

Coming Soon! A Warehouse Near You

Changes Following on the Heels of Zero-Emission Logistics

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Diesel exhaust is bad for people's health. It degrades neighborhoods near warehouses and accelerates global warming. Conventional diesel trucks are free riders on the air we share. Diesel fuel provides only 6.5 percent of their propulsive power. The rest comes from the air, which provides 14.5 times more combustion fuel than the petroleum in their tanks.¹ After combustion, the exhaust is released back into the air as carbon dioxide, nitrogen, nitrogen oxides, nitrated hydrocarbons, and particulate matter.²

The California Air Resources Board (CARB) and South Coast Air Quality Management District (AQMD) have issued rules that will help catalyze a rapid transition to clean truck propulsion technology. Since the beginning of this year, CARB is requiring all *new* drayage trucks entering seaports and intermodal railyards have zero emissions.³ Diesel trucks that that were registered with the state before the end of 2023 can remain in operation until 2035. The AQMD has made warehouses accountable for emissions from trucks delivering cargo to and from warehouses in the four-county air quality district.

The ripple effects from these clean-air initiatives are altering land use, road use, electricity infrastructure, jobs, and community health. If we see these changes coming and intelligently nudge them in the right direction, rather than letting things take their own course, the ripple effects can build environmental justice and environmentally safe communities and livelihoods.



Unsold diesel trucks, photo credit: Economic Roundtable

High-income communities are the biggest consumers of imported consumer goods made by low-wage foreign workers. The warehouses that send the goods to them are often located in communities of color and offer inadequate wages to the local residents who they employ. The harmful side effects on public health from the diesel trucks that move the goods fall disproportionately on disadvantaged communities near warehouses. There is fundamental environmental and economic inequity between the neighborhoods that do the heavy lifting of the logistics system and the neighborhoods that consume the goods.

Heavy-duty electric trucks using battery power eliminate these problems because they carry all of the energy that propels them onboard and they use energy twice as efficiently as diesel trucks.⁴ Because they carry all their energy in batteries, rather than drawing most of it from air, the distance that electric trucks can travel before recharging is currently shorter than the distance that diesel trucks can travel before refueling.

The physics of propelling heavy-duty trucks without harming the environment is one cause of change. Other causes are obsolescence of warehouses, combined with an abundant supply of new construction in the Inland Empire (San Bernardino and Riverside Counties), and high tariffs intended to discourage U.S. purchases of products manufactured in China, which account for 48 percent of the goods imported through the San Pedro Bay Ports.⁵

Warehouse Sites

Currently available heavy-duty electric trucks are capable of meeting the basic performance requirements for short-range drayage operations, roughly up to 175 miles between charges. Actual mileage for current models may be less on routes that require climbing grades or when hot weather increases the use of air conditioning.⁶ The California Air Resources Board has documented strong year-over-year improvement in battery technology,⁷ but their current mileage does not reach the level of diesel-powered trucks, which are now obsolete.

The current shorter range of electric heavy trucks is projected to shift some warehouse operations closer to urbanized areas to preserve logistics profits. The current routes that move consumer goods 60 miles to low-cost warehouses in San Bernardino County, then drive the same goods another 60 miles in the opposite direction to homes in Pacific Palisades, San Marino and Newport Beach, or other logistics destinations, will be less profitable.⁸ This likely outcome means that new adaptive uses will need to be found for outlying obsolete warehouses as the logistics industry moves toward the next generation of "just-in-time" inventory systems.

Warehouses have a history of relocating to keep costs down and accommodate the changing needs of urban economies. Throughout the twentieth century, for instance, many warehouses near city centers were abandoned as metropolitan areas sprawled outward and distribution destinations shifted to the suburbs and exurbs. This out-migration left behind large buildings that remained vacant for decades—in neighborhoods like the Arts District, adjacent to Downtown Los Angeles—until a new wave of capital finally swept in to repurpose the properties for retail, office and residential uses.

In the coming years, higher trucking costs and more automation, resulting in less need for a job-hungry labor force, are projected to create new incentives to open smaller fulfillment centers closer to the urban population (these are often called the last-mile sites). Some outlying warehouses with up to 1,000,000 square feet under one roof are projected to remain vacant, create a new market for adaptive reuse.⁹

Warehouse developers overbuilt during the pandemic boom. There are 30 million square feet of completely vacant warehouse space in the Inland Empire. Fifty-five percent of the vacancies are in newer warehouses – built since 2010.¹⁰ These newer vacant warehouses have an average of over 400,000 square feet of space, nearly twice as big as older warehouses.

Some of these short-term vacancies from over-development are likely an omen of permanent restructuring coming to the logistics industry. For example, Amazon's hub system already integrates large distribution centers that provide a consolidation function (what used to be called break-bulk) with smaller neighborhood or last-mile centers that are close to consumers. The need to minimize heavy electric truck mileage is projected to shift more of the work of reorganizing, storing and distributing consumer goods from warehouses in the Inland Empire to coastal storage and delivery centers.

Adaptive Reuse

Warehouses are overrepresented in disadvantaged communities throughout California. In a society where affordable housing is already in short supply, warehouses often expand without restriction and in some cases they even cause the demolition of affordable housing.¹¹ California needs better warehouse designs that benefit the surrounding communities more and are capable of easily evolving to other uses as logistics demand shifts.¹²

Over half a million cubic feet of concrete are used to build a 400,000 square foot warehouse.¹³ Over 7.4 million pounds of carbon dioxide have already been released into the atmosphere in manufacturing the concrete used to build the warehouse.¹⁴ The 30 million square feet of vacant warehouses in the Inland Empire represent over 556 million pounds of carbon dioxide that has accelerated global warming. New adaptive uses for unneeded warehouses will prevent the environmental cost of building these warehouses from going to waste.

The severe shortage of homes means that the biggest demand is for housing. Some older warehouses have already been converted into lofts. The middle of roofs over newer hulking empty warehouses could be cut away to create large open-air courtyards surrounded by homes, with the remaining roof covered in solar panels.¹⁵ Conservation tillage and planting trees with high life-long carbon capture could make the courtyards eligible for carbon credits. The proceeds could help make some of the homes affordable for low-income workers.

There is also a shortage of living-wage jobs in the Inland Empire. The median annual wage for warehouse workers in these counties is only \$28,900 a year.¹⁶ Furthermore, warehouses provide

only one job for every 9,148 square feet of built space. In contrast, if warehouses are adapted for durable manufacturing industries such as medal fabrication, there will be one job for 758 square feet of space.¹⁷ Metal fabrication workers earn an average of \$66,924 a year.¹⁸

Metal fabrication has a comparatively strong foothold in the Inland Empire,¹⁹ and would produce only half as much on-site greenhouse gas emissions per job as warehouses, however, based on dated information, the life-cycle emissions per job from metal fabrication would be almost three times greater than from warehouses after taking into account the impacts from off-site generation of the electricity that is used.²⁰ These trade-offs underscore the importance of generating clean electricity.

The idea of converting warehouses to data centers has superficial appeal but the downsides are that the centers require an abundant supply of inexpensive electricity, which is not available, and produce very few jobs. A data center requires large capital investments for a massive array of computer servers but typically provides only five to thirty permanent jobs.²¹

Communities can insist on a more balanced use of space and land. Warehouses and delivery centers can be designed to be converted to affordable housing or high-value manufacturing once



526 vacant warehouses in the Inland Empire. Image credit: CoStar.

their useful life is over. Community benefits can include rooftop gardens, solar panels to feed into micro grids and safe pathways for active transportation.

New Warehouses

The continuing growth of e-commerce is making efficient last-mile deliveries and proximity to affluent hilly and coastal neighborhoods in Los Angeles and Orange Counties, where deliveries are concentrated, more important. Proximity is projected to result in higher land costs that will be partially offset by shorter truck trips. Automated systems like conveyor belts, robotic picking arms and robotic forklifts are projected to make new warehouses reliant on fewer workers.

Warehouse employment is projected to decline in the Inland Empire and partially shift to fewer workers, more of them higher skilled, in new, more automated warehouses in Los Angeles and Orange Counties.

Trucking Companies

Trucks from all over the United States haul cargo out of the ports, but 44 percent of the companies are located around the ports. Electric truck dealers and fleet operators have identified delays in obtaining electric power for charging stations as the most serious obstacle for deploying electric trucks. There is a mismatch between the multi-year timeline that is typical for upgrading the utility infrastructure and the rapid deployment of electric trucks required by the California Air Resources Board. Fleet operators report being told by utilities that it will take two years to obtain electric power for their charging stations.²²

Diesel trucks typically remain in operation for 12 years and then are replaced. However, this life cycle may be extended by trucking companies that are reluctant to adopt a new technology. This reluctance and extended years of operation for older diesel trucks may become a necessity if electric power for recharging battery-powered trucks is not available for trucking companies.

If an adequate supply of clean electric is available, it is projected to give first-mover advantages in the regional logistics network to local trucking companies that are early adopters of battery electric trucks. This is projected to enable early adopters to establish strong company recognition for zero-emission goods movement and build service loyalty before other less innovative trucking companies follow in their steps.

Electric Infrastructure

Charging stations for battery-electric trucks represent growth for electric utilities. The locations where there will be demand for electrical power to charge trucks are already known based on where truck companies and large warehouses are located. Charging stations will be needed at all of these sites, and both trucking companies and warehouses are clustered in specific areas.

Southern California Edison, the Los Angeles Department of Water and Power and other municipal utility districts must become proactive in identifying the system requirements for providing power for electric trucks and move expeditiously to build the necessary distribution

infrastructure in advance of the oncoming wave of commercial applications for electrical service upgrades. Utility districts will be a bottleneck unless they act proactively to build the electrical distribution infrastructure required to support clean trucking.

High-road jobs for workers hired from local communities can be one of the benefits from upgrading the electric utility system. Additionally, adopting community-led infrastructure designs can support longer-term plans for ensuring the resilience of crucial emergency services, schools, hospitals, public transit, and other community needs besides logistics.

Generating Local Clean Electricity

The South Coast Air Quality Management District requires warehouses to reduce and offset the emissions created by the trucks that deliver cargo to their sites.²³ Diesel trucks have the second highest greenhouse gas emissions per ton-mile of any mode to cargo movement, exceeded only by cargo aircraft. Their high greenhouse gas emissions and wide deployment make them a significant contributor to climate change.²⁴ One of the ways warehouses can reduce carbon emissions is by installing onsite solar panel systems.

A typical warehouse roof provides a good landscape for operating a solar power system. Not only does it have ample square footage to support a large array of solar panels, but it is also high enough off the ground that shade usually is not a problem. Further, most warehouse roofs are well pitched for catching the sun's rays throughout the day.

A warehouse solar power system can be up to several megawatts in size, depending on the size of the roof and the amount of electricity the facility needs for on-site operations and recharging electric trucks. Green electricity generation can both reduce warehouse emissions and support decentralized micro grids that increase community energy resilience.

Jobs

Warehouses employ eight percent of Inland Empire workers, a share that is eight times greater than the average for California.²⁵ This over-dependence on a low-wage industry with heavy, uncompensated impacts on the road system and the environment is the result of a pattern and practice of government land use regulation that disproportionately burdens communities of color. Low-wage workers who become involuntary part-time workers or lose their jobs will pay yet another price for these discriminatory policies.

Jobs lost in warehouses are projected to be offset by jobs created by electrification. One job is created for every \$111,512 spent on the electrical infrastructure required to recharge electric trucks and transmit electricity generated by solar panels. Electrical construction jobs are growing and have strong multiplier impacts in the supplier chain as well as the consumer sector. Every ten jobs in electrical construction create seven additional jobs in other industries.²⁶

Workers who build the electric utility infrastructure are largely employed to build distribution systems. This includes electrical power line installers, construction laborers, and construction

equipment operators. Workers who install wiring and electrical equipment at trucking companies and warehouses are largely electricians and electrician helpers who assist them.²⁷

The electricity sector provides living wage jobs. The average hourly wage for frontline electrical construction workers in the Inland Empire is \$35 an hour.²⁸

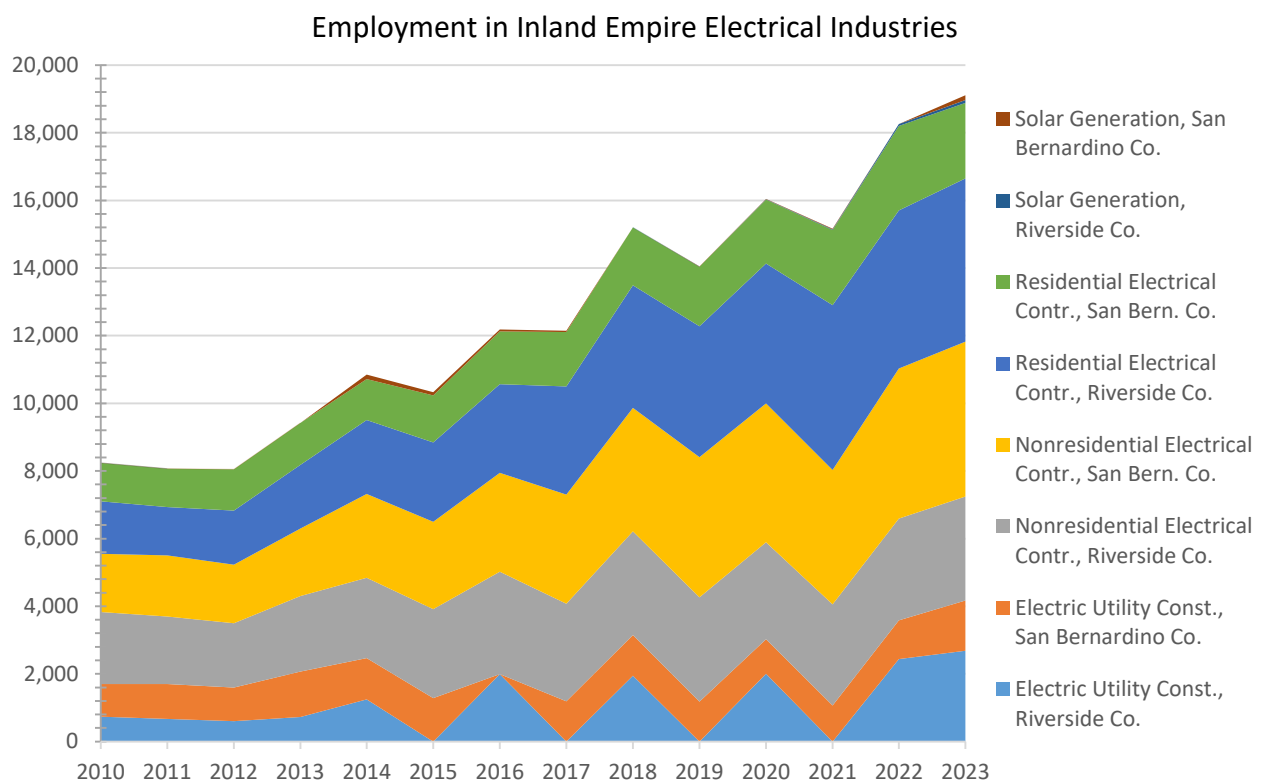
Electrical industries in the Inland Empire have had stronger growth than the overall labor market. From 2013 to 2023 the average annual comparative changes have been:²⁹

- 13 percent in the payroll for *electrical* industries
- 7 percent in the payroll for *all* industries
- 9 percent in employment in *electrical* industries
- 3 percent in employment in *all* industries

The above average growth rate in electrical industries in the Inland Empire is evidence that despite the projected loss of warehouse jobs, there are offsetting benefits from electrification.

Warehouse workers who want jobs in electrical construction will need to have strong mathematical abilities, knowledge about building construction, mechanical systems, and technical plans, and manual skills for tasks such as threading wire through conduit and installing electrical components.³⁰ Ten specific skills in which upgrade training is likely to be needed are:

1. Operations Analysis
2. Repairing



3. Installation
4. Equipment Maintenance
5. Troubleshooting
6. Equipment Selection
7. Materials Management
8. Systems Analysis
9. Complex Problem Solving
10. Mathematics

The International Brotherhood of Electrical Workers Union has apprenticeship programs for training workers who want to become electricians and join the union. The minimum requirements include having a high school education with one year of algebra, achieving a qualifying score on the aptitude test and being drug free.³¹

Tariffs on Chinese Imports

The United States is attempting to revive and protect manufacturing jobs and businesses by eliminating the “the People’s Republic of China’s unfair technology transfer-related policies and practices that continue to burden U.S. commerce and harm American workers and businesses.”³² Tariffs of 25 percent and higher are being imposed on batteries, solar panels, critical minerals, electric vehicles, steel and aluminum products, ship-to-shore cranes, semiconductors, syringes and needles, medical gloves, and facemasks.

The higher cost to buy these products from Chinese manufacturers is projected to reduce the volume of imports. Products made in China currently account for almost half of the cargo that comes into the San Pedro Bay Ports.³³ Shrinking the flow of these imports is projected to have cascading impacts on the logistics system. Less cargo to move is projected to result in less employment for longshore workers, truck drivers and warehouse workers. Reduced warehouse activity is projected to increase the amount of vacant and underutilized space in less-competitive Inland Empire warehouses.

Reshoring the manufacturing of cranes used in the ports to unload cargo from ships can help safeguard U.S. security and longshore jobs. The security issue arises from evidence of espionage devices built into terminal cranes made in China.³⁴ The cities of Los Angeles and Long Beach own the ports, but their primary function is to unload products made by foreign companies from ships owned by foreign companies at port terminals leased by foreign companies.³⁵

Well-paid longshore jobs are the primary domestic benefits provided by the ports, aside from the stream of consumer goods. At least a dozen independent studies have concluded that automation does not increase productivity and may not offset the capital costs of automation.³⁶ There are significant operational challenges for automated terminals including a shortage of needed capabilities in the labor force, poor data, siloed operations, and difficulty handling exceptions to routine cargo flows. In practice, automated ports have been found to be less productive than their

conventional counterparts.³⁷ The attraction of automation for terminal operators appears to be avoiding the necessity of dealing with the longshore workers' union.

Improved Health in Neighborhoods near Trucking Corridors and Warehouses

There are 365,000 apartment buildings and houses located within 2,000 feet of a large warehouse in the Los Angeles region. Working-poor Latinx families make up a disproportionate share of these residents. Because of diesel truck emissions, they make more frequent visits to emergency rooms, have higher rates of asthma and heart disease, and even more premature deaths than other residents in the region.³⁸

Zero-emission electric trucks are projected to reduce the public harm caused by drayage on truck corridors from the ports to the Inland Empire and in neighborhoods near warehouses.³⁹

Carbon Pricing

Holding warehouses and trucking companies accountable for reducing and ending the environmental and human costs of diesel emissions could be part of a solution to the climate crisis. This would mean that carbon taxes to offset the adverse impacts of fossil fuels would be collected from fuel suppliers. The cost for products and services would include the environmental and public costs of the carbon energy they use.

This could mean fewer trucks are on the road, less traffic congestion, and fewer purchases of plastic items that last days in the home and centuries in landfills.

Paying the environmental cost of making and shipping the things we buy, as well as the environmental cost of discarding them, could encourage us to use things more than once, repair things rather than replace them, give old items to friends or charitable groups, start a compost bin in our yard, drive less, work at home more, install solar panels on our roofs, and reduce the amount of energy we use in our homes.⁴⁰ Locally made products and food would have a competitive advantage when we shop.

In addition to regulatory curbs on pollution, the use of carbon pricing to internalize social and environmental costs could be applied to things like infrastructure. For example, public funding is used to build transportation infrastructure that carries truck, rail, sea, and aircraft traffic. A carbon tax could be applied to offset the environmental load created by users of this infrastructure.

Environmental Preservation

Warehouses in the Inland Empire are typically built on greenfield sites, that is, open land that is home to native plant and animal species. The environmental impact reports for building warehouses on these sites have documented the environmental degradation that will occur but asserted that the new warehouse jobs are an over-riding benefit that justifies the environmental harm. Warehouse jobs have also been cited as the overriding benefit that justifies locating warehouses close to developed areas and displacing residents from affordable housing.



Homes that would be demolished for the Airport Gateway Project. Photo credit: Economic Roundtable.

For example, the Airport Gateway Project is a plan to convert a 678-acre residential and mixed-use area north of San Bernardino International Airport into 9.2 million-square feet of warehouse and industrial space. The draft environmental impact report identifies the following 29 issues: Aesthetics, Agriculture and Forestry Resources, Air Quality, Biological Resources, Cultural Resources, Cumulative Effects, Drainage/Absorption, Energy, Flood Plain/Flooding, Geology/Soils, Greenhouse Gas Emissions, Growth Inducement, Hazards and Hazardous Materials, Hydrology/Water Quality, Land Use/Planning, Mandatory Findings of Significance, Mineral Resources, Noise, Population/Housing, Public Services, Recreation, Schools/Universities, Septic System, Sewer Capacity, Solid Waste, Transportation, Tribal Cultural Resources, Utilities/Service Systems, Vegetation, Wetland/Riparian, and Wildfire.⁴¹

One of the impacts would be demolishing the affordable housing occupied by 2,471 residents in the neighborhood where the warehouses would be built. The cities that want to implement the project assert that the human and environmental costs of the project are less important than the expansively described benefits:

“A thriving concentration of commercial, industrial, and office-based businesses engaged in manufacturing, logistics, and technology, and more. The new area will potentially provide thousands of jobs to residents and introduce new food, entertainment, and hotel options to the community.”⁴²

The plan “on pause”⁴³ because of community opposition, but the officials who advocated the plan still hold office and have stated that they “will continue to pursue infrastructure opportunities that benefit the region.”⁴⁴ If the project comes back to life and the new warehouse space is built, it is projected to compound the likely oversupply of warehouse space in the Inland Empire.

Adapting obsolete warehouses in the Inland Empire for new uses that provide needed housing and manufacturing jobs can help preserve the natural environment, prevent additional harm to public health and community livability, and curtail the growth of greenhouse gas emissions.

Summary of Changes

Clean trucks and zero-emission logistics are projected to be catalysts that lead to locating warehouses and distribution centers closer to the homes of consumers, resulting in more vacant warehouses in the Inland Empire. This will create an adaptive reuse challenge for preventing the environmental cost of building these warehouses from going to waste by repurposing them for residential and manufacturing uses.

Warehouse employment is projected to decline in the Inland Empire as some warehouses become obsolete. Some jobs are projected to shift to new, more automated warehouses in Los Angeles and Orange Counties. These dislocations could lead better-informed government agencies and neighborhood groups to insist on a more balanced use of space and land, and on design requirements for new warehouses and delivery centers that make them adaptable for affordable housing or high-value manufacturing once their useful life is over.

If there is an adequate supply of clean electric power for recharging electric trucks, it can give first-mover advantages in the regional logistics network to local trucking companies that are early adopters of battery electric trucks. Insufficient electric power could compel trucking companies to extend the working life of aging diesel trucks.

Charging stations for battery-electric trucks represent growth for electric utilities, but they will be a bottleneck unless they act proactively to build the electrical distribution infrastructure required to support clean trucking.

A typical warehouse roof provides a good landscape for operating a solar power system. Green electricity generation can both reduce warehouse emissions and support decentralized micro grids that increase community energy resilience.

Jobs lost in warehouses are projected to be offset by jobs created by electrification. This includes electrical power line installers, electrical equipment installers, construction laborers, and construction equipment operators. Local governments in the Inland Empire will need to develop job training programs and economic development strategies to open new career opportunities for their residents.

Tariffs on imports from China are projected to have cascading impacts on the logistics system because of reduced imports. Less cargo will mean less employment for longshore workers, truck drivers and warehouse workers. Reduced warehouse activity is projected to increase the amount of vacant and underutilized space in less-competitive Inland Empire warehouses.

Zero-emission electric trucks are projected to reduce the harm to public health caused by drayage on truck corridors from the ports to the Inland Empire and in neighborhoods near warehouses.

Asking warehouses and trucking companies to pay the environmental and human costs of diesel emissions can be part of a monetary solution to the climate crisis. This means that the cost for products and services would include the environmental and public costs of the carbon energy they use.

Reducing or ending the construction of new warehouses in the Inland Empire can help preserve the natural environment, prevent additional harm to public health and community livability, and curtail the growth of greenhouse gas emissions.

About the Authors

Juan De Lara is the inaugural director of the Latinx and Latin American Studies Center and an associate professor of American studies and ethnicity at the University of Southern California. His interdisciplinary research focuses on three broad themes. The first centers on urban political economy, racialization, and the politics of space. A second set of research interests focuses on the use of data science and technology to reorganize how various state agencies are restructuring the social relations of race, immigration, and labor. A third set of projects focus on public-facing research that support community-based organizations in their efforts to resolve social disparities. His first book, *Inland Shift: Race, Space, and Capital in Inland Southern California*, uses logistics and commodity chains to unpack the black box of globalization by showing how the scientific management of bodies, space, and time produced new racialized labor regimes that facilitated a more complex and extended system of global production, distribution, and consumption.

Daniel Flaming has been president of the Economic Roundtable since 1991. Previously he directed housing, community development, job training, and research programs for Los Angeles County. He has led more than 100 major research projects at the Roundtable that have illuminated critical changes in the regional economy, the environment, and housing and labor markets. These research projects have addressed homelessness, wage equity, affordable housing, environmental sustainability, public sector economic development strategies, social and demographic profiles, the business environment, employment strategies for under-paid workers, and technology commercialization strategies.

Fernando Gaytan is a senior attorney with Earthjustice focused on litigation and advocacy aimed at compelling a shift away from fossil fuels and toward equitable zero-emissions solutions across the power, transportation, and building sectors. He has over 18 years of litigation and policy experience working on issues ranging from affordable housing preservation, defending the civil rights of people experiencing homelessness, and protecting worker rights. Fernando is a member of the Economic Roundtable Board of Directors. His collaboration on this paper is in his individual capacity.

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Endnotes

¹ X-Engineer, “Air fuel ratio,” <https://x-engineer.org/air-fuel-ratio/>.

² W. Addy Majewski, “What Are Diesel Emissions,” DieselNet Technology Guide (March 2023), <https://dieselnet.com/tech/emissions.php>.

³ California Air Resources Board, Advanced Clean Trucks Rule, <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks>; enforcement of this rule is pending approval of a waiver by the U.S. Environmental Protection Agency; Tony Briscoe, “California voted to ban new diesel trucks at ports. Why did L.A. and Long Beach just add 1,000more?” Los Angeles Times (June 13, 2024), <https://www.latimes.com/environment/story/2024-06-13/new-diesel-trucks-los-angeles-long-beach-ports-epa-waiver-delay>

⁴ U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, “All-Electric Vehicles,” <https://www.fueleconomy.gov/feg/evtech.shtml>.

⁵ Daniel Flaming and Patrick Burns, *Someone Else’s Ocean: Dockworkers, Foreign Shippers and Economic Outcomes*, Economic Roundtable (2022), p.33, <https://economicrt.org/publication/someone-elses-ocean/>.

⁶ Daniel Flaming and Patrick Burns, *Exhausting Our Air: Environmental and Human Costs of Diesel Trucks*, Economic Roundtable, (September 2023), p.40, <https://economicrt.org/publication/exhausting-our-air/>.

⁷ California Air Resources Board, “Battery-Electric Truck and Bus Energy Efficiency Compared to Conventional Diesel Vehicles,” (May 2018), <https://ww2.arb.ca.gov/resources/documents/battery-electric-truck-and-bus-energy-efficiency-compared-conventional-diesel>.

⁸ Roughly 40 percent of the cargo that is unloaded at the San Pedro Bay Ports is consumed in the Los Angeles region. The origins and destinations of the truck trip generated by large warehouses include the Ports of Los Angeles and Long Beach (34 percent) of truck trips, freight rail intermodal yards account (27 percent), other warehouses (22 percent), local retail stores (14 percent), and cargo airports (3 percent). *Exhausting Our Air*, pp. 51-52.

⁹ We identify two reasons for vacant large warehouses. The first is overbuilding. The second is abandonment of some warehouses as companies move to smaller sites. Mega warehouses or distribution centers play a different role than the smaller facilities operated by companies like Amazon (fulfillment centers). It is the smaller fulfillment centers that have been moving closer to urban population (these are often called the last-mile sites). The reason these smaller sites are projected to gain ground is that direct-to-consumer shipments are projected increase over retail shipments (which rely on the larger distribution centers).

¹⁰ CoStar commercial real estate information, <https://www.costar.com/>.

¹¹ Daniel Flaming and Patrick Burns, *Demolishing Homes for Air Cargo: San Bernardino Airport Gateway Plan*, Economic Roundtable (2023), pp. 6-7, <https://economicrt.org/publication/demolishing-homes-for-air-cargo/>.

¹² In general, cities would benefit from more forward-looking construction that can adapt to the changing needs of the population. See Nathan Mark Hutson and Anthony W. Orlando, “The Effects of COVID-19 on Downtown Land Use: Evidence from Four U.S. Cities,” *Journal of Urban Affairs*, <https://doi.org/10.1080/07352166.2023.2195665>.

¹³ The estimated cubic feet of concrete in a 400,000 square foot warehouse is based on a structure that is 632 feet square, with walls that are 40 feet high, with 12-inch-thick concrete in both floor and walls. Specifications for

structural elements are from “Tilt-Up Concrete,” Portland Cement Association (2024), <https://www.cement.org/cement-concrete/paving/buildings-structures/concrete-homes/building-systems-for-every-need/tilt-up-concrete>.

¹⁴ The carbon footprint from concrete used to build warehouses is based on 400 pounds of carbon dioxide emitted from manufacturing a cubic yard of concrete, Portland Cement Association, “Carbon Footprint,” <https://www.cement.org/docs/default-source/th-paving-pdfs/sustainability/carbon-foot-print.pdf>. This does not include the carbon energy used to extract and transport the gravel, sand and water used to create concrete, or the energy used to mix transport the concrete to construction sites.

¹⁵ Additional structural elements will be required to reinforce/stiffen the opening edges for gravity loads. To address any seismic diaphragm irregularity, it may be necessary to introduce steel brace frames. The reason is that the roof / upper floors act as a diaphragm with collector beams so if they are interrupted, there needs to be a place for the horizontal loads to go and come down. It is also necessary to ensure compliance with building code requirements for thermal performance, fire safety, access, and openings that allow daylight to enter. Typical requirements for adapting warehouses for residential use include:

- Fire-proofing all structural elements.
- Placing automatic sprinklers in all spaces not separated vertically and horizontally by fire or smoke partitions, barriers or fire walls.
- Exit corridors that are at least ten feet wide.
- At least 30 feet separation between interior exit stairways.
- Atriums at least every 70 feet to bring natural daylight into the building.
- Providing thermal upgrades for the roof.
- Ensuring that all bedrooms need to have at least 90 square feet of space and a window.

¹⁶ American Community Survey, Public Use Microdata Sample 2017-2021. Data is for Riverside and San Bernardino Counties. Wages are adjusted to 2021 dollar values and include all employees, including managers and technical workers.

¹⁷ Economic Roundtable reports, *Exhausting Our Air: Environmental and Human Costs of Diesel Trucks (2023)*, and *Jobs, Wages and Housing: Affordable Housing Benefit Fee Study (2012)*, <https://economicrt.org/>.

¹⁸ U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW) for NAICS Code 332, *Fabricated Metal Product Manufacturing*, Riverside and San Bernardino Counties in 2022.

¹⁹ Employment data for Riverside and San Bernardino Counties for 2023 from the Bureau of Labor Statistics Current Employment Survey shows that the share of the labor force that is employed in NAICS Code 332, *Fabricated Metal Product Manufacturing*, is greater than the share in California or Los Angeles County, but less than the share in Orange County.

²⁰ Data for industry emissions per job is from 2011. California’s transition to clean electricity means that current life cycle emissions per job will be substantially lower than in 2011, however more recent data is not available. Data is from a report for the California Energy Commission that was prepared by Daniel Flaming, Patrick Burns and Stephanie Pincetl, *Industry Greenhouse Gas and Wage Sustainability*, Economic Roundtable (2015), pp. 26 and 30, <https://economicrt.org/publication/sustain-los-angeles/>.

²¹ John Lenio, “The Mystery Impact of Data Centers on Local Economies Revealed,” Area Development (2015), <https://www.areadevelopment.com/data-centers/data-centers-q1-2015/impact-of-data-center-development-locally-2262766.shtml>.

²² Economic Roundtable, *Exhausting Our Air*, p. 42, op. cit.

²³ South Coast Air Quality Management District adopted the Warehouse Indirect Source Rule 2305. The rule applies to warehouses with at least 100,000 square feet of space.

²⁴ *Ibid.*

²⁵ U.S. Bureau of Labor Statistics, Current Employment Statistics (CES).

²⁶ Employment impacts are from the 2019 IMPLAN model for California, sector 52, construction of new power and communication structures. Dollars have been adjusted to 2022 values. Based on the IMPLAN crosswalk to Census Bureau industry classifications (<https://www.census.gov/construction/c30/definitions.html>) sector 52 includes:

- Electric power facilities including plants, dry-waste generation, thermal, wind and solar energy facilities.
- Electrical distribution facilities including electric distribution systems, electrical substations, switch houses, transformers, and transmission lines.
- Communication facilities including telephone, television, and radio, distribution

²⁷ U.S. Bureau of Labor Statistics occupational matrix for NAICS 238210, the electrical contractor industry.

²⁸ California Employment Development Department, Occupational Employment and Wage Statistics (OEWS) Survey.

²⁹ Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW). The NAICS codes and titles of the four industries included in the electrical industry group are:

- 238212 Nonresidential Electrical Contractors
- 237130 Power/Communication System Construction
- 238211 Residential Electrical Contractors
- 221114 Solar Electric Power Generation

³⁰ O*NET occupational information for Electricians, Standard Occupational Classification 47-2111.00, <https://www.onetonline.org/link/summary/47-2111.00>.

³¹ IBEW NEC Electrical Training Alliance, <https://www.electricaltrainingalliance.org/training/apprenticeshipTraining>

³² U.S. Trade Representative Katherine Tai, “U.S. Trade Representative Katherine Tai to Take Further Action on China Tariffs After Releasing Statutory Four-Year Review,” Executive Office of the President (May 14, 2024).

³³ U.S. Census Bureau, Economic Indicators Division.

³⁴ Dustin Volz, “Espionage Probe Finds Communications Device on Chinese Cranes at U.S. Ports,” Wall Street Journal (March 7, 2024), <https://www.wsj.com/politics/national-security/espionage-probe-finds-communications-device-on-chinese-cargo-cranes-867d32c0>.

³⁵ Economic Roundtable, *Someone Else’s Ocean*, pp. 32-37, op. cit.

³⁶ *Ibid.*, pp. 58-61.

³⁷ *Ibid.*, pp. 61-64.

³⁸ Economic Roundtable, *Exhausting Our Air*, pp. 102-109, op. cit.

³⁹ The California Air Resources Board estimates that the advanced clean fleet rule, which will trigger rapid conversion to zero emissions, is expected to save \$26.5 billion in statewide health benefits from criteria pollutants

and a net cost savings of \$48 Billion in reduced costs for California Fleets (May 17, 2023), <https://ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-fleets-regulation-summary>.

⁴⁰ These are some of the reasons why economists across the ideological spectrum support the idea of a carbon tax. See, e.g., N. Gregory Mankiw, "Smart Taxes: An Open Invitation to Join the Pigou Club," *Eastern Economic Journal* 35: 14-23.

⁴¹ Governor's Office of Planning and Research, CEQAnet environmental database of the State Clearinghouse, "Airport Gateway Specific Plan (AGSP)," <https://ceqanet.opr.ca.gov/2022060349>.

⁴² Inland Valley Development Agency, Airport Gateway Specific Plan Environmental Impact Report, Frequently Asked Questions – Internal, (March 14, 2023), <https://www.ivdaipa.org/wp-content/uploads/2023/03/IVDA-AGSP-FAQs-3.14.23-FINAL.pdf>

⁴³ Manny Sandoval, "Gateway Specific Plan Canceled, Community BBQ Signals Victory for Environmental Justice in the IE," IE Community News (2023), <https://iecn.com/gateway-specific-plan-canceled-community-bbq-signals-victory-for-environmental-justice-in-the-ie/>.

⁴⁴ Anthony Victoria. "Airport Gateway Specific Plan 'no longer moving forward,'" KVCR (October 24, 2023), <https://www.kvcrnews.org/2023-10-24/airport-gateway-specific-plan-no-longer-moving-forward>.