WHITE PAPER

Going for Gold

ON THE

Road to 2028

A Medal Framework for Accelerating Transportation Electrification and Clean Energy Deployment in Greater Los Angeles Ahead of the 2028 Games

LOS ANGELES CLEANTECH INCUBATOR

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Executive Summary

Background

Since 2018, the LA Cleantech Incubator (LACI) has been bringing together key public and private sector leaders in an unprecedented regional and state collaboration to accelerate transportation electrification and clean energy ahead of the 2028 Olympic and Paralympic Games. The Transportation Electrification and Clean Energy Partnerships created the Zero Emissions Transportation and Clean Energy 2028 Roadmaps, respectively, to set ambitious sectoral targets to reach meaningful GHG reductions by the time the world arrives for the 2028 Games.

Partnerships Unlocking Pilots, Projects, Policy, and Preparation

The modus operandi of the Partnerships is to go further and faster together to ideate, problem solve, and collaborate. With the Partnership members and key allies, LACI works through key pathways to advance progress toward the Roadmap targets and goals, including:

01

Pilots:

Deploying technology, business model, and policy innovation pilots that connect local governments, startups, and occasionally corporations, and then working together to scale the successful solutions that work best, such as zero-emission delivery zones and EV car sharing.

02

Projects:

Working in collaboration with public agencies, environmental justice and community based organizations, and private sector, identify key project needs and secure funding to bring cleaner air to frontline communities, such as investment plans for electrifying heavy duty goods movement and scaling key solutions such as flexible interconnection.

03

Policy:

Advance regional and statewide policy and budget priorities that support local deployment of resources to increase community investment, grow key economic sectors, and create green jobs.

In parallel, LACI is training workers for careers in cleantech sectors, strengthening the regional workforce development ecosystem, and incubating startups to respond to market signals from policymakers.

Since the Partnerships began, the federal government first made historic investments and later unprecedented roll backs of funding and policies, including tax credit incentives for clean technologies. With the current Administration actively challenging California's ability to set its own emissions standards, it has created uncertainty that slows decisions and investments.

However, the federal government cannot put the genie back in the bottle; investment in clean energy and EVs will continue to grow as California and Los Angeles (LA) establish climate policy that attracts capital, inspires innovation, and creates jobs. High gas prices due to conflict and war in the Middle East have further made the case for LA and California to continue leading the way.

While the Partnerships and their members will collectively not achieve all the targets set forth in the 2028 Roadmaps, we have made tremendous progress as a region. For LACI and the Partnerships the targets are still valid, hence the work will continue beyond 2028.

Taking Stock and Assessing How We Win the Gold (and Silver and Bronze)

Thanks to LA and California's ambitious climate policies, the region and state have seen incredible innovation and investment unlocked through the market signals sent to entrepreneurs. This paper assesses the estimated economic investment and GHG reductions achieved since 2020 across LA County and lays out how we can win the Gold, and Silver and Bronze, in the remaining 2 years before July 2028 and beyond for transportation electrification and clean energy.

LA County alone generated $802 billion in GDP in 2023, rivaling the economies of Saudi Arabia and Switzerland. If LA County were a U.S. state, it would be the 11th largest by population and 16th largest by economy. The broader five-county Greater LA region is the world's third largest metropolitan economy, and one of the most important centers of goods movement, mobility, aerospace, infrastructure, entertainment, and consumer influence in the world. For nearly every automaker, LA is the single largest urban auto market outside of China, a key reason why 20 OEMs have their design centers in the region.

California has set the most ambitious climate and environmental policies in the U.S. while at the same time growing to be the 4th largest economy in the world. Since signing AB 32 into law in 2006, California's economy has grown from the 8th largest to the 4th, only eclipsed by the U.S. as a whole, China, and Germany. What happens here in LA and California matters because of scale. It also matters because LA and California remain early movers; this is a place where adoption happens visibly. Because of our influence, the world pays attention. With millions of people arriving in LA and California in July and August of 2028, and billions around the globe watching, it matters to tell our story and showcase the progress and what's to come.

Over the next 2 years, the priority in Greater LA is focused and sustained delivery while preparing for the work over the next decade and beyond. **In the spirit of the Games, we will use a Gold, Silver, Bronze approach as an organizing framework to prioritize the key actions to take over the next two years.** Gold Medal projects need urgent action to overcome deployment hurdles and maximize impact by 2028. Silver Medal projects are those that aim to meet California's climate goals by 2030 and 2035. Bronze Medal projects are projects with a decades-long runway and a need for visioning to achieve tangible climate progress and leadership by 2045. A more detailed breakdown of these categories can be found in section 3 of this report, beginning on page 4.

$11 Billion Invested Across LA County Since 2020 Alone

Since 2020, an estimated $11 billion has been invested across LA County, going from climate ambition to deploying clean transportation and energy infrastructure.[1] This includes:

84,000

EV CHARGERS

Charging infrastructure grew from roughly 19,000 ports to approximately 84,000 by 2025—roughly 65 percent of the TEP's target of 129,000 chargers by 2028.

Hundreds

OF ELECTRIC BUSES

LADOT has electrified approximately 40 percent of its DASH bus fleet and LAUSD has electrified roughly 14 percent of its school bus fleet, representing significant progress toward regional zero-emission fleet targets.

450,000

ELECTRIC HEAT PUMPS

An installed base of approximately 425,000 to 450,000 HVAC heat pump systems now serves the county, with roughly 170,000 to 215,000 added since 2020, along with heat pump water heaters and panel and service upgrades.

443 MW

OF BATTERY STORAGE

Behind-the-meter battery storage reached approximately 443 MW across nearly 40,000 systems, and distributed energy resources (DERs) scaled across the region.

1.7 Million

TONS OF GHG AVOIDED

Taken together, those investments avoided an estimated 700,000 metric tons of carbon dioxide equivalent (CO_2e) in 2025 alone, achieving an estimated 1.7 million metric tons avoided cumulatively across LA County since 2020 through early 2025. These avoided emissions will grow as adoption, utilization, and system performance continue to improve.[2]

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[1] Approximate midpoint estimate derived from directional deployment × installed-cost analysis across EV charging, building electrification, energy storage, and distributed energy resources between 2020 and early 2025. The $11 billion figure is the inclusive midpoint across all five categories. Full methodology, category assumptions, and sensitivity ranges are provided in Appendix A.

[2] Estimated avoided emissions of roughly 700,000 metric tons CO2e in 2025, the midpoint of an approximately 0.4–1.0 million tonne range, and approximately 1.1–2.5 million metric tons avoided cumulatively from 2020 through early 2025 (midpoint ~1.7 million). These are deliberately conservative, order-of-magnitude estimates covering directly quantifiable contributions from HVAC heat pumps, heat pump water heaters, distributed solar, and EV charging infrastructure deployed since 2020; they exclude storage, managed charging, and virtual power plants. Full methodology, assumptions, and sensitivity ranges are provided in Appendix B.

Why LA Matters for California's Climate Goals (and to the World)

California's ability to meet its statutory climate goals by 2030, 2035, and beyond depends greatly on whether Greater LA delivers at an accelerated pace compared to the rest of the state. Given the size of the regional economy, if LA accelerates progress, it fundamentally alters the statewide trajectory.

At the same time, LA still faces real challenges, including the worst air quality in the country for smog. The opportunity before 2028 is not just to prepare for the world to visit. It is to leave a legacy of cleaner air for frontline, vulnerable communities, more resilient neighborhoods and systems, and a more competitive regional economy for the people who live here. Now we have to turn momentum into proof, and tell LA and California's story.

When the world arrives in 2028 it will not just be LA on the world stage, it will be California. How visitors, athletes, and the media experience EVs, charging infrastructure, public transit, and clean energy investment in communities will matter. Most important, both for the sake of the athletes that breathe at a rate of 20x a normal human as well as for the frontline communities that face disproportionate air pollution burdens, is whether the benefits of this transition are tangible and delivering real benefit from cleaner air, more investment and jobs, and higher-quality transportation options.

California Accepts The Challenge

Given Governor Newsom's recent announcement of $1 billion for zero-emission truck incentives, funded via Low Carbon Fuel Standard (LCFS) credits and the agreement between the Governor and Legislature for $135 million light-duty passenger vehicle incentives matched dollar-for-dollar by automakers, totaling $270 million, there is continued opportunity for California to maintain its leadership. Over the first half of 2026, LACI advocated for funding these incentives for both light and heavy duty vehicle incentives, and in the face of federal rollbacks, celebrates these historic $1.25 billion in funding commitments by the State of California.

Call For Gold Medal Winners: Commitments to Action for an Additional $1 Billion

As LACI's Road to 2028 continues, we are calling for Commitments to Action to achieve an additional $1 billion or more in new investment by the time the world arrives in Greater Los Angeles for the 2028 Games. The inaugural Road to 2028 Summit, hosted in December 2025, generated more than $125 million in Commitments to Action. The second Summit, hosted in July 2026, built on this momentum significantly and generated nearly $600 million in new commitments.

LACI is looking for Commitments to Action for Greater LA. A Commitment to Action is a concrete pledge by an individual, company, agency, or organization to advance clean energy, clean transportation, clean air, resilient rebuilding, or other sustainability solutions as part of LACI's Road to 2028 initiative. Commitments may include projects, investments, new or expanded programs, or other activities that help scale climate solutions in Greater LA before and beyond the 2028 Games. The key is that the Commitment will be completed or reach a major milestone by 2028.

Consider joining us if you are:

- A company with the ability to build, deploy, or scale clean energy and/or transportation electrification.
- An investor looking for one of the most visible and consequential infrastructure markets in the world.
- A philanthropic partner looking to accelerate impact, where catalytic support has the most leverage.
- Anyone who knows that climate ambition in LA and California can move global markets.

Section I:

Why Los Angeles and California Matter Now

If Los Angeles (LA) can make this transition work at scale it changes what the rest of the country, and much of the world, believes is possible.

LA is not just a market of first movers and early adopters that serves as a symbolic proving ground. It is one of the largest metropolitan economies in the world, with LA County generating $802 billion in GDP in 2023.[3] The LA region sits at the center of one of the most important freight, mobility, and infrastructure systems in the United States.

What happens here matters because of scale, and because California's statewide climate goals will be achieved (or missed) here more than anywhere else. If LA accelerates, the state's pathway becomes more credible. If it stalls, statewide progress becomes harder and more expensive for everyone. That is why the outcome is so important for the debate in California's legislature over incentives and for how the Governor's office considers where to direct state resources.

LA has already shown how leveraging state policy and working together through regional coordination can move the market. Since 2020, the region has helped turn roughly $11 billion from climate ambition into deployed infrastructure, and that momentum is real, visible, and still building.

It is also one of the few places in the United States where policy ambition, market scale, private capital, and global visibility are colliding in real time. In a period of national uncertainty, what LA demonstrates—about whether clean infrastructure can be financed, built, and operated at scale—will shape confidence far beyond the region.

LA still faces some of the toughest challenges, including the worst persistent air quality in the nation in terms of smog-forming NOx, with the largest source of pollution coming from the region's goods-movement system at the San Pedro ports complex, where 40 percent of the nation's goods move through. Add in more extreme heat for longer periods of time, increasing risks to local residents as well as athletes. That is not a liability. It is what makes success here so consequential. If clean transportation and clean energy infrastructure can perform in Los Angeles, the case for replication everywhere else becomes much stronger.

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[3] *LA County Economic Development Corporation, 2024.*

Section II:

Why 2028 Is a Delivery Window

The 2028 Olympic and Paralympic Games do not create the need for delivering a clean economy at scale. They make it visible.

The Games create a hard public deadline and a global stage. They compress timelines, raise expectations, and turn long-range ambition into near-term accountability. By the time the world arrives Los Angeles (LA) will be judged not on the merits of its planning but on whether the systems put in place actually work, which means:

01	Visible and reliable charging operating at scale—not just in port count, but in uptime and user trust
02	Cleaner operational freight and fleet corridors in the highest-impact goods-movement zones
03	A power system that absorbs new electric load without visible strain, delay, or reliability events
04	Distributed energy and storage assets that are enrolled, dispatched, and performing when the grid needs them, supporting the local grid and deferring unnecessary one-time spending on distribution and transmission
05	Tangible benefits reaching the communities that have faced the longest wait for cleaner air, more reliable service, and real economic opportunity

2028 is therefore not simply a date on a roadmap. It is a test of whether LA can convert climate ambition into operating reality, and in full public view.

LA is ready for that test. Infrastructure is being deployed, capital is committed, and systems are taking shape across transportation and energy. The next two years are not about setting new targets. They are about making the most important systems work and proving, in the most visible metro area in the world, that the clean energy transition is not a promise. It is a reality.

That reality is what creates and shapes investment opportunities. When infrastructure systems hold up under pressure in a market as visible and complex as Los Angeles, they build confidence, attract capital, and create replicable models that can scale beyond the region.

Results in LA can help re-anchor confidence in climate-aligned infrastructure as an investable asset class at a moment of national uncertainty.

Section III:

The Medal Framework: What Must Perform by 2028

The Road to 2028 is about making the most important systems work reliably and at scale, and being honest about what can and cannot credibly be delivered by 2028.

Los Angeles (LA) has already built much of the foundation, but to drive the largest impact ahead of 2028, it needs sequencing and prioritization: which systems must perform, which pathways need redesign before scaling, and which long-horizon investments must be protected for the decade ahead. Getting that sequencing right is what turns a strong deployment record into a strong delivery story.

3.1 Gold: Deploy and Commit to Action (2028)

Gold Medal priorities are projects and actions that are already underway, have funding now, or are close enough to delivery that urgent coordination can maximize their impact by 2028. These are not long-range concepts. They are near-term deployment opportunities that require focused action to overcome permitting, interconnection, energization, procurement, operational, or coordination barriers before the world arrives in Los Angeles.

To achieve Gold, LA should focus on near-term delivery: prioritizing existing CEC, CARB, and Caltrans funding for LA-area legacy projects, restoring demand to freight electrification, leveraging DERs for grid support, accelerating permitting and time-to-power, and ensuring the systems most visible by 2028 are reliable, accessible, and operating at scale.

3.2 Silver: Advancing Key Investments, Infrastructure, and Policy to Achieve State Goals (2035)

Silver Medal priorities are projects, policies, and market structures that may not be fully delivered by 2028, but are essential to meeting California’s 2030 and 2035 climate goals. These are the investments and reforms needed to move from near-term proof points to broader market scale.
To achieve Silver and meet the State’s 2030 and 2035 climate goals requires advancing investments,

infrastructure and policy (e.g., pathways to scale building electrification at replacement, supporting the Electric Vehicle Infrastructure Training Program (EVITP) and the trained contractor ecosystem and workforce needed to deliver these projects, ensuring investment in underserved communities, etc). These pathways are essential to long-term decarbonization but require focused redesign to address cost, throughput, workforce, and adoption barriers before they can scale reliably.

3.3 Bronze: Looking to Long Term Progress and Leadership (2045)

Bronze Medal priorities are longer-horizon projects and strategies with a decades-long runway. These are not necessarily the actions that will deliver the most visible results by 2028, but they are essential to achieving tangible progress towards California's 2045 climate goals.

To achieve Bronze, LA and California must protect the long-term trajectory for deep retrofits, full fleet electrification, broad grid modernization, and other system-level changes that will be needed for durable climate leadership beyond 2028.

Section IV:

Transportation Electrification Partnership (TEP): Progress and What Must Happen Next

The Transportation Electrification Partnership has helped make Greater Los Angeles (LA) one of the most important transportation electrification markets in the United States. Since 2020, the region has made visible progress across charging infrastructure, managed load, freight corridor planning, and fleet electrification. In several areas, especially charging deployment, LA is no longer operating only at pilot scale. It is now working at infrastructure scale, where the next phase of progress depends on continued deployment, stronger operational performance, and coordinated delivery in the places where transportation electrification can have the greatest impact by 2028.

The priority now is to continue scaling what is working while addressing the operational and deployment barriers that could limit impact by 2028. That means building more charging in the right places, improving uptime and user trust, accelerating energization, sustaining fleet and consumer demand, and focusing regional coordination on the corridors and communities where transportation electrification can deliver the greatest air quality, mobility, and economic benefits.

On the Road to 2028, the transportation electrification agenda should focus on five priority areas: light-duty EVs and charging; managed charging and EV load flexibility; medium- and heavy-duty charging and freight depots; transit, bus, school, and community fleets; and ridehail electrification. The sections that follow elaborate on each priority area and identify Gold, Silver, and Bronze recommendations to support near-term delivery, market scale, and long-term climate leadership.

4.1 Light-Duty EVs and Charging: Scale and Performance

To meet the needs of the growing number of nearly 600,000 EVs on the road across LA County, the region is well-positioned to build on one of the largest metropolitan charging networks in the United States. LA has proven that rapid charging deployment is possible, but the network now needs to mature from scale alone to scaling with reliability and strategic capacity. Total public and shared-private charging ports increased from approximately 19,000 in late 2020 to approximately 84,000 by 2025 (CEC, Q3 2025), roughly 65,000 net new level 2 (L2) and DC Fast Charging (DCFC) ports. Using benchmarks of $13,000–$20,000 per port (blended Level 2 and DCFC average, per NREL 2024 benchmarks and CEC CALeVIP grant data), that growth implies roughly $0.9–1.4 billion in deployed capital since 2020. See Appendix A, Section A2 for full methodology.

The challenge has evolved from simply adding ports to building a charging network that is larger, better-sited, and better-performing. As deployment continues, the critical issues are not only how many chargers are installed, but where they are located, how reliably they operate, how quickly faults are detected and repaired, and whether users and public agencies can see performance clearly.

Public funding programs already include high uptime requirements, often at or above 97 percent. Therefore, the issue is whether those standards are being met consistently across tens of thousands of distributed assets, and whether public agencies, drivers, fleets, and communities have enough visibility into charger performance to identify gaps, target investment, and improve accountability.

It is worth being candid about the headwind: new ZEV sales share in California has declined from a peak of about 25 percent in late 2024 to under 16 percent in early 2026, following the end of federal ZEV tax incentives in September 2025. California continues to lead the nation and has surpassed 2.5 million cumulative ZEV sales, but the near-term sales trajectory makes the case for continued targeted charging investment and stronger network performance more important, not less. A reliable, convenient, and well-sited charging network is essential to restoring consumer confidence, supporting fleet electrification, and ensuring that the transition remains accessible across communities.

The TEP also set a 20 percent mode shift target of reducing single-occupancy vehicle trips by moving people to transit, shared mobility, walking, and biking. Metro ridership has grown for 26 consecutive months and surpassed 300 million annual boardings in 2024, and the opening of the D Line extension into West LA represents meaningful new infrastructure supporting that shift. A comprehensive accounting against the mode shift target remains work in progress.

By 2028, Los Angeles's charging network must be larger, more reliable, and more accessible. That requires continued deployment in priority zones and underserved communities, stronger performance and uptime, and smarter siting that concentrates capacity where demand is highest and limits underutilized assets.

Priority Recommendations

Gold • 2028

Sustain near-term EV incentives and target charging investment for Los Angeles.

Continued funding at the state level for EV incentives, such as the approved $135 million in light-duty passenger vehicle incentives this year, and targeted charging for LA ahead of the Games.

Gold • 2028

Expand reliable charging in priority 2028 mobility zones.

Continue deploying public and shared-private charging where demand is highest, including venue corridors, airport and hotel areas, dense urban districts, high-use fast charging corridors, and underserved communities.

Gold • 2028

Use cross-cutting tiger teams to unlock projects and yield permanent process improvements to deployment by 2028.

Building on LACI's tiger team work with LADWP and the City of Los Angeles, regional partners should work across jurisdictional, utility, permitting, and energization issues to move priority charging, fleet, and freight projects from planning to deployment.

Silver • 2030 & 2035

Strengthen operational performance and uptime.

Standardized performance, utilization, and reliability data can help target investment, identify gaps, and improve user trust.

4.2 Managed Charging to Serve as a VPP and EV Load Flexibility: Turning Load Into Capacity

As EV adoption grows, LA is creating a significant opportunity to add flexibility alongside new load. Unmanaged charging can increase system strain in constrained zones during peak periods. Managed charging can function as an operating asset by shifting load, reducing pressure, and helping the system absorb electrification more efficiently.

LA has the potential to unlock approximately 250–300 MW of managed charging flexibility (with a midpoint estimate of roughly 281 MW, subject to enrollment and performance verification) if charging assets are enrolled, coordinated, and dispatched effectively. At that scale, managed charging is no longer a niche optimization. It becomes a meaningful form of operational capacity that can often be scaled faster and at lower cost than traditional grid upgrades. The binding constraint is enrollment and verified performance.

Priority Recommendations

Gold • 2028

Make managed charging dependable enough to be treated as real system capacity.

By 2028, that means building managed charging into new deployment standards from the start, establishing shared protocols between utilities and network operators, targeting enrollment in the most constrained zones first, and verifying dispatch performance so flexible load is counted as dependable capacity.

4.3 Medium- and Heavy-Duty Charging and Freight Depots: Restoring Demand, Preparing Depots

Freight electrification is one of the highest-impact opportunities on the Road to 2028, and one of the hardest to deliver well. Medium- and heavy-duty transportation sits at the intersection of Los Angeles's biggest economic, environmental, and infrastructure challenges, contributing disproportionately to local air pollution and diesel exposure in communities closest to major goods-movement corridors.

The dominant constraint has shifted. For most of this period, the pacing questions for medium-and heavy-duty electrification was power and whether depots could be energized on time. While those challenges are still present, the near-term constraint is now the loss of the regulatory demand signal that was beginning to move the market. The federal action purporting to disapprove California's Advanced Clean Trucks (ACT) waiver, together with the litigation delaying ACT and the non-public and municipal portions of the Advanced Clean Fleets (ACF) rule, has weakened the regulatory signal that was driving manufacturers to build and sell zero-emission trucks, even as the infrastructure to support them comes online. The immediate problem is no longer only how to power the trucks; it is how to sustain demand, investment, and fleet confidence while the regulatory landscape remains uncertain.

Energization remains a genuine operational challenge. On any given project, the pacing item may still be interconnection and energization timelines, transformer and switchgear availability, commissioning capacity, or the skilled electrical workforce needed to energize and commission these systems. While still a challenge, meaningful regional and collaborative work with regional utilities and stakeholders is currently underway; the priority now is to rebuild the demand signal that ACT provided while continuing to make a bounded set of freight and depot systems power-ready, bankable, and operationally viable.

The 2026–2028 objective is therefore twofold: restore the demand signal that ACT provided through other levers, and make a bounded set of freight and depot systems operationally bankable so capacity is ready as demand returns. In the interim, California state incentives must now do the heavy lifting that regulations and incentives previously did in unison. Governor Newsom's recent announcement of $1 billion for zero-emission truck incentives for the California Clean Fuels Reward program, funded via Low Carbon Fuel Standard (LCFS) credits, is the most important near-term demand lever and should move quickly.

To reinforce the market signal created by incentives, California should pair near-term funding with durable strategies that improve the operating and investment case for fleets. LACI's recently completed Department of Energy Vehicle Technologies Office grant, First to Last Mile: Creating an Integrated Goods Movement Charging Network around the I-710 Corridor, identified strategies to improve total cost of ownership for fleets and support a more integrated goods movement charging network. The priority now is to turn those strategies into a focused delivery agenda that restores fleet and manufacturer confidence, concentrates investment in power-ready freight zones, and improves the economics of early zero-emission truck deployment.

Priority Recommendations

Gold • 2028

Restore the demand signal for zero-emission trucks.

California should use state incentives, fleet commitments, public procurement, port and warehouse policies, and other market-shaping tools to maintain manufacturer and fleet confidence in zero-emission truck deployment as the ACT regulatory signal is currently weakened. The state's more than $1 billion commitment for zero-emission truck incentives should move quickly as the most important near-term demand lever which can increase utilization at sites built through our CEC 710 Blueprint Implementation grant.

Gold • 2028

Advance power-ready planning and committed capacity in priority freight zones.

To avoid making major infrastructure commitments without clearly defined energization pathways, utilities should target existing areas of industrial and heavy commercial activity with existing truck traffic, similar to the twenty locations identified through LACI's I-710 Blueprint, including three that have since received implementation funding. Given the proximity of the 2028 Games, the state should work with its funding agencies to align existing clean transportation funding programs with near-term solicitations for shovel-ready Los Angeles projects that can be energized in time for the Games. In pre-energized freight and depot zones, as well as other bankable, high-impact locations, proactive grid-side investment can support faster rollouts.

Gold • 2028

Deploy storage and flexibility to reduce delivery risk.

Improve charging certainty and help constrained sites, like one currently under construction through our 710 Blueprint Implementation grant, become operable sooner with strategically deployed distributed energy resources, storage, and flexible interconnections.

Silver • 2030 & 2035

Assert local pollution authority to sustain zero-emission freight progress.

In light of the federal action purporting to disapprove the EPA waiver for the Advanced Clean Trucks rule (and the federal actions and ongoing litigation delaying implementation of ACT and the non-public and municipal sections of the Advanced Clean Fleets rule, while state and local elements of the ACF framework remain in place) states and cities should investigate the applicability of indirect source rules to assert control over pollution and emissions from the logistics industry.

Silver • 2030 & 2035

Improving total cost of ownership for early EV truck adopters.

California and regional partners should strengthen the business case for early zero-emission truck adopters by pairing charging OpEx subsidies with CapEx grants, offering discounted access to medium- and heavy-duty charging infrastructure networks, and using financing tools such as loan guarantees or concessionary debt to improve lease affordability, support realistic residual values, and strengthen the secondary EV truck market.

Silver • 2030 & 2035

Create green lanes.

At marine terminals, warehouses, or other nodes in the goods movement network, designated access for ZEVs creates greater revenue opportunities for early adopters and improves that fleet's total cost of ownership; these preferential access policies are explained further in LACI's DOE grant, First to Last Mile.

Silver • 2030 & 2035

Standardize depot archetypes.

By creating repeatable templates to reduce design friction and compress permitting, speed to energization for crucial projects will increase, as demonstrated through the multi-charger ski framework Prologis Mobility deployed at their Vernon Hub, supported by LACI's 710 Blueprint Implementation .

Silver • 2030 & 2035

Govern for utilization and performance to support scalable freight electrification.

Treat utilization and uptime as core metrics, not just installed megawatts, so medium- and heavy-duty charging infrastructure is measured by whether it is reliable, well-used, and capable of supporting broader fleet adoption.

Bronze • 2045

Track operating performance of deployed zero-emission trucks.

Tracking the operating profiles of deployed zero-emission trucks, namely the Tesla Semis and other battery-electric trucks, can help identify opportunities to scale deployments with the modern generation of Class 8 trucks. This analysis should examine longer-range duty cycles, charging needs, vehicle performance, total cost of ownership, and implications for a secondary EV truck market.

By 2028, LA needs to prove that a major goods-movement economy can keep the zero-emission freight market moving despite regulatory uncertainty while converting its most critical corridors and depot systems into cleaner, power-ready, operationally viable infrastructure. That proof point would matter far beyond Los Angeles, and it is within reach.

4.4 Transit, Bus, School, and Community Fleets: Credible Progress Under Real Constraints

Electric buses, school buses, and community fleets are among the most visible and community-facing parts of the transportation electrification transition. They are also concentrated where clean transportation delivers direct public-health and equity benefits, especially in communities that have faced disproportionate diesel exposure and underinvestment. But transit electrification depends on a harder combination of factors than light-duty charging: high vehicle costs, depot transition complexity, procurement constraints, and operating model changes that take time to mature. Vehicle economics remain largely outside regional control. On the Road to 2028, the move is to ensure that depots, charging systems, power pathways, and operating protocols are in place not only to serve near-term fleet deployments, but to leave behind durable public-serving infrastructure in the communities where cleaner transportation matters most.

These investments also double as clear legacy investments. Electric buses, particularly school buses like Highland Electric Fleets, can be visible during the Games, but their benefits continue to bear results via cleaner rides for students and transit riders, lower operating emissions, power-ready depots, trained operators, and charging infrastructure that can continue serving communities long after 2028.

Priority Recommendations

Gold • 2028

Depot and charging readiness for public-serving fleets that can perform by 2028.

LADOT has converted approximately 160 DASH buses out of a total fleet of roughly 400; LAUSD has received an approximately 190-bus award through the state's Zero-Emission School Bus and Infrastructure program, with CARB working directly with LAUSD on deployment; and Highland Electric Fleets has committed to provide 500 electric school buses to serve the Games. The near-term priority is ensuring that these vehicle commitments are matched with charging, depot readiness, power pathways, and operating plans that can support reliable service.

Gold • 2028

Targeted deployments where readiness aligns.

Fleet deployments should be prioritized where procurement, infrastructure readiness, utility coordination, charging reliability, and operating capacity align. Early deployments should be visible, reliable, and confidence-building, with managed charging paired where feasible to support both fleet operations and grid performance.

Silver • 2030 & 2035

Shared depot models that reduce cost and improve utilization before broader scale.

Shared depots for buses, trucks, and community fleets (such as the Prologis Vernon location) can maximize available charging capacity, reduce costs for schools and transit systems, create revenue opportunities for EVSE providers, and unlock additional investment. These models also leave behind flexible charging assets that can serve multiple public and commercial fleet needs beyond 2028.

Bronze • 2045

Procurement and manufacturing pathways that protect the long-term fleet transition.

Metro has 73 electric buses as of this writing and is on track to have 250 by 2028, but transit agencies continue to face constraints from the limited number of bus manufacturers eligible for federal funding. In 2024, LACI CEO Matt Petersen and former CARB Chair Mary Nichols wrote a *Los Angeles Times* op-ed calling for an industrial policy push to increase domestic manufacturing; expanding the number of domestic producers and the scale of electric bus adoption would support 2028 goals and the broader post-2028 fleet transition.

The legacy value of these investments is straightforward: buses, school buses, depots, and shared charging infrastructure are visible during the Games, but their benefits continue every day after in cleaner air, lower operating emissions, stronger public fleets, and transportation infrastructure that remains rooted in the communities it serves.

4.5 Ridehail Electrification: High-Mileage Leverage

Ridehail is a strategically important use case because it combines high vehicle utilization with high public visibility. Electrifying ridehail can deliver disproportionate emissions reductions per vehicle because ridehail accumulates significantly more miles than typical personal vehicles. It also shapes public perception directly, because riders experience the transition from the passenger seat.

While the TEP goal of 100 percent EVs for transportation network companies (TNCs) by 2028 may not happen, we see massive investment from Uber and others into EV incentives for drivers and charging infrastructure to support fleets. In addition to EVs being more economical for high-mileage drivers, the movement is also accelerated by the state's Clean Miles Standard.

A key challenge is whether drivers have adequate, reliable access to fast charging in the places and hours they actually need it, and whether participation is economically workable within ridehail operations. A credible approach treats ridehail as a targeted, zone-based strategy: expanding charging deployment in priority areas, streamlining delivery of charging infrastructure, and improving reliability especially where driver demand is concentrated for 2028 mobility.

Priority Recommendations

Gold • 2028

Expand ridehail-serving fast charging in priority areas.

Targeted deployment of adequate, reliable DC fast charging in the places where driver demand is concentrated, especially airport, venue, hotel, dense urban, and high-demand 2028 mobility zones.

Gold • 2028

Streamline delivery and energization of charging infrastructure.

Prioritize projects that can be built, energized, and operating in time for the Games, especially where charging access is needed to support high-mileage ridehail operations.

Bronze • 2045

Integrate with flexible load programs where feasible.

Use ridehail charging hubs and high-utilization sites to support managed charging, virtual power plants, and grid reliability without undermining driver performance.

Ridehail electrification in LA at scale is no longer a theoretical use case; it is important to build on the positive momentum we are seeing in the segment. The remaining challenges are logistical and operational: getting enough charging built at the right locations, energizing them in time for the Games, and integrating flexible load programs in use cases where they can support the system without undermining driver performance. That is a harder problem than adoption alone, and it is where a bulk of work is concentrated for the next two years.

Section V:

Clean Energy Partnership (CEP): Progress, System Value, and What Must Happen Next

The Clean Energy Partnership has helped position Los Angeles (LA) as one of the most important urban markets in the country for building electrification, distributed energy, and grid-interactive clean energy systems. Since 2020, the region has mobilized substantial capital across these categories. Going forward, the question is whether these categories can be further integrated to add more capacity and treated as part of a higher-performing regional energy grid.

CEP's value is coordination and system integration: helping LA turn a growing base of distributed assets into infrastructure that can be relied upon. The central challenge on the Road to 2028 is ensuring those assets can be further deployed, energized, and coordinated fast enough to help meet power demand, especially during summer peak periods such as the Games.

The clean energy agenda should focus on two priority areas: building electrification, and distributed generation, storage, and grid readiness. The sections that follow elaborate on each priority area and identify Gold, Silver, and Bronze recommendations to support near-term delivery, market scale, and long-term climate leadership.

5.1 Building Electrification: Scale and Throughput

Building electrification is one of the most important, and most underappreciated, areas of progress in Los Angeles's clean energy transition. An installed base of approximately 425,000 to 450,000 HVAC heat pumps now serves LA County, with approximately 170,000 to 215,000 of those added since 2020. Across HVAC heat pumps, heat pump water heaters, and panel or service upgrades, the region has mobilized an estimated $2.5–5.5 billion in building electrification investment on the since-2020 basis, with overlap controls applied. (Source: California Heat Pump Partnership Blueprint, TECH Clean California program data, and LA County household-share methodology; full methodology in Appendix A, Section A3.)

The bottleneck has now shifted to throughput. The core challenge is whether LA can make electrification happen at the speed, simplicity, and reliability required to capture replacement-cycle decisions before 2028. Three constraints matter most: 1) panel and service upgrade costs and timing; 2) workforce and contractor defaults that revert to fossil fuel systems under time pressure; and 3) the concentration of older housing stock and renter-heavy communities where upgrade costs stall adoption, which makes equitable delivery a throughput issue, not just a fairness issue.

Meeting that throughput challenge heavily depends on the skilled electrical workforce and contractor ecosystem needed to deliver these projects; the licensed contractors and trained electricians who install, energize, commission, and maintain increasingly complex electrical systems, supported by established apprenticeship and training pipelines that can scale with demand.

A credible building electrification strategy should focus on increasing electric adoption at the moment of equipment replacement, reducing cost and delay from panel and service upgrades, streamlining permitting, and expanding practical pathways for multifamily, affordable housing, and underserved communities consistent with the County's Equitable Building Decarbonization Program.

Priority Recommendations

Gold • 2028

Make electric equipment the default at replacement.

Programs should focus on the moment when HVAC and water heating systems fail or reach end of life, when customers are most likely to make fast decisions and contractors often default to like-for-like fossil fuel replacement. Capturing those replacement-cycle decisions before 2028 is one of the fastest ways to accelerate building electrification.

Gold • 2028

Standardize heat pump permitting across jurisdictions before 2028.

LA County should advance a consistent set of heat pump permit requirements across local jurisdictions. Today, requirements vary by jurisdiction, which makes the process complex and unpredictable for contractors. Because a heat pump changes fuel type, some jurisdictions may require multiple permits, such as separate plumbing and electrical permits, which adds fees and delays. A more standardized approach would lower effort for building officials, installers, and customers and directly improve adoption.

Gold • 2028

Expand panel-avoidance and power-efficient appliance strategies.

Where feasible, programs should prioritize technologies and designs that reduce or avoid costly panel and service upgrades, including power-efficient heat pumps, load management, circuit-sharing technologies, battery-integrated induction stoves, and right-sized equipment. These approaches can help customers electrify faster while reducing cost and avoiding unnecessary strain on local electrical infrastructure.

Silver • 2030 & 2035

Build the contractor and electrical workforce ecosystem needed for 2030 and 2035 goals.

To scale beyond early adopters, LA will need more licensed contractors, trained electricians, building officials, and apprenticeship pathways that can deliver electrification safely, consistently, and at greater volume. Workforce readiness should be treated as core infrastructure for building electrification, not as a secondary implementation issue.

Silver • 2030 & 2035

Use practical equity-focused program models to reduce adoption barriers.

The state's Solar on Multifamily Affordable Housing program offers a useful model for reaching multifamily affordable housing, where limited access to capital, panel and service upgrade constraints, split incentives, and complex customer pathways can slow adoption. Similar program designs should be adapted for building electrification so underserved communities can participate at greater scale.

Bronze • 2045

Plan for deep building retrofits beyond replacement-cycle electrification.

Replacement-cycle electrification is the near-term priority, but LA will eventually need broader retrofit strategies that address envelope improvements, whole-building electrical readiness, resilience, and long-term affordability across the building stock. These longer-horizon strategies are essential for meeting 2045 climate goals and ensuring that building electrification becomes durable, equitable, and systemwide.

5.2 Distributed Generation, Storage, and Grid Readiness: Turning Assets Into System Capacity

LA has already made real progress in distributed energy and storage deployment, with an installed base that can play a larger role in system performance if assets are enrolled, visible, and dispatchable. Since 2020, estimated investment includes approximately $1.7–2.1 billion in energy storage, based on LA County's installed capacity of approximately 1.25–1.35 GW of all grid-connected storage at a blended cost of $1.0–1.6 million per MW per NREL 2025 benchmarks, the CEC Energy Storage System Survey, and CAISO interconnection data. Full methodology is provided in Appendix A, Section A4.

Of that installed capacity, approximately two-thirds is utility-scale and approximately 443 MW is behind the meter, with about 334 MW added since 2020. The distributed portion is most relevant to the discussion that follows because it can support local resilience, reduce pressure in constrained grid areas, and help meet peak demand if assets are properly enrolled and coordinated. An additional approximately $3–6 billion went into distributed solar and related DERs, based on approximately 1.5–2.0 GW of installed capacity additions per California Distributed Generation Statistics and CEC Tracking Progress data at $2–$3 per watt per LBNL Tracking the Sun benchmarks. (Appendix A, Section A5.)

Distributed energy resources matter because they can do more than reduce emissions. If properly orchestrated and given access to the markets they can serve, they can help absorb new electric load, improve local resilience, reduce strain in constrained grid areas, defer unnecessary one-time spending on distribution and transmission, improve affordability, provide public visibility of the clean energy transition, and support faster electrification in priority corridors.

The constraint is not deployment alone, but twofold: orchestration and market access. Orchestration is the ability to enroll assets into operating frameworks, observe them through usable telemetry, dispatch them when needed, and measure them against clear performance expectations. Market access is the ability for distributed resources to participate in the markets they can serve through aggregation pathways and the regulatory and tariff structures that govern them, spanning both distributed programs and, where appropriate, mechanisms such as the CAISO wholesale market and utility integrated resource planning. Without both, the grid and delivery value of deployed assets goes unrealized.

By 2028, the standard for clean energy systems is operational readiness: energized, integrated into operating practice, observable through usable data, maintainable over time, and capable of delivering measurable system value when needed.

There are two headwinds bearing note: the forthcoming end of California's successful statewide virtual power plant program, the Demand Side Grid Support (DSGS) program, and the loss of most federal clean energy tax credits, though the ITC for stationary battery storage remains in place and provides an important anchor for storage deployment.

Where site conditions allow, utilities and project developers should work together to use managed load, storage dispatch, and aggregated DERs to support faster energization and coordinate with LADWP and SCE to identify circuits where this approach can accelerate project timelines while fully preserving reliability standards. This is not a shortcut around engineering requirements; it is a way to put existing installed assets to work while permanent infrastructure catches up.

To make distributed energy and storage count in the 2028 delivery story, LA should focus less on capital formation and more on operational integration. The Clean Energy Partnership has helped build a substantial installed base; the immediate gap is enrollment, telemetry, dispatch coordination, and market access. Getting distributed assets into operating frameworks before 2028 will require enrollment-first strategies, market-access pathways that let distributed resources participate in the value they create, priority fast-track zones for DER and EV charging integration, standardized telemetry and performance verification, storage integration where it reduces delivery risk or increases local resilience, and extension of the DSGS program through 2028.

Priority Recommendations

Gold • 2028

Extend California's Virtual Power Plant Program (Demand Side Grid Support) through 2028.

In the near term, California has the opportunity to extend the DSGS program through 2028 so Angelenos can capitalize on this unique organizing framework and advance with as much clean energy as possible.

Gold • 2028

Advance market-access pathways for distributed resources.

California should advance aggregation pathways, tariffs, and regulatory structures that allow distributed resources to participate in the value they create, including where appropriate through CAISO wholesale markets and utility integrated resource planning.

Gold • 2028

Establish priority fast-track zones for DER and EV charging integration.

Utilities, project developers, and public agencies should identify constrained circuits and priority corridors where distributed energy resources, storage, and managed charging can support faster electrification while preserving reliability standards.

Gold • 2028

Standardize telemetry and performance verification.

Distributed resources should be observable through usable data and measured against clear performance expectations so utilities, regulators, aggregators, and public agencies can understand whether assets are delivering system value when needed.

Silver • 2030 & 2035

Use aggregated DERs to support faster energization and local resilience.

Utilities and project developers should work together to identify where these tools can accelerate project timelines while fully preserving engineering and reliability standards. Storage should be prioritized where it can help support local resilience or improve the performance of EV charging and other electrification projects.

Bronze • 2045

Build toward a grid that treats distributed assets as part of system planning.

Over the long term, LA and California will need broader grid modernization that integrates distributed solar, storage, managed charging, and virtual power plants into planning and operations.

Bronze • 2045

Continue long-term grid modernization beyond the most constrained circuits.

Near-term work should focus on the highest-priority zones for 2028, but the region will also need broader modernization across substations, circuits, and operating systems to support full transportation electrification, building electrification, and clean energy deployment through 2045 and beyond.

Section VI:

Capital Already Mobilized: The Baseline (2020–Early 2025)

Since 2020, Los Angeles (LA) has attracted an estimated $9–13 billion in clean transportation and clean energy infrastructure investment—one of the largest metropolitan clean infrastructure buildouts in the United States over that period. This figure is the midpoint-anchored range derived from a consistent deployment x installed-cost methodology applied to assets physically deployed in LA County between 2020 and early 2025, and includes ZEV bus, van, and medium-and heavy-duty truck asset values. The "roughly $11 billion" headline used throughout this paper is the inclusive midpoint of this range. Full methodology, source basis, cost assumptions, and sensitivity analysis are documented in Appendix A, Section A7.

These estimates count installed assets only. They explicitly exclude upstream transmission investment, speculative or uncommitted projects, and private-sector spending catalyzed by but not directly part of infrastructure deployment. They are conservative by design: they count deployed assets only, apply low-end cost assumptions where uncertainty is high, and exclude the broader economic activity (private EV purchases, private catalytic spending, etc.) that infrastructure deployment has helped enable. A full-economy measure of clean-transition activity in LA over this period would be materially larger.

The baseline makes clear what the Road to 2028 actually requires: not more capital formation, but conversion. Turning deployed infrastructure into systems that are energized, coordinated, and operating reliably under real conditions.

Section VII:

Conclusion

Los Angeles (LA) has already moved roughly $11 billion from climate ambition into deployed infrastructure. The transition is underway and the market is responding visibly across charging, buildings, storage, and freight. What comes next is the most important chapter: converting that momentum into systems that perform consistently, under real-world conditions, in the places and corridors where performance will matter most by 2028.

The Gold, Silver, Bronze medal framework creates an investment agenda. LA is inviting the market to help accelerate something already underway and already working. 2028 is a deadline that exposes performance. Systems will be judged by lived experience; whether chargers are there and work, freight corridors are cleaner, distributed energy shows up when and where it is needed, and the benefits of the transition are visible in communities that have waited the longest.

LACI is the integrator that makes that acceleration possible by connecting institutions, operators, investors, and public agencies around a shared delivery agenda, and ensuring that catalytic capital lands where it has the highest leverage. LACI is collecting and tracking Commitments to Action to illustrate regional progress and share LA's story. LACI welcomes partners to build on the existing $125 million in Commitments to Action and enlist $1 billion in new commitments by July 2026, December 2026, and July 2027, including investment in projects, startups, and community solutions. It will be critical to the legacy of 2028 to share in the wins of investments to date alongside the economic growth and innovation that LA and California have generated while setting the strongest climate policies in the nation.

When the world arrives in Los Angeles, it will not be looking for another roadmap. It will be looking for evidence that this works, and LA has a chance to be that evidence.

Appendix A

Quantitative Methods, Assumptions, and Source Basis
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A0. Scope and Analytical Boundaries

This appendix documents the analytical methods, formulas, assumptions, and primary source bases used to estimate direct infrastructure capital mobilization and operational capacity in Los Angeles County between 2020 and early 2025. The methodology is conservative, transparent, order-of-magnitude defensible, and aligned with the delivery-first logic of the white paper.

Where a figure is derived by LACI rather than taken directly from a published source, it is labeled as a LACI estimate, LACI assumption, or LACI calculation so the analytical chain is explicit. Public program targets are fixed external reference points and are reproduced as published.

The estimates cover infrastructure physically deployed and clean vehicles deployed as transportation assets, including: EV charging infrastructure (public and shared-private); building electrification equipment (HVAC heat pumps, heat pump water heaters, panel upgrades); energy storage systems; distributed solar and distributed energy resources (DERs); and zero-emission buses, delivery vans, and medium- and heavy-duty trucks.

What Is Intentionally Excluded

To maintain analytical clarity and avoid double counting, the following are explicitly excluded: private passenger EV purchases; upstream transmission expansion; speculative or uncommitted project commitments; venture capital investment in climate technology; private-sector spending catalyzed by but not directly part of infrastructure deployment; and home EV charger installations, electrical panel upgrades beyond those tied to electrification, utility distribution upgrades, workforce spending, and soft costs.

These exclusions mean the estimates represent direct infrastructure and clean vehicle asset investment only, not the full economic activity associated with the regional energy transition. A full-economy accounting would be materially larger.

Two Investment Ranges

This appendix maintains two investment ranges. The infrastructure-only range (sections A2–A5) excludes vehicle purchases. The expanded range (section A7) adds ZEV bus, van, and MD/HD truck asset values from section A-ZEV. Both are documented in A7. The white paper uses “roughly $11 billion” as the headline figure, representing the inclusive midpoint of the analytical range.

Interpretation

Results should be interpreted as: conservative estimates of infrastructure and clean vehicle assets deployed, not total economic activity; order-of-magnitude validation of capital mobilization, not audited accounting; and a foundation for understanding the physical delivery capacity of the regional energy transition. Unless otherwise stated, dollar figures are nominal USD; estimates include installed/deployed assets only; and forward-looking commitments are excluded unless deployment has begun.

A1. Capital Mobilization Methodology

The five categories combine to an estimated range of approximately $9–13 billion, with an inclusive midpoint near $11 billion, consistent with the headline used throughout this paper. The infrastructure-only range (excluding ZEV vehicle assets) is approximately $8–12 billion. The aggregate range reflects genuine variation in five underlying categories. Each is explained below, with the primary driver of range width identified so readers can assess the estimates on their own terms.

EV Charging Infrastructure for Light and Medium Duty Vehicles: ~$0.9–1.4 Billion (Midpoint ~$1.15 Billion). Approximately 84,000 public and shared-private charging ports were in service in LA County as of Q3 2025—roughly 65,000 net new ports since 2020. The figure is drawn from the CEC Electric Vehicle Charging Station dataset, which uses the same multi-source approach the CEC applies to statewide reporting; an earlier LA County-specific count from the OurCounty dashboard reported 60,536 ports as of April 2025. Installed cost assumptions of $13,000–$20,000 per port reflect a blended Level 2 and DCFC average per NREL 2024 benchmarks and CEC CALeVIP grant disclosure data. These figures cover hardware and installation only and exclude utility-side make-ready upgrades, which are tracked separately. (Appendix A, Section A2.)

Building Electrification: ~$2.5–5.5 Billion on the Revised Since-2020 Basis. Building electrification is the largest and most range-sensitive category. It comprises three components, each estimated independently with overlap controls applied to the total:

- HVAC heat pumps: an installed base of approximately 425,000–450,000 systems now serves LA County; approximately 170,000–215,000 were added since 2020. At $12,000–$20,000 per installed system, the since-2020 capital is approximately $2.0–4.3 billion (the installed-base value is larger, illustratively ~$5.1-9 billion). Sources: California Heat Pump Partnership Blueprint (1.9 million heat pump systems installed statewide by end of 2024, on RECS/HARDI/ENERGY STAR analysis), TECH Clean California program data (LA County median installed cost ~$16,000), LA County household-share allocation (~22–24% of statewide deployment). This is the single largest value pool in the building electrification category. (Appendix A, Section A3.1.)

- Heat pump water heaters: early-stage deployment. California's annual HPWH market was approximately 25,000–40,000 units statewide as of 2024. LA County's installed base since 2020 is estimated at 15,000–40,000 units at $3,000–$6,000 per unit, or approximately $50 to $240 million. Sources: TECH Clean California program data, California Heat Pump Partnership market estimates, DOE water heating cost analysis. ENERGY STAR's national HPWH tracking is paused; TECH Clean California's county-level project dataset is the authoritative source for a more precise figure. (Appendix A, Section A3.2.)

- Panel and service upgrades: approximately 100,000–200,000 upgrades at $3,000–$6,000 each, or directionally $0.3–1.2 billion, conservatively capped to avoid double-counting with HVAC-associated upgrades. Sources: CEC electrification readiness studies; CPUC electrification proceedings; RSMeans contractor cost benchmarks. (Appendix A, Section A3.3.)

The width of the building electrification range reflects two compounding sources of uncertainty: deployment counts (drawn from CAHPP, CEC program reporting, CPUC proceedings, and TECH Clean California data, which do not provide a single audited regional total) and installed costs (which vary materially by housing type, contractor market, and whether panel upgrades are bundled). This range intentionally avoids summing maximum values across categories. (Appendix A, Section A3.4.)
Energy Storage: ~$1.7–2.1 Billion (Midpoint ~$1.9 Billion). LA County has approximately 1.25–1.35 GW of all grid-connected battery storage installed, exceeding the CEP 2028 target of 701 MW by approximately 80–90 percent if all grid-connected storage is counted given the target was set to specifically meet peak demand. Approximately two-thirds is utility-scale (about 811 MW online) and approximately 443 MW is behind-the-meter. At a blended utility-scale and distributed installed cost of $1.0–1.6 million per MW (per NREL 2025 benchmarks of approximately $334/kWh for a 4-hour system), this yields approximately $1.7–2.1 billion. The range reflects uncertainty in the regional allocation rather than in the per-unit cost, which is well-supported by NREL, Lazard, and BloombergNEF benchmarks. Sources: CEC Energy Storage System Survey (October 2025); CAISO interconnection data. (Appendix A, Section A4.)

Distributed Solar and DERs: ~$3–6 Billion (Midpoint ~$4.5 Billion). Distributed solar investment is estimated from installed capacity additions using California Distributed Generation Statistics (CDGS) and CEC Tracking Progress data, at $2–$3 per watt installed, which is consistent with Lawrence Berkeley National Laboratory's Tracking the Sun benchmarks and NREL's U.S. Solar Cost Benchmark series. Range reflects variation in the installed capacity estimate. Includes rooftop, distributed, and local solar across residential, commercial, and institutional sites. (Appendix A, Section A5.)

ZEV Buses, Delivery Vans, and Medium-/Heavy-Duty Trucks: ~$0.7–1.4 Billion (Midpoint ~$1.1 Billion). Approximately 2,688 medium- and heavy-duty ZEVs are registered in LA County as of early 2025, including electric buses, delivery vans, and ZEV trucks over 10,000 lbs GVWR. At a blended average value (approximately $100,000–$200,000 per delivery van, $436,000 average per Class 8 ZEV truck (per CARB 2024 pricing assessment), and $600,000–1,000,000+ per electric transit bus) this yields approximately $0.7–1.4 billion in installed asset value. Source: CEC MD/HD ZEV dataset, updated annually from California DMV on-road registrations. (Appendix A, Section A-ZEV.)

Capital Attracted or Deployed = ∑ (Units Deployed x Installed Cost per Unit)
This method is standard in infrastructure, utility planning, and clean-energy market sizing where audited project-level investment data is fragmented or unavailable. The objective is order-of-magnitude confirmation, not audited accounting. This approach is validated by IEA World Energy Investment; McKinsey Global Institute capital deployment tracking; Rocky Mountain Institute clean energy investment tracking; and California Energy Commission program participation and deployment reporting. Overlap controls and conservative assumptions are applied throughout to avoid double counting.

A2. EV Charging Capital (Light and Medium Duty)

EV Charging Capital = Number of Ports × Average Installed Cost per Port

Deployment Basis

Approximately 84,000 public and shared-private charging ports were in service in LA County as of Q3 2025. Source: California Energy Commission Electric Vehicle Charging Station dataset (Q3 2025), using the same multi-source methodology the CEC applies for statewide reporting (CEC dataset, AFDC, PlugShare, and grant-recipient reporting).
An earlier LA County-specific count from the OurCounty LA County dashboard reported 60,536 ports as of April 2025; the CEC count is more current and more complete. Net new ports since 2020 are approximately 65,000 (LACI calculation: the ~84,000 Q3 2025 count less an approximate 19,000 ports in 2020, the latter per CEC/AFDC historical reporting).

Cost Assumptions

$13,000–$20,000 per port (blended Level 2 + DC fast charging). Sources: NREL Costs of EV Charging Infrastructure (2024 update); International Council on Clean Transportation (ICCT); CEC CALeVIP grant disclosures; LADWP and SCE utility rebate program documentation.

Results

≈ $0.9–1.4B (midpoint ≈ $1.15B). Explicit exclusions: vehicle procurement; utility-side make-ready distribution upgrades (tracked separately); transmission expansion; site acquisition costs; home (Level 1 / Level 2) charger installations.

A3. Building Electrification Capital

Building electrification capital is estimated as the sum of three components: HVAC heat pumps, heat pump water heaters (HPWH), and electrical panel and service upgrades. Explicit overlap controls are applied.

A3.1 HVAC Heat Pumps

HVAC Capital = Number of Installed Heat Pumps × Installed Cost per Unit
The deployment basis distinguishes two quantities. The installed base — HVAC heat pump systems now serving LA County buildings — is approximately 425,000–450,000 units. The post-2020 net new installations — systems added during the 2020–early 2025 assessment period, which form the basis for the capital mobilization estimate below — are approximately 170,000–215,000 units (LACI estimate; derivation below).

- **Installed base:** California had an estimated 1.9 million heat pump units (HVAC and HPWH combined) installed statewide in residential and commercial buildings as of the end of 2024. Applying LA County's proportional share (~22–24%, a LACI assumption) yields approximately 425,000–450,000 units. Source: California Heat Pump Partnership (CAHPP) Blueprint (March 2025), based on CAHPP internal analysis of RECS, HARDI distributor sales, and ENERGY STAR data.

- **Post-2020 net new (LACI estimate):** Statewide air-source heat pump HVAC sales are approximately 199,000 units per year (CAHPP Blueprint, Appendix B, HARDI-based). Applying a LACI deployment-ramp assumption (lower volumes in 2020–2021 before TECH Clean California launched — single-family 2021, multifamily 2022 — rising toward ~199k/yr by 2024) yields approximately 750,000–900,000 statewide HVAC installations over 2020–2024. LA County's share yields approximately 170,000–215,000 HVAC units. The ramp shape is a LACI assumption applied to CAHPP-published annual rates, not a CAHPP-published series.

- **LA County share (LACI assumption):** approximately 22–24% of statewide deployment, expressed on a household basis per expert guidance (CAHPP/BDC review, June 2026). Consistent with LA County representing approximately 25% of California households; carried as a LACI assumption.

- **System lifespan:** 12–15 years (ASHRAE-consistent, per CAHPP). Replacement turnover of post-2020 stock within the window is negligible; gross installations approximate net additions for this period.

Methodology note: reviewed in June 2026 with the California Heat Pump Partnership (operated by the Building Decarbonization Coalition). The top-down allocation was validated as consistent with CAHPP's own practice; CAHPP does not publish county-level data. The CAHPP dashboard series begins in 2022; the 2020 back-projection is an explicit LACI assumption endorsed in that review.

Cost Assumptions: $12,000–$20,000 per installed system, anchored to the TECH Clean California installation dashboard, which reports a median installed cost of approximately $16,000 for LA County. Supporting sources: NREL Heat Pump Cost and Performance; RMI Economics of Electrifying Buildings; U.S. DOE; RSMeans contractor cost benchmarks.
Result: ≈ $2.0–4.3B (capital mobilized since 2020; midpoint ≈ $3.0B at the TECH median cost). The installed base of 425,000–450,000 systems represents a substantially larger embedded capital stock — illustratively ≈ $5.1–9.0B (LACI calculation). The since-2020 figure is reported here consistent with the assessment period used throughout the white paper. This remains the single largest value pool in the building electrification category.

A3.2 Heat Pump Water Heaters (HPWH)

HPWH Capital = Number of Installed Units × Installed Cost per Unit
Approximately 15,000–40,000 HPWH units installed in LA County since 2020 (LACI estimate). Derived from the California statewide annual HPWH market (approximately 25,000–40,000 units per year as of 2024; CAHPP Blueprint Appendix B; TECH Clean California), an LA County share of approximately 20–25% on a household basis (LACI assumption), and a deployment ramp (smaller market 2020–2022).

Note: ENERGY STAR's national HPWH unit tracking has been paused indefinitely; CAHPP now tracks this segment manually. TECH Clean California county-level project data is the recommended source for a more precise figure. This category represents one of the largest gaps against the CEP 2028 target of 1.6 million units (LA County).

Cost Assumptions: $3,000–$6,000 per installed unit. Sources: TECH Clean California; DOE HPWH technology cost analysis; NREL water heating cost curves; utility rebate disclosures.

Result: ≈ $50M–$240M. Confidence: C (needs hardening via TECH Clean California county-level data).

A3.3 Electrical Panels and Service Upgrades

Panel Upgrade Capital = Number of Upgrades × Installed Cost per Upgrade
Approximately 100,000–200,000 panel or service upgrades associated with electrification, on a household basis (LACI estimate). Sources: CEC electrification readiness studies; CPUC electrification proceedings; utility service upgrade data (directional); National Electrical Code impact analysis. Cost: $3,000–$6,000 per upgrade (NREL; RMI; RSMeans). Overlap control: panel upgrade costs are capped to prevent double counting with HVAC-driven upgrades where inseparable from the system replacement.

Result: ≈ $0.3–1.2B (directional, overlap-capped).

A3.4 Total Building Electrification Capital

Applying conservative stacking and overlap controls across A3.1–A3.3, total building electrification capital is approximately **$2.5–5.5B** on the since-2020 basis (midpoint ≈ $4.0B).

The HVAC heat pump category (≈ $2.0–4.3B since 2020) is the dominant component. The HPWH estimate reflects early-stage market deployment. The panel upgrade estimate is directional and overlap-controlled. This range intentionally avoids summing maximum values across categories.

A4. Energy Storage Capital

Storage Capital = Installed Storage Capacity (MW) × Installed Cost per MW
LA County installed storage capacity is approximately 1,250–1,350 MW (1.25–1.35 GW) of all grid-connected storage. This total is dominated by utility-scale facilities; the behind-the-meter (distributed) component is a minority share. Per the CEC California Energy Storage System Survey (October 2025 edition), LA County online capacity comprises approximately 811 MW of utility-scale storage (20 facilities) and approximately 443 MW of behind-the-meter storage — 308 MW residential across roughly 38,500 systems plus 135 MW commercial — for approximately 1,253 MW online (an additional ~276 MW of utility-scale capacity is planned but not yet online).

Sources: CEC Energy Storage System Survey (October 2025); CAISO interconnection queue and storage reporting; CPUC Integrated Resource Planning (IRP) data. (California grew from approximately 500 MW in 2018 to 16,900+ MW by mid-2025.)

Scope note: the 1.25–1.35 GW figure is all grid-connected storage. Approximately two-thirds is utility-scale; behind-the-meter distributed storage is approximately 443 MW, of which approximately 334 MW was added since 2020 (LACI calculation from CEC survey installation approval-year data). The white paper's distributed-energy narrative should reference the behind-the-meter figure where the discussion concerns distributed assets specifically.

Cost Assumptions: $1.0–1.6M per MW (blended utility-scale + distributed). Sources: NREL Battery Storage Cost and Performance (2025 update, ~$334/kWh for a 4-hour lithium-ion system ≈ $1.3M/MW); Lazard Levelized Cost of Storage; BloombergNEF. Because the LA County base is approximately two-thirds utility-scale, the blended $/MW is weighted toward utility-scale costs. The reported range holds installed capacity near the central estimate (approximately 1.3 GW) and varies the blended installed cost across its plausible band (roughly $1.3–1.6M per MW), rather than multiplying low-capacity by low-cost and high-capacity by high-cost, which would overstate the spread. This yields approximately $1.7–2.1B.

Result: ≈ $1.7–2.1B (midpoint ≈ $1.9B). LA County all-grid-connected storage already exceeds the CEP 2028 target of 701 MW by approximately 80–90%. The challenge has shifted from deployment to dispatch integration and market access.

A5. Distributed Solar and DERs

DER Capital = Installed Capacity (Watts) × Installed Cost per Watt
LA County distributed solar capacity added since 2020 is approximately 1.5–2.0 GW (LACI estimate from CDGS and CEC Tracking Progress installation data), spanning residential, commercial, and institutional systems. Sources: California Distributed Generation Statistics (CDGS); CEC Tracking Progress; utility interconnection datasets. Cost: $2–$3 per watt installed (NREL U.S. Solar Cost Benchmark; LBNL Tracking the Sun; BloombergNEF).

Result: ≈ $3–6B (midpoint ≈ $4.5B). Includes residential, commercial, and institutional distributed and local solar installations, consistent with LACI internal reference estimate scope (2025).

A-ZEV. Zero-Emission Vehicle Asset Value

ZEV Asset Value = Units Deployed × Average Vehicle Value
Approximately 2,688 medium- and heavy-duty zero-emission vehicles registered in LA County as of early 2025, including electric buses, delivery vans, and ZEV trucks over 10,000 lbs GVWR. Source: CEC MD/HD ZEV dataset, updated annually from California DMV on-road registrations.

Blended average vehicle value by type: delivery vans / Class 2–4 approximately $100,000–$200,000; Class 5–7 medium-duty trucks approximately $200,000–$350,000; Class 8 ZEV trucks approximately $436,000 average (CARB Class 8 Zero-Emission Vehicle Technology and Cost Assessment, 2024); electric transit buses approximately $600,000–1,000,000+ (CEC fleet vehicle data; CARB fleet cost assessments).

Result: ≈ $0.7–1.4B (midpoint ≈ $1.1B). Early-stage relative to targets but the highest per-unit asset value in the clean transportation buildout. Included in the expanded range; excluded from the infrastructure-only range.

A6. Managed Charging and Flexible Load (Operational Capacity)

This section estimates operational grid capacity, not capital investment.

Flexible Load (MW) = Enrolled EVs × Avg Charging Power × Participation Rate × Dispatchable Coincidence Factor

Enrollment scenarios aligned with utility pilots, CEP VPP targets, and managed charging programs. Sources: NREL managed charging and V2G studies; CPUC demand response and load flexibility proceedings; CAISO and LADWP virtual power plant pilots; IEA demand-side flexibility research.

Result: ≈ 250–300 MW (midpoint ≈ 281 MW). This represents avoided peak capacity and reliability value, not new generation. The estimate encompasses VPP-aggregated capacity including managed EV charging, storage dispatch, and DER orchestration where enrolled and verified. This is the near-term enrollment target. With over 1.25 GW of battery storage already installed in LA County and California statewide VPP capacity scaling rapidly, the long-term potential is materially larger with full enrollment, orchestration, and market access.

A7. Aggregate Capital Cross-Check

Building electrification is the largest category and carries the widest uncertainty, so the portfolio total applies a conservative stacking factor rather than summing category maximums. On the published CAHPP/HARDI/TECH deployment basis, portfolio cascade modeling places the inclusive midpoint near $10.9B.

Infrastructure-Only Range (A2–A5)

CATEGORY	LOW	HIGH	MIDPOINT
EV Charging (A2)	$0.9B	$1.4B	$1.15B
Building Electrification (A3)	$2.5B	$5.5B	$4.0B
Energy Storage (A4)	$1.7B	$2.1B	$1.9B
Distributed Solar + DERs (A5)	$3.0B	$6.0B	$4.5B
TOTAL — Infrastructure Only	$8.1B	$11.5B	$9.8B

Expanded Range Including ZEV Vehicle Assets (A2–A5 + A-ZEV)

CATEGORY	LOW	HIGH	MIDPOINT
Infrastructure Total (above)	$8.1B	$11.5B	$9.8B
ZEV Vehicle Assets (A-ZEV)	$0.7B	$1.4B	$1.1B
TOTAL — Expanded	$8.8B	$12.9B	$10.9B

The white paper uses “roughly $11 billion” as the headline figure — the inclusive midpoint of the expanded range — because it is the most defensible single figure. A full-economy accounting including home chargers, utility distribution upgrades, workforce spending, and private EV purchases would be materially larger.

A8. Delivery Performance and System Throughput Metrics

While capital deployment provides evidence of momentum, infrastructure performance increasingly determines delivery outcomes. Several metrics referenced in the body text reflect operational capacity rather than installed capital.

- Charging Uptime — share of time charging infrastructure is operational and capable of delivering power. Benchmark target: 97–99% for public fast charging. Sources: DOE AFDC; NREL charging reliability studies; CEC CALeVIP reporting.

- Charging Utilization — share of time infrastructure is actively dispensing power. Low utilization indicates stranded capacity; high utilization indicates congestion risk. Sources: NREL; CEC.

- Time-to-Power — elapsed time between project initiation and electrical energization (interconnection study, permitting, transformer procurement, distribution upgrades). Sources: utility interconnection reporting; CPUC proceedings; CAISO planning.

- Dispatchable DER Capacity — distributed energy resources actively controlled to provide grid services, including storage, managed EV charging, demand response, and VPPs. Sources: CAISO demand response reporting; CPUC proceedings; utility VPP pilots.

A9. Limitations, Conservatism, and Key Sensitivities

General Limitations

Regional allocation introduces uncertainty (conservative shares used throughout; LA County share assumptions are labeled as LACI assumptions); project-level variance is high (aggregation smooths extremes); deployment timing uncertainty is addressed through LACI ramp assumptions where needed; and estimates are order-of-magnitude directional, not audited accounting.

Key Sensitivities by Category

- **HVAC heat pumps:** LA County figures derived from CAHPP statewide data (CAHPP Blueprint, March 2025) via a LACI household-share assumption (~22–24%) and a LACI deployment-ramp assumption. The installed base (~425,000–450,000) and the post-2020 net new flow (~170,000–215,000) are distinct quantities; the capital estimate uses the flow. Methodology reviewed with CAHPP/BDC, June 2026.

- **HPWH:** statewide annual market of 25,000–40,000 units (CAHPP; TECH Clean California) constrains the LA County estimate. ENERGY STAR national tracking is paused; TECH Clean California county-level data is most precise.

- **Distributed solar:** commercial and institutional installations included based on CEC Tracking Progress and CDGS. Site-level utility interconnection data is most precise.

- **Energy storage:** LA County figures from the CEC Energy Storage System Survey (October 2025), separable into utility-scale (~811 MW online) and behind-the-meter (~443 MW). The since-2020 behind-the-meter figure (~334 MW) is a LACI calculation from the survey's approval-year data.

ZEV vehicles: based on CEC MD/HD ZEV dataset from DMV on-road registrations. Vehicle value estimates use CARB Class 8 pricing assessment (2024) for heavy trucks and CEC fleet data for buses and vans.

Appendix B

Carbon Impact Summary and Methodology—Estimating Emissions Avoided Enabled by Infrastructure Deployed Since 2020

Carbon Impact Summary

Based on a conservative, infrastructure-linked methodology, Los Angeles County has plausibly enabled approximately 0.4–1.0 million metric tons of CO_2e avoided per year since 2020, with a midpoint estimate of roughly 0.7 $MMTCO_2e$ annually. On a cumulative basis, infrastructure deployed between 2020 and early 2025 is estimated to have enabled approximately 1.1–2.5 $MMTCO_2e$ of avoided emissions, with a midpoint of roughly 1.7 $MMTCO_2e$. These estimates translate to approximately 0.12–0.27 MMTCE annually and 0.29–0.67 MMTCE cumulatively.

These avoided emissions come from four directly quantifiable wedges: HVAC heat pumps, heat pump water heaters, distributed solar generation, and charging-enabled transport electrification. Together these represent the portion of the regional transition traceable through a defensible chain: infrastructure deployed → energy service delivered → fossil fuel displaced → net avoided emissions.

The analysis deliberately excludes storage, managed charging, and VPPs from direct CO_2 accounting unless dispatch behavior and marginal emissions effects can be measured with confidence. The estimate is therefore best understood as conservative and partial, not a full measure of all decarbonization underway in Los Angeles County.

For building electrification, emissions reductions are calculated as gas combustion avoided minus incremental electricity consumed, applied to the post-2020 net new installed base and scaled by the share of installations that displace gas heating. For distributed solar, reductions are based on solar generation multiplied by the California grid emissions factor. For EV charging, the methodology uses a stock-and-throughput triangulation rather than treating ports as equivalent to carbon savings.

Three caveats matter. First, results reflect directly quantifiable infrastructure effects only. Second, the estimate is sensitive to heat pump fuel displacement, solar output, charging utilization, and public charging share. Third, results are directionally plausible relative to a Los Angeles-scale emissions base of roughly 90–100 $MMTCO_2e$ per year. These figures are cited in the white paper executive summary (footnote 2) and should be read in conjunction with the capital mobilization baseline in Appendix A.

B1. Baseline Year and Accounting Frame

B1.1 Baseline Year.

The baseline year is 2020, consistent with the capital mobilization estimates in Appendix A and the deployment period defined throughout the white paper.

B1.2 Reporting Perspectives.

Annual avoided emissions: net reduction associated with the stock of qualifying infrastructure in operation in a given year. Cumulative avoided emissions: total net reduction accumulated from 2020 through the reporting year. Expressed in $MMTCO_2e$ and MMTCE (using MMTCE = $CO_2e \times 12/44$).

B1.3 Geographic Boundary.

Los Angeles County / the LA metropolitan region, consistent with Appendix A and B definitions.

B2. Core Accounting Principle

Emissions reductions are estimated only where there is a defensible chain: installed infrastructure → delivered energy service → displaced fossil energy → net avoided emissions.

B2.1 Technologies Treated as Directly Quantifiable:

HVAC heat pumps (post-2020 net new installations; see B4.1); heat pump water heaters (see B4.2); distributed solar generation; EV charging infrastructure (through stock-and-throughput triangulation; see B4.6).

B2.2 Technologies Treated as Enabling but Not Directly Quantified:

Battery storage (not assigned direct CO_2e reductions without measured dispatch profiles and marginal emissions data); managed charging / flexible load (requires dispatch timing and marginal emissions data); DER orchestration / VPP programs (same constraints). This is not because they lack emissions significance, but because the current evidence base does not include the measured activity or dispatch data required to quantify them defensibly.

B3. General Calculation Approach

Net avoided CO_2e = fossil fuel emissions avoided – incremental electricity emissions added
For each technology, annualized operating assumptions are applied and summed to produce cumulative results. Where installation timing by year is unavailable, a LACI deployment-ramp assumption is used: installations are assumed to increase progressively from 2020–2025, so cumulative reductions reflect an average in-service period for the installed stock.

B4. Technology-Specific Methodologies

B4.1 HVAC Heat Pumps

Deployment basis: approximately 170,000–215,000 HVAC heat pump systems added in LA County since 2020 (LACI estimate; the post-2020 net new flow, which is what applies to carbon accounting). This is distinct from the installed base of approximately 425,000–450,000 systems now serving the county. The flow is derived from CAHPP statewide air-source heat pump sales (CAHPP Blueprint, March 2025, Appendix B: approximately 199,000 units per year, HARDI-based) with a LACI deployment-ramp assumption for 2020–2021, allocated to LA County on a household-share basis (~22–24%, a LACI assumption). See Appendix A, Section A3.1 for the full derivation.

A heat pump reduces emissions only when it displaces a combustion-based heating system, typically a natural gas furnace. Not all installations do: those replacing air conditioners (gas heating retained), electric resistance heating, or serving all-electric new construction displace little or no gas. The gas-displacement rate is therefore stated explicitly:

Base rate: approximately 62% of LA County occupied housing units use utility gas as the primary heating fuel (U.S. Census ACS Table B25040, 2024). This rises to approximately 66% among homes that use any heating fuel. This mirrors CARB's methodology in its zero-emission space and water heating analysis, which uses ACS B25040 where sub-utility geographic granularity is required.

Cross-check: 2019 California Residential Appliance Saturation Study (RASS) for SCE and LADWP service territories; RECS 2020 statewide frame.
The displacement rate is applied to net new installations and not increased for fuel-switching incentive requirements; unpermitted installations add uncertainty in both directions.

Net CO_2e = (Therms displaced × EF_gas) – (kWh × EF_grid), applied to the post-2020 unit base multiplied by the displacement rate, with the LACI deployment ramp for in-service timing. System lifespan: 12–15 years (ASHRAE-consistent, per CAHPP). Cost and performance sources: NREL Heat Pump Cost and Performance; RMI Economics of Electrifying Buildings; DOE; RSMeans. Confidence: Medium. Primary sensitivity: gas displacement rate, now grounded in ACS B25040 and RASS rather than assumed.

Derivation note (HVAC annual avoided emissions). The annual figures in D9 Table 1 are computed as: (post-2020 net new units) × (gas-displacement rate) × (net avoided CO_2e per displacing unit per year). The per-unit net annual factor used here is approximately 0.44 tCO_2e/unit-year, derived from the per-home gas heating demand displaced (natural gas furnace therms avoided × EPA/CARB gas combustion EF) net of incremental heat pump electricity (kWh × average California grid EF per CARB GHG Inventory / CEC generation-mix reporting). Worked example (midpoint): 192,500 units × 0.64 displacement × 0.44 tCO_2e/unit-yr ≈ 0.055 $MMTCO_2e$/year. Low and high bounds apply the unit range (170,000–215,000) and displacement range (0.62–0.66). The 0.44 tCO_2e/unit-year factor is a LACI parameter consistent with the per-unit basis implied by prior LACI carbon estimates; it should be refined if a county-specific per-home gas-heating-load figure becomes available.

B4.2 Heat Pump Water Heaters (HPWH)

Deployment basis: approximately 15,000–40,000 HPWH units in LA County since 2020 (LACI estimate), derived from the California statewide annual market (approximately 25,000–40,000 units per year as of 2024) and LA County household-share allocation (~20–25%, a LACI assumption). Sources: CAHPP market estimates (CAHPP Blueprint, Appendix B); TECH Clean California; DOE HPWH technology cost analysis; NREL water heating cost curves; utility rebate disclosures.

Note: ENERGY STAR national HPWH tracking has been paused indefinitely; CAHPP now tracks this segment manually. TECH Clean California county-level project data is the authoritative source for a more precise figure.

Net CO_2e = (Therms displaced × EF_gas) – (kWh × EF_grid), with the same gas-displacement logic as D4.1. Confidence: Medium. Hot-water demand is more consistent than space heating but depends on replacement timing assumptions.

B4.3 Distributed Solar Generation

Avoided CO_2e = Solar generation x EF_grid; Solar generation = Installed MW x 8,760 hours x Capacity Factor. Sources: CDGS; CEC Tracking Progress; LBNL Tracking the Sun. Confidence: High to Medium. Solar output is well-characterized; grid emissions factor varies.

B4.4 Battery Storage

Storage reduces emissions when it stores lower-carbon electricity, displaces fossil peaker plants, or enables higher renewable utilization. Current treatment: enabling infrastructure only. Direct emissions reductions are not assigned unless dispatch profiles and marginal grid emissions are modeled with confidence. Sources: CAISO dispatch data; CPUC IRP; NREL storage studies. Confidence: Low for direct CO_2e accounting.

B4.5 Managed Charging / Flexible Load / VPPs

Managed charging can reduce emissions by shifting demand away from higher-emissions hours. Quantification requires dispatch timing and marginal emissions data. Current treatment: not directly quantified. Sources for future quantification: CAISO/CPUC demand response data; utility VPP program dispatch records. Confidence: Low for direct CO_2e accounting.

B4.6 EV Charging Infrastructure

Charging ports themselves do not reduce emissions. Reductions occur only when electricity delivered → EV miles driven → gasoline miles displaced. The methodology uses a stock-and-throughput triangulation: estimate EV population growth (DMV EV registrations); estimate public charging energy demand (EV stock × annual miles ~11,000–12,000 x kWh/mile ~0.30 x public charging share ~15–20%); cross-check against charging capacity (chargers x power x hours x utilization; charging stock ~84,000 ports per CEC Q3 2025; LA County utilization 15–30%); convert energy to EV miles; estimate gasoline emissions avoided (ICE ~400g CO_2/mile); and subtract electricity emissions.

Net avoided CO_2e = (EV miles x ICE EF) – (Electricity x EF_grid). Result: approximately 0.23–0.46 $MMTCO_2e$ per year (midpoint ~0.35). Because this wedge is throughput-based (driven by EV population and charging energy, not port count), the updated port stock does not materially change the result. Sources: DOE AFDC EV registration data; NREL charging studies; EPA vehicle emissions factors. Confidence: Medium.

B5. Emissions Factors

B5.1 Natural Gas.

Standard combustion emissions factors expressed per therm, consistent with EPA and CARB published factors.

B5.2 Grid Electricity.

California's grid has become materially cleaner over time, and storage increasingly displaces marginal fossil generation. Base case: average California grid emissions factors for electrification and solar. Sensitivity: marginal emissions factors for storage and flexible load where dispatch timing data is available. Sources: CARB California GHG Inventory; CEC electricity generation mix reporting.

B6. Double-Counting Rules

Rule 1: Electrification and solar savings are counted separately; each technology is quantified independently. Rule 2: Storage is not credited with solar generation displacement unless dispatch data confirms the relationship. Rule 3: Managed charging is not double counted with EV charging or storage estimates.

B7. Confidence Framework

CONFIDENCE	TECHNOLOGIES / BASIS
High	Distributed solar generation
Medium	HVAC heat pumps (post-2020 flow basis; gas-displacement rate from ACS B25040); HPWH; EV charging-enabled electrification
Low	Battery storage, managed charging, VPPs (enabling infrastructure — not directly quantified)

B8. Main Drivers of Uncertainty

Heat pump gas displacement rate (HVAC and HPWH) — now anchored to ACS B25040 LA County utility-gas share (~62%); RASS/RECS cross-check. Post-2020 net new HVAC installation count (~170,000–215,000; LACI estimate on CAHPP Blueprint flow basis with household-share allocation). Per-unit HVAC avoided-emissions factor (~0.44 tCO_2e/unit-year; LACI parameter — see D4.1 note). EV miles driven and public vs. private charging share. Charging utilization rates (15–30% for LA County). Solar capacity factor. Grid emissions factors (improving as California grid decarbonizes). Deployment timing and ramp assumptions across 2020–2025 (LACI assumption).

B9. Annual and Cumulative Output Tables

Table 1 — Annual Avoided Emissions ($MMTCO_2e$)

TECHNOLOGY	LOW	MID	HIGH	CONFIDENCE / SOURCE BASIS
HVAC heat pumps	0.047	0.055	0.063	Medium. \~170,000–215,000 LA County post-2020 net new units (LACI estimate; CAHPP flow basis) x \~62–66% gas-displacement (ACS B25040) x \~0.44 tCO_2e/unit-yr (LACI parameter).
HPWH	0.008	0.015	0.024	Medium. 15,000–40,000 LA County units (CAHPP; TECH Clean California).
Distributed solar	0.145	0.261	0.436	High–Medium. CDGS; CEC Tracking Progress; LBNL Tracking the Sun.
EV charging-enabled electrification	0.230	0.350	0.460	Medium. Stock-and-throughput triangulation; DMV registrations; NREL utilization; EPA ICE factors.
Total	~0.430	~0.681	~0.983	—

Table 2 — Cumulative Avoided Emissions Since 2020 ($MMTCO_2e$)
Using a 2.5x deployment-ramp multiplier (a LACI modeling assumption, unchanged from prior methodology) applied to annual figures, reflecting the average in-service period of installations deployed progressively from 2020–2025:

TECHNOLOGY	LOW	MID	HIGH	CONFIDENCE / SOURCE BASIS
HVAC heat pumps	0.117	0.137	0.157	Medium. LACI estimate; CAHPP flow basis; ACS B25040 displacement.
HPWH	0.020	0.038	0.060	Medium. CAHPP; TECH Clean California.
Distributed solar	0.362	0.653	1.090	High–Medium. CDGS; CEC Tracking Progress; LBNL.
EV charging-enabled electrification	0.575	0.875	1.150	Medium. DMV registrations; NREL; EPA ICE factors.
Total	~1.074	~1.702	~2.457	—

Table 3 — Converted to MMTCE (MMTCE = CO_2e x 12/44)

METRIC	LOW	MID	HIGH
Annual MMTCE	~0.117	~0.186	~0.268
Cumulative MMTCE	~0.293	~0.464	~0.670

B10. Reconciliation to Published Inventories

Results should be checked against LA County greenhouse gas inventories and California CARB emissions data. The mid-estimate of approximately 0.68 $MMTCO_2e$ annually represents approximately 0.7–0.8% of the total LA County emissions base of roughly 90–100 $MMTCO_2e$ per year (per CARB California GHG Inventory and LA County GHG emissions reports) — consistent with the interpretation that the transition is real and measurable, but still an early wedge in a much larger decarbonization challenge.

B11. What This Methodology Does and Does Not Claim

This methodology estimates emissions impacts from infrastructure deployed since 2020, not the total decarbonization observed in Los Angeles. It does not claim that all EV charging infrastructure is fully utilized; that all electrification occurred solely due to the programs tracked; or that storage and VPPs have zero emissions value. It does claim that infrastructure deployment can be translated into order-of-magnitude avoided emissions; that estimates are transparent and conservative; and that the analytical chain from deployment to avoided emissions is explicit and auditable.

B12. Recommended Publication Posture

Emphasize the directly quantifiable wedges (solar and EV charging are most robust; HVAC is now on a firmer post-2020 flow basis with an explicit displacement rate, but is a smaller wedge than previously estimated). Describe storage and flexibility as system enablers, not direct carbon assets, until dispatch data is available. Present emissions reductions as conservative, infrastructure-linked estimates with explicit uncertainty ranges. White paper footnote 2 cites the range (~1.1–2.5 $MMTCO_2e$ cumulative; ~0.7 $MMTCO_2e$ annual midpoint).

Appendix B cross-references: Appendix A (capital baseline and deployment counts used as carbon calculation inputs); Appendix B (Claim 18 for HVAC, Claim 19 for HPWH); Appendix E (HPWH and HVAC progress against CEP targets in the TEP/CEP scorecard).