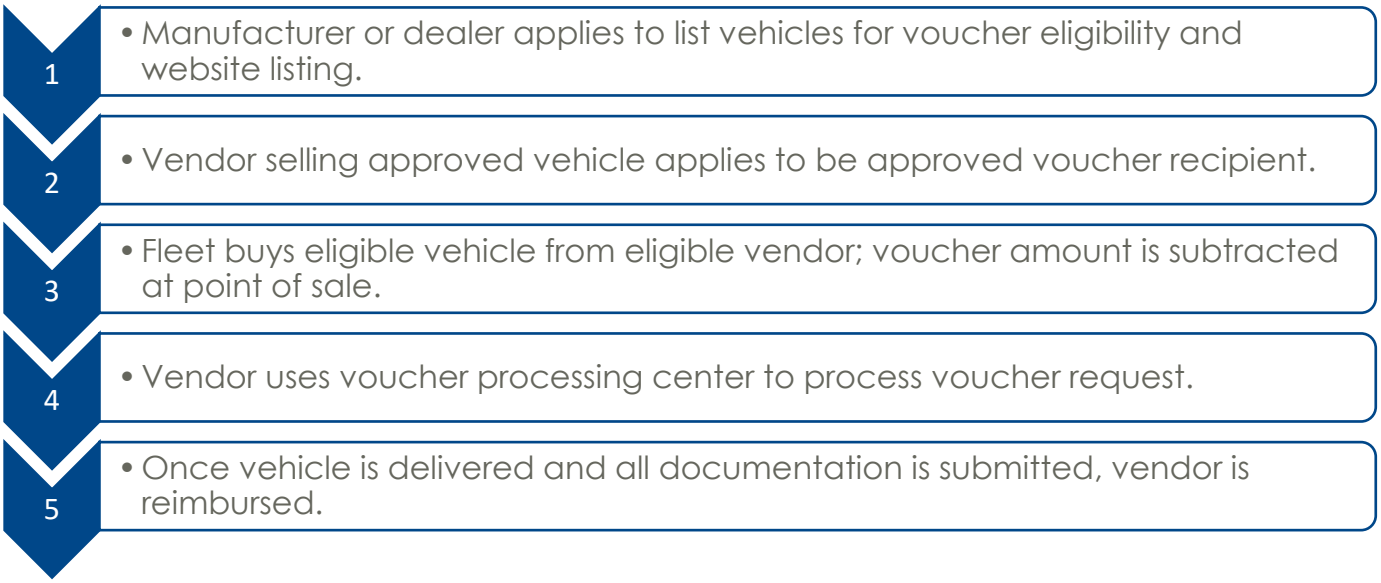
At the creation of a VIP, the local funding agency decides which vehicles will be eligible for incentives and priorities they may wish to encourage (e.g., encouraging placement of clean vehicles in communities facing the highest emissions burdens). The administrator works with vehicle manufacturers to sign up eligible vehicles in the program and assign

voucher amounts. Vendors who sell those vehicles are trained on the VPC and assigned user accounts. The VIP process begins when a sale is arranged. Vendors request vouchers on behalf of the fleet purchasers.

Upon delivery of the vehicle, the fleet pays the vendor for the cost of the vehicle, reduced by the value of the voucher, which will be reimbursed to the vendor through a voucher redemption request that begins at vehicle delivery. Vendors are responsible for collecting information from all parties and managing the voucher application through every phase of the program, including redeeming the voucher once the vehicle is ready for delivery to the customer.

The VPC tracks the voucher status and, upon vehicle delivery and satisfactory documentation, approves the voucher for payment. The vendor must submit the voucher redemption information and all required sales documentation to the VPC. Once all the information is verified, the program administrator/sponsor pays the voucher amount to the vendor. In HVIP, the time between document approval and payment is typically less than two weeks. At the end of the process, the manufacturer and vendor will have completed the sale of one or more clean vehicles and received full payment, while a fleet operator will be reducing emissions and saving money on operations through a discounted truck or bus. Figure 1 below summarizes these stages of the VIP process.

Figure 1. Major Stages of Voucher Application and Processing in a VIP



Once vehicles purchased with the assistance of vouchers are delivered and operating, the fleet operator must adhere to program rules that may govern the use of the vehicle. To ensure compliance with these rules, a VIP should include a process for vendors and fleets

to acknowledge programmatic requirements. Program rules that fleet operators and/or vehicle manufacturers must adhere to may include documenting and reporting annual vehicle mileage for several years, retaining ownership of a vehicle for a set period, or domiciling and operating a vehicle within established geographic boundaries (e.g., disadvantaged communities (DACs), environmental justice areas, or counties in nonattainment with National Ambient Air Quality Standards (NAAQS)).

Design Flexibility to Advance Policy Goals and Conform to Funding Requirements

The VIP model can be designed to accommodate a wide range of policy objectives and funding requirements; the successful implementation of VIPs across three different jurisdictions with distinct policy goals and funding sources attests to its design flexibility. A single jurisdiction can modify a VIP to comply with a wide range of influences, which could include:

- Promoting or excluding fuels or technologies based on their GHG or criteria pollutant impacts (e.g., requiring renewable fuel use);
- Adjusting funding caps by GVWR or by technology type to emphasize particular classes of vehicles or technologies (e.g., transit buses or heavy-duty trucks);
- Reserving incentives or adding additional incentives for vehicles domiciled in or predominantly serving areas that are identified as environmentally or socially disadvantaged (e.g., HVIP's plus-up incentive adder for vehicles domiciled in DACs);
- Scrapping old vehicles as a prerequisite for earning incentives on new, clean vehicles (as required for projects using Volkswagen Settlement funds); and
- Ensuring that manufacturers comply with any production or assembly requirements mandated by funding sources (e.g., Buy America requirements associated with Congestion Mitigation and Air Quality Improvement (CMAQ)).

Establishing which vehicle technologies will be eligible for incentives and setting the funding levels for those technologies and/or vehicle classes necessitates choices about how the program will be administered. As an example, CARB's fiscal year 2022–23 programmatic decisions for zero-emission trucks and buses are reflected in the incentives in Table 1 and Table 2 (HVIP, n.d.b.).

Table 1. HVIP FY22-23 Zero-Emission MHDV Voucher Amounts

GVWR (lbs.)	Base Amount
8,501 – 10,000	$7,500
10,001 – 14,000	$45,000
14,001 – 19,500	$60,000
19,501 – 33,000	$80,000
>33,000	$120,000

Table 2. HVIP FY22-23 Zero-Emission MHDV Voucher Modifiers

Modifier Type	Amount Above Base
Class 8 Drayage Early Adopter	+ 25%
Refuse	+ 25%
Disadvantaged Community	+ 15%
Class 8 Fuel Cell	+ 100%
Public Transit Agencies	+15 %
School Buses for Public School Districts	+ 65%
Plug-in Hybrid	- 50%
In-Use Converted/Remanufactured	- 50%

These tables demonstrate flexibility to adapt to industry and market changes, highlight the priorities for the program, and showcase a highly streamlined way of managing and conveying those priorities. For the year shown (July 2022 through June 2023), CARB has established base voucher amounts for all zero-emission MHDVs. These amounts can change from year to year, reflecting market conditions, component costs, and other factors. This single base voucher amount by vehicle weight does not create differential

prices between trucks and buses, as was the case in previous years, therefore reflecting the common components in like-sized zero-emission trucks and buses.

Where differences are needed for certain platforms or technologies, they are reflected in the modifier Table 2. CARB has prioritized added funding for early adopters of Class 8 drayage trucks and refuse trucks. Public transit agencies are provided additional funding as are public school districts. Fuel cells, which are less technically ready for scaled production, receive a significant bonus. Any vehicle based and used in a California-recognized DAC also receives additional funding from the base amount.

This specific example highlights the broader point: the VIP model can be designed to accommodate a wide range of policy objectives and funding requirements. The successful implementation of VIPs across multiple jurisdictions with distinct policy goals and funding sources attests to its design flexibility. A single jurisdiction can modify a VIP to comply with a wide range of influences, which could include: small fleet support; deployments in non-attainment air sheds; operations in DACs; and domestic or regional manufacturing.

Just as VIPs can be adjusted to meet policy goals, they can also conform to meet strict funding requirements. For example, Federal Highway Administration (FHWA) funds are subject to a Buy America requirement, which specifies that projects must use domestic steel, iron, and manufactured products to receive funding (FHWA, 2016). Through June 2018, VIPs funded through the CMAQ program had received a Buy America waiver from FHWA, requiring only that a manufacturer complete final assembly of incentive-eligible vehicles in the United States. A VIP funded by CMAQ can reflect the applicable Buy America provisions by working with participating manufacturers to document domestic content and/or location of final assembly when determining vehicle eligibility.

However, since 2018, CMAQ Buy America guidance, and any waivers, have been frozen by politics causing both confusion and stalling any new programs from launching. Because of the Infrastructure Investment and Jobs Act (IIJA), this issue may be resolved in 2023 but has not been as of the date of publication (FHWA, 2023).

Likewise, Appendix D of the 2016 Volkswagen Settlement requires that new vehicle projects correspond to scrapped older, polluting diesel engines. The scrappage requirement assures that new, clean technologies are replacing the polluting diesel vehicles and taking emissions off the road rather than adding to the total vehicle population (typically referred to as the problem of additionality). In this case, a VIP funded using a portion of a state's Appendix D allocation could meet this requirement by designing a scrappage program to verify that an older diesel engine is destroyed prior to (or at the time of) vehicle delivery or voucher redemption.

New Federal Funding Sources for State VIPs

With the passage in 2021 and 2022 of two major pieces of federal legislation to spur investments in infrastructure deployment and inflation reduction, the nation and states also gained new, powerful, and multiyear sources of funding for programs to reduce climate emissions and create jobs in the transportation and energy sectors. IIJA and its subsidiary programs are the primary driver of the new funds that states can use to fund their own regional programs, including VIPs, which represent the immediate programs to target. However, the programs flowing from the Inflation Reduction Act (IRA), particularly the tax credits for zero-emission MHDVs and for MHDV infrastructure, can be foundations upon which state and regional programs can further expand and enhance their effectiveness.

Within IIJA's massive $1.3 trillion overall scope, roughly $35 billion has been dedicated specifically for investments that reduce transportation emissions (Garcia Coyne, 2022). A significant portion will be distributed to states and local governments via formula funding and competitive grants. There is additional funding available that can be used for transportation emissions reductions, but it is not earmarked solely for this purpose. These amounts represent large increases in funding available to state and local jurisdictions. For example, in 2022, the first year of IIJA implementation, funding to states under the Federal-Aid Highway Program (which covers most highway assistance funding) increased by roughly 30 percent over the previous year, according to the Georgetown Climate Center (Levandowski, 2023).

Based on research from CALSTART, four IIJA programs stand out as the best new or augmented federal funding sources for VIP-style state and regional incentive programs (Garcia Coyne, 2022). These funding programs and their allocations are (White House, 2022):

- Carbon Reduction Program—$6.4 billion over five years
- CMAQ—$13.2 billion over five years
- National Highway Freight Program—$7.1 billion over five years
- Tribal Transportation Program—$2.9 billion over five years

CMAQ is the best known of these programs, and its funding has been significantly enhanced under IIJA. It has already been used by several states to fund VIP programs, and as part of IIJA, it includes additional language supporting its use for zero-emission vehicle incentives. The addition of other big funding sources now provides even greater options for states to create their own incentive programs. Nonetheless, to meet the scale of emissions reductions required and to comply with IIJA match funding requirements, state and local

governments will need to bring their own sources of funding to the table as well. This can take the form of state cap-and-trade funding (such as California's AB 32 program or the Regional Greenhouse Gas Initiative (RGGI)), programs such as the Low Carbon Fuel Standard, bond funding, general fund revenues, and potentially private sector contributions in the form of match for vehicle purchase.

These specific programs are important because they can support VIP use and their budgets have been increased. However, states also have tremendous flexibility to further increase the funding in these programs. States have the power to move their allocated federal funds from one funding program into another and to use the rules of the program where the funds have been moved. This is powerful flexibility to meet state priorities, because while funding for the programs that can support VIPs have increased, they are small compared to the $148 billion in the National Highway Performance Program (NHPP) or the $72 billion in the Surface Transportation Block Grant (STBG) Program (White House, 2022).

A Georgetown Climate Center brief provides an excellent definition of what flexibility means to create transportation emissions-reduction programs such as VIPs. It reports that states have the authority to transfer up to 50 percent of the funding in Federal-Aid Highway Programs to another program funded under the same authority. For example, a state could use this flex authority to reallocate some percentage, up to 50 percent, from their NHPP or STBG funds to CMAQ, the Carbon Reduction Program, or the National Highway Freight Program if these uses better match their priorities. For some states, this allows them to turn freeway concrete dollars into emissions-reduction dollars (Levandowski, 2023).

In parallel with this significant amount of direct funding states can use to establish their own VIP incentive programs, it is important to note that IRA enacted two important national tax credits to support overall zero-emission MHDV deployment. One is a 30 percent tax credit for zero-emission commercial vehicles themselves (capped at $40,000 for vehicles from 14,000 pounds (lbs.) GVWR and higher, and $7,500 for vehicles under that weight) and the other is a 30 percent tax credit for MHDV infrastructure, with a cap of $100,000 (Internal Revenue Service, 2023; EV Connect, 2022).

As this white paper has shown, tax credits alone are not the preferred tool for speeding commercial vehicle transformation by fleets or industry. The primary reasons are: 1) not all fleets—particularly small fleets—can make use of the credit because it requires having sufficient tax liability; 2) tax credits do not directly reduce the vehicle price at the time of sale and therefore do not change commercial purchase decisions; and 3) tax credits are further discounted based on the tax rate of the entity involved.

However, a tax credit that is combined with a regional direct incentive, such as a VIP, would be a very powerful combination. It might also allow the regional incentive to be smaller than if it were operating alone. Therefore, states are now able to use new federal funds to create their own regional incentive programs and through them can enhance the national tax credit's effectiveness by using VIP funds to directly reduce the vehicle's base cost. The two tools working together make for a very attractive incentive strategy.

VIPs are just one critical part of what comprises a larger transition to clean commercial vehicles. VIPs work well in concert with complementary efforts to help fund infrastructure installation, fleet planning assistance, and workforce development. The following IIJA programs appear best suited for vehicle and infrastructure incentive programs (Table 3). The assessment and workforce programs are listed not because they fund incentives but because they can be used in parallel with incentive funding as part of a total zero-emission transportation transformation strategy.

Table 3 provides an overview of the IIJA funding categories mapped against potential state use of the funding for incentive and support projects.

Table 3. State Actions Compatibility with IIJA Programs

State Actions	ATTIMD	CARP	CMAQ	CORP	DGPCFI	IRAGP	NEVI	NHFP	RSTGP	SIB	STBGP	TTP
1. Point-of-sale Voucher Incentives		**X**	**X**					**X**				**X**
2. Needs Assessments and Project Implementation Grants	X	X	X	X				X				X
3. Depot Charging Incentives		X	X					X	X			X
4. Publicly Accessible Corridor Charging and Refueling Incentives	X	X	X		X	X	X	X	X		X	X
5. Publicly Accessible Urban Hub Charging and Refueling Incentives	X	X	X		X	X	X	X	X		X	X
6. Workforce Development Programs		X	X		X		X		**X**		X	X
7. Fleet Assessment Services		X	X					X				X

Chart adapted from *Investment Strategies to Accelerate Clean Transportation in the Northeast*, a CALSTART white paper published May 31, 2022.

Funding compatibility accurate as of May 10, 2022, based on eligible projects and use of funds descriptions stated in the U.S. Code. (U.S. Congress, 2021; 23 U.S. Code §129, §133, §149, §167, §503, §202, §173, §117, §151, §175, §610; 49 U.S. Code §5339, §5302; U.S. DOT, 2022a; U.S. Congressional Research Service, 2022.)

Key	
ATTIMD - Advanced Transportation and Technologies and Innovative Mobility Deployment CARP - Carbon Reduction Program CMAQ - Congestion Mitigation & Air Quality Improvement Program CORP - Congestion Relief Program DGPCFI - Discretionary Grant Program for Charging and Fueling Infrastructure IRAGP - Infrastructure for Rebuilding America Grant Program	NEVI - National Electric Vehicle Infrastructure (NEVI) Formula Program NHFP - National Highway Freight Program RSTGP - Rural Surface Transportation Grant Program SIB - State Infrastructure Banks STBGP - Surface Transportation Block Grant Program TTP - Tribal Transportation Program

Key Takeaways

A VIP is a well-structured, highly transparent tool that: 1) makes abundantly clear how the program operates and the available level of funding, 2) lays out the responsibilities and processes for manufacturers, vendors, and fleets, and 3) provides support and certainty for participants. VIP designs are not entrenched or rigid but rather are highly customizable to allow program planners to express preferences for clean air goals, invest in targeted communities, and evolve to add new technologies.

Additional city, state, and regional government agencies adopting the VIP model for clean vehicle funding programs will drive an accelerated pace of zero-emission commercial vehicle adoption that can meet increasingly more demanding requirements necessary to combat the effects of climate change. Each jurisdiction should emphasize the technologies and applications of greatest interest to their regional goals and consider how to engage organizations such as CALSTART to serve as a resource to help implement and administer their VIPs.

III. Flexible Designs for Any Funding Source

This section reviews some of the multiple funding sources that have been used for VIPs: state-level funding, regional climate funding, federal Department of Transportation funding from the CMAQ program, and funding distributed through a series of 2016 and 2017 settlements between Volkswagen and the U.S. Environmental Protection Agency (EPA). Examples of state-level funding sources include proceeds from policy initiatives, such as a cap-and-trade market (i.e., California's AB 32 market), dedicated license plate fees, or other legislative appropriations. Regional funding is represented by RGGI in the Northeast and Mid-Atlantic. Additionally, states may pass legislation directing discretionary funding to zero-emission and clean vehicle programs. Because state-level funding has specific constraints that apply only to a state or region, and because fewer jurisdictions have access to state-level funding than to CMAQ and Volkswagen Settlement funding, the latter two funding sources will be explored in greater detail.

State Funding: California Cap-and-Trade

The original clean vehicle VIP, California's HVIP, was developed by and is funded through CARB and has been administered by CALSTART since February 2010 on its behalf. The project started using state funds from license plate and registration fees specifically dedicated to support advanced vehicle and fuel demonstration and deployment. HVIP is a key component of AQIP, which is focused on supporting development and deployment of the advanced technologies needed to meet California's longer-term, post-2020 air quality goals.

HVIP was initially launched in 2010 to help speed up the early market introduction of clean, low-carbon hybrid trucks and buses by addressing the biggest barrier to their purchase—high incremental cost. At that time, production volumes were too low to realize price reductions through production volumes or design improvements. Recognizing that market growth for new technology takes time and requires predictability, CARB envisioned HVIP as a flexible, multi-year program to support initial fleet deployment of primarily hybrid trucks and to support early zero-emission and clean truck and bus manufacturers.

The market for clean trucks and buses and the demands of climate change have rapidly evolved since HVIP launched. As a result, HVIP is now focused exclusively on zero-emission

commercial vehicles, in step with the requirements of the state's Advanced Clean Trucks (ACT) rule, which requires zero-emission truck sales from all manufacturers starting in 2024. Similarly, HVIP's funding sources have evolved and increased as well. After the inception of a cap-and-trade program to curb GHG emissions in furtherance of AB 32, subsequent legislation (SB 1204) authorized the use of cap-and-trade auction proceeds to fund a Low Carbon Transportation Program in California, including investments in clean trucks and buses (CARB, n.d.; CARB, 2018). HVIP is currently supported by several funding sources through the Low Carbon Transportation Program. CARB annually approves a funding plan, which now features significant investments from California's General Fund as well. These funds in particular highlight the importance the state places on fighting the climate battle, providing clean air faster for frontline communities, and supplying economic opportunities through these vehicles.

While some hybrids remain in HVIP (plug-in models), the value of hybrid incentives has decreased significantly. Low nitrogen oxide (NOx) engines are no longer funded, having been determined fully market ready on their own and no longer in line with program goals.

In addition to being flexible for changing market and societal requirements, HVIP's design provides great flexibility to accept and accommodate multiple funding sources in a blended approach, bringing funding from similar clean vehicle programs under the HVIP umbrella. As examples, the South Coast Air Quality Management District and the San Joaquin Valley Air Pollution Control District have provided additional funding, programmed through HVIP, for vehicles deployed in their respective regions. The California Energy Commission (CEC) has provided additional incentives for all-electric buses and trucks. The Port of Los Angeles has also provided funding to be programmed through HVIP but specifically targeting zero-emission drayage trucks in the Los Angeles region. These additional incentive funds can be used to extend the base program, or be stacked, offering a greater incentive than the standard voucher amount alone.

Other states can follow California's self-funding example by tapping similar revenue-generating sources, such as what Massachusetts has done with Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) Trucks. In the Northeast and Mid-Atlantic, RGGI provides predictable funding from a long-term power sector cap-and-trade system, which New Jersey is using (RGGI, n.d.). The Transportation and Climate Initiative (TCI) could offer future promise for a transportation-specific, cap-and-invest framework for a similar grouping of states (TCI, 2018).

Federal Funds: The Congestion Mitigation and Air Quality Improvement Program

Unlike California's HVIP, which is based on state level funding, the VIPs in New York and Chicago began by using CMAQ funding, eliminating the need to pass authorizing legislation or to raise revenues to pay for the programs. CMAQ is a federally funded program administered by FHWA and designed to improve air quality and reduce congestion in all 50 states and the District of Columbia. CMAQ receives annual funding and is distributed to states via formula (FHWA, 2012). With the 2021 passage of IIJA, the funds for CMAQ have been significantly expanded, and their use in vehicle incentive projects have been further clarified and supported. This was discussed in Section II: New Federal Funding Sources for State VIPs. The program's requirements stipulate that these funds must be spent on projects that improve air quality in regions that do not meet NAAQS for ozone, carbon monoxide, or particulate matter (non-attainment areas), or in areas that are newly in compliance (maintenance areas) (FHWA, 2016a).

CMAQ is a flexible funding source. Funds are allocated to local and regional planning organizations and municipal and state transportation departments, which in turn have a large degree of autonomy in deciding what projects to fund, provided that those projects meet federal guidelines and advance the goals of the federal CMAQ program. Key decisions on how to spend CMAQ dollars are therefore made at the state and local levels, and processes differ by region. Clean vehicle incentives and vouchers are an eligible use of CMAQ dollars, as demonstrated by the existing CMAQ-funded voucher programs and augmented language in IIJA.

It is important to note that state and local authorities already make long-term plans for their CMAQ funds. The recommendation here is not to reallocate those funds but to take a percentage of the significant new funding and use it to create VIPs.

Important Considerations for CMAQ-Funded Voucher Programs

Although FHWA has ultimate discretion over broad CMAQ project eligibility rules, the specific types of projects supported with CMAQ funds are determined at the state and local level, and the key considerations vary by location and need. From a federal perspective, vehicle incentive programs (such as VIPs) are an eligible use of CMAQ funds and are included in CMAQ approved use language. Proposed projects must be included in a state's transportation improvement plan (TIP), which is a prioritized list of projects and investments for a given area over a multi-year period. The process of getting a project such as a VIP included in the TIP and then funded and operational may be complex, and

proposed projects may compete against other priorities. However, the increased funding available, when coupled with the reality of the need for faster climate action and the viability of zero-emission transportation as a solution, has raised the profile of VIP-like projects.

Each jurisdiction balances these considerations through separate processes, which can be seen in both locations that have operated VIPs supported (in full or in part) with CMAQ funding. Though the CMAQ funding is disseminated from the same federal sources, VIPs in New York State and Chicago have worked with FHWA to reserve CMAQ funding based on projected demand for their eligible projects; once reserved, the funding is reimbursed to the sponsoring agency.

CMAQ Limitations

The primary advantage of using CMAQ funding for state and local voucher programs is clear—CMAQ provides the flexibility to fund a program with readily available funding sources, bypassing the need to pass new legislation or apply for budget appropriations. However, while CMAQ is a flexible funding source, it also comes with conditions attached that may meaningfully impact how the program can be designed and implemented. In recent years the uncertainty around some of these conditions has caused some states to look at other revenue sources.

Purchase incentives for CMAQ-funded vehicles are tied to the federal Buy America requirement that obligates manufacturers to demonstrate that the "steel, iron, and manufactured products" in their vehicles are produced entirely in the United States (FHWA, 2016). Traditionally, FHWA has granted waivers that have permitted vehicle manufacturers to complete the final assembly of incentive-eligible vehicles in the United States in lieu of sourcing all of their metals and manufacturing domestically.[4] However, the waiver process has been in review and essentially frozen since 2018. No new waivers or guidance for the Buy America requirement have been issued for clean vehicle programs since projects proposed in 2016 were approved in April 2018 (FHWA, 2018). Ongoing programs with pre-existing waivers have been able to continue deploying vehicles under those existing programs, but no new contracts have proceeded. With the passage of IIJA, there is new guidance for Buy America requirements and strong hopes that new programs can launch with revised compliance rules and/or new waivers. At the time of publication, Buy America

[4] FHWA granted Buy America waivers for both Drive Clean Chicago and NYTVIP for voucher projects completed as recently as mid-2018; under the conditions of these waivers, while participating manufacturers in these programs would not have been able to demonstrate that all metals in their vehicles are domestic, they have been able to qualify for vouchers by demonstrating that they complete their vehicle assemblies in the United States.

guidance has been provided for infrastructure, and the process for developing guidance for vehicles finally started, with the possibility that final guidance will arrive in 2023 (FHWA, 2023). Until then, CMAQ funding may be inaccessible for new VIPs or other clean vehicle deployment programs. Nonetheless, given lead times needed to shape a program, immediate action is essential.

CMAQ funds may also be limited geographically within a state. CMAQ requires that "funds must be invested in a State's non-attainment and maintenance areas" on projects that reduce specific criteria air pollutants (FHWA, 2017). This directive creates geographical limits on a program funded through CMAQ, and consequently, some potentially interested fleets operating in less polluted counties may not be able to participate. Those states without areas in non-attainment and maintenance will receive a minimum percentage of total CMAQ funding to spend on projects without geographic restrictions but must meet CMAQ or Surface Transportation Program eligibility (FHWA, 2017).

The CMAQ funding process can be complicated but does offer a strong potential source of funds for VIPs that does not require legislative action. This funding model currently used in Chicago and New York could and should expand to other areas and spread the use of clean vehicles once a resolution for the Buy America requirement has been established.

Collaborating on CMAQ Program Design

As noted above, the process for proposing new CMAQ-funded projects can be complicated. To improve the chances of success, interested stakeholders in a given area should work together to understand and navigate the CMAQ funding landscape, starting with answering the following questions:

- **Decision-making Process:** What is the process and timeline? What is required in a proposal? Who makes the ultimate decisions, and what are the decision-making criteria?
- **Priorities:** What are the local priorities for CMAQ funding? What is eligible, and what sorts of projects have received CMAQ funding in this area?
- **Stakeholders:** Who are the key stakeholders? Who would support a truck voucher program, and what resources can they bring to bear in designing and supporting the program? Who might oppose this idea—what other groups would be potential competitors for CMAQ dollars in this area?

Given IIJA funding increases for CMAQ, navigating the CMAQ funding process for a VIP should be considered well worth the effort.

The Volkswagen Settlement, Appendix D: The NOx Mitigation Trust

Given new IIJA funding available in other accounts, the Volkswagen Settlement funds, and their limitations, have become less attractive for VIPs. Nonetheless, it is an option being used by at least one state (New York) and is worth exploring.

All 50 states, the District of Columbia, and U.S. and tribal territories are eligible for allocations from more than $2.7 billion established through Appendix D of the Volkswagen Settlement, also called the NOx Mitigation Trust (Center for Climate and Energy Solutions, 2016). These funds stem from a settlement of damages negotiated by the U.S. Department of Justice and Volkswagen for the use of emissions-control defeat devices on their vehicles. Appendix D funding, which is reserved for MHDV deployments (Class 4 and higher), provides a ready funding stream for every state and territory's clean vehicle investments. FHWA's definitions of vehicle classes are included in Table 4 for reference (U.S. Department of Energy, n.d.).

Table 4. Vehicle Class Definitions by Weight

Vehicle Class	GVWR (lbs.)	GVWR Category
1	<6,000	Light Duty ≤10,000 lbs.
2	6,000-10,000	
3	10,001-14,000	Medium Duty 10,001 - 26,000 lbs.
4	14,001-16,000	
5	16,001-19,500	
6	19,501-26,000	
7	26,001-33,000	Heavy Duty >26,001 lbs.
8	>33,000	

Given that Volkswagen Settlement funds have a limited time frame and some important restrictions on their use—most notably a scrappage provision—these funds may not be as attractive to states starting a regional VIP program today. Indeed, scrappage provisions can be a major barrier that deters fleets from participating, particularly smaller fleets.

Scrappage requirements should ideally be discouraged as they act counter to the VIP goal of simplicity of design. Nonetheless, because Volkswagen Settlement funds are still available, it is worth outlining the process and issues.

Important Considerations for Mitigation Trust-Funded Voucher Programs

In late 2018, the Wilmington Trust began to accept proposed beneficiary mitigation plans (BMP) from states as the appointed national trustee for the Mitigation Trust. Each state's BMP describes how it plans to spend its funding allocated through the Settlement among 10 distinct eligible mitigation actions, as laid out by the Settlement and the U.S EPA. Mitigation actions fall under one of the following 10 categories (U.S. Department of Justice, 2016):

1. Class 8 Local Freight Trucks and Port Drayage Trucks
2. Class 4–8 School Bus, Shuttle Bus, or Transit Bus
3. Freight Switchers
4. Ferries and Tugs
5. Ocean Going Vessels' Shore Power
6. Class 4–7 Local Freight Trucks
7. Airport Ground Support Equipment
8. Forklifts and Port Cargo-Handling Equipment
9. Light-Duty Zero-Emission Vehicle Supply Equipment

Appendix D explicitly lists the type of vehicle technologies that are eligible for funding and provides percentages of total costs for each eligible vehicle based on fuel type. All-electric, hybrid, compressed natural gas (CNG), propane, diesel replacement, all-electric repower, and diesel repower technologies are all eligible for funding through the Mitigation Trust. The terms of the Settlement also provide a differentiated percentage cap of costs for vehicles depending on the ownership of a fleet. For example, privately owned Class 8 trucks may receive up to 75 percent of the cost of a new all-electric truck or 50 percent of the cost of a new diesel or alternate fuel vehicle, whereas the same vehicles owned by public fleets would be eligible for 100 percent of the new costs of the vehicles.

Each jurisdiction may choose how to apply the terms of the Mitigation Trust to a proposed or existing VIP. The differentiated cap based on ownership allows for voucher amounts that pay for the entire cost of a new vehicle, but each jurisdiction may prefer to stretch its funding across more projects by reducing the voucher limits to smaller amounts. The standard VIP practices of providing payments for incremental vehicle costs are consistent

with the Mitigation Trust terms. Eligible vehicles may receive up to the Trust-prescribed percentage of costs, but each VIP administrator may set vehicle caps as they deem fit within those prescribed award percentages. Similarly, cities and states have considerable flexibility to choose which vehicle technologies are eligible under a VIP and if using Settlement funds can structure the program to award funds to any subset of the technologies listed above. They can specifically be focused on zero-emission technologies only.

The types of investments that a state prefers are outlined in its BMP, which includes proposed estimates for funding, vehicle deployments, and air pollutant and GHG reductions by eligible mitigation action. Regardless of a state's BMP allocation decisions, a VIP provides a flexible and administratively simple method of implementing its clean transportation funding strategy.

Mitigation Trust Funding Limitations

Funding from the Volkswagen Settlement is only available within a limited timeframe. Once BMPs are approved and funding is disbursed to each state, the funds must be spent within 10–15 years and will not be replenished. Up to a third of each state's funds may be spent within the first year, and a second third may be spent within the second year, with the remainder available to be spent over the duration of the funds' availability.

Notably, the Mitigation Trust identifies eligible clean truck and bus applications for Classes 4–8. These medium- and heavy-duty class segments operate widely across occupations and services, but the designation of Classes 4–8 as eligible omits lighter vehicles that have been eligible under VIPs, namely those in Classes 2b and 3. Vehicles in these classes include delivery vans, shuttles, fleet work trucks, and more.

To ensure that the Settlement produces air quality improvements, the Mitigation Trust requires an eligible truck or diesel engine to be scrapped. The scrappage requirement specifies that the vehicle must match the description of new vehicles made available under each Mitigation Action with diesel engines from model years 1992–2009. (In some cases, model years 2010–2012 are also eligible for scrappage.) All eligible projects must pair new vehicle proposals with eligible vehicles or engines to scrap. Engines must be rendered inoperable and available for recycling by cutting a 3-inch hole in the engine block for all engines. Vehicles that will be replaced must have their chassis disabled by cutting the vehicles' frame rails completely in half. (This step does not apply to repowers.) These requirements must not only be performed but also verified to qualify for Settlement funding.

Scrappage requirements act counter to the VIP goal of simplicity of design. These requirements add administrative and reporting burdens and complications for vendors as

well as for program administrators. Similarly, the scrappage step adds scrapyard operators as significant stakeholders in the VIP process for removing older, polluting vehicles from roads. The requirement to retire an older diesel vehicle can also limit fleet eligibility if applied narrowly. Guidance from top private fleets taking part in the Electric Fleet Readiness Group observed that "requiring scrappage of a pre-2010 vehicle immediately disqualifies many of the fleets most inclined to purchase new zero-emission trucks because they simply don't have vehicles old enough to scrap" (Environmental Defense Fund, 2021).

Nonetheless, if necessary, adding a scrappage program into the VIP framework can be managed. It is an actionable and a well-known process that can be integrated into existing voucher processing and redemption sequences. For instance, scrappage has been integrated into one of the funding streams under NYTVIP since 2019. NYTVIP allows fleets using the program the flexibility to acquire eligible scrappage vehicles from other fleets in order to qualify. Similar programs, such as the New York City Clean Trucks Program (formerly the Hunts Point Clean Trucks Program), require scrappage and certification to correspond to the new vehicle types deployed through the programs. Adding a scrappage requirement may take multiple forms and borrow from existing programs.

Example of Scrappage Requirement Added to Existing VIP

To comply with Mitigation Trust funding requirements, a scrappage step must be added to the current VIP process. The scrappage process must be simple, replicable, and effective.

The actual scrappage should be performed at a dedicated and approved scrapyard. To ensure reliable and accurate compliance with Settlement and existing VIP requirements, scrapyards should be licensed and registered as eligible sites that can perform the specific required scrappage tasks and provide reliable documentation. To facilitate the scrappage process for vendors, a statewide network of certified scrapyards that can perform Settlement-eligible scrappage actions should be established. This step will allow vendors to regularly and reliably contact known scrapyards to perform the required actions, reducing uncertainty and streamlining the process of determining scrapyards' eligibility. The network should be made readily available to verified vendors. Each eligible scrapyard will need to demonstrate that it possesses the required materials and expertise to scrap vehicles and accurately verify compliance. Once a network of eligible scrapyards has been established, the following practices should help to create a simple, replicable process for performing and reporting scrappage:

- The vendor should coordinate scrappage with a vehicle purchaser and an eligible scrapyard. From the vehicle purchaser perspective, the interaction would be similar to a vehicle buyback, earning value for an old vehicle while acquiring a new vehicle. The scrappage company should be responsible for transporting old vehicles from vendors to scrapyards for retirement. Scrap value should be negotiated independently from the voucher amount, which is already firmly established within the VIP.
- Vehicles should be scrapped after the delivery of new vehicles and approval for vouchers under the Settlement. This process will avoid retiring an old vehicle before funding for a new vehicle has been approved and delivery has been completed. Once the rebate has been approved and the vehicle has been delivered, scrappage should be performed and verified. This would be the final step to demonstrating compliance and releasing the approved funding to the vendor.

Key Takeaways

The voucher incentive design can be effectively revised to accommodate the disparate funding sources available for zero-emission and clean commercial vehicles. The VIP design itself is highly effective, and the benefits and constraints of each funding source can be addressed in a VIP's specific design and implementation. States and cities interested in developing a clean vehicle VIP should explore the merits of each resource and consider how any limitations would affect their proposed programs and ultimate goals.

- A state-funded program is highly effective to meet local and regional needs, such as California's programs that reward deployments in DACs. Passing new legislation and/or allocating funds to pay for zero-emission and clean vehicle programs may be difficult.
- CMAQ is a ready funding source available to all 50 states and the District of Columbia that has proven effective in deploying clean vehicles in Chicago and New York. However, geographic requirements for vehicle deployments may impact program implementation, and uncertainty over the FHWA Buy America requirement may impede jurisdictions' ability to leverage CMAQ funds for clean vehicle projects.
- Funding through the Volkswagen Settlement's Mitigation Trust is also nationally available to all states and territories and will provide more than $2.7 billion for clean vehicles but will not be available on an ongoing basis and has major limitations to use (Center for Climate and Energy Solutions, 2016). This funding source requires eligible vehicle projects to include a scrapped diesel engine at minimum and does not include funding for on-road vehicle classes lighter than Class 4.

IV. A Solution Across Regions: Successful Voucher Programs Across the United States

California's HVIP was an immediate success that validated the VIP design. In its first year of operation, HVIP disbursed its funds faster than any program in CARB history and was recognized as the number-one emerging state energy project by the American Council for an Energy Efficient Economy (ACEEE, 2010). HVIP's success has led to spin-off voucher and voucher-style programs in California, one for off-road equipment and one for infrastructure, and elsewhere.

Programs in New York and Chicago both sold out their initial CMAQ funding, deploying hundreds of vehicles in programs tailored to their particular regional needs. New Jersey and Massachusetts followed with more recent programs using regional and state funding sources. All these programs now focus exclusively on zero-emission vehicles. Total funding amounts, eligible vehicle categories, and per-vehicle incentive levels differ slightly between these programs, but each provides a simple, streamlined purchase incentive to reduce upfront costs for zero-emission trucks and buses.

This section highlights the successes each program has had in placing clean vehicles on U.S. roads, outlines the components of each program's design features, and compares the details of the distinct VIP designs.[5]

Comparing Voucher Program Design Elements

California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)

California's HVIP was established in 2009 and launched in 2010 to spur the development and more rapid deployment of clean truck and bus technologies that will make substantial contributions to the needed air quality improvements over the decades to come.[6] The program helps the state to meet its clean air and climate goals with an evolving suite of incentives. CARB reviews and approves all technologies for eligibility in the program.

[5] CALSTART compiled funding and voucher data from each of the VIPs through discussions with program staff, publicly posted information, and other sources.

[6] Specific data regarding HVIP was provided through HVIP's website at https://californiahvip.org/impact/ and by Tarah Campi and Tom Brotherton (HVIP administrators) in discussion with Bill Van Amburg, 2023.

Though HVIP was initially funded for the deployment of hybrid vehicles, the eligible fuel and vehicle technologies have evolved rapidly as the capabilities for full electrification have become commercialized. Eligible vehicle technologies now focus exclusively on zero-emission vehicles and include:

- Zero-emission (battery-electric or hydrogen fuel-cell electric) buses or trucks, or plug-in hybrids with minimum zero-emission range capability;
- Trucks with electric power takeoff (ePTO), including exportable power; and
- Vehicle conversions to zero-emission and plug-in hybrid powertrains.

HVIP differentiates voucher values primarily by vehicle weight class. Vouchers for conversions and plug-in hybrid vehicles are discounted by 50 percent from base vouchers. Base voucher amounts for zero-emission vehicles are set to cover approximately the full incremental cost of the vehicles, using GVWR-based incentive levels ranging from $7,500 (for Class 2b vans) to $120,000 (for Class 8 tractors). Trucks and buses use the same base voucher.

For technologies or deployment categories or locations that HVIP seeks to prioritize, the vouchers are increased in value by simple percentages. This keeps the system streamlined and easy to use and understand. For instance, zero-emission Class 8 tractors used in regional drayage applications qualify for a 25-percent bigger voucher ($150,000 in 2023). Similarly, a vehicle used in a state-recognized DAC qualifies for a 15 percent increase over a base voucher. A fuel cell electric Class 8 vehicle qualifies for a 100 percent increase in the voucher value because of its earlier stage of technology and market readiness. These vouchers can also be additive, meaning they can be added up on top of each other to increase value (to a cap). See Table 5 below for an example of eligible voucher amounts for zero-emission vehicles.

As indicated in the table, voucher amounts differ not only between zero-emission technology types but also between different vehicles and deployments for the same technology. Factors that affect HVIP voucher amounts include:

- Zero-emission type;
- Vehicle weight and length;
- Vehicle deployment in a DAC; and
- Transit or public school fleet.

HVIP has been extremely effective in speeding up the deployment of clean and zero-emission vehicles and is now beginning to scale fleet adoption. As of January 2023, HVIP

has awarded voucher requests for more than 11,000 vehicles worth nearly $1 billion since its inception; more than 6,000 of these have been zero-emission vehicles, rapidly growing in the last several years as vehicle models expand and regulatory requirements, such as ACT and Advanced Clean Fleets, have emerged.

Through the use of cap-and-trade funds, general funds and funds from a license plate fee collected for clean air programs, the dollars available for zero-emission vehicles have grown substantially in California over the past several years. These funds have expanded as HVIP has proven success in their use. As of January 2023, HVIP had more than $700 million available for voucher requests. Much of this funding is available on a first-come, first-served basis to all vehicle types but also now includes specific set-asides targeted at drayage trucks, transit buses, school buses, and small fleets.

Because of program equity design elements that prioritize vehicle placement in regions facing the highest social and environmental burdens, more than 60 percent of HVIP funds have been used on deployments in California's designated DACs. Moreover, more than 40 percent of the funding has been awarded to public or small fleets, and the fiscal year 2022–23 funding further prioritizes small fleet access to funding, including a new stand-alone project testing new financial and business model funding to support small fleet transition called the Innovative Small E-Fleet (ISEF) project.

HVIP has also spurred and informed two important new programs in California (described in detail below) that illustrate the fast-emerging zero-emission capabilities and the need to keep up with market needs. The off-road sector has seen a rapid increase in capability to electrify in the past several years. To encourage and support this, a new program, the Clean Off Road Equipment Project (CORE), was created in parallel to HVIP to serve this segment. The two programs are closely coordinated to make sure users are aware of which vehicles and equipment fall in what program (for instance, terminal tractors moved to CORE). Similarly, as zero-emission trucks and buses have expanded in the market, the need to support infrastructure installation became critical. In California, CEC manages fuel and infrastructure issues. It launched the Energy Infrastructure Incentives for Zero-Emission (EnergIIZE) Commercial Vehicles project to fill that need. While managed by a different agency, EnergIIZE and HVIP are closely coordinated to ensure vehicle purchases are linked with infrastructure planning and funding. This has become a powerful takeaway of today's VIPs.

Of additional importance to other regions looking to develop their own programs, HVIP has been a powerful contributor to California's green economy. When HVIP launched, there were only four participating vehicle makers; this has grown to more than 30 in 2023 with over 150 separate eligible models available. More than $3.4 billion dollars in private and

public investment have been generated and leveraged by HVIP vouchers through 2022, a more than 3-to-1 ratio of economic activity generated (HVIP, n.d.). Several of the vehicle and component makers involved in the program started in California or were attracted to the state because of its policies and incentives. Examples include BYD, Proterra, Phoenix Motors, Green Power Motors, Motiv Power Systems, and Xos, as well as component suppliers acquired by Cummins and Meritor.

HVIP proves the power of a well-funded direct incentive to meet emerging air quality objectives, support technology-forcing regulations, and generate economic activity in a new and growing sector. See Tables 5 and 6 (HVIP, 2022).

Table 5. HVIP Zero-Emission Truck Incentives

GVWR (lbs.)	Base Amount
8,501 – 10,000	$7,500
10,001 – 14,000	$45,000
14,001 – 19,500	$60,000
19,501 – 33,000	$80,000
>33,000	$120,000

Table 6. HVIP Incentive Modifiers

Modifier Type	Amount Above Base
Class 8 Drayage Early Adopter	+ 25%
Refuse	+ 25%
Disadvantaged Community	+ 15%
Class 8 Fuel Cell	+ 100%
Public Transit Agencies	+15 %
School Buses for Public School Districts	+ 65%
Plug-in Hybrid	- 50%
In-Use Converted/Remanufactured	- 50%

California's Clean Off-Road Equipment Voucher Incentive Project (CORE)

Due in large part to the success of HVIP, CORE was launched by CARB in 2017 to address multiple realities.[7] First and foremost, the percentage contribution of off-road equipment to regional air pollution is projected to grow as cleaner technology and more stringent requirements mitigate on-road vehicles. Second is the growing capability to reduce emissions in off-road equipment with zero-emission technology. Electrification of this sector has been enabled by the direct and rapid transfer of components and systems (such as energy storage, electric motors, and power electronics) from on-road vehicles (trucks and buses) to off-road applications in goods movement, cargo handling, and other off-road sectors.

Like HVIP, CORE was designed as a streamlined VIP structured to reduce the purchase price differential of eligible zero-emission off-road equipment at the time of purchase. CORE's initial focus at launch was the goods movement sector due to the significant impact it has on urban regions and the proximity of goods movement hubs, such as ports and multi-modal rail yards, to highly impacted communities. CORE began with $40 million in funding

[7] Specific data regarding CORE was provided through https://ww2.arb.ca.gov/our-work/programs/clean-off-road-equipment-voucher-incentive-project/about, by Jacob Whitson (CORE administrator) in discussion with Bill Van Amburg, 2023, and by Todd Sterling (CARB staff) in review of this white paper.

and sold out within a few months, even with its limitation to goods movement categories only. The biggest categories of zero-emission equipment included terminal tractors (yard tractors), transportation refrigeration units, mobile power units, large forklifts (above 10,000 lbs. lift capacity), and rail car movers.

Following rounds of funding for CORE were larger, reflecting the high demand and an expansion to zero-emission construction and agricultural equipment, as well as a new category for zero-emission landscaping. As of February 2023, CORE has committed an additional $165 million in vouchers for both the equipment categories listed above as well as agricultural equipment like tractors and loaders, cargo-handling equipment (CHE) like top picks, airport ground service equipment, commercial harbor craft, and even rail switcher engines. The new zero-emission landscaping category has only recently launched, but as of February 2023, it features 451 pieces of equipment available from over 250 dealers and 17 manufacturers. The state is providing an additional $273 million for all categories in the next round of funding for fiscal year 2022–23.

Besides its real benefits spurring faster and earlier adoption of zero-emission equipment in a sector with far less stringent emissions standards, California has realized meaningful economic results from CORE. The existence of CORE has attracted best-in-world equipment makers to bring their products to the state, such as electric rail car movers. It has also forged partnerships between on-road component makers with off-road manufacturers who wanted to quickly develop zero-emission offerings. Several of these companies have been California-based. Like HVIP, CORE has not only launched faster deployments of zero-emission equipment but has also supported the growth of a green tech economy.

California's Energy Infrastructure Incentives for Zero-Emission (EnergIIZE) Commercial Vehicles

The VIP model, while designed initially for vehicles, can also be modified for use to support streamlined incentive funding for zero-emission infrastructure. CEC engaged CALSTART to achieve that objective for zero-emission MHDVs in a project called Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles, or EnergIIZE.[8] Established in 2021 with initial funding of $50 million, the project, as of March 2023, had more than $64 million in available incentives in its first year of implementation, with more than $106 million planned for year two. $38.6 million of this funding has been committed for hydrogen fueling sites. EnergIIZE has seen strong demand to date, awarding 93 projects with more than 60 percent

[8] Specific data regarding EnergIIZE was provided through the EnergIIZE website at https://www.energiize.org/participate and by Alyssa Haerle (EnergIIZE administrator) in discussion with Bill Van Amburg, 2023.

of the funding going to priority populations. Importantly, EnergIIZE coordinates strategy and operations closely with HVIP, even though the programs are funded by different agencies. Both CARB and CEC understand the vital need to ensure vehicle deployments and infrastructure installation are deeply aligned and coordinated.

EnergIIZE uses a novel approach to take the framework of a streamlined, point-of-sale voucher and adapts it to the more complex needs and longer installation timelines required for infrastructure. EnergIIZE established a list of eligible equipment and participating vendors and created four tracks, or funding lanes, depending on fleet readiness to proceed. The EV Fast Track funding lane operates similarly to a vehicle VIP in that it is first-come, first-served and awards shovel-ready projects quickly if they meet readiness criteria. The Hydrogen, EV JumpStart, and Public Charging lanes are competitively funded with scoring criteria that prioritize project readiness, maintenance planning, and community engagement.

EnergIIZE funds 50 percent of eligible equipment and software costs up to a $500,000 cap for electric vehicle charging projects and $3 million for hydrogen fueling projects. Eligible costs include charging/refueling equipment, charge management software, switchgear, electrical panel upgrades, wiring and conduit, utility smart meters, and transformers. Eligible electric vehicle charging equipment currently includes Level 2 electric vehicle supply equipment, DC fast chargers, vehicle-to-grid capable chargers, and wireless inductive charging technologies.

Importantly, showing how the design can be adapted to meet multiple state goals for infrastructure projects that meet equity criteria, EnergIIZE will cover up to 75 percent of eligible costs, and the project cap is $750,000 for electric vehicle projects and $4 million for hydrogen projects. This is designed to encourage and support adoption and use of zero-emission commercial vehicles in communities most in need of emissions reductions and economic opportunities.

New York Truck Voucher Incentive Program (NYTVIP)

In 2013, the New York State Energy Research and Development Authority (NYSERDA), New York Department of Transportation (NYSDOT), and New York City Department of Transportation (NYCDOT) launched a $19 million program to expand the use of diesel emissions controls, CNG, hybrid, and all-electric medium- and heavy-duty trucks in parts of New York State with poor air quality.[9]

[9] Specific data regarding NYTVIP was provided by CALSTART staff in discussion with Bill Van Amburg, 2023, and NYSERDA staff in review of this white paper.

NYTVIP used CMAQ funding for this launch. During the first iteration of the program, NYTVIP was organized into three separate funds, each with distinct technological and geographic requirements: a state-wide electric vehicle program, a New York City alternative fuel vehicle program, and a New York City diesel emissions reduction program. All three used a streamlined point-of-sale voucher structure, but because of the technologies involved, particularly the diesel particulate filter (DPF) incentives, each had a unique rule set to follow. Before transitioning to an updated program, 597 vehicles received $14.5 million in incentives; 65 of the vehicles were zero-emission, and the remainder were natural gas, hybrid, or DPF (NYSERDA, 2018).

In 2019, the program was expanded in a unique way by combining Volkswagen Settlement funds with a continuation of the CMAQ program to create a $66.3 million program. Current agency partners are NYSERDA, NYSDOT, and New York State Department of Environmental Conservation (NYSDEC), which manages the state's Volkswagen funds. Unlike the first version of NYTVIP, the current program is only focused on zero-emission vehicles (battery-electric (BEV) and fuel cell electric (FCEV) new vehicles and repowers). The CMAQ funds could be used in Classes 3 to 8 but only in qualifying counties meeting air quality criteria. The Volkswagen Settlement funds are limited to Class 4 to 8 only, target funding to some key vehicle categories (transit and school buses), and require scrappage. These funds can be used statewide, and for transit buses, school buses, and CHE, the domicile address must be in a DAC (NYSERDA, n.d.a). Notably, NYTVIP was able to continue to operate on its pre-existing Buy America waiver, unlike other programs which have been stalled waiting for new waivers to operate. Under NYTVIP, final stage assembly of all CMAQ-funded vehicles must be in the United States.

The program takes a slightly different approach to set voucher amounts. First, it bases its voucher levels on a percentage of the incremental cost of the vehicle, from 90 percent for port CHE to 100 percent for buses. It then sets a cap to vouchers by application and weight class. Finally, unlike the HVIP program which has set incentive levels for all vehicles by weight class, NYTVIP sets specific voucher amounts for every eligible vehicle. This process involves additional administrative time to establish.

As of May 2022, all the CMAQ funds (which did not require scrappage) have been exhausted. All remaining vouchers require scrappage. At this date, $40.8 million in funding has been reserved. The program funds the following categories: on-road trucks (Class 4–8) as both BEV and FCEV; transit buses and paratransit buses as both BEV and FCEV; BEV school buses; and new or repowered BEV port CHE.

Because of the scrappage requirement, there are additional steps that must be taken to document scrappage before a voucher can be redeemed. This does constrain demand

from some fleets. NYTVIP attempts to compensate for this by allowing generous cap levels in most categories. See Table 7 for NYTVIP voucher amounts and caps (NYSERDA, n.d.).

Table 7. NYTVIP Voucher Amounts and Caps

Vehicle Type	Fuel Type	Cost %	Class 4	Class 5	Class 6	Class 7	Class 8
On-Road Trucks	BEV/FCEV	95%	$100,000	$110,000	$125,000	$150,000	$185,000
Transit Buses	BEV/FCEV	100%	$100,000	$125,000	$150,000	$250,000	$385,000
Paratransit Buses	BEV/FCEV	100%	$100,000	$125,000	$150,000	N/A	N/A
School Buses	BEV	100%	$100,000	$120,000	$150,000	$200,000	$220,000
Port Cargo-Handling Equipment	New BEV	90%	$170,000 across all classes				
	Repower BEV	90%	$140,000 across all classes				

On-road trucks that are based or operating in New York City Industrial Business Zones can also take advantage of a separate program, the New York Clean Trucks Program.

New Jersey Zero Emission Incentive Program (NJ-ZIP)

One of the newest VIP-like programs has been developed by the New Jersey Economic Development Authority and is funded by New Jersey's involvement in RGGI, which generates funds from cap-and-trade activities in the Northeast.[10] NJ-ZIP was launched in 2021 with $90 million to be programmed through two phases. As of fall 2022, Phase 1 was complete with roughly $39 million in approved vouchers. It targeted Class 2b through Class 6 trucks and buses specifically in the state's metropolitan regions facing the most severe emissions burden: the Greater Camden, Newark, and New Brunswick regions.

Phase 2 of the program will begin in early 2023 with $45 million in funding. It will become available state-wide and will expand the eligible vehicle classes to include 2b through 8.

[10] Specific data on NJ-ZIP was provided through the NJ-ZIP website at https://www.njeda.com/njzip/ and by CALSTART staff in discussion with Bill Van Amburg, 2023.

Base voucher amounts are capped at 100 percent of vehicle costs and are listed in Table 8.

Table 8. NJ-VIP Phase 2 Base Voucher Amounts

GVWR (lbs.)	Vehicle Class	Voucher Amount
8,501-10,000	Class 2b	$20,000
10,001-14,000	Class 3	$50,000
14,001-16,000	Class 4	$65,000
16,001-19,500	Class 5	$75,000
19,501-26,000	Class 6	$90,000
26,001-33,000	Class 7	$135,000
33,001+	Class 8	$175,000

In addition to the base levels, Phase 2 of NJ-ZIP includes bonus criteria that can increase the base voucher levels, including those for:

- Certified woman-, minority- or veteran-owned business: +4%
- Small business: +25%
- EJ Bonus: +10% (for small business or city vehicles agreeing to drive 50 percent of time in NJ overburdened communities)
- NJ manufacturing bonus: +25% (for vendors that show 25 percent or more of the cost of the vehicle is spent in New Jersey)
- School bus: +25%

New Jersey's program design showcases their climate, clean air, and economic priorities. Use of the RGGI funding provides significant latitude for New Jersey to design a program to meet its specifications and the ability to move quickly to establish it.

Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) Trucks

Another new program since the last update of this report in 2019 is the Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) Trucks project funded by DOER.[11] It provides incentives for Class 2b–8 MHDVs in the form of both rebates (for vehicles from 8,501 lbs. to 14,000 lbs. GVWR) and vouchers (for vehicles from 14,001 lbs. to 33,001+ lbs. GVWR) for purchasing zero-emission trucks, buses, and vans. MOR-EV Trucks serves as an extension of the much larger MOR-EV program, which Massachusetts has offered to passenger car EVs since 2014.

The voucher structure used is more of a blend of a rebate and a voucher than a pure voucher approach. Like a voucher, purchasers can apply for and reserve the voucher to be applied to their vehicle purchase. This does provide certainty of outcome. However, it does not directly reduce the cost of the purchase directly, as a voucher does, but instead provides the payment as a rebate after full proof of purchase and registration takes place.

MOR-EV Trucks provides funds using a three-tiered declining rate approach that rewards faster action (Table 9). In other words, it has base funding in each vehicle category reserved for a limited number of vehicles, called a block. Once that number of vehicles has claimed vouchers, the value drops by 15 percent for the next block. Once those are claimed, the voucher value drops a final 15 percent for the last block until sold out. If a fleet requests more than 10 percent of the vouchers in any block, all vehicles beyond that limit also have their voucher value reduced to that of the next block's.

The program funds can be combined with EPA's Diesel Emission Reduction Act grant funding but not with other state programs. A 10-percent increase in the voucher value is added for vehicles registered or operating more than half the time in locations that meet Massachusetts' environmental justice income criteria. Vehicles purchased after February 16, 2021, were eligible to use the rebate or the voucher in the first funding made available for the program. At the time of this report, the program has set aside 800 rebates for vans of which 605 remain, and 450 vouchers for vehicles in Classes 4–8, of which 424 remain.

[11] Specific data regarding MOR-EV Trucks was provided through its website at https://mor-ev.org/mor-ev-trucks.

Table 9. Block 1 Rebate and Voucher Levels in MOR-EV Trucks

GVWR (lbs.)	Vehicle Class	Rebate Amount[12]	Voucher Amount
8,501–10,000	2b	$7,500	-
10,001–14,000	3	$15,000	-
14,001–16,000	4	-	$30,000
16,001–19,500	5	-	$45,000
19,501–26,000	6	-	$60,000
26,001–33,000	7	-	$75,000
33,001+	8	-	$90,000

MOR-EV Trucks rebate and voucher levels are generally lower than other programs operated by other states, and to date, reservation of incentives have been slow. However, the program has no scrappage requirements and has a simple application process.

In addition, MOR-EV Trucks is being augmented with a complementary and parallel fleet advisory program, Mass Fleet Advisor. This program is designed to help fleets plan for electrification by providing insights on available vehicle models and funding, plan deployments, and even prepare for infrastructure installation. This is an important addition to an overall incentive and investment portfolio for transformation.

Drive Clean Chicago

The City of Chicago launched Drive Clean Chicago in November 2012. The initial $14 million program created a VIP for hybrid and all-electric trucks and buses, as well as incentives for taxi conversions to natural gas or electric and for natural gas refueling and electric vehicle recharging infrastructure.[13]

[12] Rebate and voucher amounts are reduced 15% below these numbers once Block 1 volumes are claimed and Block 2 levels begin. An additional 15% reduction takes place once all Block 2 volumes are claimed and Block 3 begins.

[13] Specific data regarding Drive Clean Chicago was provided through https://legacyenv.com/portfolio/drive-clean-chicago/ and Chicago Department of Transportation's Drive Clean Truck presentation at https://www.cmap.illinois.gov/documents/10180/1109463/CDOT+Drive+Clean+Truck_2020_02_24.pdf/e07c1759-d859-a16e-ff79-2b26a08f578e.

Like New York, Chicago used CMAQ funding to capitalize its VIP. Because the program was designed to focus on a particular metropolitan region, eligible vehicles were required to operate 75 percent of the time in one of six approved counties in the Chicago area.

Chicago's initial program was adjusted to respond to market conditions and ended its first round of funding very successfully. By 2018, it had sold out all incentive dollars and placed 288 hybrid and zero-emission vehicles on the road. Drive Clean Chicago used a similar design to NYTVIP, creating a cap for incremental costs by GVWR and technology type. The caps by GVWR for electrified vehicles are listed in Table 10 (Welch, 2019).

Table 10. Drive Clean Chicago Electrified Vehicle Voucher Caps

GVWR (lbs.)	Zero-Emission	Plug-in Hybrid	Hybrid
6,000–10,000	$55,000	$45,000	$20,000
10,000–14,000	$60,000	$50,000	$30,000
14,000–19,500	$90,000	$55,000	$40,000
19,501–26,000	$100,000	$60,000	$50,000
26,001–33,000	$110,000	$70,000	$60,000
33,001–38,000	$120,000	$100,000	$80,000
> 38,000	$150,000	$120,000	$100,000

Chicago planned to follow up this first tranche of CMAQ funding with a second round of $17.8 million, which was approved and ready to be set in motion. However, unlike New York, Chicago could not extend its original Buy America waiver and instead had to submit a new one. This waiver—and many more for other CMAQ programs of many types—has been in a holding pattern for five years. In the interim, the Chicago program stayed active on other fronts to support clean and zero-emission vehicle deployment. It has developed and published the Chicago Commercial Electric Vehicle Guidelines to help fleets prepare for zero-emission vehicles and has supported the Green Drives Conference and Expo to further share information and availability.

The IIJA and IRA legislation has spurred a renewed energy into creating updated Buy America guidelines, and those are expected in 2023. However, due to the long delay, Chicago elected to move in a different direction. Because Buy America guidance is now

available for infrastructure, Chicago is allocating its Drive Clean Chicago CMAQ funds to an infrastructure incentive program. This certainly showcases another potential and valuable use of CMAQ funds for zero-emission transportation support.

Chicago's dilemma shows the challenges that can be faced using federal funding. CMAQ funds have provided tremendous flexibility and been strong assets for incentive programs. However, the Buy America language needed to implement these funds has been essentially frozen as political debates flared but were never resolved over its re-definition. While a solution now appears close in 2023, Chicago lost a half a decade of opportunity and the momentum it had built from its first program. This is a critical lesson for policymakers at the national stage to recognize. Chicago was already requiring that all eligible vehicles be assembled in the United States as part of its waiver, but for five years, U.S. assembled vehicles whose accelerated sale with Chicago incentives could have created jobs and reduced emissions faster were not able to get assistance—in short, this issue derailed a critical good.

Direct Design Comparison

To make comparisons easier, Table 11 illustrates the differences and similarities between each of the current VIPs, their shared design elements, and the features that make them unique.

Table 11. Comparison of Different Design Approaches for VIPs

Program	California HVIP	NYTVIP	NJ-ZIP
Agency partners	California Air Resources Board (CARB)	NYSERDA, NYSDOT, NYSDEC	New Jersey Economic Development Authority
Funding amount (as of 1/31/23)	$959 million since inception; over $700 million available	$80.8 million since inception; $25.5 million available	$90 million since inception; $45 million available in Phase 2
Funding source	California Cap-and-Trade Auction Revenues, General Fund, License Plate fees	CMAQ (now exhausted), Volkswagen Settlement Funds	Regional Greenhouse Gas Initiative (RGGI) proceeds
Voucher types	• Zero-emission vehicles and technologies (battery-electric, fuel cell electric, hybrid-electric, electric power take-off) • Trucks and buses use same voucher • Off-road equipment has separate program (CORE) • Small fleets have parallel program (ISEF) • Set aside funding for drayage trucks, school buses, and transit buses	• Zero-emission vehicles (battery-electric and fuel cell electric) • Trucks, buses, and port CHE	• Zero-emission vehicles (battery-electric and fuel cell electric) • Trucks, school buses, and shuttles
Voucher amount	• Targets 100% of incremental cost by weight class with fixed voucher amounts	• Targets 90–100% of incremental cost, up to caps by weight class • Each vehicle voucher amount set individually	• Targets up to 100+% of incremental cost, capped by weight class

Program	California HVIP	NYTVIP	NJ-ZIP
Vehicle weight classes	Class 2b–8	Class 3–8 (CMAQ funds, now exhausted); Class 4–8 (Volkswagen funds)	Class 2b–6 (Phase 1); Class 2b-8 (Phase 2)
Eligible fleets	Private, public, non-profit	Private, public, non-profit	Private, public, non-profit
Availability	First-come, first-served	First-come, first-served	First-come, first-served
Priorities	Voucher enhancements for: • Disadvantage community operation • Class 8 drayage truck or refuse truck • Public transit bus • School bus in public district • Class 8 fuel cell	Voucher requirements: • Scrappage required for Volkswagen funds (all remaining funds are Volkswagen funds) • Final vehicle assembly must take place in U.S. (CMAQ funds, exhausted as of May 2022) • Funds cannot be used for fuel-fired heaters • School and transit buses and CHE must be based within one half mile of a DAC	Voucher enhancements for: • Woman-, minority- or veteran-owned business • Small business • Environmental Justice communities operation • New Jersey manufacturing • School bus
Distinguishing features	Streamlined and simplified voucher amounts; closely integrated with separate infrastructure funding	Scrappage requirement for Volkswagen-funded vouchers (only funds currently available)	Big focus on economic development

VIP Results

Across all the states with VIP programs, more than $1.3 billion has been invested into clean and zero-emission vehicle deployments and over 15,000 vehicle and equipment sales have been supported (Table 12). Over 60 percent of these have been zero-emission. All current VIPs now focus exclusively on battery-electric, fuel cell electric, or hybrid-electric solutions.

With nearly $1 billion in funding already reserved by vehicles since the inception of the program in 2010, HVIP has shown striking success in linking strong policies with real deployment and market action. On its own, it has placed more than 11,000 clean vehicles on California's roads, roughly 6,000 of which are fully zero-emission (HVIP, n.d.). Equally important are the strong equity and economic co-benefits HVIP has helped provide—60 percent of HVIP funds have gone to vehicles in or serving DACs and 41 percent has gone to public or small fleets.[14] More than 30 vehicle makers take part in HVIP as of this writing.

California's green tech industry has benefitted directly in terms of jobs. HVIP investments were credited with creating 3,500 jobs as of June 2022, with matching private investment spurring an additional 11,000 jobs (HVIP, 2023). HVIP investments are significantly leveraged by private and other public funds: every dollar in voucher funding leads to more than three dollars in additional investment. Requests for vouchers exceeded $240 million in 2022 and has been growing steadily, which is encouraging with zero-emission MHDV sales requirements set to start in 2024 under the state's ACT rule (HVIP, 2023).

Two other states with strong VIPs, New York and New Jersey, also have adopted ACT regulations but took very different paths to develop and structure their voucher programs. New York's program, NYTVIP, started in 2013 and like HVIP in California, originally provided incentives to multiple technology and fuel types including battery-electric, hybrid electric, natural gas, and even DPF retrofits. Originally built around CMAQ funding, it was primarily aimed at air quality improvement and was limited to key geographies of the state with the worst emissions challenges.

With its expansion in 2019, NYTVIP combined funding from two sources, CMAQ and Volkswagen Settlement Funds, creating a novel hybrid. While use of the Volkswagen funds required scrappage, it also enabled use of funds state-wide. Effective in early 2022, NYTVIP has also entirely focused remaining funds on zero-emission vehicles given climate and air quality imperatives. The program has helped spur sales for more than 800 vehicles as of March 2023[15] and is a core element of helping the state meet its climate goals. New York's

[14] Tom Brotherton and Tarah Campi (HVIP administrators) in discussion with Bill Van Amburg, 2023.

[15] Provided by NYSERDA staff in review of this white paper.

parallel investments in charging infrastructure provides important added assistance for deployment.

New Jersey's program, New Jersey Zero-Emission Incentive Program (NJ-ZIP), takes yet another approach with a strong economic development bent blended with environmental equity and climate outcomes. NJ-ZIP is funded from New Jersey's proceeds from the RGGI, a multi-state cooperative market structure to cap and reduce carbon emissions from the electric power sector. The program features voucher amounts comparable to HVIP and other states, but its local priorities are highlighted in the actions that can add additional dollars to a voucher. The largest increases by far are for vehicles with a large percentage manufactured in the state (a 25% increase over the base voucher), for vehicles used by a small business (25% increase), and for school buses (25%). Using the vehicle in an environmental justice community adds 10 percent. The approach was attractive enough to essentially sell out the funding for its Phase 1 pilot (over $40 million and roughly 400 vehicles) and sets the stage for Phase 2 starting in 2023 (NJYEDA, n.d.).

These examples paint a picture of powerful outcomes considering the scale of early action and leveraged investments across all the states with VIP programs. An impressive 60 percent—more than 9,000—of the over 15,000 vehicles and equipment deployed across all the existing VIPs are zero-emission at the time of this writing (Table 12). Demand has been greatly increasing in recent years in advance of climate requirements for electrification. These vehicles have been strongly targeted and deployed in those communities with the most critical need for air quality improvements.

As an additional powerful argument for policymakers, another important outcome is the spurring of economic activity. Using HVIP's demonstrated leverage of more than $3 of outside investment to every $1 invested in vouchers, VIP actions to date are on track to spur more than $5.2 billion dollars in clean tech industry activity (HVIP, n.d.). When available funding already in the expenditure pipeline is included, these programs alone will drive over $9.6 billion in clean tech economic activity (Table 12).

Table 12. Impact: Regional VIP Voucher Funds Reserved or Awarded, Available Funding and Vehicle Sales (as of Jan 2023)

VIP Program	Voucher Funding to Date	Funding Available	Total Vehicles & Equip. to Date	Zero-Emission Vehicles & Equip.	Hybrid Vehicles	E-PTOs	Natural Gas & LPG[16] Vehicles	DPFs[17]
California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)	$959 M	$738 M	11,379	6,026	2,580	304	2,469	-
New York Truck Voucher Incentive Program (NYTVIP)	$54.9 M	$25.9 M	814	239	319	-	132	124
New Jersey Zero-Emission Incentive Program (NJ-ZIP)	$44.25 M	$45 M	400	400	-	-	-	-
Drive Clean Chicago	$11.3 M	$0	288	49	221	18	-	-
Massachusetts Offers Rebates for Electric Vehicles – Trucks (MOR-EV Trucks)	$10 M	TBD	221	221	-	-	-	-
Clean Off-Road Equipment Voucher Incentive Project (CORE)	$239 M	$273 M	2,297	2,297	-	-	-	-
Totals	**$1,318.5 M**	**$1,082 M**	**15,399**	**9,225**	**3,120**	**322**	**2,601**	**124**

[16] Only currently offered in NYTVIP.

[17] No longer offered by any VIPs.

Key Takeaways

Using the same framework for VIP design, programs in California, New York, and New Jersey are successfully deploying zero-emission MHDVs in their regions, reducing harmful criteria air pollutant and GHG emissions and creating economic opportunities for their citizens. Though the jurisdictions are separate and distinct, and each program features unique design elements tailored to its funding requirements and regional priorities, the simplified VIP structure and process has accommodated and benefited funders and the stakeholders that are responsible for deploying clean and zero-emission vehicles.

By comparing the programs' designs, a few common principles of a successful VIP emerge:

- Simplicity of Design: While each program weighs their regional priorities differently, these enhancements can be simply integrated into the VIP structures. The use of enhancement percentages for meeting key regional goals is particularly effective and streamlined for users. Such designs make it easy for fleets to understand the amounts available and how to increase them while providing the best option for their unique needs.
- Transparency and Certainty of Outcome: The clearly outlined and transparent approval structure shared among all programs provides a funding guarantee in advance of purchase if all rules are followed. This creates certainty of outcomes for manufacturers, vendors, and fleets, in addition to state and/or local sponsors. The VIP design establishes program rules and processes; publicizes the amount of available and remaining funding; and provides those funds on an open and first-come, first-served basis that provides certainty in a rapidly evolving marketplace for clean vehicles.
- Flexibility/Adaptability: The core VIP design can be tailored to accommodate funding requirements, such as geographical focus or limits or scrappage requirements. Importantly, VIPs can be designed to adapt for changing societal requirements and technological advances. When the first VIPs were launched, multiple technologies and fuels were accommodated. As climate demands increased and as zero-emission vehicles reached market readiness, all VIPs have shifted their funds to speed deployments in this category. Similarly, all VIPs contain mechanisms allowing them to adjust voucher amounts to accommodate market needs through yearly adjustments to caps or category amounts, keeping the programs relevant and vital.

V. Lessons Learned, Recommendations, and Expanding the Voucher Impact

Voucher programs are the gold standard to efficiently deploy zero-emission commercial vehicles, providing certainty of outcome, compelling business cases, and the ability to reach a wider range of eligible fleets than tax incentives. This white paper has explored the flexibilities of program design, demonstrated the successful application of VIPs across the country, and identified funding sources for new or renewed voucher programs. To conclude, this section will share lessons learned from existing programs, recommend best practices for program design, and place voucher programs and the need for zero-emission commercial vehicles in the context of efforts to reduce GHG emissions and improve air quality. Resources on VIPs and CALSTART contacts are provided to encourage readers to take action and explore how to implement an innovative voucher program in their jurisdictions.

Lessons Learned

Since the first VIP launched, CALSTART has maintained regular collaboration with funders and industry experts via an ongoing series of outreach meetings with program participants to assess industry needs, identify barriers to deployment, and identify opportunities to speed adoption. The key lessons learned are shared below:

- **There is a lack of reliable information on total cost of ownership (TCO) and technology.** Despite VIP success to date, many fleets and dealers still have misperceptions about technology performance and the impacts on TCO. The largest misconceptions among fleets and dealers for hybrid and electric vehicles have been about battery life and costs. Such misperceptions greatly affect fleets' calculations for return on investment and residual value. Fleets also need information on the cost of electricity as fuel, maintenance, and repair.
- **Outreach is needed to realize program benefits.** Conversations with dealers and fleets have indicated that continued outreach is a valuable component to grow confidence in, and uptake of, zero-emission vehicle technologies. A program administrator or partner should reach out on an on-going basis to market participants to provide information and education about the technology, application segment opportunities, and TCO improvements of zero-emission vehicles, including providing

access to TCO calculators and pricing information. Doing so will make additional fleets and dealers aware of the availability of vehicle vouchers. Outreach also provides a personal component that creates trust in the program and its administrators.

- **Infrastructure planning and funding is critical to success.** All VIPs have shifted funding exclusively to zero-emission vehicles, and those vehicles are beginning to arrive in the market at initial scale. As a result, the largest and fastest growing need is for fleets to plan their infrastructure installation in advance of their vehicle purchase, and for funding assistance to be provided to help fleets make the transition. All VIP programs need to provide clear guidance to fleets about how to plan adequately for infrastructure, whether for electric charging equipment and utility connections or for hydrogen fueling systems. These installations have lead times that can be longer than the build time for the vehicles. Ideally, infrastructure funding and vehicle incentives would be handled as a package, and CALSTART recommends that agencies capable of managing both activities together consider doing so. The reality is often that vehicle funding flexibility is limited to certain agencies and budgets, as is infrastructure investment funding. California has attempted to bridge this gap by creating close cooperation and links between HVIP vehicle incentives, funded by CARB, and EnergIIZE infrastructure incentives, funded by CEC. Direct links and guidance on each program's websites guide fleets to both incentives. New York has also linked eligibility for utility make-ready assistance to participation in a vehicle incentive program, which enables finite resources to be stacked and can maximize the chances of financial viability.
- **Hands-on assistance is needed for fleets.** The transition to zero-emission technology, while providing multiple benefits to operations and business case, is still a paradigm shift that can be daunting to fleets, particularly smaller fleets and owner-operators. Often fleets lack staff engineers or experts to tap for planning vehicle adoption and procurement, route selection, infrastructure installation, and driver training. Whether included within the framework of the VIP program as part an outreach function, or separately created as a parallel support program, fleets need extra hands-on assistance to go from the fuels and maintenance practices they know to entirely new vehicles. The Mass Fleet Advisor program is a parallel program to MOR-EV trucks that can provide direct planning assistance to fleets in finding incentive funds, identifying vehicles that meet their needs, and planning infrastructure installation. HVIP in California is building fleet assistance into the voucher project itself.

- **Experiencing zero-emission vehicles breaks down myths.** Even as some jurisdictions have started to see the first hundreds of zero-emission MHDVs on their roads, these vehicles are still mostly in targeted states and locations within those states (such as around ports or in urban centers). Most fleets have yet to touch, feel, and drive these vehicles. Such an experience can be transformative. Almost no one who drives one of these vehicles comes away unconvinced of their reality and utility (Stone, 2022). Indeed, it makes fleets ready to plan and buy them. Zero-emission truck and bus showcase events inviting dealers and manufacturers to bring their vehicles for fleets to see and drive, packaged with training sessions, have been highly successful as part of a total outreach and support strategy.
- **Incentives are needed in more than one state**. HVIP has created tremendous interest and spurred significant zero-emission vehicle sales in California, and the VIPs in Chicago, New York, New Jersey, and Massachusetts have each generated initial growth in zero-emission truck and bus markets and the accompanying green economy. However, these remain pockets of deployment. There is a clear need to expand voucher programs to new states to build overall national vehicle volumes and fleet user experience and knowledge to match the pace of vehicle adoption climate change will require.
- **Requirements drive interest.** While incentive programs are vitally important, both to create the early market and to accelerate the rapid pace of adoption needed, they do not function in a vacuum. Having clear state and federal goals and regulations setting the pace and timing for the transition to zero-emission commercial vehicles establishes the need and the urgency that incentives can help address. Without these two elements working together, the pace of market change alone, even with incentives, will not meet climate targets nor support faster improvement in community air quality. States are encouraged to adopt regulations supporting zero-emission vehicle sales and purchase in conjunction with incentive programs.
- **Longer-term certainty creates opportunity for growth.** Market growth takes time; voucher programs need to build awareness and confidence in the program while engaging manufacturers and fleets on adopting or developing new vehicle technologies. Vouchers that are available over a long period create predictability and cost certainty for fleet adoption. For example, the California HVIP program was initially envisioned as a three- to five-year effort, which provided the base for early adoption, but annual funding increased through AB 32 have assured manufacturers and fleets that volume and scale points can be reached to create sustainable cost reductions. Annual HVIP vehicle voucher demand has grown to more than $240

million in 2022 (HVIP, 2023). Additional certainty could be provided if the funding sources were allocated for several years at a time rather than single-year allocations.

- **Maintain simplicity; resist complexity.** The VIP program design provides streamlined funding for fleets and sales for manufacturers and vendors. However, as programs evolve, there is always a need to add new elements, restrictions, categories, and technologies. Often this has been done by adding additional funding tables, separating vehicle categories by technology or use and other approaches. The result can be highly confusing to fleet users. Most current VIPs have addressed this complexity in an elegant design strategy: the modifier or plus-up table. Core voucher funding is expressed in a single table, usually by weight class. Any modifications or restrictions are indicated in a single plus-up (or plus-down, in the case of reductions) table. Both NJ-VIP and HVIP now list their funding in easy-to-follow charts with custom modifications expressed as a percentage increase or decrease. For example, in New Jersey, operating a vehicle in a DAC adds 10 percent to the voucher's value in any weight class. In California, a Class 8 drayage truck receives a 25 percent increase. These approaches accommodate complexity but maintain the simplicity of design and ease of understanding that make VIPs successful.
- **Train users on requirements in a clear, concise manner.** While simple in design, all these programs also designate clear and ongoing requirements for participants. For instance, some programs require each fleet that receives voucher funding to submit yearly or semi-annual mileage reports, but fleets may not properly comply without adequate training. In these circumstances and more, engaging with vendors and fleets early—before their order is made—to clearly review and demonstrate understanding of program requirements will help participants and administrators with compliance and efficient voucher applications.

The experience derived from leading VIPs and engaging directly with manufacturers, fleets, and vendors in several distinct jurisdictions has been beneficial to improve the program's performance and facilitate the deployment of clean vehicles. Because VIPs are flexible and adaptable, any new program should seek the perspectives of valued program participants to continue to improve the voucher experience.

Recommended Steps for Voucher Program Design

Establish Eligible Vehicles to Include and Priorities to Incentivize

The commercial vehicle segment includes an extensive variety of vehicle types, classes, and applications. Programs that prioritize improving air quality may include added incentive value for zero-emission vehicles deployed in communities most impacted by air pollution. Most current VIPs today have provisions to reward equity actions, including supporting small fleets. Focusing additional funding on applications most in need of acceleration, such as refuse, drayage, or school buses, is another common priority. Rewarding technologies that shut down engines at work sites and provide power (ePTO) is an example of broadening the suite of technologies. Including off-road equipment, as done in NJ-ZIP, or creating a targeted program, as in CORE, shows another option for broadening those applications. The technologies incorporated in each of these programs reflect the goals that each program is trying to achieve through clean vehicle deployments.

VIPs that include multiple zero-emission technologies and vehicle classes generally have the greatest flexibility and allow the market to compete and meet clean vehicle opportunities. Even if certain technologies have not consistently met all duty cycles for each weight class (such as fuel cell electric systems as of 2023), providing a voucher incentive for these vehicles will create an economic opportunity for manufacturers to develop technologies that meet all duty cycles. To promote market and technology growth and advancement, VIPs should allow for the addition of new zero-emission vehicle technology options that are not yet identified or commercially available. The ability to add such technologies is especially important during the life of multi-year programs.

Design Voucher Programs and Process

Voucher programs can be designed as single, all-encompassing funds that include all eligible vehicles in a common pool, or programs can be subdivided by applications, technology, or geography. NYTVIP structured a multi-technology voucher system and three separate vouchers within the larger umbrella program. NJ-ZIP structured two phases: the first focused on key urban centers, the second opened state-wide. MOR-EV Trucks uses a rebate approach for vehicles up to 14,000 lbs. and a voucher approach for heavier vehicles. HVIP has an open-to-all main program combined with specific set-asides for drayage, transit, school buses, and small fleets.

Critically, the process for qualifying for, applying for, and receiving vehicles and vouchers must be designed as simply and transparently as possible. The value of creating a simple

design that manufacturers, vendors, and fleets can interact with can be expressed in many ways:

- **Transparency/Certainty**: A transparent program that defines the amount of funding available and allows for vouchers to be processed quickly creates clear economic opportunities for stakeholders to participate;
- **Simplicity/Fairness**: A simple program that is easy for participants that typically deal in vehicle operations to follow will create a sense of fairness—that all projects and participants are equally valued and that the program works to promote clean vehicle deployments in an honest manner; and
- **Low Transaction Costs**: The ease of participating in the program will reduce administration costs and an electronic processing center will streamline interactions, as well as reduce user time and expense to secure funds.

Incorporate Funding Sources and Local Priorities

As established in Section III, a voucher program can (and must) be tailored to fit the requirements of its funding source. A city, state, or region can incorporate specific funding requirements with the chosen technologies and processes to yield a complete VIP that will deliver clean vehicles in a precise, unique, and optimal manner. Depending upon the funding source, requirements may pertain but are not limited to:

- Permissible vehicle types (low GHG output from California cap-and-trade funding);
- Scrapping existing vehicles (Volkswagen Settlement NOx Mitigation Trust);
- Meeting requirements of domestically sourced, assembled, or purchased materials or components (CMAQ); and
- Location of vehicle deployments (CMAQ and California cap-and-trade funding).

Modifications and additions to the VIP design are not limited to funding requirements but can stem from the particular concerns or interests of local policymakers and other stakeholders. To ensure that a VIP most effectively meets the clean transportation needs of fleets and residents within a particular jurisdiction, the program's designers should convene working groups or listening sessions to gather information. Examples of stakeholders that should inform the conversation may include:

- City and state air, energy, and transportation agencies;
- Vehicle and component parts manufacturers;
- Fleets that have adopted clean vehicles and fleets that have not yet adopted clean vehicles; and

- Community groups representing residents affected by transportation pollution.

An effectively organized design process that incorporates feedback from knowledgeable and invested stakeholders will produce a VIP that will meet the demands of its constituents and successfully deploy clean vehicles that meet the program's emissions goals.

Ongoing Collaboration with Industry and Policy Experts

Marrying continued efforts to improve the program with a thoughtful and targeted design is crucial to achieve a VIP's clean vehicle deployment goals. As technologies improve and populations shift, adjustments may be necessary to ensure that the program is working effectively. Outreach activities may include the following strategies:

- Promoting the program to interested fleets and manufacturers to ensure that all qualified and interest parties are aware of and have access to clean vehicle funding;
- Collaborating with the vehicle manufacturers to identify and certify new technologies that will be eligible under program guidelines;
- Tracking vehicle usage to ascertain the mileage, air quality impacts on neighborhoods, and types of duty cycles that the vehicles are meeting; and
- Developing a feedback loop with all stakeholders about the relative successes and shortcomings of the project to continue refining and improving the program.

To achieve ongoing collaborative goals, a funding agency may prefer to engage a trusted and knowledgeable contractor. An unbiased third-party group such as CALSTART could play a useful coordinating role in understanding the landscape and requirements, as well as tapping the knowledge of all interested parties. CALSTART's extensive experience with several programs would also be beneficial at the program's beginning phases since the organization has effectively designed and implemented five separate incentive programs and has a solid understanding of the needs and priorities of industry and fleet decision-makers. CALSTART also works with federal agencies and other partners involved with complex federal and state funding. With a network of national offices, accumulated expertise on commercial vehicle technologies and strategies, and a demonstrated record of success in deploying clean vehicles, CALSTART embraces the opportunity to expand the adoption of its proven VIP design and to work with new jurisdictions to deploy zero-emission vehicles through the VIP model.

A Tool to Activate New Beachhead Markets for Clean Commercial Vehicles

Voucher programs at the state and city levels have proven highly successful in activating local or regional markets for advanced clean—and now primarily zero-emission—vehicle options. However, this market activation must expand beyond early adopter states to meet the critical climate and air quality goals committed to at the federal level and adopted as well by many states. The voucher incentive design can be replicated, using newly available federal funds, to create a larger national network of incentive programs that will collectively reduce GHG emissions and improve air quality for U.S. residents. Expanding to additional states and cities will benefit all clean vehicle industry stakeholders—fleets, manufacturers, suppliers, government, and nonprofit groups focused on air quality and energy security—as well as states, cities, and their residents that benefit from the cleaner air enabled by zero-emission vehicle deployments.

When combined with the federal tax credit for zero-emission MHDVs, a broader network of state and regionally based voucher incentives will greatly increase the size and scope of the transitional market, leading directly to additional air quality and petroleum reduction benefits. It will drive expanded vehicle sales, creating and retaining national and local jobs in this industry. Perhaps most importantly, a broader network of incentives will help boost volumes and drive down component and vehicle costs through economies of scale, creating a virtuous cycle that will increase deployment and further drive down costs. The effect of incentive programs as a market catalyst will grow as the reach of these incentives expands beyond a few early adopter states and cities.

CALSTART's Global Commercial Vehicle Drive to Zero Program (Drive to Zero) seeks to leverage early successes for zero-emission vehicle adoption, such as those in areas with VIPs, for deeper market transformation while extending the reach of these markets by working with additional jurisdictions to seed new markets. In expanding beyond early adopter areas, Drive to Zero intends to help establish regional beachhead markets across the globe where the conditions are present for zero-emission commercial vehicles to become viable across a wide range of applications.

A series of these fast-mover markets can develop local supply chains and make large-scale zero-emission commercial vehicle adoption more affordable and manageable for fleets. The potential benefits of establishing incentives and driving the zero-emission vehicle economy can include:

- Manufacturers expanding operations to new markets to meet local demand;

- Regional supply chains improving, making component parts and replacements more affordable;
- Building infrastructure to service and fuel zero-emission vehicles (infrastructure installation and maintenance is a hyper local employment opportunity);
- Expanding vehicle options for fleets to support additional use applications and speed adoption;
- Generating greater investment in new technology and manufacturing capacity through a growing regional zero-emission vehicle economy; and
- Reducing GHG and criteria air pollutant emissions through the adoption of zero-emission vehicles.

Establishing a VIP generates clear, localized economic and environmental benefits, but a regional approach that can cultivate a beachhead market will attract additional support from industry partners; existing beachhead markets like California, China, and Northern Europe are seen as critical bellwethers and conduits for growing national and international zero-emission commercial vehicle adoption. For instance, CALSTART works with partners in beachhead markets to develop institutional and industry knowledge to help establish and grow zero-emission commercial vehicle markets. By establishing a VIP in a beachhead market, jurisdictions can compound the benefits of a voucher program through impactful and extensive industry and nonprofit collaboration.

Key Takeaways

Direct purchase vouchers are the preferred tool for zero-emission and clean commercial vehicle deployment. These simple, streamlined incentives can greatly improve the business case for new technologies, helping fleets purchase more efficient vehicles and helping manufacturers and suppliers increase sales to build the production volumes needed to comply with standards and to lower purchase price.

Vouchers reduce user uncertainty as well as administrative burden; can be easily utilized by tax-exempt fleets; and effectively lower capital costs at the point of purchase, which is a key barrier. The certainty, simplicity, and transparency inherent in the voucher process make this method of incentives the preferred option of manufacturers and fleets.

The VIP design is flexible to conform to funding-source requirements, from state-specific revenues for clean energy to federal clean air programs or a unique settlement or appropriation, such as provided by the Volkswagen Mitigation Trust. Each jurisdiction can revise the program design to meet local needs, including environmental equity concerns

and individual air quality and GHG goals. The successes of distinct and separate voucher programs demonstrate how capably a VIP can be adapted to meet funding requirements while facilitating clean bus and truck deployments.

Cities and states across the United States are searching for the best methods to meet their climate goals and reduce harmful criteria air pollutants that damage the health and wellbeing of residents. VIPs are a proven, effective tool to speed replacement of polluting commercial vehicles with the zero-emission options available now.

VI. Get Involved

Contact

CALSTART can serve as a resource for any questions about the VIP design and implementation process. Please reach out to the following offices with any questions or information requests:

Southern California (Headquarters & HVIP) 48 S Chester Avenue
Pasadena, CA 91106
626-744-5600
calstart@calstart.org
info@californiahvip.org

Northeast Regional Office (NYTVIP)
Jennifer Kritzler, Northeast Regional Deputy Director
67 35th St, Suite B508
Brooklyn, NY 11232
929-295-6540
jkritzler@calstart.org

To be involved in the national effort on vouchers, contact Tom Brotherton, Senior Director of Market Acceleration, at tbrotherton@calstart.org; Orville Thomas, State Policy Director, at othomas@calstart.org; or Alissa Burger, Regional Policy Director, at aburger@calstart.org.

Additional Resources

The following websites, reports, and regulations found below may provide valuable information resources for the topics and programs discussed in this white paper.

Additional Resources

VIP Websites

- California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP): https://californiahvip.org
- California's Clean Off-Road Equipment voucher incentive Project (CORE): https://californiacore.org/
- California's Energy Infrastructure Incentives for Zero-Emission (EnergIIZE) Commercial Vehicles Project: https://www.energiize.org/
- Massachusetts' MOR-EV Trucks: https://mor-ev.org/mor-ev-trucks
- Massachusetts Fleet Advisor: https://www.massfleetadvisor.org/
- New Jersey's New Jersey Zero Emission Incentive Program (NJ-ZIP): https://www.njeda.com/njzip/
- New York's Truck Voucher Incentive Program (NYTVIP): https://www.nyserda.ny.gov/All-Programs/Truck-Voucher-Program
- Drive Clean Truck, City of Chicago (completed): https://www.cmap.illinois.gov/documents/10180/1109463/CDOT+Drive+Clean+Truck_2020_02_24.pdf/e07c1759-d859-a16e-ff79-2b26a08f578e
- Drive Electric Chicago, City of Chicago: https://www.chicago.gov/city/en/progs/env/drive_electric_chicago.html
- Eco-Trucking Program, Ontario Ministry of Transport and Sustainable Mobility: https://www.transports.gouv.qc.ca/fr/aide-finan/entreprises-camionnage/aide-ecocamionnage/Pages/aide- ecocamionnage.aspx

Additional Information

- Global Commercial Vehicle Drive to Zero Program (CALSTART): http://globaldrivetozero.org/
- Zero-Emission Technology Inventory (ZETI)—a listing of available zero-emission vehicles nationally and globally (CALSTART): https://globaldrivetozero.org/tools/zeti/
- Global Roadmap for Reaching 100% Zero Emission Medium- and Heavy-Duty Vehicles by 2040 (CALSTART): https://globaldrivetozero.org/publication/global-roadmap-for-reaching-100-zero-emission-medium-and-heavy-duty-vehicles-by-2040/
- Building a Better America: A Guidebook to the Bipartisan Infrastructure Law for State, Local, Tribal and Territorial Governments, and other Partners (The White House, version 2): https://www.whitehouse.gov/wp-content/uploads/2022/05/BUILDING-A-BETTER-AMERICA-V2.pdf
- Apportionment of Federal-Aid Highway Programs for Fiscal Year (FY) 2022, U.S. Federal Highway Administration (FHWA): https://www.fhwa.dot.gov/legsregs/directives/notices/n4510858/n4510858_t1.cfm
- Issue Brief: Flexible Federal Funding Opportunities for State and Local Clean Transportation Investments (Georgetown Climate Center): https://www.georgetownclimate.org/blog/federal-transportation-funding-flexibility.html
- Issue Brief: Estimating the Greenhouse Gas Impact of Federal Infrastructure Investments in the IIJA (Georgetown Climate Center): https://www.georgetownclimate.org/articles/federal-infrastructure-investment-analysis.html#ref-10
- Congestion Mitigation and Air Quality Program Laws and Regulations (Federal Highway Administration): https://www.fhwa.dot.gov/environment/air_quality/cmaq/laws_and_regs/

Additional Information

- California Climate Investments (California Air Resources Board): https://ww2.arb.ca.gov/resources/documents/cci-investment-plan
- Volkswagen Clean Air Act Civil Settlement (U.S. Environmental Protection Agency): https://www.epa.gov/enforcement/volkswagen-clean-air-act-civil-settlement
- Amended Partial Consent Decree (U.S. Environmental Protection Agency): https://www.epa.gov/sites/production/files/2016-10/documents/amended20lpartial-cd.pdf
- Volkswagen Settlement Beneficiary Mitigation Plan Toolkit (National Association of State Energy Officials): https://www.naseo.org/Data/Sites/1/naseo-vw-beneficiary-mitigation-plan-toolkit-final.pdf

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