Metrics, Outcomes & Evaluation Framework

Zero Emission Delivery City Climate Innovation Challenge

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Acknowledgements

The Los Angeles Cleantech Incubator (LACI) - in partnership with Climate Mayors and C40 - developed the Zero Emissions Delivery (ZED) City Climate Innovation Challenge to spur the move to zero emissions delivery by piloting startup and private sector solutions among a national multi-city cohort committed to advancing transformative climate solutions. The cities selected to participate represent a diversity of geographies and a critical mass of populations across the U.S. They demonstrate the opportunity and willingness to create innovation "sandboxes," where business models, pilot designs, and policies can be tested in different-sized cities, political climates, etc., related to zero emissions delivery. The ZED City Climate Innovation Challenge is supported by the U.S. Department of Transportation Ride and Drive Electric funding program, the State of California, the Eli & Edythe Broad Foundation, MUFG Bank, Rockefeller Foundation, and Wells Fargo.

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INTRODUCTION

As cities seek to find and implement climate solutions, Zero Emissions Delivery (ZED) pilots provide an opportunity to test out partnerships with the private sector in an effort to create equitable and innovative solutions to first-last mile delivery challenges.

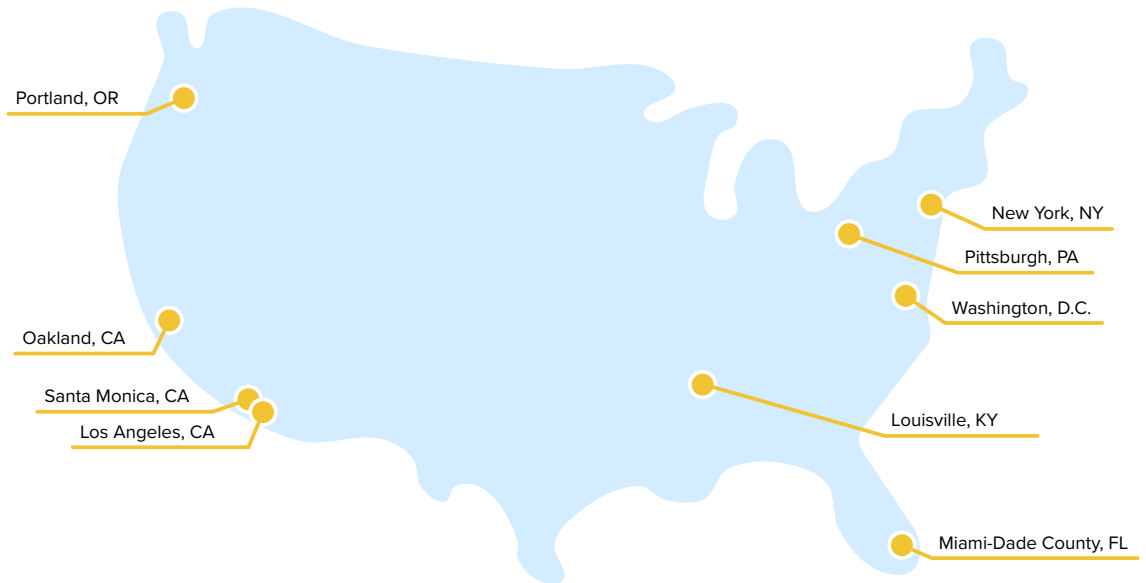
This framework guides cities through the design, implementation, and evaluation of ZED pilots, and provides insights into the pilot development process for non-governmental partners. The pilots associated with the ZED City Climate Innovation Challenge create an important testing ground for cohort cities to evaluate what outcomes are measurable and achievable (or not), including model ZED policies and business model interventions for other cities to apply, test, and potentially scale in the future.

As such, this framework is a resource to assist cities in identifying measurable, achievable, and relevant outcomes and metrics when developing a ZED pilot program. The framework is being applied to the ZED City Climate Innovation Challenge cohort pilots as a test case, demonstrating how the framework can be applied to real-life ZED pilots in different political and geographic contexts.

This framework will also help cities develop clear criteria to evaluate the ZED business models deployed as part of a pilot program. Business model evaluation allows a city to both test and measure the efficacy of applying different levers and incentives to private sector partnerships, and can help inform necessary mid-pilot adjustments and/or pilot extensions, termination, or scaling. Overall, this evaluation framework will help cities measure and assess the impacts that different business models, policies and technologies have on addressing their problem statements/use cases in order to meet their overarching ZED goals and desired outcomes.

In addition to city audiences, this framework can also be a beneficial resource for the private sector, NGOs, and academia, as it provides information about how cities design and measure pilots and their implementation through policies, partnerships, and processes. This guidance is especially useful to the companies with ZED solutions, as it can guide their product offerings and go-to-market strategies.

Map of Participating Cities



FRAMEWORK GOALS

This framework is designed to help cities (and their partners) design effective, measurable, and equitable ZED pilots, and to better understand learnings from these pilots related to key questions and needs posed at the onset of pilot design. Additionally, it should assist private sector partners as they evaluate the effectiveness of their business model and technology in addressing the needs of the use case. These framework goals were developed in partnership with the ZED City Innovation Challenge cohort, and are reflective of their specific needs.

Ensure Outcomes-Driven Pilots

At the onset of a pilot's design, clearly articulate priorities and goals, so as to serve as the critical throughline from pilot conception to implementation to ensure the pilot is meeting a true purpose and need.

Develop Measurable Outcomes & Metrics

Define pilot and business model evaluation criteria to develop measurable metrics and realistic, desired outcomes. Outcomes and metrics to assess a pilot are only as good as they are measurable; therefore, ensuring a city has a practical and achievable method for evaluation is critical to ensuring that a pilot's impact can be measured.

Establish a Roadmap for Cities Beyond the Cohort

Serve as a roadmap for cities outside of the cohort interested in building their own ZED pilot by providing process and outcome-oriented considerations, recommendations, and references for establishing desired outcomes, associated metrics and evaluation criteria.

Foster Public Private Partnerships to Innovate ZED Solutions

Offer private sector vendors guidance to better understand how to design, sell and contract products and services that both meet the needs of the public sector and generate a successful business case.

Ensure Pilots are Rooted in Equity

The Justice40 Initiative establishes the goal that 40% of overall benefits of federal investments flow to disadvantaged communities (DACs). Cohort cities used this guideline to inform the geographic locations and overall design of their pilots, so as to target benefits from these initiatives toward disadvantaged communities. Relevant Justice40 policy priorities considered for DAC's within pilot designs include:

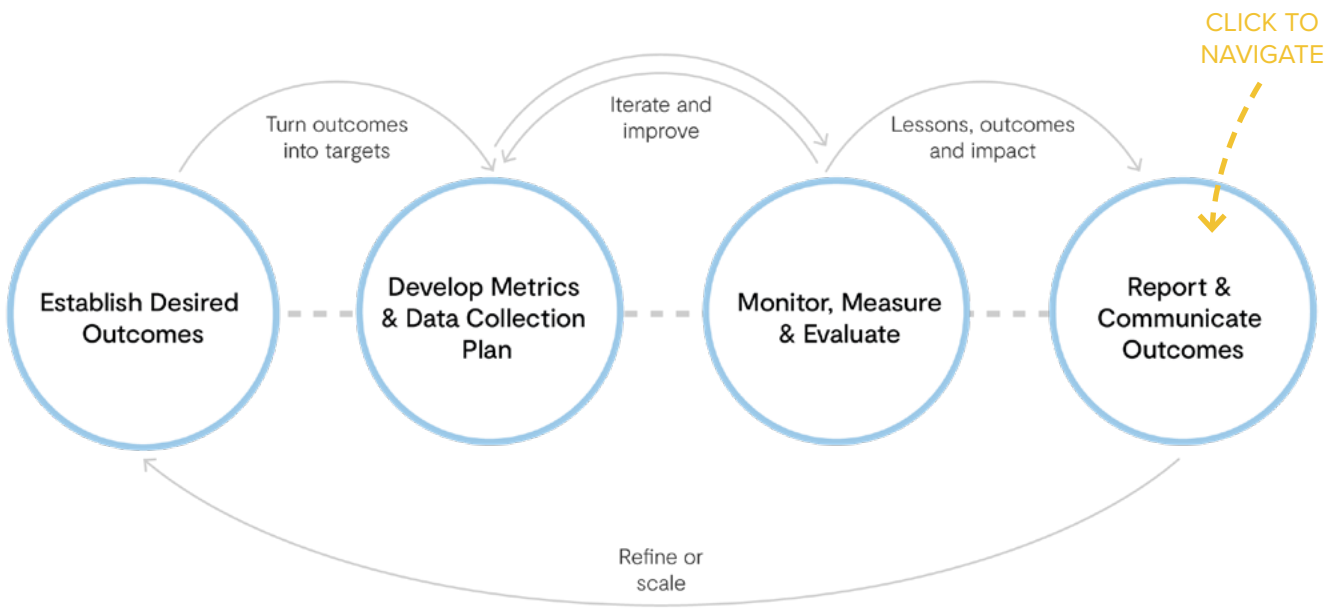
- Decrease environmental exposure and burdens
- Increase parity in clean energy technology access and adoption
- Increase clean energy enterprise creation and contracting
- Increase clean energy jobs, job pipeline and job training for individuals

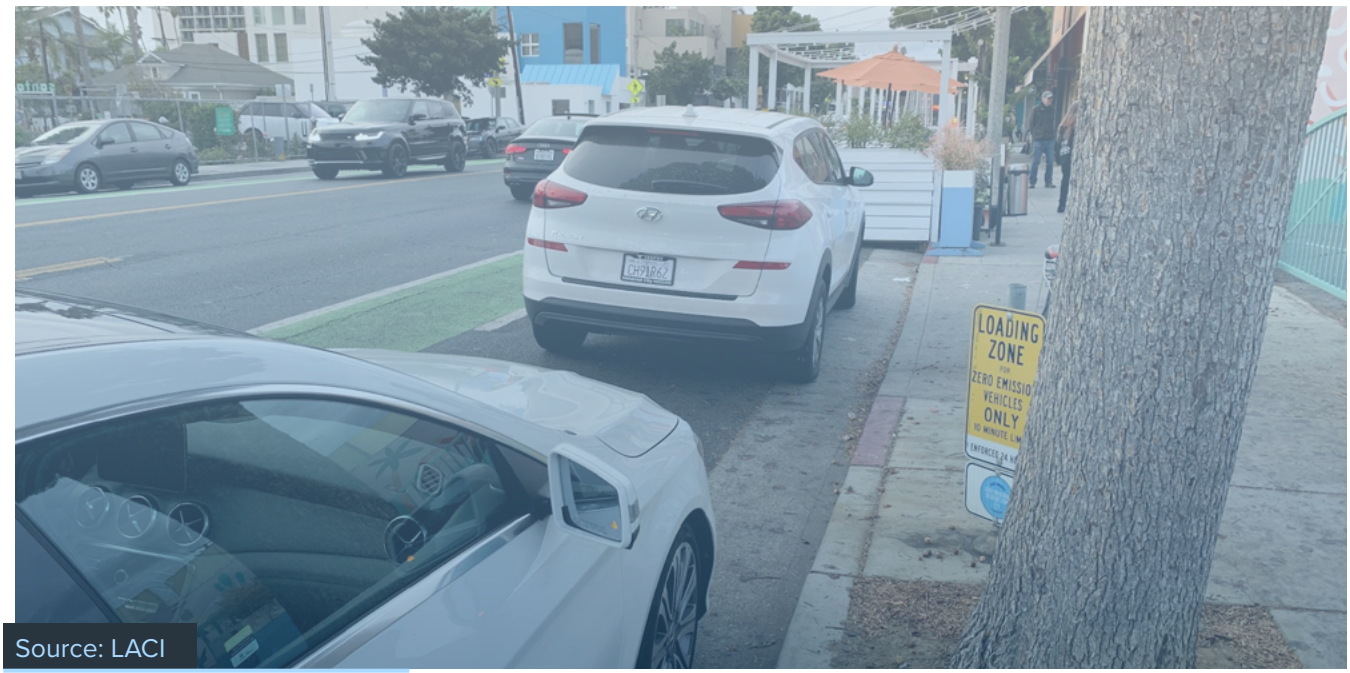
Determine Effectiveness and Scalability of Pilots

Provide guidance on how to measure the impact of a pilot to learn about the effectiveness of a chosen intervention and use case. Ensure the ability to develop rigorous and realistic evaluation criteria, identify appropriate data collection, monitoring and reporting strategies, and craft persuasive and audience-specific narratives that articulate the pilot's findings and learnings. Provide guidance as to whether a city should scale a pilot, taking into consideration the effectiveness of their intervention, what made the intervention successful (or not), whether that same use case is best to be tested in other areas, and/or what other critical factors should be considered to determine a future location and/or target population for piloting.

METRICS, OUTCOMES, AND EVALUATION FRAMEWORK
HOW-TO GUIDE

The framework is designed with a checklist to support iteration, recognizing that as insights are gained, revisiting and refining earlier steps may be necessary.





Source: LACI

PHASE 1

ESTABLISH DESIRED OUTCOMES

Desired outcomes should act as a North Star throughout the pilot process, align with broader citywide priorities and policy goals, be measurable and specific, and solve for a true purpose and need.

While a pilot can have more than one desired outcome or goal, it is important to keep testing focused on a limited number of variables in order to discern which factors affect the outcome of the pilot.

- ☐ **Establish the problem statement(s):** Identify what the pilot is trying to test, and what problem it is trying to solve for. This can be written as a hypothesis, i.e., "if x happens, then y will happen." The problem statement should serve as the basis of the pilot, and should make clear the challenge the community is facing and how the pilot will attempt to solve it.

- ☐ **Identify goals for the pilot:** Identify one or more Specific, Measurable, Achievable, Relevant, and Time-Bound (SMART) pilot goals that will help to solve the specified problem(s). These goals should be shared with key external stakeholders affected by the problem statement (i.e. residents, community-based organizations, local businesses, etc.), and relevant feedback should be considered and incorporated. This will help lay the groundwork for buy-in from the community.

- ☐ **Ensure goals align with broader agency and City goals / values:** Identify a clear connection between the goals of the pilot, and agency and/or City's other priorities. Generally, if the pilot does not align with at least one City-wide goal, it should not proceed. There should be a clear connection between how a pilot's success will help achieve overarching policy goals, plans, and priorities.

- ☐ **Ensure that the pilot actively considers equity, environmental justice, and other societal cost-benefits:** Consider the societal cost-benefit (i.e., weigh the "fully loaded" cost-benefit scenario for action) of how the pilot could impact factors such as social equity, the environment, health, safety, economy, and fiscal sustainability. This should consider both short-term impacts, as well as the potential effects of extending the pilot into a sustained program if proven successful and viable. In particular, the pilot design process should consider the impact of the intervention on vulnerable populations so that the City can conduct due diligence of engaging affected populations and/or geographic areas, providing stakeholders with necessary outreach and education to provide resources about the pilot.

- ☐ **Engage relevant external stakeholders (i.e., business improvement districts, businesses, community organizations, advocacy groups, etc.) that will have an active interest or investment in the pilot and its goals:** Identifying relevant organizations and stakeholders is a vital aspect of pilot development and implementation. Community organizations should be brought into the pilot design process, engaged in education campaigns about the pilot, and ideally support outreach to garner buy-in for the pilot and its intended outcomes[1].

- ☐ **Identify potential private sector collaborators:** Consider the problem statement and the pilot's intended goals, and conduct a market scan to identify potential partners who may offer products or services that meet the specific needs of the pilot. This can determine what technologies and/or services are needed from the market to test a solution to the problem statement, and/or meet desired goals.

Go Back to the Beginning to Reassess

[1] For the purposes of this framework, this recommendation only details engagement with stakeholders at a high level. While the framework provides critical guidance for engagement, cities should also develop a separate, more robust and continuous community engagement plan around their pilot (and in some cases, this plan will involve direct engagement with the public) to promote pilot co-design/creation, educational awareness and community buy-in.

PHASE 2

DEVELOP METRICS & DATA COLLECTION PLAN

To determine what a City wants to learn (both in terms of process and outcomes), City administrators should establish key performance indicators (KPIs) and metrics at the outset of the pilot.

These measures will allow for ongoing evaluation, and will help a City determine if a mid-pilot shift is necessary, and/or if the pilot should be scaled or simply conclude at the end of the proposed service dates. Data collected to inform measures will also tell a City whether or not they are learning what they set out to learn at the onset of the pilot. Establishing a data collection plan is also important to identify data sources, as well as inform data-sharing agreements, including components related to privacy, security, and standardization.

- ☐ **Identify Key Performance Indicators to measure progress toward desired outcomes:** Using the identified outcomes as a guidepost, identify a targeted list of KPIs and specific metrics to track throughout the pilot. These measures should be focused, realistic, and quantifiable (i.e., ensure the City has the necessary resources to collect, store, and analyze data). Ensure that the selected data can give information about the effectiveness of the pilot toward achieving desired outcomes and solving the problem statement, including data reflecting process learnings (e.g., did the internal workflows, procurement and contracting strategies, etc., work well to design and implement the pilot?) and end-result (e.g., % reduction in vehicle miles traveled (VMT) during the course of pilot) outcomes.

- ☐ **Identify required data and data sources to inform KPIs and metrics:** Leverage KPIs and other metrics to inform data collection methods and data assessment - if the data being tracked does not provide information to inform the measurement of KPIs and/or metrics, it is not relevant to the pilot. This process is iterative - if it is unrealistic or infeasible to collect the data necessary to achieve the identified desired outcomes, consider adjusting outcomes to reflect the data reality. Identify the data that will help establish a baseline state prior to pilot deployment. For example, if the pilot measures the impact of a Zero Emissions Delivery Zone (ZEDZ) on congestion, identify baseline data that demonstrates what average congestion levels were prior to the deployment of the ZEDZ. Establish whether that data is available through a City department or external source, and what else needs to be collected before pilot implementation.

- ☐ **Collect relevant contextual data:** Consider collecting contextual data (e.g., socioeconomic data, etc.) to help paint a broader picture of the context and impact of the pilot's intervention.

- ☐ **Establish a Data-Sharing Agreement:** If data is being shared between private sector and City partners, establish a data-sharing agreement. Data-sharing agreements should be developed collaboratively with project partners within a project charter or memorandum of understanding. This agreement should take into consideration what type of data each partner has access to, whether they are willing (or able) to share it, if there are incentives or levers the City can use to gain access to private sector data that would inform evaluation of the pilot, as well as privacy, security, and anonymized data considerations.

- ☐ **Create and Implement a Data Collection Plan:** Leveraging all previous steps, establish a data collection method (how, by who, and when will data be collected; data sources; frequency of data collection; privacy and security protocols, etc.), to design a workflow for how to collect, measure, and retain data. Data can be collected from various city agencies, private sector partners, federal and state data resources, etc. When identifying data sources, consider data maturity, standardization, storage, acquisition, and completeness/accuracy. This assessment will help to ensure the health of the data, and accuracy of relevant measurements and evaluation.

Go Back to the Beginning to Reassess

Data Collection and Information Flow

Outcomes and Process Learnings

Process Learnings: focus on how the program is being implemented and the effectiveness of the systems, practices and procedures involved. These learnings are primarily concerned with understanding the "how" and "through what means" of the pilot, including operational procedures, program execution, adaptation and troubleshooting, etc.

Outcome Learnings: focus on the results or impact of the pilot, examines whether the pilot achieved its intended goals and objectives, and evaluates the effectiveness of the intervention. These learnings are primarily concerned with understanding the "what" and "why" of the pilot, including the impact on target population, performance metrics, and long-term sustainability of the program.

Key Performance Indicators

Specific type of metric that is strategically aligned with the objectives of the pilot. These measures should help the project team assess whether the pilot is meeting its critical goals.

Metrics

A broad measurement that provides data on various aspects of the pilot program's performance. These are not necessarily tied to the objectives of the pilot, but help to track relevant data that individually gives insight into pilot activities, and together provides insight into pilot performance.

PHASE 3

MONITOR, MEASURE & EVALUATE

Monitoring and continuous measurement are critical components to effective pilot implementation, and help a City determine progress toward the pilot's desired outcomes, as well as determine if a mid-pilot adjustment is necessary and/or if the pilot should be scaled.

Pilot monitoring and measurement allow a City to understand how effective the pilot intervention is toward solving the identified challenge, purpose, and/or need.

- ☐ **Conduct continuous evaluation:** The previously established data collection plan should include details on how to perform data collection to inform analysis on the impact, process, and efficiency of the intervention. Evaluation at pre-determined intervals is helpful to determine if an adjustment to data collection, frequency of collection, designated metrics, or any other component of the use case is required.
- ☐ **Evaluate at the conclusion of the pilot to determine if it was "successful" or not:** Pilots are about testing interventions to solve challenges. A well-run and "successful" pilot is one that results in lessons learned, not necessarily one that achieves desired outcomes. Connect back to the purpose and problem statement, goals/desired outcomes; evaluation criteria; and data collected to make the determination. The evaluation process should consider what was learned about the internal pilot process, the utility of any public-private partnerships, and what outcomes and impact the intervention had (including any policies that should be considered for permanent adoption).
  - ☐ **If the pilot was "successful", determine if it should be scaled and/or replicated:** If the intervention was determined to be successful (i.e., the city learned what they set out to learn), City staff should evaluate the benefits (and costs) of scaling and/or replicating the pilot. This can mean deploying the same use case in a new geography, a new use case using the same technology/intervention in the same or different geographic area, or considering how to scale the pilot to a full program with dedicated funding.
  - ☐ **If the pilot was "unsuccessful," determine whether it needs to pivot or be concluded:** At the conclusion of the pilot, the specific intervention deployed may not have been successful in providing new or useful information about the problem statement or in achieving intended outcomes. This information is still valuable, as it helps a City determine changes that may be necessary to improve this or other ZED use cases in the future (e.g., change the use case, pilot design, public-private partnership agreement, hours of operation, etc.).

Go Back to the Beginning to Reassess

PHASE 4

REPORT & COMMUNICATE OUTCOMES

Reporting and communicating outcomes are an important final step in the pilot process.

After the pilot concludes and is evaluated, the City should share lessons learned, outcomes achieved, and impact assessed. These reports should be catered to targeted audiences, with tailored messaging for key stakeholders, including internal and external partners, and the public. Any communication after the conclusion of the pilot should take into consideration the internal and external components of the pilot - for instance, could the City provide a public-facing data dashboard that informs residents about the pilot's learnings and outcomes?

- ☐ **Solicit community and stakeholder feedback:** Re-engage with the stakeholders and community groups engaged prior to pilot deployment, as well as staff and private sector partners. Collect key takeaways and feedback from/about the pilot, and incorporate into learnings, reports, and scaled versions of the pilot.
- ☐ **Develop a plan for disseminating information and learnings:** Communication materials and strategies should be tailored to the specific audience (i.e., internal vs. external audiences, community partners vs. private sector, etc.). Materials developed during this process should be designed to be repurposed for different settings / audiences.

Go Back to the Beginning to Reassess

Source: Evan Costagliola

HOW MIGHT CITIES EVALUATE ZED BUSINESS MODELS?

While companies like DHL and Amazon regularly test new delivery concepts within their proprietary delivery ecosystem, ZED pilots often require public-private partnerships, as the public sector plays an important role in the regulations and policies governing the right of way where pilots occur.

Levers that the public sector steward can include street and curb use, real estate access, regulatory tools, financial tools, and more. As such, cities and their partners should evaluate the effectiveness of the pilot's underlying business model before, during and, after pilot deployment. Proactive evaluation is beneficial to cities for many reasons, including, but not limited to:

- Ensuring the partnership is financially viable for industry and business partners
- Testing new and/or modified tools and levers the City can use to improve future public-private partnerships
- Informing the scalability of the pilot (and/or the sustainability of a future program)
- Assisting City partners in identifying alternative partners in the future

Cities have historically kept a distance from influencing business models. However, successful public-private partnerships in the ZED space are a direct reflection of how nurturing a city's regulatory, incentive, and partnership testing ground might both achieve better outcomes for the community, as well as provide viable business cases for private partners. If business models consistently fail in spaces that require private enterprise success to achieve broader community and mobility outcomes, then cities must introspectively evaluate their levers and the health of their testing ground.

ZED BUSINESS MODEL EVALUATION CRITERIA

As cities enter into partnerships with private organizations, they need to evaluate the strengths and weaknesses of the intrinsic business model to provide insight into longer-term sustainability of the pilot/program if proven successful. If cities are going to leverage public funding or other critical assets (e.g., public space or municipal real estate) to support the pilot, then fair value exchange should be the foundation of the public-private partnership, and cities need to reasonably request and/or research the underlying data necessary to evaluate the ZED business model. In this case, cities should choose to activate their resources with clear rules of engagement, and negotiate a data exchange[2] with the private partner to support a useful evaluation of the pilot and business model. While city staff are not expected to know the ins and outs of venture capital and start-up business models, they should gain a general understanding of how these technology companies become profitable and/or rely on government assistance to effectively negotiate access to information that can be used to evaluate the soundness of the business model, and therefore, provide insight into pilot effectiveness.

Evaluation Timeline

Pre-pilot business model evaluation occurs in the **pilot development stage**, and can help to inform pilot design.

Mid-pilot business model evaluation occurs at **regular intervals** once the pilot has been launched to determine if adjustments are necessary.

Post-pilot business model evaluation occurs **upon completion of pilot** period to decide whether the pilot will be scaled, replicated, adjusted, or concluded.

		Pre-Pilot	Mid-Pilot	Post-Pilot
Funding Considerations	Reliance on government subsidy and intervention			
Funding Considerations	Creative secondary revenue streams			
Pilot / Partnership Design	Government levers			
Pilot / Partnership Design	Primacy			
Funding Considerations	Profitability measures and prediction			
Funding Considerations	Venture capital reliance and/or impact:			
Pilot / Partnership Design	Bottlenecks			
Private Sector Partner Compatibility	Outcome alignment			
Private Sector Partner Compatibility	Cost/benefit			

The following pages include key evaluation criteria that cities can use to assess the strength, sustainability, and outcome-alignment of ZED business models. Due to the many different types of business models and associated factors, these criteria are intended to provide general guidance on ZED business model evaluation, rather than a step-by-step "how-to" guide. Throughout the pilot process, these criteria (and others) can be tailored to a specific ZED pilot to help determine whether adjustments are needed to the partnership agreement and/or to the pilot design.

In the table, the rationale for each criteria is included, as are key questions to be considered when evaluating those criteria. These questions are meant to guide interactions with and requests of the private sector partner, and/or to inform independent research.

[2] Refer back to "How-To Guide" pg. 6 on building a data sharing agreement

Funding Considerations

Evaluation Criteria

Venture capital reliance and/or impact: Although a private company's funding data is not always publicly available, cities can ask for details related to their last/current raise, EBITDA, current capitalization mix, etc. as part of the pilot or permit program application. Understanding the funding runway is important at each step of the pilot process to anticipate any potential pivots that may be necessary due to unexpected funding changes.

Key Questions: What is the company or companies' funding runway? Do they have an upcoming funding round where they are using this as an opportunity to boost their raise?

Profitability measures and prediction: Understand, generally, if the business model will be profitable, self-sufficient, and able to operate without long-term financial support or public investment.

Key Questions: Can the private partner measure and track profit over the course of the pilot? In the pre-pilot phase, can the private partner reasonably model profitability and the conditions of profitability, both with and without financial intervention from the government? If profitability cannot be achieved (or will be difficult to measure), can the City balance the outcomes with the conditions for profitability in the pilot's design?

Reliance on government subsidy and intervention: Prior to launch, this evaluation will help to establish the funding design and expectations of the pilot. Following the conclusion of the pilot period, understanding the funding requirements informs the future financial sustainability of the pilot, especially if geared toward becoming a sustained program.

Key Questions: Is there: 1) a clear government business model in place that can be sustained, 2) a pathway to reduced government intervention, and/or 3) a clear indication of long-term government funding sources?

Creative secondary revenue streams: If the pilot program is the main source of revenue for the private partner, they are unlikely to be able to sustain or scale the pilot program. The city should determine whether the private partner has potential to collect alternative revenue to supplement the project.

Key Questions: Are there multiple revenue streams that can generate sufficient revenue to fund and scale the pilot? Can the secondary revenue streams enable revenue share or pay for agreed upon community benefits?

Pilot / Partnership Design

Evaluation Criteria

Bottlenecks: Throughout the pilot design, implementation, and evaluation process, looking around corners and anticipating potential challenges will help to improve the execution of the pilot.

Key Questions: Are there perceived bottlenecks in the business model framework that will hinder the business model? Are they addressable within the pilot timeframe? If not, are the risks less than the benefit of piloting the business model?

Primacy: Early on in pilot design, the City needs to understand how central partners are to the pilot's success and the viability of the pilot's business model.

Key Questions: If large delivery companies and third-party logistics companies elect not to participate or pull out of the pilot, will it impact the viability of the business model? Are there upstream market impacts that might influence the viability of this business model?

Private Sector Partner Compatibility

Evaluation Criteria

Outcome alignment: Ensuring alignment between business model design and the City's desired outcomes for the pilot can help determine if the partnership is the right fit, if the partner provides a technology or service that narrowly solves the pilot's problem statement(s) and whether or not to continue the partnership in the future.

Key Questions: Does the business model thrive when climate and equity outcomes are addressed? Is there potential reinvestment into the community to ensure secondary and tertiary benefits (e.g., jobs created, safer streets, partnership with local small businesses, etc.) to residents and business owners?

Cost/benefit: After the launch of the pilot, establishing a cost-benefit analysis to determine whether both the private and public sector partners are achieving their desired outcomes will help evaluate whether the partnership will continue.

Key Questions: Does the cost of the pilot operation provide sufficient business benefit (i.e., revenue, profit, marketing potential), while achieving public interest outcomes? Note that not all pilots can, nor private partners will, release revenue data without a formal data sharing agreement and, in some cases, an NDA. Alternatively, the City and private partners can get report outs on key business indicators to ensure business and City outcomes are being met.

Source: Mika Baumeis - Unsplash

COHORT OUTCOMES & METRICS

The LACI ZED City Climate Innovation Challenge cohort represents a diverse group of cities, each with unique interests and priorities for their ZED pilots. While they are each approaching pilots with different political, geographical, and sociodemographic perspectives, as a cohort, it is advantageous to align on and adopt a common set of outcomes that reflect collective values, regardless of their specific ZED pilot or policy objectives. This will allow cities to coalesce around the collective learnings of the cohort, and therefore, ZED use cases, in order to ensure application of these learnings on a broader scale. Similarly, although cities designed unique ZED pilots for their specific contexts and problem statements, the pilots fit into at least one of three overarching categories[3]:

Microfreight Solutions

Zone & Curb Management Programs

Microdelivery Hubs and Delivery Efficiency

Cohort-wide Outcomes and Metrics

Desired Outcomes	Aligned Metrics
Emission Reduction: GHG and carbon emissions reductions in participating cohort cities.	• GHG & carbon emissions[4] in targeted geographic areas • Air quality (SOx, NOx, etc.) before and after interventions
Fleet Transition: Private sector transitions fleet to zero emissions vehicles.	• Private sector adoption of zero emissions delivery vehicles / systems, and / or fleet transition • Deliveries made by zeros emissions vehicles
Effective Communications: Messaging to the community effectively communicates the benefits of ZED, without exclusively relying on carbon emissions and climate considerations.	• Increased understanding of non-climate related ZED benefits by key stakeholders • Increased support for ZED pilots by local stakeholders and businesses in pilot geographies
Business Strength: Sound business opportunities and business model foundations are a foundation of strong and lasting ZED public-private partnerships.	• Increase operational efficiencies • Maintain driver/staff satisfaction • Provide regulatory support (sticks & carrots)

[3] For the purposes of this framework, we are interested in the similarities and dissimilarities between the ZED City Climate Innovation Challenge pilots. For that reason, Oakland's pilot is categorized within the Microdelivery Hubs and Delivery Efficiency category for the pilot's impact on delivery efficiency.

[4] In the absence of air quality monitors, zero emissions vehicle adoption will have to be used as a proxy for emissions reduction and/or air quality measurements.

INDIVIDUAL PILOT OUTCOMES & METRICS

City	Desired Outcomes	Aligned Metrics
Los Angeles, CA	TBD/In Development After Pilot Concept is Selected	
Louisville, KY	TBD/In Development After Pilot Concept is Selected	
Miami-Dade County, FL *This pilot project aims to develop and implement a network of battery swap lockers designed specifically for microfreight vehicles. The initiative seeks to enhance the efficiency and sustainability of last-mile delivery services by addressing the challenges associated with battery management, charging times, and vehicle downtime.*	**Efficiency Improvement:** Reduction in delivery times due to minimized downtime for battery charging.	• Average time saved per delivery due to battery swapping
	Sustainability: Increase the use of electric microfreight vehicles by providing accessible and convenient battery solutions.	• Carbon / GHG emissions reductions • Improved air quality • Reduced double parking & congestion
	Data Collection: Gain valuable insights into battery lifecycle and user behavior, leading to more effective strategies for scaling the service.	• Number of battery swaps completed • User satisfaction ratings from microfreight operators
New York, NY *This pilot will provide convenient, secure, and efficient package delivery services while reducing package theft and delivery truck trips. The initiative seeks to reduce GHG emissions, package theft, and congestion.*	**Traffic Reduction:** Remove truck congestion on limited road space.	• Vehicle Miles Travel (VMT) reduction • Reduced double parking & congestion
	Pilot Uptake: Increased demand and supply of parcel locker deliveries.	• Number of unique users and transactions • Occupancy rates of locker units • Package volume • Feedback surveys • Locker condition
	Sustainability: Reduce GHG emissions through fewer truck trips in dense urban areas.	• Delivery vehicle VMT reduction • Carbon / GHG emissions reductions • Improved air quality
Oakland, CA *This pilot will deploy charging infrastructure at an "anchor tenant" location, providing charger access to other small businesses in the community. These chargers will leverage battery energy and solar storage capacity as well as traditional grid connectivity to test financial viability of battery and storage models.*	**Pilot Uptake:** High demand for and consistent usage of charging infrastructure.	• Number of unique charges and transactions • kWh usage
	Cost Effectiveness: Battery and solar energy models are adopted by businesses offering EV charging infrastructure due to its cost efficiency.	• Energy costs using battery and solar energy lower than traditional grid connectivity
Portland, OR *This pilot will launch a microhub to facilitate the transition from large box trucks to zero emissions cargo vans and e-cargo trikes, serving the densest part of the city.*	**Behavior change:** Facilitate zero emissions deliveries through consumer and logistics provider behavior change.	• Number of unique users and transactions • Feedback surveys • Parcels delivered • Delivery miles reduced
	Sustainability: Decrease emissions through mode shift.	• Carbon / GHG emissions reductions

Individual Pilot Outcomes & Metrics [CONT]

City	Desired Outcomes	Aligned Metrics
Washington, D.C. *The City of Washington, D.C. has developed two separate pilots, with overlapping desired outcomes and metrics:* • *Test electric microfreight vehicles and delivery microhubs to replace truck drivers in a designated area.* • *Transition food delivery drivers from gas mopeds onto electric low speed vehicle alternatives.*	**Improve Safety:** Reduce truck related crashes, and make bike lanes safe for microfreight and electric low speed vehicles.	• Collision rates
	Fleet Transition: Increase number of deliveries made by microfreight vehicles, and food deliveries by electric low speed vehicles.	• Truck VMT • Private logistics operator fleet transitions
	Traffic Reduction: Reduce truck congestion on urban streets.	• Congestion rates • Reduced double parking
	Sustainability: Reduce emissions related to freight and food delivery.	• Carbon / GHG emissions reductions
	Behavior change: Facilitate conversion from gas scooter use among food delivery drivers to zero emissions alternatives.	• Number of zero emissions scooters used for food delivery • Feedback surveys

COHORT CITIES WITH PRE-EXISTING ZED PILOTS

These cities are participants in the cohort and sharing their learnings to increase the utility of ZED findings, but have designed their pilots outside of this framework and U.S. Department of Energy Ride and Drive funding, with support from other federal funding sources.

City	Desired Outcomes	Aligned Metrics
Pittsburgh, PA *This pilot implemented Smart Loading Zones to manage curb space, increase delivery efficiency and decrease congestion and emissions.*	**Sustainability:** Decrease emissions from unnecessary idling and circling.	• Carbon / GHG emissions reductions • Idling reduction
	Traffic Reduction: Reduce parking-caused traffic and double parking, increase parking turnover for local businesses.	• Average park duration • Average double park duration
	Efficiency Improvements: Reduce dwell time, and increase delivery efficiencies.	• Average dwell time • Average delivery time
	Improve Safety: Reduce collision incidents for pedestrians, cyclists and other curb users.	• Collision rates
Santa Monica, CA *This pilot created dedicated Zero Emissions Vehicle Loading Zones in a one-square mile pilot area. Parking spaces are marked by signage and monitored by video cameras.*	**Sustainability:** Incentivize mode shift to decrease emissions.	• Carbon / GHG emissions reductions • Improved air quality • Reduced noise & congestion
	Improve Safety: Reduce incidents of double parking and truck related crashes.	• Collision rates • Double parking incidents

OUTCOMES & METRICS BY PILOT TYPE

Microfreight Solutions

Desired Outcomes	Cities	Aligned Metrics
Behavior Change	Portland, OR	• Number of unique users and transactions • Feedback surveys • Parcels delivered • Delivery miles reduced
Data Collection	Miami-Dade County, FL	• Number of battery swaps completed • User satisfaction ratings from MicroFreight operators
Efficiency	Miami-Dade County, FL	• Average time saved per delivery due to battery swapping
Fleet Transition	Washington, D.C.	• Truck VMT • Private logistics operator fleet transitions
Traffic Reduction	Washington, D.C.	• Congestion rates • Reduced double parking
Safety	Washington, D.C.	• Collision rates
Sustainability	Miami-Dade County, FL Portland, OR Washington, D.C.	• Carbon / GHG emissions reductions • Improved air quality • Reduced double parking & congestion

Zone & Curb Management Programs

Desired Outcomes	Cities	Aligned Metrics
Efficiency	Pittsburgh, PA	• Average dwell time • Average delivery time
Safety	Pittsburgh, PA Santa Monica, CA	• Collision rates • Double parking incidents
Sustainability	Pittsburgh, PA Santa Monica, CA	• Carbon / GHG emissions reductions • Idling reduction • Improved air quality • Reduced noise & congestion
Traffic Reduction	Pittsburgh, PA	• Average park duration • Average double park duration

Microdelivery Hubs & Delivery

Desired Outcomes	Cities	Aligned Metrics
Behavior Change	Portland, OR Washington, D.C.	• Number of unique users and transactions • Feedback surveys • Parcels delivered • Delivery miles reduced • Number of conversions from ICE to zero emissions vehicles
Cost Effectiveness	Oakland, CA	• Energy costs using battery and solar energy lower than traditional grid connectivity
Data Collection	Miami-Dade County, FL	• Number of battery swaps completed • User satisfaction ratings from MicroFreight operators
Efficiency	Miami-Dade County, FL	• Average time saved per delivery due to battery swapping
Fleet Transition	Washington, D.C.	• Truck VMT • Private logistics operator fleet transitions
Safety	Washington, D.C.	• Collision rates
Pilot Uptake	New York, NY Oakland, CA	• Number of unique users and transactions • Feedback surveys • kWh usage
Sustainability	New York, NY Miami-Dade County, FL Portland, OR Washington, D.C.	• Delivery vehicle VMT reduction • Carbon / GHG emissions reductions • Improved air quality • Reduced double parking & congestion
Traffic Reduction	New York, NY Washington, D.C.	• Vehicle Miles Travel (VMT) reduction • Reduced double parking & congestion • Congestion rates

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C40 CITIES

CLIMATE MAYORS

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