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Heavy Duty Diesel Truck
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Exhausting Our Air

Environmental and Human Costs of Diesel Trucks

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Economic Roundtable

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Sierra Club

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1. Executive Summary

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Economic Roundtable*

Structural Inequity

Displacement of brick-and-mortar retail stores by online retailing and sprawling warehouses is coming at the cost of climate change, bad air, low wages, and extreme disparities between neighborhoods where consumer goods are warehoused and neighborhoods that can afford to buy the goods.

In each of the past three decades, 175 million more square feet warehouse space has been built in the four Southern California counties of Los Angeles, Orange, Riverside and San Bernardino. Each new warehouse has increased diesel truck emissions in working class neighborhoods where frontline warehouse workers earn median annual wages of \$25,154.

Petroleum waste products produced by moving consumer goods from the seaports to warehouses, and then from warehouses to affluent homes, are released into the air we all breathe. But pollutants are most heavily concentrated in the neighborhoods of low-wage warehouse workers.

Battery-electric trucks will eliminate six million tons of emissions a year and create good jobs in the electricity sector, unless California's mandate for clean trucks is derailed by utility district delays in providing electricity.

Trucking companies and electric truck dealerships report that it takes two years or more to get electricity for recharging the trucks. This is completely out of step with the Air Resources Board's mandate for deploying zero-emission trucks starting January 1, 2024.

Neighborhoods with Warehouses

Warehouses and the workers employed in them are located in lower income communities. The consumers that benefit most from the logistics sector are higher-income communities, far-removed from the noise and emissions caused by diesel trucks and warehouses. There is fundamental environmental and economic inequity between the neighborhoods that do the heavy lifting of the logistics system and the neighborhoods that benefit.

There are over 3,300 warehouses with 100,000 or more square feet of space in the four county region. They cover over 800 million square feet and bring in over \$6 billion a year in revenue.

Recent warehouse construction is concentrated in San Bernardino County, where low land costs offset the distance from retail stores, consumer neighborhoods, and the San Pedro Bay Ports.

Drayage Trucking Companies and Drivers

Drayage companies, which make short-haul trips with heavy cargo, are concentrated near the San Pedro Bay Ports, with secondary concentrations

in the Inland Empire. Most truck drivers live near these trucking companies. Their livelihoods expose them to the emissions and noise of diesel trucks when they are working, and often these impacts are also part of the after-work environment in their neighborhoods.

Two-thirds of trucking companies are small businesses with nine or fewer trucks. However, large corporate trucking companies dominate the industry. Companies with 125 or more trucks own 95 percent of the trucks that move cargo into and out of the Ports of Los Angeles and Long Beach.

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 emissions and wide deployment make them a significant contributor to climate change.

Deploying Electric Trucks

The California Air Resources Board (CARB) and South Coast Air Quality Management District (AQMD) have mandated a rapid transition to clean truck propulsion technology.

Beginning January 1, 2024, CARB is requiring all *new* drayage trucks entering seaports and intermodal railyards to be electric. Diesel trucks that are registered with the state before the end of 2023 can remain in operation until 2035. This is the Advanced Clean Trucks Rule.

There is strong opposition to this regulation by trucking companies. Nineteen states are seeking appellate court review in a challenge to the Environmental Protection Agency waiver granted for California's Advanced Clean Trucks Rule.

Similarly, the California Trucking Association is challenging the AQMD rule that makes warehouses accountable for emissions from diesel trucks delivering cargo to and from warehouses in the district.

Eight heavy-duty truck manufacturers have initiated small-scale manufacturing and sales for zero-emission, battery-electric tractors. Most currently available heavy duty electric trucks are capable of meeting basic performance requirements for short-range drayage operations, roughly up to 175 miles between charges. This means that current battery-electric models are restricted to short-hauls or lighter-weight drayage tasks.

There is strong year-over-year progress in the robustness and capabilities of zero-emission trucks. The capabilities and reliability of electric trucks will continue to improve and in the coming years they will be able to perform all drayage functions currently performed by diesel trucks.

Given the current low-volume of electric truck sales, the purchase subsidies available in California are currently sufficient to reduce their cost to less

than the cost for a diesel truck. However, there are only enough subsidy funds to cover a small fraction of the zero-emission trucks that must be put in service by 2035. As sales ramp up, there will be an interval when subsidies are scarce and the cost of electric trucks has not come down to the cost for diesel trucks.

The current subsidy programs prioritize small truck fleets, but truck dealerships report that small operators are overwhelmed by the paperwork and documentation required to obtain subsidies, and often abandon the effort to obtain a subsidy as well as to buy an electric truck.

In the interest of equity, it is important to continue prioritizing small fleets for subsidies and also to streamline the application process and provide user-friendly technical assistance for small fleet owners seeking subsidies.

Electricity for Charging Stations

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.

The supply of electricity to recharge battery-electric trucks is lagging the timetable set by California Air Resources Board for the transition to zero-emission drayage. Utility districts will be a bottleneck unless they act proactively to build the electrical distribution infrastructure required to support clean trucking.

Impacts of Warehouse Trucking

Diesel trucks travel over 415 million miles a year to and from large warehouses in the four-county region. There are \$1 billion in annual uncompensated public costs from wear and tear on roads and bridges; delays caused by traffic congestion; injuries, fatalities, and property damage from accidents; and harmful effects from exhaust. California ranks 46th among the 50 states in the share of roads that are in acceptable condition.

The 11 million annual heavy-truck trips produce almost six million tons of greenhouse gases that accelerate global warming. They also produce 1,161 tons of nitrogen oxides, which can irritate sensory organs, and cause shortness of breath with fluid build-up in the lungs. And they produce 29 tons of fine particulate matter, which causes bronchitis and asthma attacks.

The annual health costs for residents from current diesel truck emissions, and, conversely, the health benefits from having electric trucks move cargo instead of diesel trucks are an estimated \$166 million a year.

Workers and Jobs

One job is created for every \$111,512 spent on the electrical infrastructure required to recharge electric trucks. This includes jobs building electrical utility infrastructure and installing electrical wiring and equipment to charge trucks, as well as jobs in industries that provide supplies and services for electrical construction, and additional jobs that are created when workers in electrical construction and supplier industries spend their wages.

The electricity sector provides high-pay, living-wage jobs. The average hourly wage for frontline electrical construction is \$35 an hour.

The introduction of new technology in warehouses and the rapid turnover of goods has increased the skill requirements for frontline warehouse jobs. However, the wages paid to warehouse workers have decreased.

The average wage in 2022 for warehouse workers in frontline occupations was \$18.95 an hour. This is less than half of a living wage.

The jobs to electrify the logistics chain that brings goods to warehouses are much better than the jobs inside warehouses. This includes jobs expanding the electrical transmission infrastructure, building recharging station for electric trucks and installing solar panels at warehouses.

Impacts of Warehouses on Frontline Families

There are just under 365,000 residential parcels located within 2,000 feet of large warehouses, across the four-county region. Three-quarters are single-family homes, and another quarter are multi-family properties. This housing provides homes for over 2.1 million residents.

Warehouses and the linked trucking and air cargo networks degrade the habitability of neighborhoods. Factors that diminish the desirability of housing in these neighborhoods include freeways, heavy traffic, truck-train intermodal facilities, cargo airports, truck depots, and warehouses.

Families living near large warehouses experience an elevated likelihood of poverty throughout the four-county region. In addition to economic distress, these families suffer from traffic noise and congestion, as well as long-term exposure to air pollution, that make it difficult to get the peace, quiet and cleaner air needed for a healthy life.

The median income within a 2,000-foot perimeter of large warehouses is 18 percent lower than in the rest of the four-county region, and the poverty rate is 22 percent higher than outside the perimeter.

Many families live near warehouses out of economic necessity, settling on less desirable neighborhoods where rent is lower. Even with lower rent, many families cannot afford housing that meets minimum standards of

space and privacy for household members. They often rent a smaller unit where more than one person is crowded into each room in order to reduce the rent. The rate of overcrowded housing is 38 percent higher within the 2,000 perimeter of large warehouses than in the region as a whole.

Households living within 2,000 feet of a large warehouse are 10 percent more likely to have children, 23 percent more likely to be headed by a female, and 40 percent more likely to be Latino than in the overall region.

Respiratory Distress

The direct pollutants from diesel truck trips to and from large warehouses, cause elevated rates of respiratory distress. This is compounded by the indirect pollutants attributable to the electricity and natural gas that these buildings consume onsite.

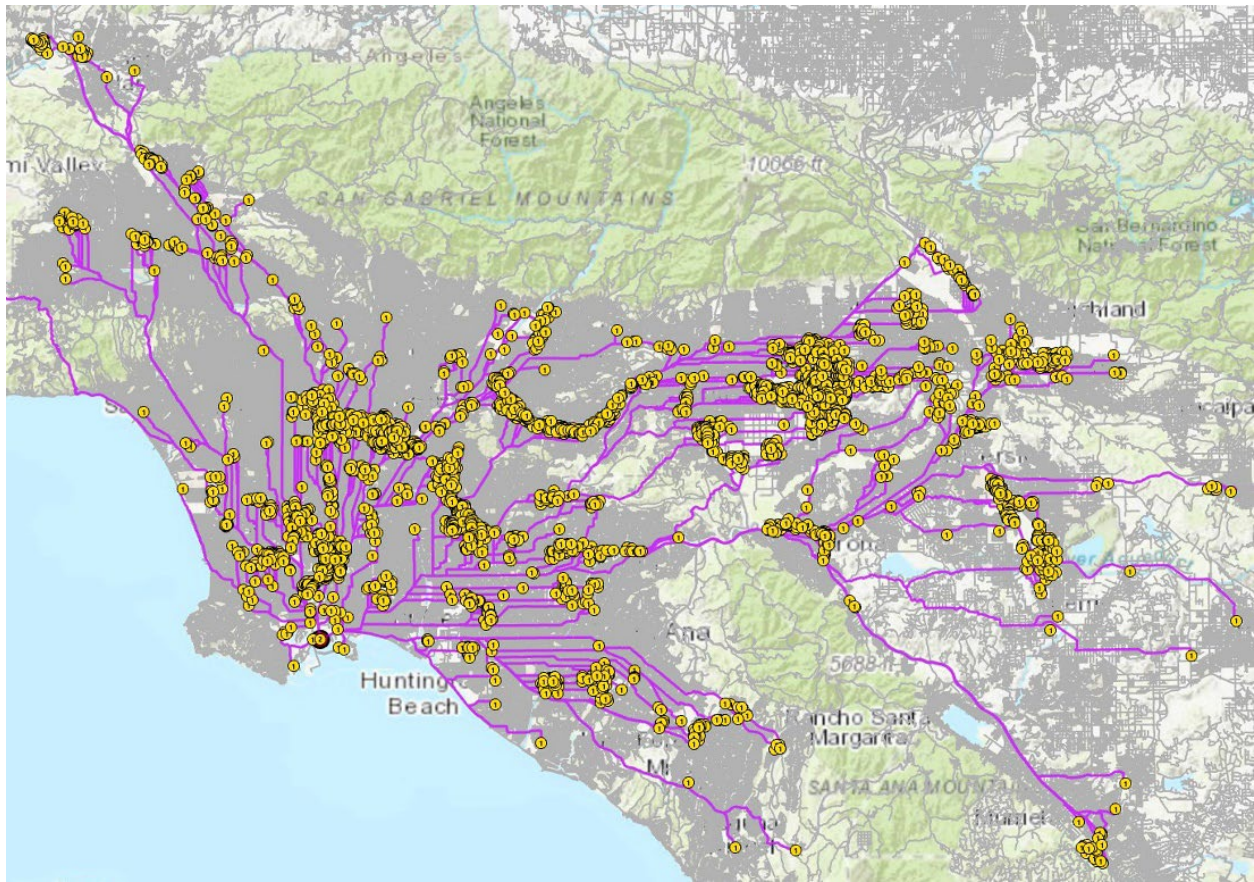
Large swaths of the Inland Empire are in the highest quintile of the pollution burden index, meaning they have the highest exposure to criteria air pollutants, including ground level ozone, carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, and particulate matter.

Homes near the large warehouse clusters by Ontario International Airport and San Bernardino International Airport breathe air with the highest level of fine particulate matter, increasing risks of asthma and heart disease.

The rate of emergency department visits for asthma attacks reflects the location of manufacturing and logistics land uses. South Los Angeles, City of Industry, Ontario and San Bernardino have elevated rates of emergency department visits as well as the largest concentrations of logistics activity.

Recommendations

1. Equitably assess the full environmental and economic impacts of warehouses before approving any new warehouse construction or the expansion of air cargo facilities.
2. Fully enforce noise regulations for all warehouses.
3. Establish a living minimum wage for warehouse workers.
4. Protect the truck electrification timeline created by the Advanced Clean Fleets Regulation and the Warehouse Indirect Source Rule.
5. Proactively upgrade the electrical networks serving trucking companies and warehouses to ensure that electricity is available to recharge trucks as soon as it is needed.
6. Enact rules requiring the Los Angeles Department of Water and Power to provide technical and financial assistance for installing commercial recharging stations.
7. Safeguard electric subsidy funds to ensure ongoing support for small trucking companies after demand grows and subsidy funds shrink.



2. Warehouse Expansion

*Routes from the San Pedro Bay Ports to warehouses
Image credit: Economic Roundtable*

Overview

Economic Inequity

Warehouses and the workers employed in them are located in lower income communities. The consumers that primarily benefit from services of the logistics sector are higher-income communities, far-removed from the noise and emissions caused by diesel trucks and warehouses.

Growth

Over the past three decades, from 1993 through 2022, warehouse space in the four-county region has increased 42 percent, or 175 million square feet, each decade. This steep rate of growth shows no evidence of slowing. The growth in warehouse space has been accompanied by a corresponding increase in diesel truck drayage.

Scale and Location

There are over 3,300 large warehouses with 100,000 or more square feet of space in Los Angeles, Orange, Riverside and San Bernardino Counties. They provide over 800 million square feet of space for storing the things that we buy and bring in over \$6 billion a year in revenue.

Recent warehouse construction has been concentrated in San Bernardino County, however Los Angeles County has the greatest number of large warehouses, followed by San Bernardino, Riverside and Orange Counties.

Low land costs offset the Inland Empire's distance from retail stores, consumer neighborhoods, and the San Pedro Bay Ports. Equally important is some county and city governments' willingness to approve the continued construction of large warehouses.

Economic Desperation

The City of Ontario is home to 278 large warehouses, by far the most warehouses of any city in the four-county region. The large number of warehouses in Ontario may be the result of economic downturns in the city's recent past, as well as economic desperation for growth of any kind. The city filed for bankruptcy in 2012 and remained bankrupt until 2017.

Wages

Nearly two-thirds of workers are employed in *the transportation and material moving* job family. These workers have median wages of \$25,154 annually.

Large Warehouses

Large warehouses continue to be built in Southern California to satisfy growing consumer demand for retail goods. This growth generates more trips by diesel-powered trucks hauling goods between entry ports, intermodal facilities, warehouses, and retail stores.

The South Coast Air Quality Management District (SCAQMD) approved Rule 2305, the Warehouse Indirect Source Rule, in May 2021 to regulate indirect emissions linked to warehouses.

Evidence about the environmental and human costs of moving cargo with diesel trucks as well as the economic and social justice benefits from improving air quality supports implementation of Rule 2035. The baseline information in this report about conditions in the Inland Empire serves as a guide for communities in other regions of the country that are similarly impacted by warehouse operations.

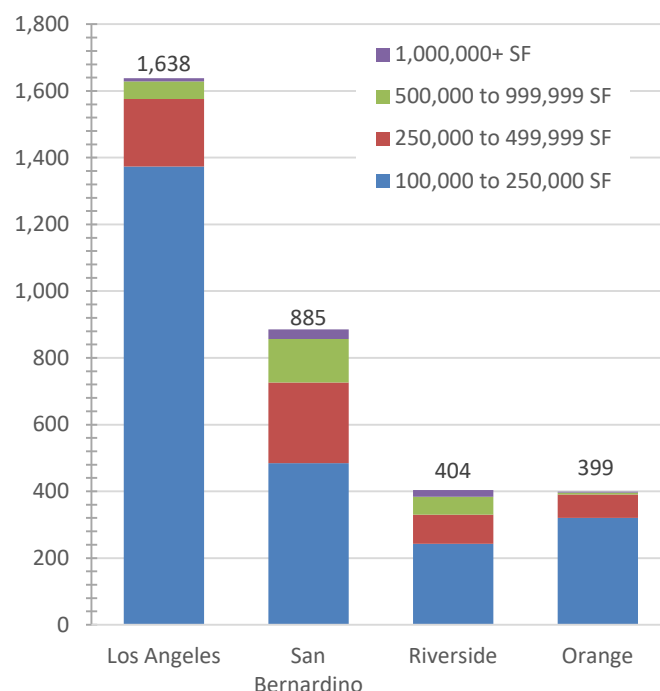
Geography of Large Warehouses

There are over 3,300 large warehouses with 100,000 or more square feet of space in Los Angeles, Orange, Riverside, and San Bernardino Counties. They provide over 800 million square feet of space for storing the things that we buy and bring in over \$6 billion a year in revenue.¹

Los Angeles County has the greatest number of large warehouses, followed by San Bernardino, Riverside and Orange Counties, as shown in *Figure 1*.

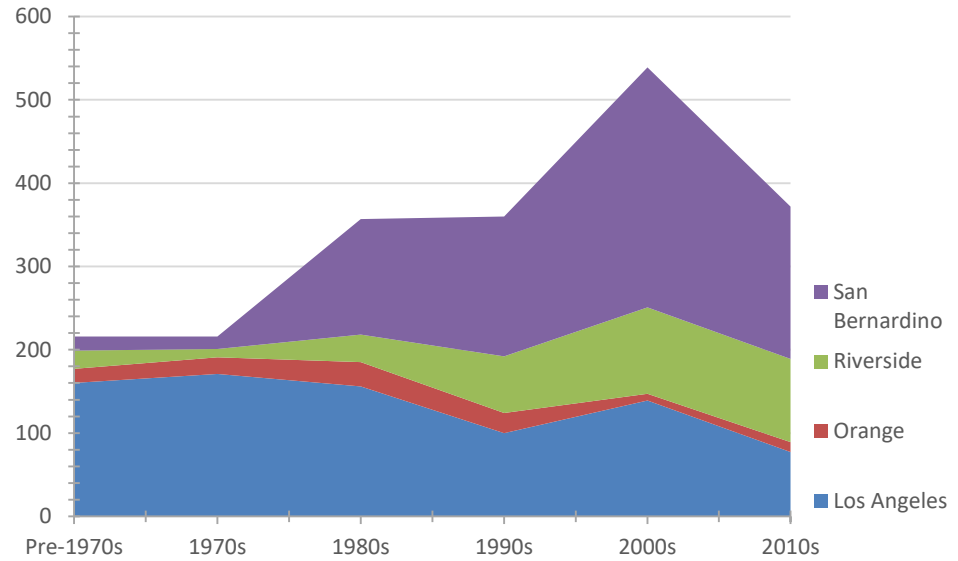
San Bernardino County has the most warehouses with one-million or more square feet of space, as well as warehouses with half a million square feet or more. This reflects a trend toward increasingly large warehouses as well as a trend toward locating new warehouses in San Bernardino County.

Figure 1: Number of Large Warehouses by County



Source: Economic Roundtable analysis; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C and other sources.

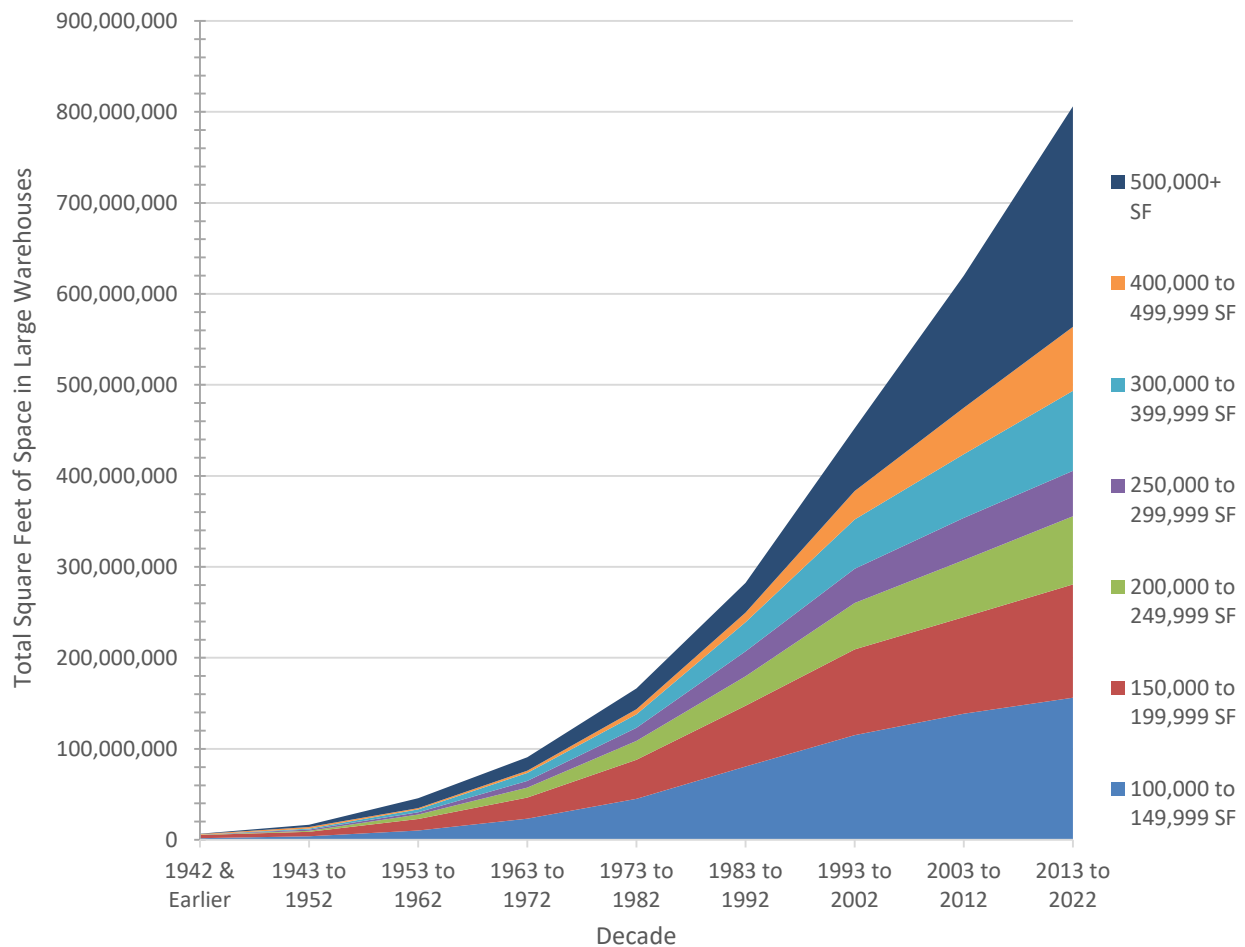
Figure 2: Number of Large Warehouses Built in Each Decade by County



Source: Economic Roundtable analysis and South Coast Air Quality Management District (SCAQMD).

Sixty-two percent of large warehouses have less than 200,000 square feet of space, but they account for only 35 percent of total warehouse space. Nine

Figure 3: Total Square Feet of Large Warehouse Space in the Four-County Region by Warehouse Size and Decade



percent of warehouses have 500,000 or more square feet, and they account for 30 percent of total warehouse space.

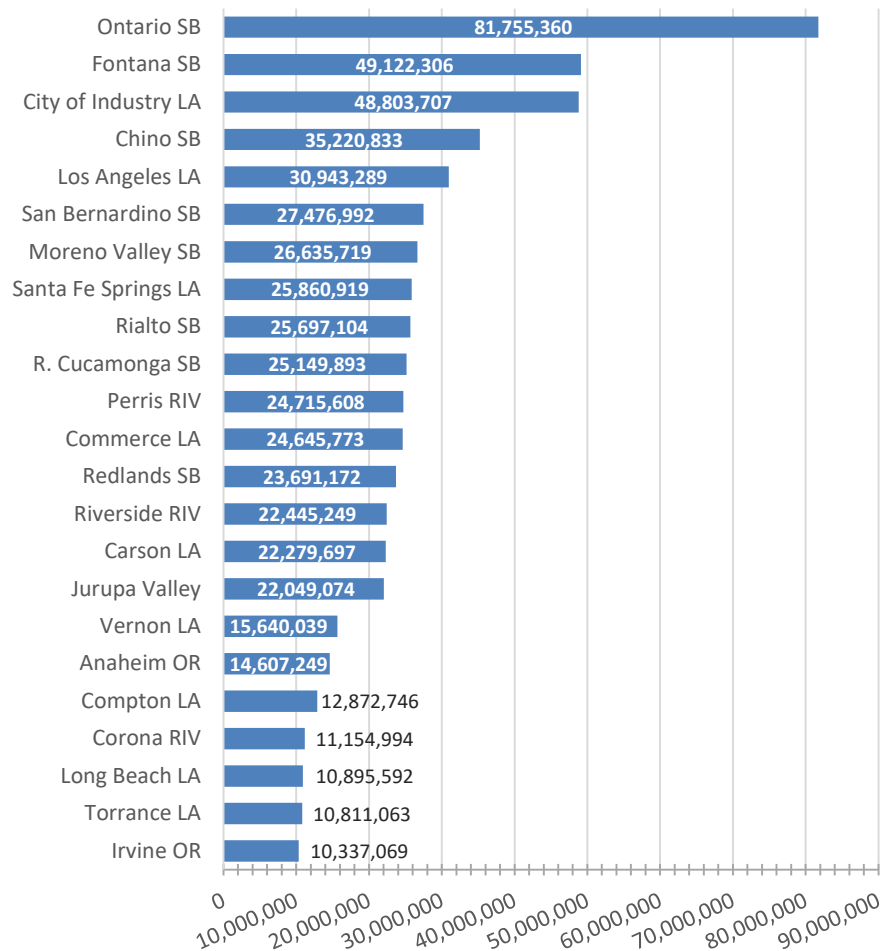
Recent construction of large warehouses has been concentrated in the Inland Empire – San Bernardino and Riverside Counties (*Figure 2*). New warehouses continue to be built, and because many of them are very large, the total square footage of warehouse space is increasing rapidly.

Over the past three decades, from 1993 through 2022, an average of over 17 million square feet of warehouse space has been built each year in the four-county region, as shown in *Figure 3*. This is an increase of 42 percent, or 175 million square feet, each decade. This steep rate of growth shows no evidence of slowing.

Warehouses are nodes in a logistics network that moves goods from where they are produced to where they are consumed. The growth in warehouse space is accompanied by a corresponding increase in diesel truck drayage.

The City of Ontario is home to 278 large warehouses, with over 81 million square feet of space – by far the most of any city in the four-county

Figure 4: Total Square Feet of Space in Large Warehouses by City



Source: Economic Roundtable analysis and South Coast Air Quality Management District (SCAQMD).

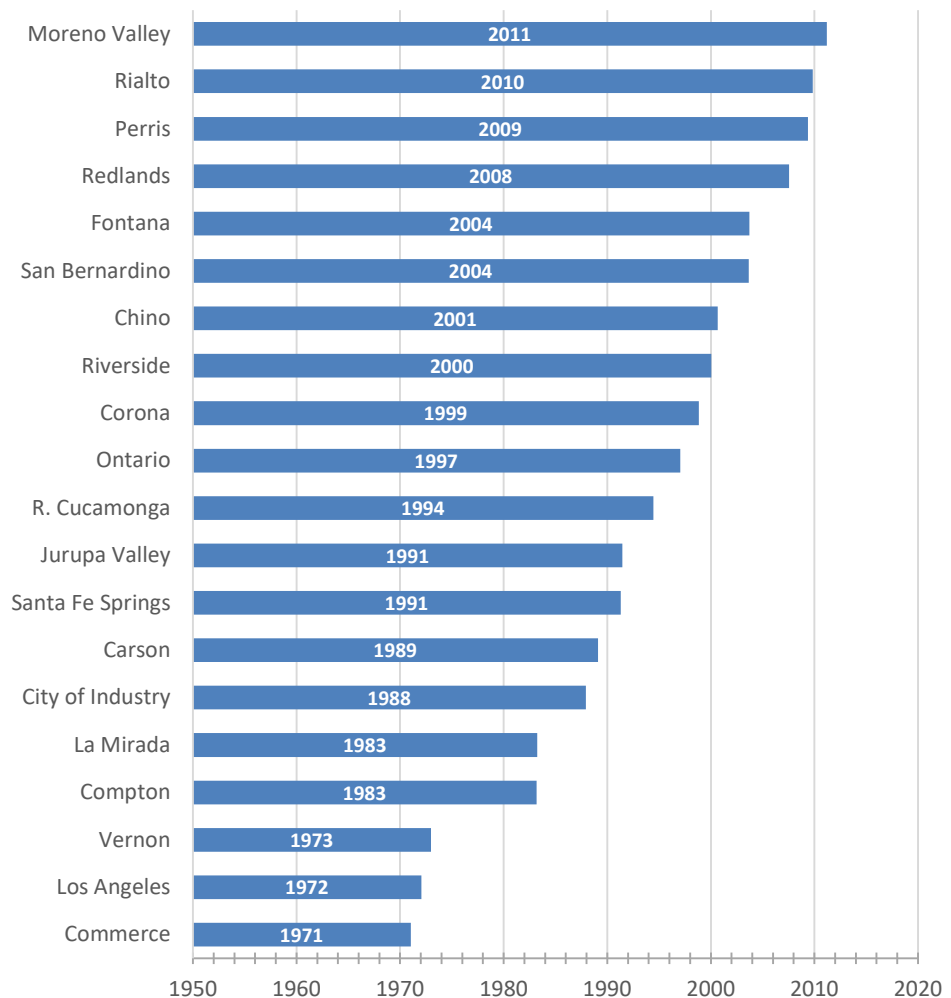
region, as shown in *Figure 4*. The large number of warehouses in Ontario may be the result of economic downturns in the city's recent past, as well as economic desperation for growth of any kind.

Facing \$296 million of unfunded liabilities, a \$45 million budget shortfall, and depleted general fund reserves, San Bernardino filed for Chapter 9 bankruptcy on August 1, 2012. In the years leading up to bankruptcy, San Bernardino suffered heavily as important sources of revenue fell, notably property taxes, vehicle license fees, and redevelopment funds.² The city remained in bankruptcy until 2017.³

There are 23 cities with over 10 million square feet of space in large warehouses shown in *Figure 4* are home to 75 percent of all of the space in large warehouses in the four-county region. Ontario has 81 million square feet of large warehouse space, which is 10 percent of the total space occupied by large warehouses in the four-county region.

The average year when warehouses in Ontario were built is 1997, a more recent vintage than warehouses in Los Angeles, as shown in *Figure 5*. The sequence of warehouse development reflects migration to more outlying

Figure 5: Average Year when Warehouses Were Built by City



areas in the past three decades as land in Los Angeles and Orange became increasingly expensive.

The runner-up with the second-most warehouses is the City of Industry in Los Angeles County. The average year of construction for these warehouses was 1988 – roughly a decade earlier than Ontario. They were built when there was low-cost, greenfield real estate in the San Gabriel Valley. Vacant fields with native plants in the City of Industry were declared to be blighted and a redevelopment authority was established to eliminate blight by building industrial and warehouse facilities along the Union Pacific railroad line.

The 114 large warehouses in the City of Carson are another example of development on low-cost land close to the urban center. The average year of construction for warehouses in Carson was 1989 – similar to the City of Industry. When Carson incorporated as a city in 1968, its landscape was pockmarked with the dozens of refuse dumps, landfills and auto dismantling plants that none of the neighboring cities would allow within their boundaries.⁴ The up-side for Carson was that it is close to the Ports of Los Angeles and Long Beach, and is bounded by four freeways. Carson's dumping grounds were replaced by facilities such as the Watson Industrial Center, a large warehouse and light industry complex.

If the only objective were to minimize transportation logistics, warehouses would be concentrated by the Ports of Los Angeles and Long Beach. However, land costs closer to these public ports are high, and the need for low land costs overrides the need for low transportation costs.

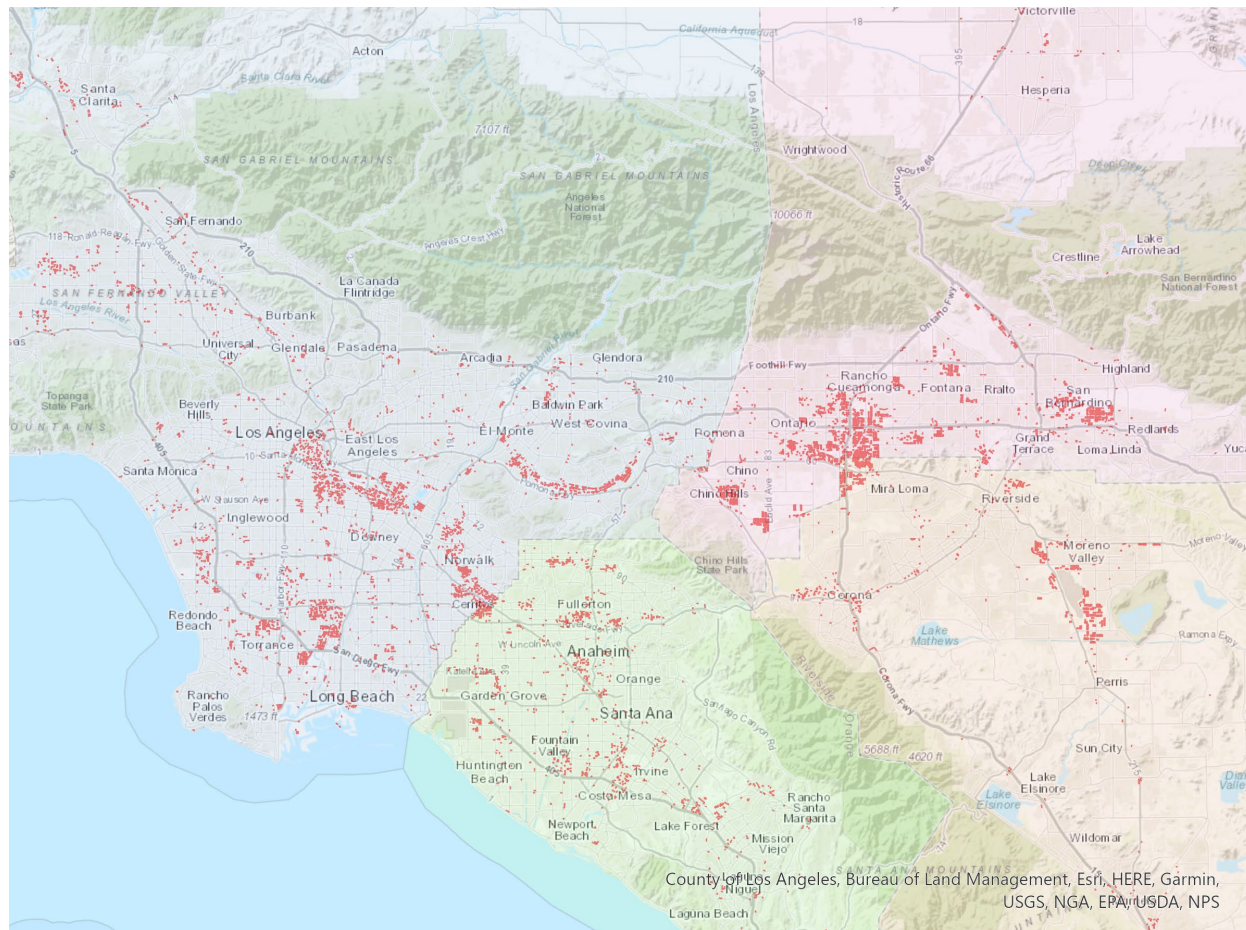
In the 1970s and 1980s, warehouse development was concentrated in Los Angeles County. In the 1990s it shifted to San Bernardino and Riverside Counties. Within the Inland Empire there has been further migration toward lower cost land, shifting most recently from Ontario to Redlands, Perris, Rialto, and Moreno Valley.

The largest warehouses cover more than 20 acres, so the cost of land is an important factor in determining where warehouses are built.

Clusters of Large Warehouses

The locations of large warehouses are the result of past infrastructure investments – such as railroad lines and rail yards, seaport drayage lands and the roads for bringing cargo in and out of the ports, as well as land costs and land use zoning. The locations of the largest warehouses, across San Bernardino, Riverside, Los Angeles and Orange Counties, with their actual building footprints, are shown in *Figure 6*.

Figure 6: Map of Large Warehouses subject to SCAQMD Rule 2305



Source: Economic Roundtable analysis, Southern California Air Quality Management District (SCAQMD) May 7, 2021, Board Meeting Packet for Agenda Item #27, "Proposed Rule 2305 – Warehouse Indirect Source Rule – Warehouse Actions and Investments to Reduce Emissions (WAIRE) Program." Data originally acquired from CoStar.

There is a large cluster of warehouses along the rail corridor connecting Los Angeles' Union Station north of downtown with the Union Pacific and Burlington Northern Santa Fe railyards Southeast of downtown.

Large warehouses are likewise clustered just north of the San Pedro Ports, where shipping containers arriving by sea have their contents unpacked, repalletized and put on truck chassis and railcars.

There is a crescent of large warehouses arcing along the Pomona Freeway in the City of Industry, Rowland Heights and Walnut, along the Union Pacific rail line.

The Inland Empire is where the newest clusters of large warehouses are located. The recent building boom of large warehouse is driven by lower warehouse leasing costs, access to interstate freeways and air cargo facilities at Ontario Airport, San Bernardino International Air Port and March Air Reserve Base.

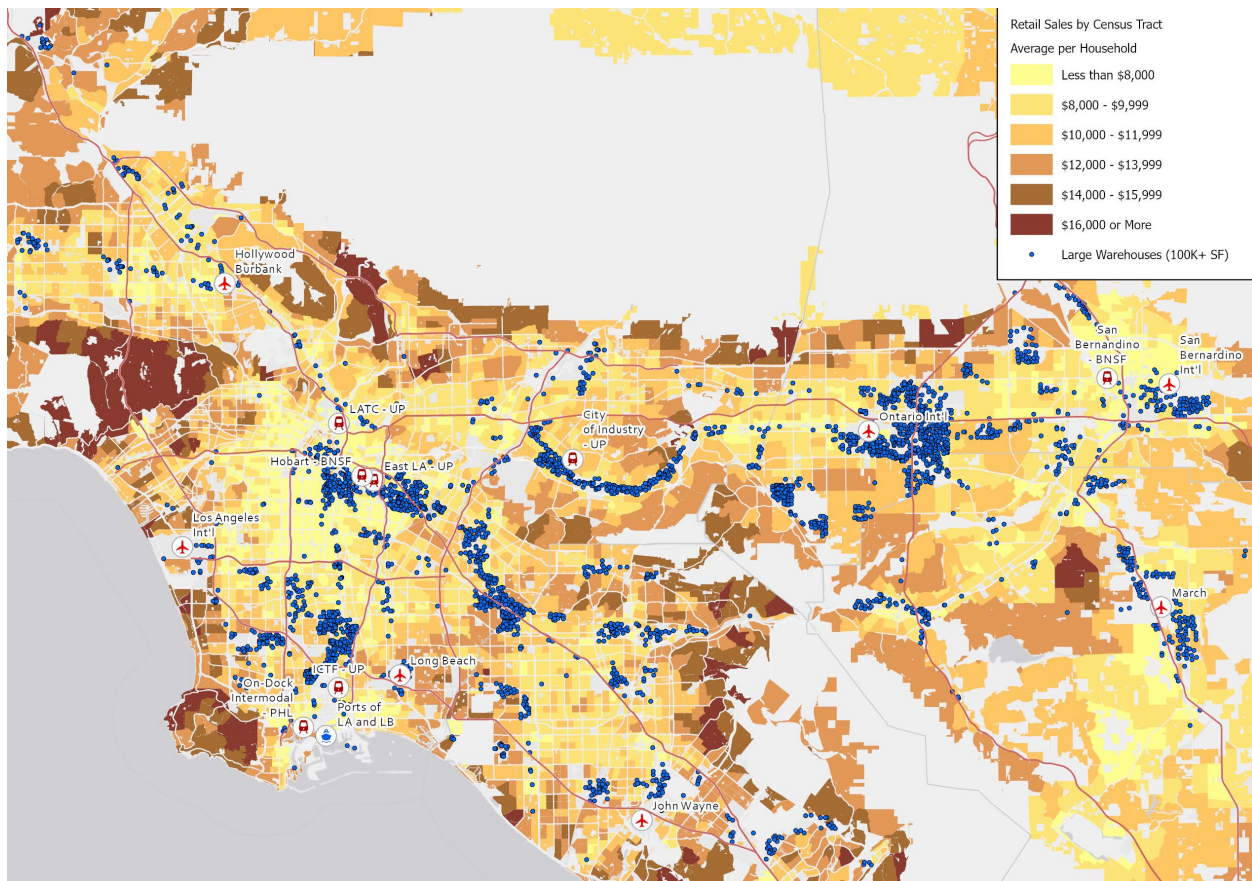
Low land costs offset the Inland Empire’s distance from retail stores, consumer neighborhoods, and the San Pedro Bay Ports. Equally important is some county and city governments’ willingness to approve the continued construction of large warehouses, opening the door to warehouse clusters in Ontario, Rancho Cucamonga, Chino, Rialto, Riverside, Redlands, Moreno Valley, and Perris.

Warehouse Locations and Economic Equity

In 2018, consumers in the four-county region purchased over \$31 billion in retail goods.⁵ These non-food retail items account for roughly 16 percent of household expenditures.

The estimated average amount of household retail purchases in each census tract in 2018 is shown in *Figure 7*. These purchase levels are closely associated with household income in each tract. The darkest shade of brown shows tracts in which the average household made \$16,000 or more in retail purchases. These tracts are located in affluent coastal and foothill areas. At the low end of spending levels, tracts that spent less than \$8,000

Figure 7: Estimated Average Retail Sales per Household by Census Tract



Source: Derived from U.S. Census Bureau American Community Survey 2013-2017 household income data, U.S. Bureau of Labor Statistics Household Consumption breakout of household consumption by item and income level.

for retail goods are shown in yellow. These are lower-income tracts in flatland areas.

Warehouses and the workers employed in them are located in lower income communities, particularly areas south and east of downtown Los Angeles, in Ontario, and further east in San Bernardino County. These lower-income communities are also where warehouse workers live.

The communities that primarily benefit from services of the logistics sector are higher-income communities, far-removed from the noise and emissions caused by diesel trucks and warehouses.

Number of Warehouse Workers

The warehouse industry in the four-county region employs just under 93,300 people in all occupations in warehouses of all sizes (*Table 1*).⁶ Los Angeles County still accounts for the plurality of these workers, over 36,000, or 39 percent of the region’s total. Orange county has the lowest number of warehouse workers, just over 5,400, or six percent.

Table 1 All Warehouse Workers by County

County	Employed Warehouse Industry Workers	Percent of all Workers
Los Angeles County	36,349	39%
Orange County	5,410	6%
Riverside County	18,973	20%
San Bernardino County	32,539	35%
<i>Region Total</i>	<i>93,271</i>	<i>100%</i>

Source: Economic Roundtable analysis; U.S. Census Bureau, 2020 5-Year American Community Survey (ACS) Public Use Microdata Sample (PUMS).

From this total, we estimate that just over 67,500 workers are employed at the region’s largest warehouses – those of 100,000 square feet or more (*Table 2*). Almost 44,000 of these workers, or 65 percent, work in the Inland Empire. Los Angeles County has a smaller share of workers in large warehouses – 29 percent, while Riverside and San Bernardino Counties account for a greater share of workers in large warehouses. Orange County has the same share of the four-county warehouse labor force in both large warehouse all warehouses.

Table 2 Large Warehouse Workers by County

County	No. of Large Warehouses	SF of Large Warehouses	Employment Estimate	Percent of Employment
Los Angeles County	1,626	314,911,990	19,686	29%
Orange County	389	74,175,185	4,071	6%
Riverside County	402	131,212,586	17,238	26%
San Bernardino County	876	283,029,002	26,570	39%
<i>Region Total</i>	<i>3,293</i>	<i>803,328,763</i>	<i>67,565</i>	<i>100%</i>

Source: Economic Roundtable analysis; U.S. Census Bureau, 2020 5-Year American Community Survey (ACS) Public Use Microdata Sample (PUMS).

Warehouse employment changes by season and also when companies re-arrange their supply chains because of changing demand in different regional markets. Our methodology accounts for the low vacancy rate in warehouse properties, since a small number sit idle at any given time.

The methodology for this employment estimate of workers in large warehouses, along with the occupational breakdown of this labor force, is described in the *Data Appendix*, which also includes a table of warehouse employment by city.

Occupations and Wages of Warehouse Workers

Workers in a wide range of occupations come together to operate warehouses, as shown in *Table 3*. The majority of the over 67,500 warehouse workers are employed in *Transportation and Material Moving* jobs, about 64 percent of the total. These workers include *forklift operators* and *packers*, as well as workers who control or tend to conveyor systems that move products to and from stockpiles. This job family also includes workers who move freight on and off trucks at warehouse docks, *shipping machine feeders / off-bearers*, who put goods into and remove them from automated packing and labelling equipment. There are about 60,000 of these workers in the four-county region, handling the stocking and filling of orders in warehouses. Their median annual pay is \$25,154.

Table 3 Warehouse Worker Occupations and Median Wages

Occupation Groups	Number of Workers	Percent of Warehouse Work Force	Median Annual Wage
11-0 Management	5,358	6%	\$52,169
13-1 Business Operations	1,168	1%	\$45,213
13-2 Financial	251	0.3%	\$30,432
15-0 Computer & Mathematical	348	0.4%	\$67,412
17-0 Architecture & Engineering	108	0.1%	\$30,683
23-0 Legal	102	0.1%	\$140,861
25-0 Education, Training, & Library	128	0.1%	\$85,422
27-0 Arts, Design, Entertainment, Sports, & Media	71	<0.1%	\$5,434
31-0 Healthcare Support	31	<0.1%	\$11,571
33-0 Protective Service	459	0.5%	\$24,546
35-0 Food Preparation & Serving Related	123	0.1%	\$36,551
37-0 Building & Grounds Cleaning & Maintenance	1,000	1.1%	\$23,491
39-0 Personal Care & Service	14	<0.1%	\$46,995
41-0 Sales & Related	902	1.0%	\$26,108
43-0 Office & Administrative Support	14,926	16%	\$28,475
45-0 Farming, Fishing, & Forestry	15	<0.1%	\$21,355
47-0 Construction & Extraction	255	0.3%	\$42,711
49-0 Installation, Maintenance, & Repair	769	0.8%	\$40,910
51-0 Production	7,598	8.1%	\$24,148
53-0 Transportation & Material Moving	59,645	64%	\$25,154
Total	93,271	100%	\$26,160

Source: Economic Roundtable analysis; U.S. Census Bureau, 2020 5-Year American Community Survey (ACS) Public Use Microdata Sample (PUMS), Occupational distribution for NAICS Industry (NAICSP) 493 (TRN-Warehouse and Storage), Employment Status Recode (ESR) is limited to "Civilian Employed, at Work" with at least \$500 annual earnings.

The second largest job family *Office and Administrative Support* workers, accounting for just under 15,000 jobs in the region, or 16 percent of the industry’s labor force. This occupation group includes *shipping, receiving, and inventory clerks, order clerks, weighers, measurers, checkers, recordkeeping clerks, general office clerks, production, planning, and expediting clerks, and their front-line supervisors*. Their median annual pay is \$28,475.

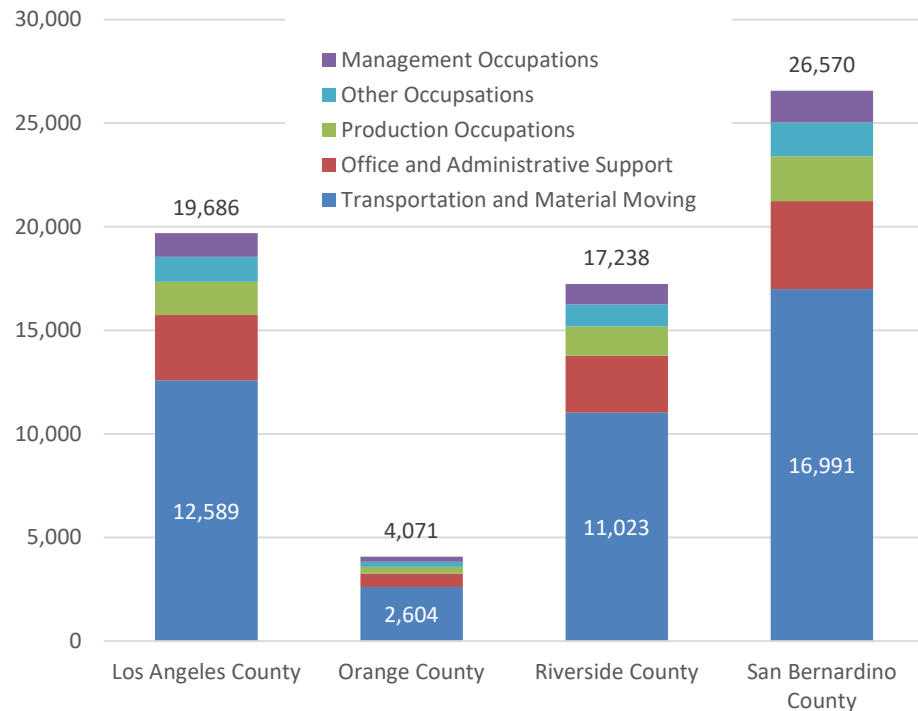
The third largest job family is *Production* workers, with an estimated 7,600 employed – just over 8 percent of the total industry workforce. This occupation group includes *package inspectors, packaging assemblers and fabricators, packaging and filling machine operators and tenders, and their first-line supervisors*. Their median pay is \$24,148.

The fourth largest warehouse job family is *Managers*, which includes those overseeing general warehouse operations, sales, facilities maintenance, human resources and information systems. There are over 5,300 of these workers in the study region – about 6 percent of the labor warehouse force. Warehouse managers’ median annual pay is just over \$52,000.

The remainder of warehouse occupations are small, adding up to just over 5,700 workers – 6 percent of the warehouse workforce.

The number of workers in large warehouses by county and rolled up into broad occupational category is shown in *Figure 8*. These occupational categories roll-up the detailed occupational breakout shown in *Table 3*.

Figure 8: Number of Workers in Large Warehouses, by Occupational Category and County



Source: Economic Roundtable analysis; U.S. Census Bureau, 2020 5-Year American Community Survey Public Use Microdata Sample, Occupational distribution for NAICS Industry 493 (TRN-Warehouse and Storage), Employment Status Recode (ESR) is limited to “Civilian Employed, at Work” with at least \$500 annual earnings.



Community Profile: Cesar Avila, Truck Driver, and Maria Rubio, Retired

Cesar Avila (65) and Maria Rubio (53) and their family live two blocks away from the San Bernardino International Airport. They are immigrants from Guatemala and Mexico who have been living in the United States for over 40 years. They have lived in San Bernardino for the past 12 years but are now at risk of losing their home because of a large redevelopment led by the airport to rezone their homes to make room for future warehouse development.

Cesar is an interstate truck driver who sometimes spends days or weeks on the road and Maria tends to their home and children. A typical day for Cesar and Maria when they are not working is to tend to the home, go to church, visit family and rest. Since 2020 Maria and Cesar have had to deal with the stresses of Maria's health and wellbeing. Maria constantly deals with coughing, bronchitis and pneumonia. Last year, she had to start using an oxygen machine at night to help her with her breathing. The doctor says she has to use it for life. They both know it is from living so close to a growing freight international airport. Cesar and Maria are deeply involved in organizing in their neighborhood for justice for themselves and their neighbors.

What is your relationship to the logistics industry? How does it show up in your life? Or in your neighborhood?

“We have been living in the United States for over 40 years. We have been living in San Bernardino since 2012. It has been getting harder to live here. We live in a small apartment two blocks away from the San Bernardino International Airport. It used to not bother us to live so close to the airport, but recently there have been more flights because of Amazon, Fedex and UPS operations, it is hard to ignore. - *Maria*

There is so much pollution that comes from the airport that it gives us coughing attacks and the flu. We have proof that it comes from the airport pollution! We went to our doctors when we got pneumonia and they said it was from the pollution. We have never smoked a day in our life but our lungs are weak. We feel like we are choking in this Country by the air pollution.” - *Cesar*

“I have been on an oxygen machine for the last eight months. I will have to use it my whole life because the doctor does not have a better recommendation for me. I want my health to get better, because there is not a life like this. I cannot always be plugged into a machine. It is also costly to constantly use it.” - *Maria*

“We cannot be enemies to them, but the truth is they contaminate and they do not filter or do anything about it. They are hurting us with their contamination. It is not just the airport - warehouses are hurting us. Too many trucks drive around here because of the warehouses that are in our neighborhoods, and nobody says anything. We hear the refrigerated trucks running all night. All of this causes too much noise - all the trucks and the planes that fly right over our heads. We have seen so much traffic and road damages because of them” - *Cesar*

“Lots of undocumented people live in these areas and they do not want to get into problems and there is a fear of deportation. Even if they are sick because of the pollution, they do not want to get involved because there is a lot of fear and discrimination.” - *Cesar*

How does the transition of the logistics industry impact you?

“I have never used a compressed natural gas truck or an electric truck but I know that it is good for the environment but that the driver might lose 5 hours because of charging. As drivers we only get 11 hours to drive and 3 to rest, shower and refuel. This is the only thing I am worried about. I am not worried about the cost because my company would get the truck. I just hope that the wages are not lowered because they had to buy the truck. Right now, I get paid enough to live and pay all my rents and bills.

One big worry that I have is that trucks are not using the exhaust filter they need to use to make their engines cleaner. The big companies I have worked for have always used the filters but I have noticed when I park at truck stops that smaller company trucks do not have them. That is fraud. And it causes constant headaches and causes you to wake up with a cough. But I know that some companies do it to cut costs.

I want things to get better. I want the pollution to get better and require the environmental agencies to push the big companies to do something.

I don't think the politicians are doing anything about the issues. I don't think they care. They only care about their purse. Politicians need to do more. Even the big companies, like Amazon, Walmart, UPS and Fedex do not care. We hear their workers complaining about them all the time too.

I used to work at a warehouse, I didn't need to go to the gym because they had me running. It squeezes you out of yourself, that's why I became a truck driver because I got paid more. Driving used to be more lucrative, but now our work has gone down one-third.” - *Cesar*

What gives you hope about our future?

“Better representatives, things changing, more housing coming in gives me hope. Being able to buy homes, retire and use the open land for our communities instead of warehousing gives me hope. We need to get more resources. With the hand of God, we have to win! Primero Dios (first God)! We know we are not doing anything bad. These are our rights we are fighting for” – *Maria*



3. Truck Drivers and Trucking Companies

*Trailer chassis with cargo containers
at Inland Empire warehouse
Photo credit: Economic Roundtable*

Overview

Trucking Companies

Trucking companies are concentrated near the San Pedro Bay Ports, with secondary concentrations in the Inland Empire. Most truck drivers live near trucking companies. Truck drivers and warehouse workers often live in the same neighborhoods. Their livelihoods require exposure to the emissions and noise of diesel trucks when they are working, and often these impacts are also part of the after-work environment at their homes.

Two-thirds of trucking companies have nine or fewer trucks. Only eight percent of companies have 125 or more trucks. Truck companies are predominantly small businesses. However, large corporate trucking companies dominate the industry. Companies with 125 or more trucks own 95 percent of the trucks that move cargo into and out of the ports.

Trucking is a far riskier line of business for small companies than for large companies. Forty-three percent of companies with one or two trucks are inactive, but almost no companies with eight or more trucks are inactive.

Ninety-three percent (15,259) of trucks moving cargo at the Ports of Los Angeles and Long Beach are currently powered by diesel fuel. Trucks typically remain in operation for 12 years. Declining annual shares of the current diesel truck fleet are likely to remain in operation until 2035.

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 emissions and wide deployment make them a significant contributor to climate change.

Deploying Electric Trucks

State and regional environmental regulations are driving a rapid transition to new truck propulsion technology. Beginning January 1, 2024, truck fleets are required to replace diesel trucks that reach the end of their duty cycle with battery-powered electric trucks.

There is strong opposition to this regulation by trucking companies. Nineteen states are seeking appellate court review in a challenge to the Environmental Protection Agency waiver granted to California's Advanced Clean Trucks Rule. Similarly, the California Trucking Association is challenging the South Coast Air Quality Management District's rule that makes warehouses accountable for emissions from diesel trucks delivering cargo to warehouses.

Eight heavy-duty truck manufacturers have initiated small-scale manufacturing and sales for commercial Class 8, zero-emission, battery-electric tractors. Most currently available electric trucks are capable of

short-range drayage operations of roughly up to 175 miles between charges. This means that current battery-electric models are restricted to short-hauls or lighter-weight drayage tasks.

There is strong year-over-year progress in the robustness and capabilities of zero-emission trucks. The capabilities and reliability of electric trucks will continue to improve and in the coming years they will be able to perform all drayage functions currently performed by diesel trucks.

Given the current low-volume of electric truck sales, the purchase subsidies available in California are currently sufficient to reduce their cost to less than the cost for a diesel truck. However, there are only enough subsidy funds to cover a small fraction of the zero-emission trucks that must be put in service by 2035. As sales ramp up, there will be an interval when subsidies are scarce and the cost of electric trucks has not come down to the cost for diesel trucks.

The current subsidy programs prioritize small truck fleets, but truck dealerships report that small operators are overwhelmed by the paperwork and documentation required to obtain subsidies, and often abandon the effort to obtain a subsidy as well as to buy an electric truck.

In the interest of equity, it is important to continue prioritizing small fleets for subsidies and also to streamline the application process and provide user-friendly technical assistance for small fleet owners seeking subsidies.

Electricity Unavailable for Charging Stations

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.

The need for electric truck charging stations is most concentrated above the ports, where many trucking companies as well as large warehouses are located, and at warehouse hubs in the City of Industry and in the Inland Empire from Ontario to the Moreno Valley. Charging stations will be needed at all of these sites.

Municipal utility districts, such as the Los Angeles Department of Water and Power, are regulated by city councils rather than the California Energy Commission and must be locally activated to build the infrastructure required to meet electrical demand for recharging battery-electric trucks.

The supply of electricity to recharge battery-electric trucks is lagging the timetable set by California Air Resources Board for the transition to zero-emission drayage. Utility districts will be a bottleneck unless they act proactively to build the electrical distribution infrastructure required to support clean trucking.

Drayage Truck Drivers

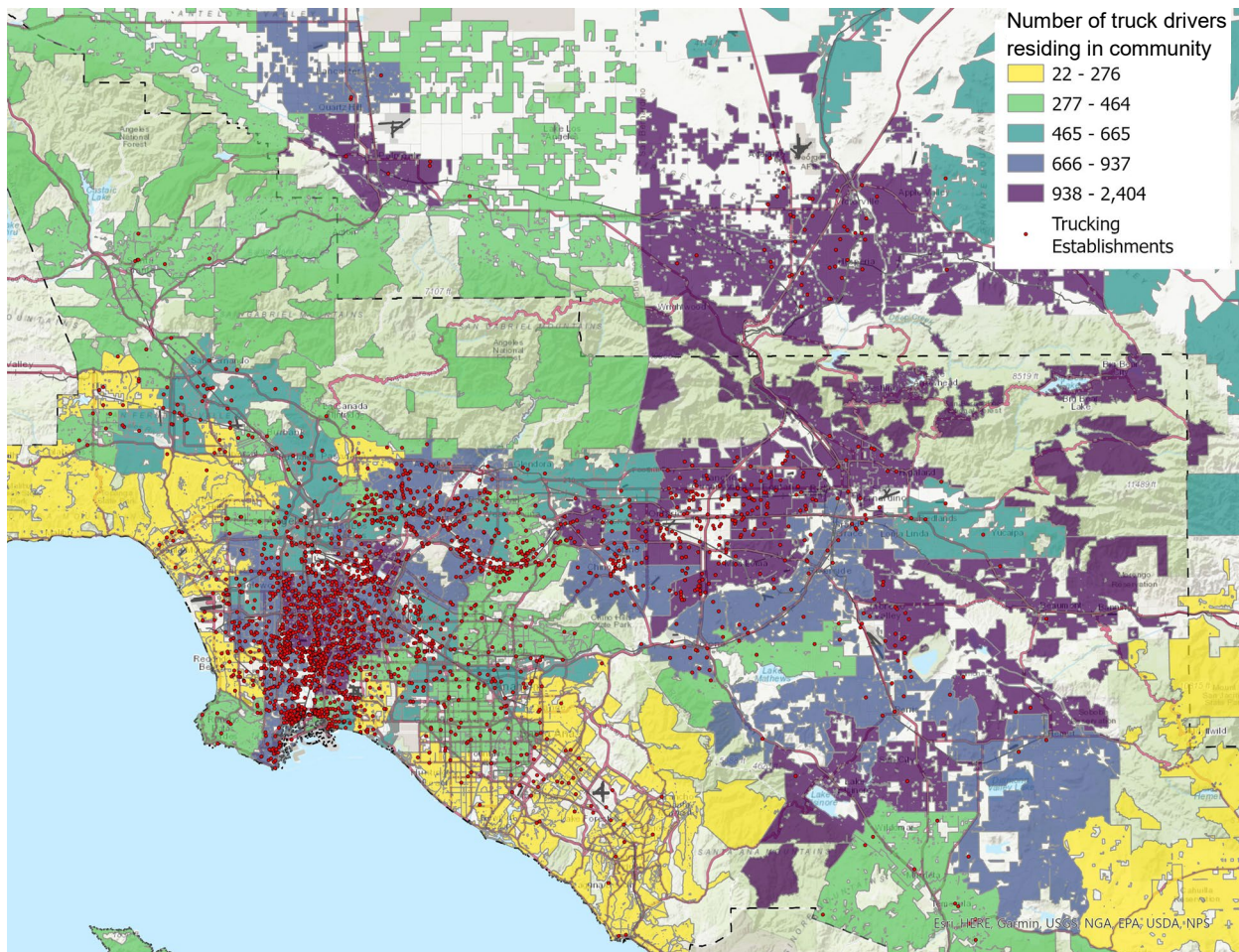
The San Pedro Bay ports are the primary gateway for the \$350 billion in goods that are imported annually to satisfy enormous consumer demand in the Western United States.⁷ There are 2,327 active drayage trucking companies registered with the Ports of Los Angeles and Long Beach that move goods from the ports to warehouses with a total of over 800 million square feet of space in the four-county region.

Drayage trucking companies are concentrated near the ports, with secondary concentrations in the Inland Empire, as shown in *Figure 9*. This is logistically practical because of proximity to the San Pedro Bay Ports.

Most truck drivers live near trucking companies. This is shown by the background colors in *Figure 9*, where darker colors represent higher residential density of truck drivers.

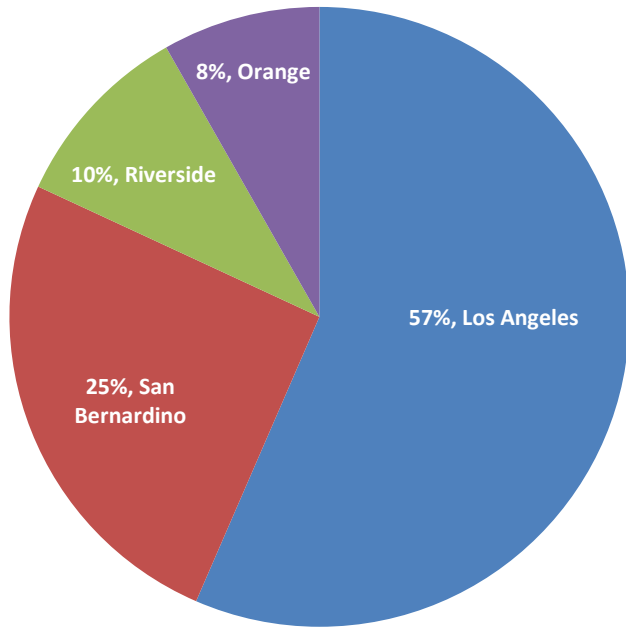
The U.S. Census Bureau's American Community Survey reports that there are 68,074 truck drivers employed by the truck transportation industry

Figure 9: Locations of Trucking Companies and Homes of Truck Drivers



Sources: Location of trucking companies is from the Port of Los Angeles truck registry. The residential density of truck drivers is from the American Community Survey Public Use Microdata Sample for 2016-2020. The red dots indicate trucking companies. The background colors indicate residential density of truck drivers.

Figure 10: Share of Truck Drivers Residing in Each County

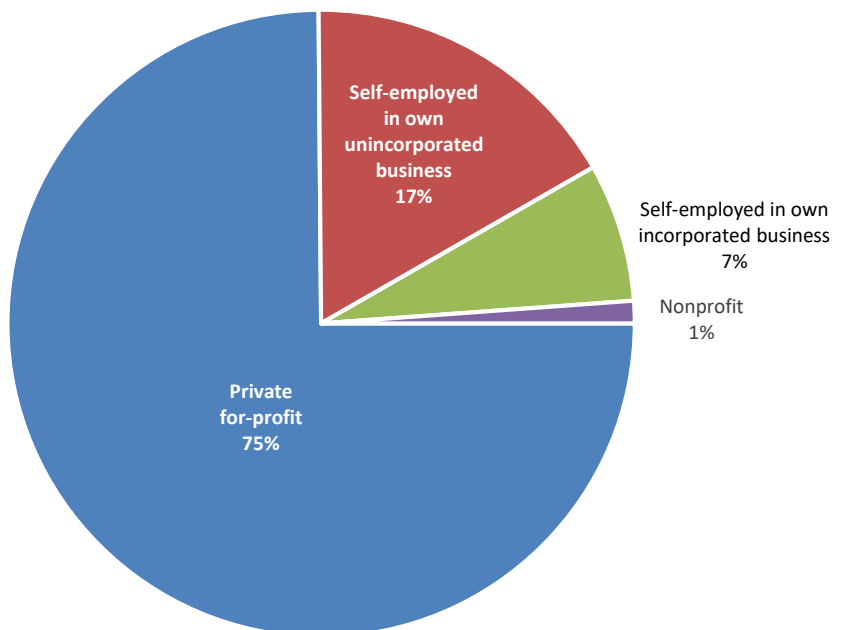


Source: U.S. Census Bureau, American Community Survey, Public Use Microdata Sample for 2016-2020, for Los Angeles, Orange, Riverside, and San Bernardino Counties.

within the four-county study area. Over half live in Los Angeles County, one quarter live in San Bernardino County, and roughly one-tenth live in each Riverside and Orange Counties, as shown in *Figure 10*.

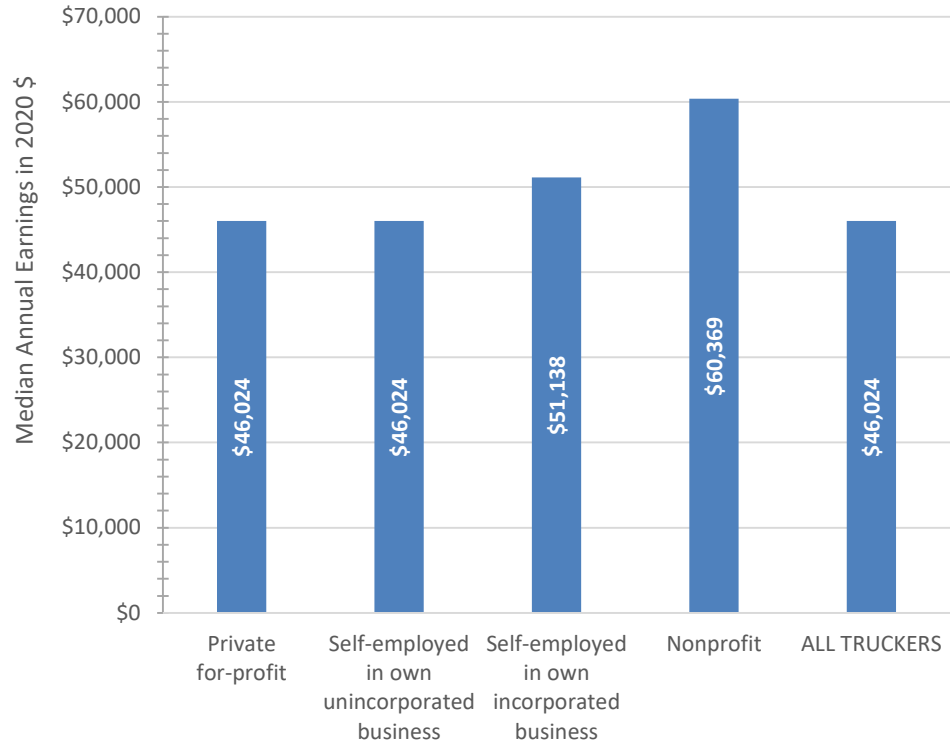
Three-quarters of truck drivers report that they are employed by a private, for-profit business, as shown in *Figure 11*. Almost one-quarter (24 percent)

Figure 11: Types of Establishments that Employ Truck Drivers



Source: U.S. Census Bureau, American Community Survey, Public Use Microdata Sample for 2016-2020, for Los Angeles, Orange, Riverside, and San Bernardino Counties. Public sector employment is excluded.

Figure 12: Median Annual Earnings of Truck Drivers by Type of Employer



Source: U.S. Census Bureau, ACS Public Use Microdata Sample for 2016-2020, for Los Angeles, Orange, Riverside, and San Bernardino Counties. Earnings in 2020 dollars are for employed truck drivers in truck transportation industry.

are self-employed in their own business, either unincorporated or incorporated, and one-percent work for a nonprofit group. This breakout excludes a small number of truckers employed by government agencies.

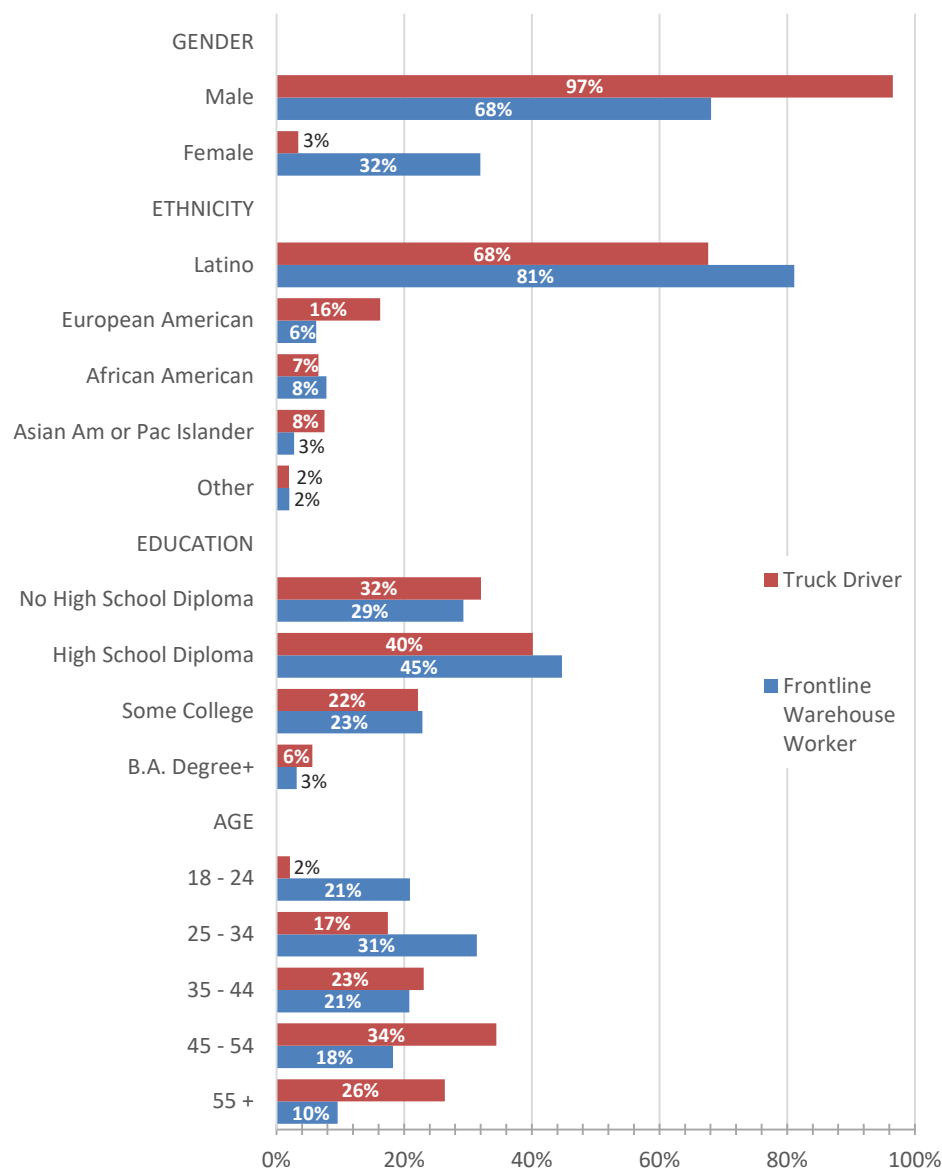
The type of employer impacts the amount of pay that truck drivers receive, as shown in *Figure 12*. The typical (median) truck driver earns \$46,024 a year; this is also the typical pay for truckers working for private, for profit companies, which dominate the industry. Earnings are higher, \$51,138, for self-employed truckers who own an incorporated business, and even higher, \$60,369, for the small number of truckers employed by nonprofit groups.

Truck drivers and warehouse workers often live in the same neighborhoods. Both groups of workers are predominantly Latino. And both groups have very similar levels of educational attainment, with almost three-quarters having no college education, as can be seen in *Figure 13*.

Truck drivers and warehouse workers differ in gender and age. Both groups of workers are predominantly male, but truck drivers are almost exclusively male (97 percent vs 68 percent of warehouse workers).

Truck drivers tend to be older than warehouse workers. Sixty percent are 45 years of age or older, while 73 percent of warehouse workers are less than 45 years old.

Figure 13: Profile of Warehouse Workers and Truck Drivers in the 4-County Study Area



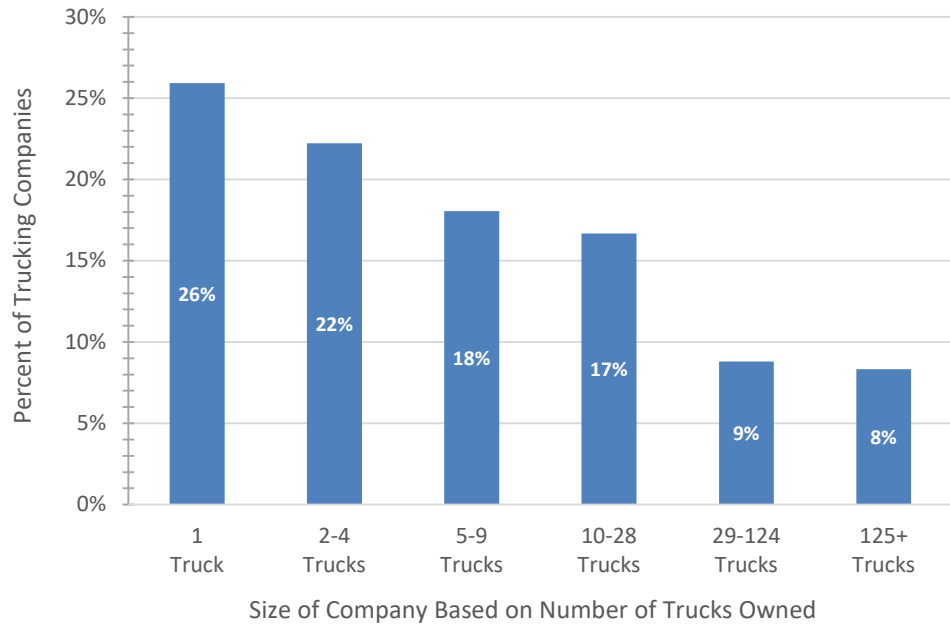
Source: U.S. Census Bureau, American Community Survey, Public Use Microdata Sample for 2016-2020, for Los Angeles, Orange, Riverside, and San Bernardino Counties.

Trucking Companies

The registry of 2,997 drayage trucking companies authorized to transport cargo containers to and from the Ports of Los Angeles and Long Beach includes companies with as few as one truck and as many as 24,000 trucks. The ports are the primary entry point for consumer goods coming into the region, so this registry provides a reliable profile of the trucking companies trucks that deliver cargo to warehouses in the four-county region.⁸

Two-thirds of drayage trucking companies have nine or fewer trucks, as shown in *Figure 14*. Only eight percent of companies have 125 or more trucks. Truck companies in the region are predominantly small businesses.

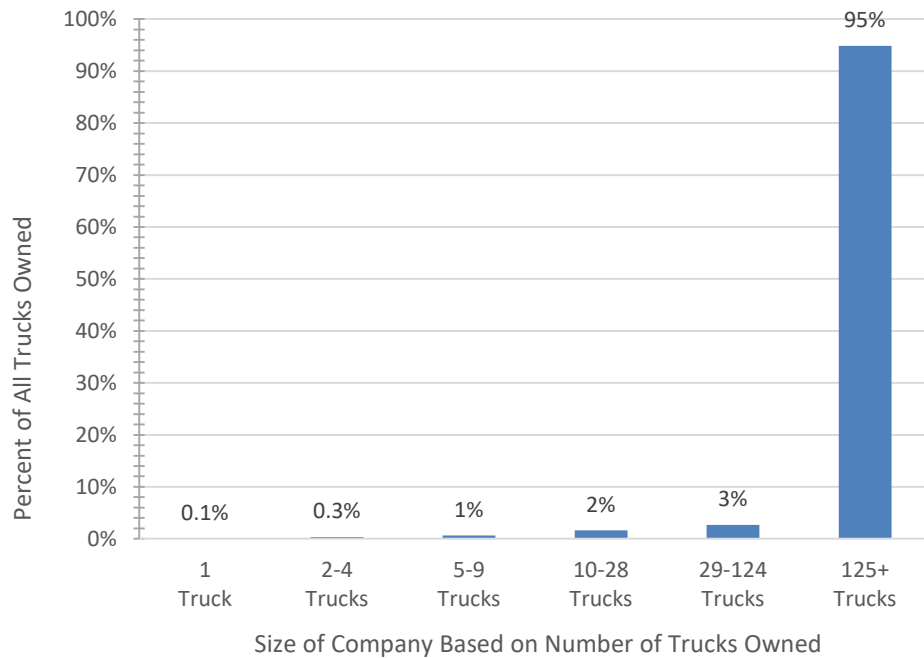
Figure 14: Distribution of Trucking Companies Serving the San Pedro Bay Ports by Number of Trucks Owned



Source: Random sample of 304 trucking companies registered with the Ports of Los Angeles and Long Beach, and data for each company from the U.S. Department of Transportation FMCSA Safety and Fitness Electronic Records System.

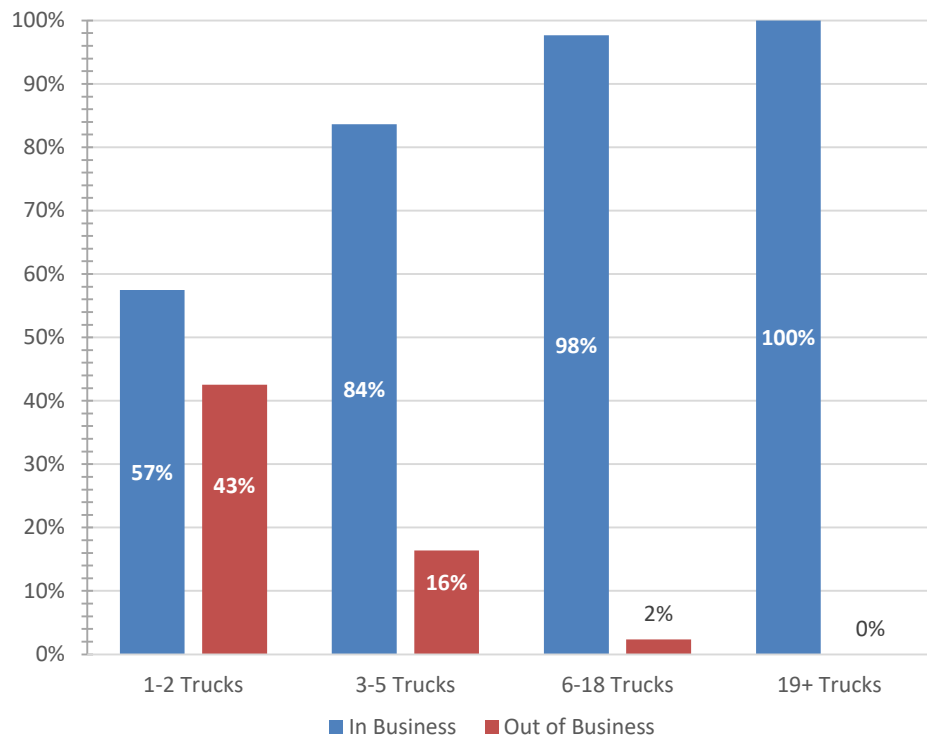
However, large corporate trucking companies dominate the industry. Companies with 125 or more trucks own 95 percent of the trucks that move cargo into and out of the ports, as shown in *Figure 15*.

Figure 15: Share of All Trucks Owned by Companies in Each Size Category



Source: Random sample of 304 trucking companies registered with the Ports of Los Angeles and Long Beach, and data for each company from the U.S. Department of Transportation FMCSA Safety and Fitness Electronic Records System.

Figure 16: Business Closure Rate for Trucking Companies Based on Size



Source: Random sample of 304 trucking companies registered with the Ports of Los Angeles and Long Beach, and data for each company from the U.S. Department of Transportation FMCSA Safety and Fitness Electronic Records System.

Large companies serving the ports include J.B. Hunt Transport, Inc., headquartered in Arizona with 24,040 trucks and Swift Transportation Company, headquartered in Arizona with 15,907 trucks

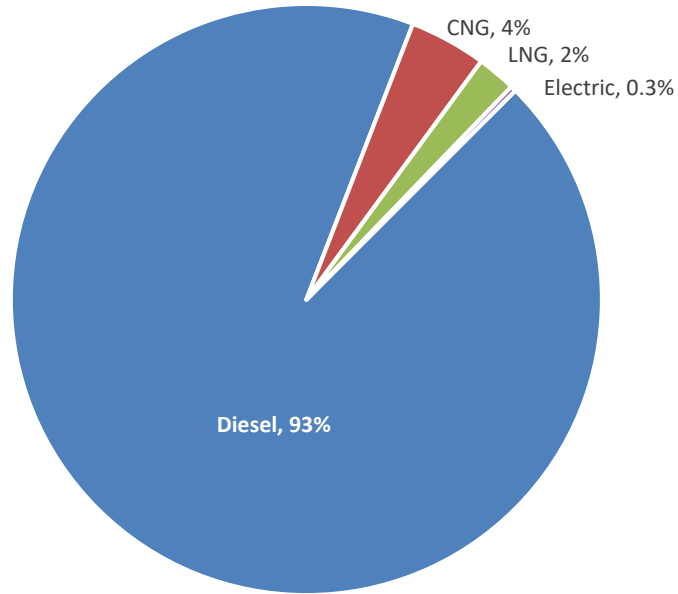
Twenty-nine percent of trucking companies registered with the Ports of Los Angeles and Long Beach have gone out of business. Nearly all of the companies that close have only one or two trucks. In the sample of 304 trucking companies analyzed, 43 percent of companies with one or two trucks are inactive, but no companies with eight or more trucks have gone out of business, as shown in *Figure 16*. Trucking is a far riskier line of business for small companies than for large companies.

Trucks

Ninety-three percent (15,259) of trucks moving cargo at the Ports of Los Angeles and Long Beach are currently powered by diesel fuel, six percent (872) use natural gas in compressed (CNG) or liquid (LNG) form, and 0.3 percent (81) are electric, as shown in *Figure 17*. This is a total of 16,232 trucks serving the ports.⁹

The shift from diesel fuel to electricity that has been mandated by the California Air Resources Board is a massive technological transition.¹⁰

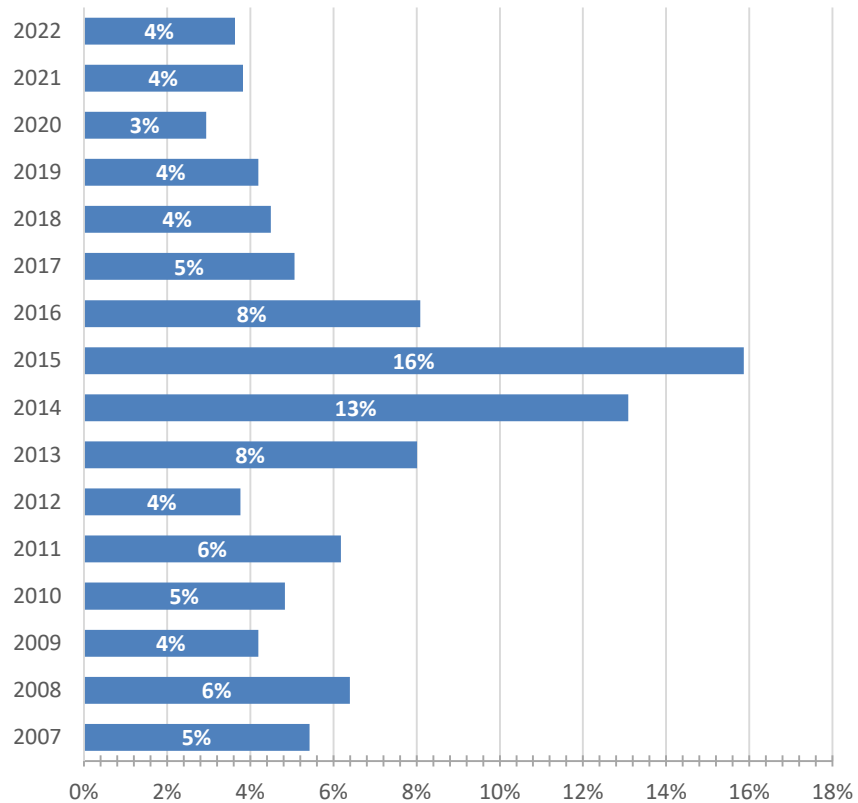
Figure 17: Fuel Type of Trucks Transporting Containers in the San Pedro Bay Ports



Source: Port of Los Angeles Clean Truck Program, Gate Move Analysis (includes the Port of Long Beach), November 2022.

Detailed records for truck trips at the San Pedro Bay Ports are available for November 2022, a month when there were 305,234 trips. Over half of the

Figure 18: Truck Trips at the Ports of Los Angeles and Long Beach by Engine Year



Source: Port of Los Angeles Clean Truck Program, Gate Move Analysis (includes the Port of Long Beach), November 2022.

trips (52 percent) were by trucks with engines built before 2015, as shown in *Figure 18*.

Trucks typically remain in operation for 12 years, although 20 percent of the trips shown in *Figure 18* were by trucks with engines that were older than this – older trucks with engines manufactured from 2007 to 2010. Nevertheless, the 12-year life cycle is a benchmark for projecting emissions produced by the current fleet of diesel trucks transporting cargo containers to warehouses, and the rate at which electric trucks will replace this fleet.

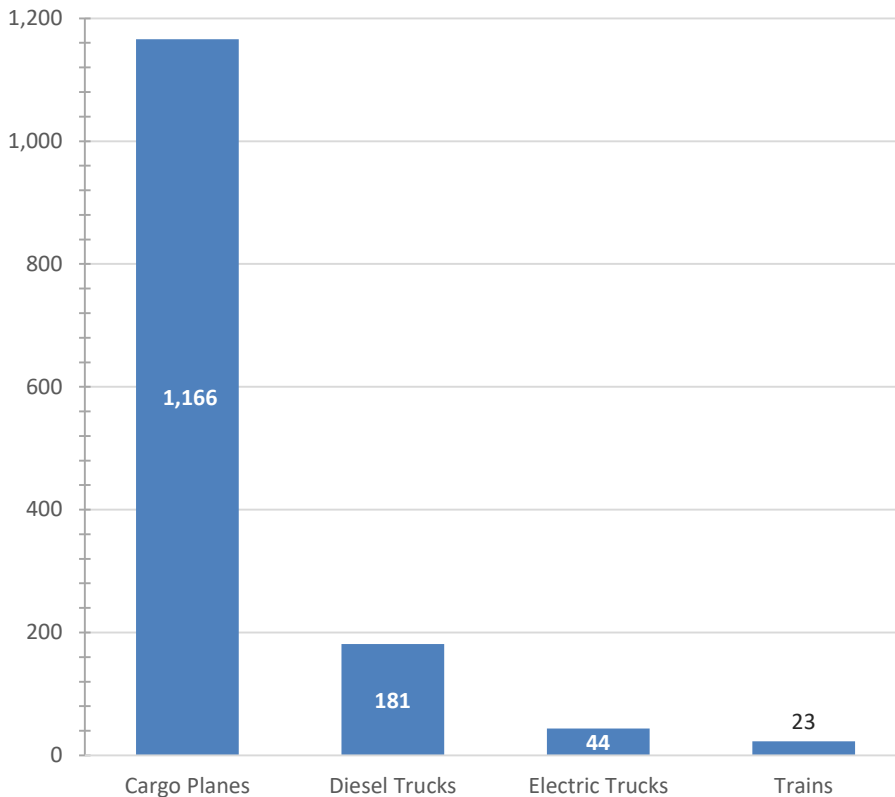
Declining annual shares of the current diesel truck fleet are likely to remain in operation until 2035.

Emissions per Cargo Mile

Cargo is moved by trains and planes, as well as diesel trucks, with the prospect of an increasing share being moved by electric truck. The most common choice is whether to move cargo containers by truck or train. Different modes of transportation have significantly different environmental impacts.

Cargo aircraft produce 50 times more *greenhouse gas* emissions per ton-mile of cargo movement than trains, as shown in *Figure 19*.

Figure 19: Grams of Greenhouse Gas Emissions per Ton-Mile of Cargo Movement



Source: Congressional Budget Office and Economic Roundtable analysis of electric trucks based on utility emissions.

The energy required to lift cargo aircraft off of the ground and move rapidly through the air produces 1,166 grams of carbon dioxide and related greenhouse gas (GHG) emissions per ton-mile of flight.

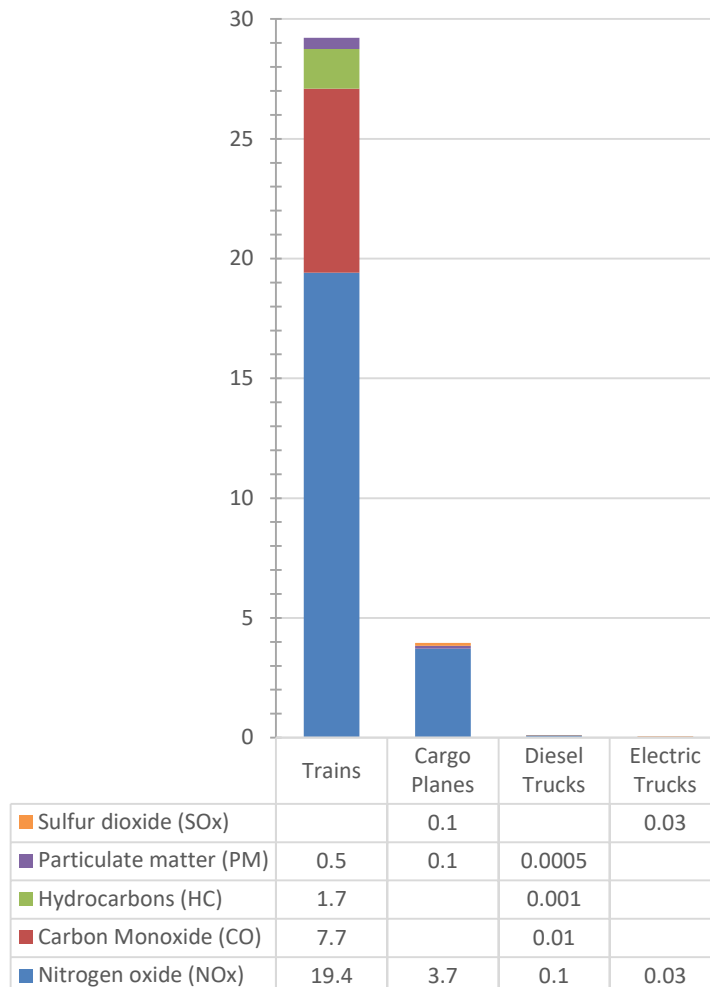
Diesel trucks have the next highest GHG emissions, producing 181 grams per ton-mile.

Electric trucks produce 44 grams of GHG per ton-mile based on the greenhouse gas emission from generating electricity for the electricity grid.¹¹

The large volume of cargo moved by a single *train* requires a small amount of fuel compared to the overall weight of the cargo, with only 23 grams of GHG produced per ton-mile.

The quantity of *criteria* emissions produced by transporting cargo is about one-thirtieth the quantity of the *greenhouse gas* emissions. This can be seen by comparing grams of *greenhouse gas* emissions in *Figure 19* to grams of *criteria* emissions in *Figure 20*.

Figure 20: Grams of Criteria Emissions per Ton-Mile of Cargo Movement



Source: California Air Resources Board and Economic Roundtable analysis of electric trucks based on utility emissions.

These emissions and their effects include:

- *Nitrogen oxide (NO_x)*, which contributes to ozone depletion in the upper atmosphere¹² and damages the human respiratory system.
- *Carbon monoxide (CO)*, which can cause fatigue, headaches, confusion, and dizziness due to inadequate oxygen delivery to the brain, and also has a weak direct effect on climate by contributing to ozone formation.¹³
- *Particulate matter (PM)*, which can cause premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, and decreased lung function. In addition to these health impacts, it is a main cause of reduced visibility (haze).¹⁴
- *Sulfur dioxide (SO_x)*, which can irritate the skin and mucous membranes of the eyes, nose, throat, and lungs. It can also damage vegetation, affect soils, acidify lakes and streams, and ruin memorials and building facades.¹⁵

Trains

Trains have the lowest *greenhouse gas* emissions of any mode of cargo movement but produce 32 times more *criteria emissions* per ton mile than any other mode of cargo transportation. This is because many of the locomotives are old and have old engine technology with little if any emission controls.

Over one-third of locomotives (37 percent) were manufactured from 1973 to 1992, and are fuel guzzlers. These old locomotives produce 15.7 grams of *criteria* emissions for each brake-horsepower-hour of operation.

Over another third (39 percent) of locomotives were manufactured from 1993 to 2011 and also are energy-intensive, producing 10.4 grams of emissions per brake-horsepower-hour of operation.¹⁶

Cargo Airplanes

Cargo airplanes have the highest *greenhouse gas* emissions of any mode of cargo movement – six times more per ton-mile than diesel trucks. They also produce the second greatest quantity of *criteria* emissions – 42 times more per ton-mile than diesel trucks.

Transporting cargo by plane gets goods into the hands of consumers quickly but is not friendly to the environment.

Diesel Trucks

Diesel trucks have the second highest *greenhouse gas* emissions per ton-mile and the second lowest *criteria* emissions per ton-mile of any mode of cargo

movement. Their high GHG emissions make them a significant contributor to climate change, while their more recent engine technology and stricter air quality controls yield lower criteria emissions.

Electric Trucks

Electric trucks have very low *greenhouse gas* emissions, created upstream from generating utility electricity used to recharge truck batteries. GHG emissions from electric trucks are slightly greater than from trains.

Criteria emissions from generating power for electric trucks are infinitesimal – by far the lowest of any mode of cargo movement. This is because the power generation facilities that produce electricity for utilities have low emissions, using air quality controls at scale and at centralized locations.

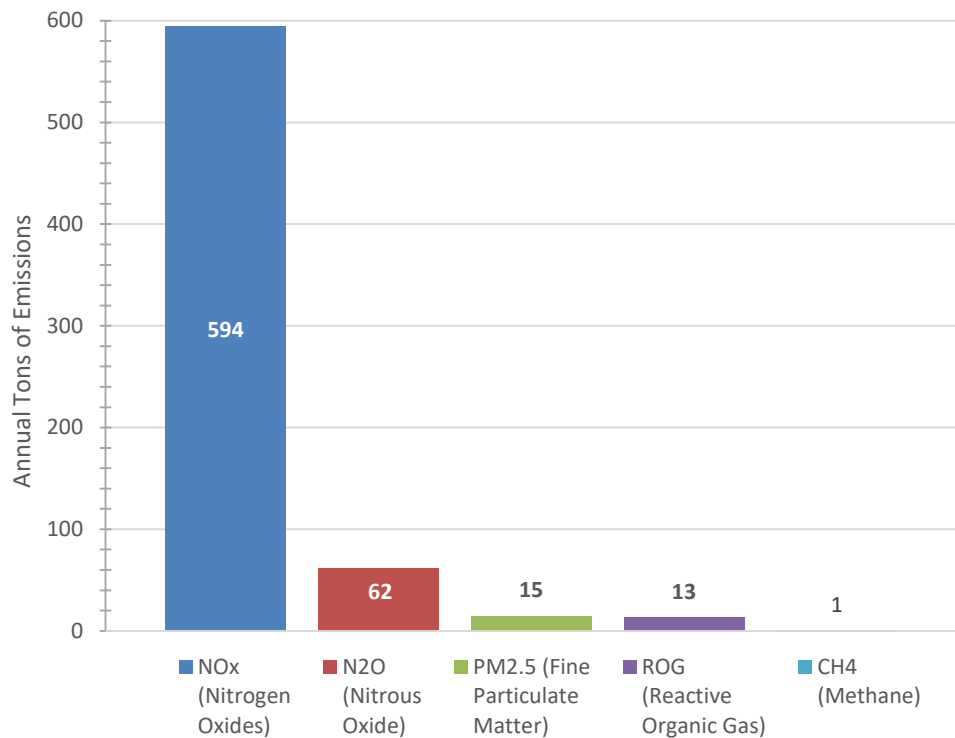
Electric trucks stand out as the cleanest mode of cargo movement.

Diesel Truck Emissions between Ports and Warehouses

Criteria Emissions

Warehouses in the four-county region are an average of 55 miles from the Ports of Los Angeles and Long Beach. In 2022, the two ports recorded

Figure 21: Estimated Annual Tons of Criteria Emissions in 2022 by Diesel Truck Trips at the Ports of Los Angeles and Long Beach



Source: Port of Los Angeles Clean Truck Program Gate Move Analysis and CARB emissions inventory.

over four million truck trips at the ports, representing over 212 million miles traveled to large warehouses by diesel trucks.¹⁷ This is only part of total drayage activity moving consumer goods in the four-county region, but the detailed port records make it possible to calculate the criteria emissions produced by these truck trips, which are shown in *Figure 21*.

Diesel truck trips from the ports to warehouses produced an estimated total of 685 tons of *criteria* emissions in 2022. *Nitrogen oxides* made up most of these emissions – 87 percent. *Nitrous oxide* made up 9 percent of the emissions. *Fine particulate matter* and *reactive organic gas* each made up 2 percent, and *methane* made up 0.1 percent.¹⁸

Greenhouse Gas Emissions

California’s current diesel truck fleet produces 3.7 pounds of carbon dioxide for each mile it travels.¹⁹ The more than 212 million miles of travel to large warehouses by diesel trucks at the ports in 2022 produced an estimated **390,459 tons of carbon dioxide** that was released into the air.

Uncompensated Public Costs from Diesel Trucks

Because trucks share the road with many other types of vehicles, they have less accountability for their impacts on the routes they travel than trains. Railroads must repair and maintain their rail systems, whereas trucking companies pay fuel and tire taxes that contribute to road maintenance.

The Congressional Budget Office determined that uncompensated public costs for wear and tear on roads and bridges; delays caused by traffic congestion; injuries, fatalities, and property damage from accidents; and harmful effects from exhaust emissions are eight times greater per ton-mile for goods transported by truck than for goods transported by train.²⁰

Clean Truck Mandate

Drayage truck regulations under the California Air Resources Board’s Advanced Clean Fleets Regulation and warehouse accountability standards under the South Coast Air Quality Management District’s Indirect Source Rule 2305 create a rapid timeline for conversion to zero-emission trucks.²¹

California Air Resources Board

On April 28, 2023, the California Air Resources Board (CARB) passed the Advanced Clean Fleets regulation, which will require truck owners to transition their vehicles to zero-emission trucks.

Trucks must register with CARB in order to obtain a California vehicle license. Beginning January 1, 2024, all new drayage trucks registering in the CARB Online System must be zero-emission. Existing internal combustion engine vehicles can remain in the Drayage Truck Registry until 2035. After that, no internal combustion engine vehicles will be allowed in the registry.

Drayage trucks are heavy-duty (Class 8) trucks that transport containers and bulk freight between ports and intermodal rail facilities or warehouses.

There are also requirements for high priority fleets, which are fleets with 50 or more trucks or annual revenue of \$50 million or more. High priority fleets can only purchase zero-emission trucks starting in January 2024 and must take trucks with internal combustion engines out of their fleets by the start of 2025. There are different annual milestones for the share of the fleet that must be zero-emission based on whether the vehicles are day-cab tractors or sleeper-cab tractors.

Government fleets must have 50 percent zero-emission truck purchases starting in 2024 and 100 percent zero-emission purchases by 2027. A fleet of fewer than 10 vehicles can wait until 2027 before being required to buy only zero-emission vehicles.

This regulation will result in nearly half of heavy-duty trucks becoming zero-emission by 2035 and about 70 percent to be zero-emission by 2042. This will reduce the harmful impacts of tailpipe emissions and disruptive noise in neighborhoods located near seaports, intermodal railyards, warehouses, and distribution centers.

There is strong opposition to this regulation by trucking companies. Nineteen states have sought appellate court review in a challenge to the Environmental Protection Agency waiver granted to California's Advanced Clean Trucks Rule. This includes Arizona and Nevada, which have less restrictive emission regulations and where many large trucking fleets that serve California are based. In addition, the size of California's trucking network might well cause its zero-emission standards to become national standards, affecting truck fleets throughout the nation.²²

South Coast Air Quality Management District

The South Coast Air Quality Management District adopted the Warehouse Indirect Source Rule, Rule 2305 to reduce nitrogen oxide and particulate matter emissions produced by trucks traveling to and from large warehouses. The rule regulates owners and operators of warehouses greater

than 100,000 square feet as indirect sources of nitrogen oxide and particulate matter emissions from trucks.

The rule establishes a menu-based system of points requiring warehouse operators to earn a specified number of points annually by completing actions such as acquiring near zero emission or zero emissions on-road trucks, cargo-handling equipment, charging infrastructure, solar panels, or particulate filters for nearby sensitive land uses. Alternatively, warehouse operators can pay a mitigation fee.²³

An accompanying Rule, number 316, establishes fees for the reports, notifications, applications, and mitigation fees called for by Rule 2305.

The California Trucking Association is challenging Rule 2305 in federal court, asserting that it is preempted by the federal Clean Air Act. The suit asserts that Rule 2305 is designed solely to accelerate the transition of truck fleets to zero-emission and near-zero-emission trucks.²⁴

Rapid Change

State and regional environmental regulations are driving a rapid transition to new truck propulsion technology. Beginning in 2024, truck fleets are required to replacing diesel trucks that reach the end of their duty cycle with battery-powered electric trucks.

Clean Trucks

Availability

Eight heavy-duty truck manufacturers have initiated small-scale manufacturing and sales for early commercial Class 8 zero-emission battery-electric tractors.²⁵ These are heavy-duty or semi-trucks that pull trailers, for example, chassis loaded with cargo containers. The manufacturers and truck models are:

1. BYD, 8TT (T9/Q3M)
2. Freightliner (Daimler), eCascadia
3. Kenworth, T680(e)
4. Lion Electric, Lion 8T
5. Nikola, Tre BEV
6. Peterbilt, e579
7. Tesla, Semi
8. Volvo, VNR Electric 6x4

These trucks are available from manufactures with a typical delivery time of six months.

Functionality

Most currently available electric trucks are capable of meeting basic performance requirements for short-range drayage operations, roughly up to 175 miles between charges. Actual mileage is often less than the listed mileage. Some routes require climbing grades, such as over the Kellogg Pass, while hot weather increases the use of air conditioning, and the weight of loads varies. This means that current battery-electric models are largely restricted to short-haul or lighter-weight drayage tasks.

Despite these limitations, current battery electric trucks can perform a significant share of drayage functions related to moving cargo containers from the ports to warehouses, for example, warehouses in Los Angeles and Orange Counties, as well as distributing goods from warehouses to retail locations within 50 miles.

The California Air Resources Board has documented strong year-over-year progress by major manufacturers in designing, testing, improving, and commercializing Class 8 battery-electric trucks suitable for drayage.²⁶ This indicates that the capabilities and reliability of electric trucks will continue to improve and that they will be able to perform all drayage functions currently performed by diesel trucks.

Cost

Truck dealerships interviewed by the Economic Roundtable cited costs of \$500,000 to \$550,000 for Class 8 battery electric trucks. However, subsidies that currently are available can reduce the purchase cost to less than the cost for a conventional diesel truck.

The subsidy programs include

- *San Pedro Ports Clean Trucks Program*, which will disburse approximately \$45 million a year to accelerate the deployment of zero-emission trucks serving the ports.²⁷
- *California Hybrid and Zero-Emission Voucher Incentive Project (HVIP)*, which will provide an estimated \$157 million in subsidies for zero-emission drayage trucks.²⁸
- *South Coast AQMD Voucher Incentive Program for On-Road Heavy-Duty Vehicles*, which has \$100 to \$150 million to subsidize small fleets in replacing trucks with engines manufactured in 2017 or earlier with new zero-emission vehicles.²⁹
- *Southern California Edison Charge Ready Program*, which has \$432 million to subsidize the costs for installing charging equipment, including helping offset the cost to design, construct, and install charging infrastructure for both cars and trucks.³⁰

These subsidies add up to half a billion dollars over the next five years to support purchases of electric trucks, with additional subsidies for charging infrastructure in areas served by Southern California Edison.

The subsidies far exceed current purchases of electric trucks, which now are in the single digits in Southern California from most manufacturers. However, there are approximately 16,232 trucks active in the San Pedro Bay Ports. Diesel trucks have a roughly 12-year life span. This means that approximately 1,353 new trucks typically enter service at the ports every year.

If the new battery electric trucks cost half a million dollars each, the cost for the typical truck replacement cycle would be \$676 million a year. This would deplete the subsidies that are available in a single year.

The practical reality is that many truck companies are likely to defer purchases of new battery-electric trucks for several additional years and that costs will come down as sales volume increases. Nevertheless, there will be an interval when subsidies are scarce and the cost of battery-electric trucks has not come down to the cost for diesel trucks. This will be particularly problematic for owner-operators and owners of small fleets, who do not have the financial resources or sophistication of large fleet owners.

The current subsidy programs prioritize small truck fleets, but truck dealerships report that small operators are overwhelmed by the paperwork and documentation required to obtain subsidies, and often abandon the effort to obtain a subsidy as well as to buy an electric truck.

In the interest of equity, it is important to continue prioritizing small fleets for subsidies and also to streamline the application process and provide user-friendly technical assistance for small fleet owners seeking subsidies.

Infrastructure

Charging stations for battery-electric trucks represent growth for electric utilities. It is reasonable for utilities to support commercial customers with electric truck adoption by offering financial incentives and rebates for charging infrastructure, as well as hiring and training experts who can help fleets design and implement necessary facility and electrical upgrades.

The California Energy Commission adopted Rule 29, which requires utilities to provide this support. Southern California Edison (SCE) explains that:

Under Rule 29, SCE will coordinate and pay for the design and deployment of eligible electrical service extension work from SCE's electrical distribution line facilities to the customer installed meter panel or meter pedestal on the utility side of the meter for separately metered EV charging station projects.³¹

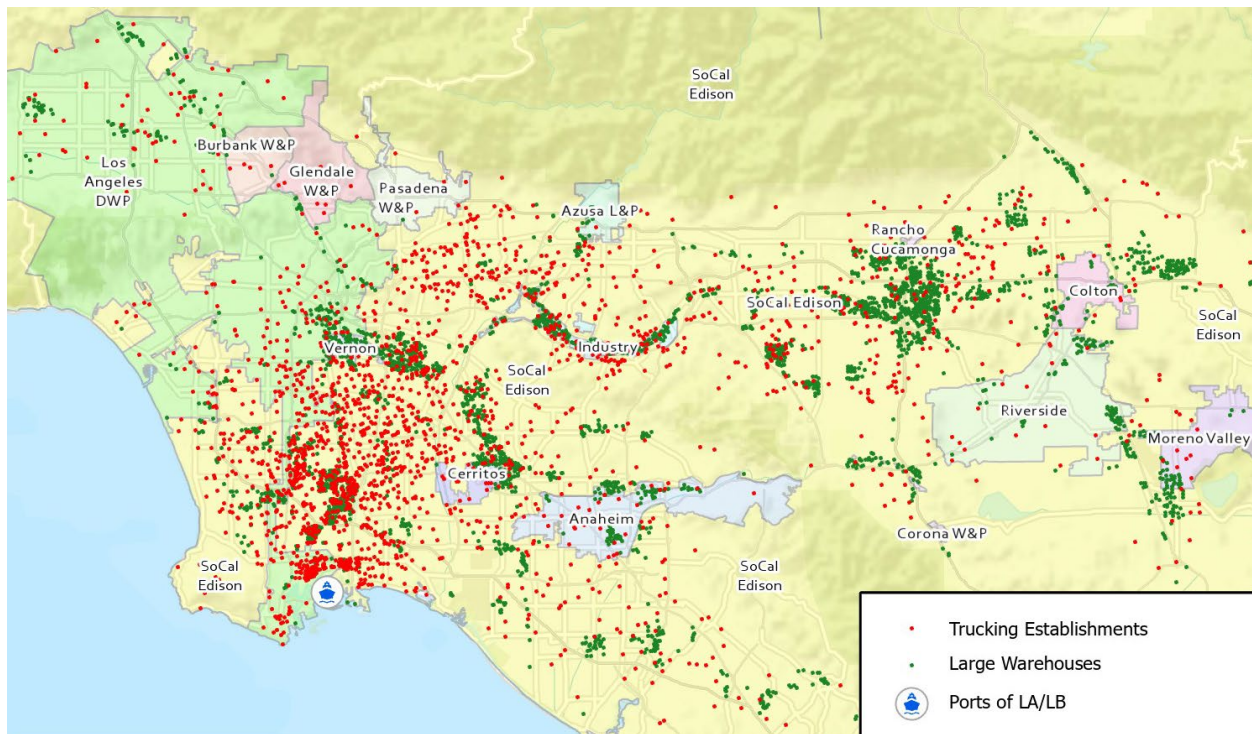
However, electric truck dealers and fleet operators have identified delays in obtaining electric power for charging stations as the most serious obstacle for deploying electric trucks. There is a mismatch between the multi-year timeline that is typical for upgrading the utility infrastructure and the rapid deployment of electric trucks required by the California Air Resources Board. Fleet operators report that they are being told it will take two years to obtain electric power for their charging stations.

Southern California Edison has stated that they are experiencing supply chain constraints in critical equipment necessary to complete and energize electric truck charging stations. This includes utility transformers and switch gear. Edison also noted that electrical capacity is inadequate in some areas of its distribution grid.³²

The need for electric truck charging stations is most concentrated above the ports, where many trucking companies as well as large warehouses are located, as shown in *Figure 22*. The utility districts serving this area are the City of Los Angeles Department of Water and Power (DWP) and Southern California Edison.

In addition to overnight charging at trucking establishments, battery-electric trucks will sometimes need to recharge after delivering cargo to warehouses. This includes warehouse hubs in the City of Industry and in the Inland Empire from Ontario to the Moreno Valley.

Figure 22: Utility Districts, Trucking Companies and Large Warehouses in the Four-County Region



Source: Economic Roundtable analysis, Southern California Air Quality Management District data from CoStar, and California Energy Commission.

Municipal utility districts, such as DWP, are regulated by city councils rather than the California Energy Commission and must be locally activated to build the infrastructure required to meet electrical demand for recharging battery-electric trucks.

One challenge facing DWP is a low-voltage electrical distribution system, which makes it harder to move large amounts of power to new locations. A second challenge is that its policies do not encourage on-site electrical generation, such as through photovoltaic arrays, which can supply some of the electricity needed for charging stations. A third challenge is that the City of Los Angeles has not adopted a counterpart to California's Rule 29, requiring DWP to provide technical and financial assistance for installing commercial recharging stations.

The demand for electrical power to charge electric trucks is 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.

Both 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.

The supply of electricity to recharge battery-electric trucks is lagging the timetable set by California Air Resources Board for the transition to zero-emission drayage. Utility districts will be a bottleneck unless they act proactively to build the required electrical distribution infrastructure.



Community Profile: Ricardo Peraza, Trucking Company Owner

Ricardo Peraza (45) is an immigrant from Maya Quintana Roo, Mexico, who lives in San Bernardino and is the owner of a small trucking company, Rope Trucking. Ricardo has built his business from the ground up and hopes to continue growing it, even through the changes in truck regulation. He lives in the Airport Gateway Specific Plan area, a neighborhood that the San Bernardino International Airport is planning to rezone for industrial use, which would cause the displacement of thousands of families. Even though he might be one of them, Ricardo is optimistic that he will be able to fight for his rights.

How do you feel about the Airport Gateway Specific Plan?

I live in that area. Some people are going to get really rich off of this project. Even those landowners! But for me, who rents, I am at risk. But I am not going to back down. I am not going to leave unless I am compensated for my move. I know sooner or later, they will try to get rid of me. This is going to impact me, my family and my money. I feel lucky I have my trucks to hold me down in case this happens. But I feel for the people who are retired or do not have those assets to move. This is just going to make more people homeless.

I see the cities widening the freeways for this project. I have a friend who had an auto body shop right in front of the San Bernardino Airport who was leasing the land and has been forced to move. I offered to help him move with my truck.

How do you feel about the explosion of warehouses in the Inland Empire?

I don't think there is more productivity or gain because of all the warehouses that have come in. I think it is the investors who are the only ones winning here. They are buying up land, pushing out the poorest people and making money off of it. I think the situation is going to keep getting worse.

Also with so many warehouses, where are the trucks supposed to go! Some warehouses do not allow the trucks to wait outside of the warehouse. Truckers have nowhere to go! They have to find a place to go to the bathroom off the side of the road because there are not places for trucks to go! Sometimes we cannot even find a place to eat because places do not have parking for our trucks. It can be hours before we eat or go to the bathroom because nothing is set up for us. Police and code enforcement are always on our backs.

I don't know what is going to happen with all these warehouses being built. It is so hard for us to go through neighborhoods or commercial areas because they were not built for our trucks! Many times, we have to drop off loads and go through these areas and we knock down lights and signs because the roads aren't wide enough.

I also recognize how loud our trucks are. We need a dedicated industrial area where we can drive in and out without bothering people. However, I don't think people understand my work. I think it is easy to complain about the noise. Sometimes, residents stay up all night partying and that is okay. But when I leave at three in the morning for work and turn on my truck, people can't see that I am just heading to work. I can't help it.

How did you get into trucking?

I started working trucking by working for companies that would supply the truck for me and I would get paid only \$300 even though the truck owner would get paid triple that.

I met a man, Don Carlos, who had a couple trucks and saw me struggling working for the trucking company. He let me borrow one of his trucks to start making trips until I made enough money to buy my own. He has had a contract for UPS moving packages for them for over twenty years. He has been able to buy multiple trucks over the years and has multiple homes paid off because of the pay. I was lucky to meet him! This is a very competitive industry and people are selfish.

One of the only reasons I was able to buy this new truck was because of the pandemic and how much work I received during that time. Amazon used to give me a lot of money during the pandemic to move packages for them. Now they barely offer \$400 for a load. And I think because truckers accept these loads at low rates, the companies take advantage of that and look for the cheapest option.

These big trucking companies are also a big threat to us smaller trucking companies. They are the ones that negotiate year-long contracts and take all the contracts away from us. I would not work for them, because they do not pay their drivers well.

I used to be a drayage driver at the Ports of Los Angeles. I was part of the group of truckers that got into the work after the Port Truck Rule happened. I bought a new enough truck to be able to go in. But I know many people who lost their jobs because their truck wasn't allowed in the Port of Los Angeles anymore.

What are your thoughts on the diesel fuel that your truck uses?

Any truck has little gaps or leaks so we are exposed to diesel throughout the day. I have noticed on days that I work 10 hours or more that my shirt gets covered in diesel. I leave my truck smelling like a mechanic who has been working all day. On hot days, I have to keep my truck engine running, because it is hot. I know I am getting covered in emissions and am breathing it. I do not smoke, but I have chronic allergies. I think sooner or later it is going to make us sick. There is a huge risk of fires and overheating. There are trucks that combust because of the heat. But this is the cheapest system that we can use in this business.

They are forcing us to buy electric trucks, but we will not be able to afford them, even if the government tries to give us money for them. There are so many costs that are not accounted for like repairs, part replacement and fueling. Right now, I repair my truck by myself because I know how too. I wouldn't know how to repair an electric truck! And it probably would be so costly since there aren't many electric truck mechanics. I think the young people should start focusing on that industry.

I think I am also really scared of overheating and fires in an electric truck. If it overheats and a fire starts, the battery would cause an explosion. With diesel, it takes time for the truck to burn. With electric and natural gas, we are talking about an explosion.

But really, it comes to who is going to be able to pay for it. I do not trust hydrogen and natural gas. I see them on the side of the road broken down.

I am part of the old school, and this is what we prefer. I worry too that these new trucks are all coming out automatic, and you need a manual to help reduce the speed or go up a hill.

If you could pilot or try using an electric truck, would you?

Depending on the programs that the government has to help us keep up with the business and maintenance of the truck. It is not just about giving us money to buy it and then us having to figure it out after. We need support throughout the life of the truck.

There are so many permits that my truck needs! I need a permit to drive the truck for the fuel I use, for crossing into other states, plus insurance and plates. These are all costs that are never accounted for that are part of the business. Depending if I enter into an airport - the insurance cost goes higher. I have to pay for background checks and fingerprints every year.

I support change but we have to make sure it works for us. I have never been spoken too about the transition the government requires. Amazon sometimes sends me emails about conferences I can go to about this, but I know it is probably for their benefit and not mine. This is a big risk!

If I could get my truck traded in for a new electric truck with 50 percent covered for 5 years, I would do it. But right now, that cannot come out of my pocket - it will hurt me. I need to have a safety net. I know California has to do it. They have a lot of money, especially money that comes from us paying for permits and licenses. The government isn't going to lose.

How do you feel about the new truck regulations that the State of California has passed?

I think it is too short of time! I think in ten years I want to retire so these truck regulations are not going to impact me. I am trying to avoid it.

I would tell the younger people that the golden era of trucking is over. There is always going to be an option to work for the big companies and keep making them rich. Having your own company is better but it is a lot of work and investment. I would tell them to study the electric trucks, circuitry and data systems for the trucks - I think that's what the future is.

I have a granddaughter, and I know the future is not going to be okay for her because of climate change. I think it is important to fight these things. I know that we are going to run out of water, that we are going to need to buy our clean air and that we are going to keep hurting the land. I think whatever we can do to delay the climate crisis, we need to do.



4. Impacts of Warehouse Trucking

*Photo credit:
Freightliner Cascadia*

Overview

Truck Mileage and Uncompensated costs

Trucks travel over 415 million miles a year to and from large warehouses in the four-county region.

The destinations of trip trips include:

- The San Pedro Ports account for one-third of truck trips.
- Freight rail intermodal yards account for over one-quarter of trips.
- Other warehouses account for over one-fifth of trips.
- Local retail stores account for 14 percent of trips.
- Cargo airports account for three percent of trips.

There are an estimated \$1.07 billion in annual uncompensated public costs from warehouse diesel trips caused by wear and tear on roads and bridges; delays from traffic congestion; injuries, fatalities, and property damage from accidents; and harmful effects from exhaust. Almost 6 million tons of CO₂, the primary greenhouse gas, are produced. California ranks 46th among the 50 states in the share of its roads that are in acceptable condition.

Health Impacts

The 11.5 million annual heavy-truck trips produce:

- 29 tons of *fine particulate matter* associated with increased bronchitis and asthma attacks.
- 7 tons of *sulfur dioxide*, a highly reactive gas that severely irritates breathing passages, eyes, and skin.
- 1,161 tons of *nitric oxides and dioxides*, which can irritate sensory organs, and cause shortness of breath and fluid build-up in the lungs.
- 100 tons of *ammonia*, which can irritate and burn the skin, mouth, throat, lungs, and eyes.
- 26 tons of *volatile organic compounds*, which can cause damage to the liver, kidney, or central nervous system.

The annual health costs for residents of the four-county region from current diesel truck emissions, and, conversely, the health benefits from having electric trucks move cargo instead of diesel trucks, range from \$65 million up to \$146 million, based on different epidemiological studies.

Emissions produced in the South Coast Air Basin spill over into other parts of California and have additional adverse health impacts outside of the four-county region. The statewide public health costs for different medical conditions caused by diesel emissions range from \$74 million to \$166 million. This is 13 percent more than costs in just the four-county region.

Warehouse Impacts on Air Quality

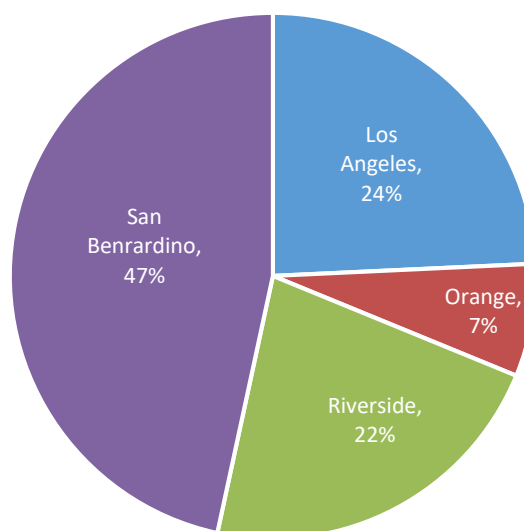
Large warehouses in Southern California are hubs in moving goods from cargo ships and aircraft to distribution centers, businesses and households. Heavy-duty diesel trucks are the dominant method of goods movement, often in tandem with oceangoing container ships and sometimes freight trains and cargo aircraft.

Truck Mileage

Trucks travel over 415 million miles a year to and from of large warehouses in the four-county region, as shown in Table 4.³³ Over two-thirds of these truck trip miles are for bringing goods in and out of warehouses in San Bernardino and Riverside Counties, as shown in Figure 23.

Riverside and San Bernardino Counties also stand out for having the most truck mileage per warehouse. Both have over twice as many annual truck trip miles per warehouse as warehouses in Los Angeles and Orange Counties.

Figure 23: Percent of Truck Mileage by County



Source: Economic Roundtable analysis; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C; Southern California Association of Governments (SCAG) Regional Data Platform and Parcel Locator; and U.S. Census Bureau. 2019. TIGER/Line Shapefiles.

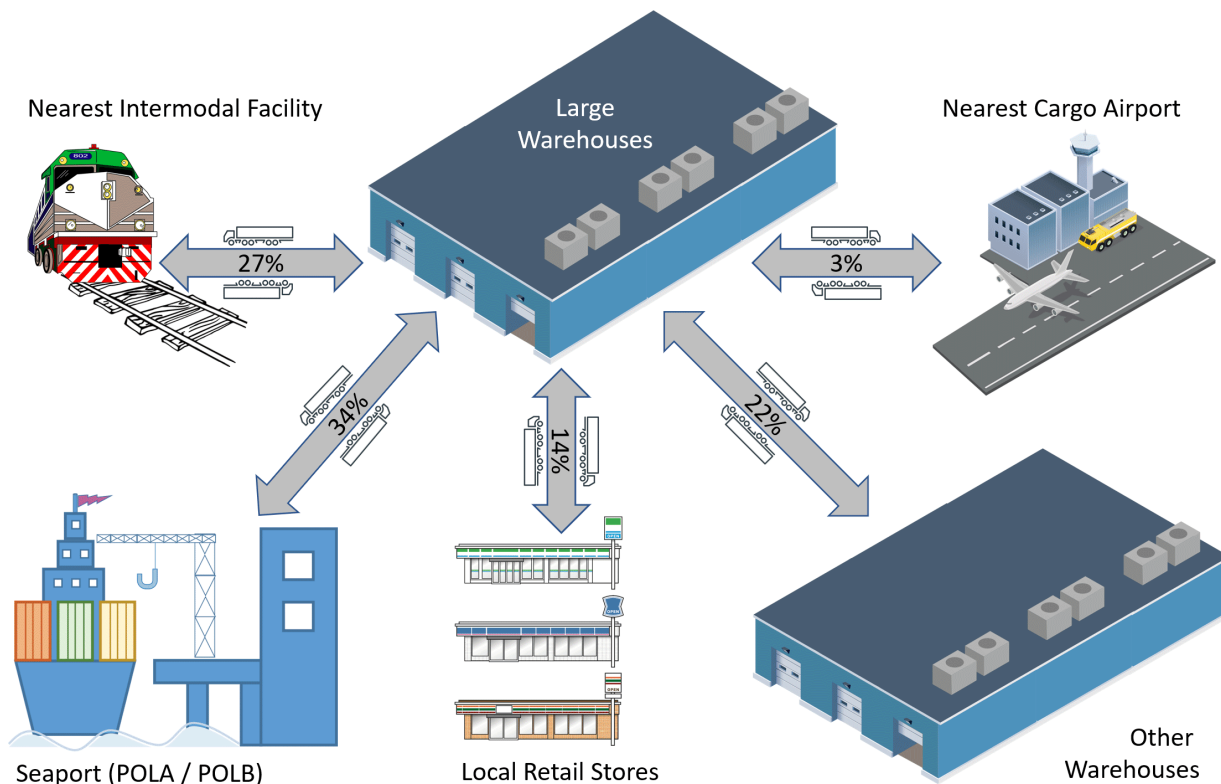
Table 4: Truck Mileage to and from Large Warehouses in the Four-County Region

County	Annual Truck Trip Miles	Percent	Number of Large Warehouses	Average Truck Miles per Warehouse
Los Angeles	100,801,918	24%	1,626	61,994
Orange	28,811,511	7%	388	74,256
Riverside	92,231,705	22%	402	229,432
San Bernardino	193,671,306	47%	875	221,339
Region Total	415,516,440	100%	3,291	126,258

Source: Economic Roundtable analysis; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C; Southern California Association of Governments (SCAG) Regional Data Platform and Parcel Locator; U.S. Census Bureau. 2019. TIGER/Line Shapefiles; and other sources.

These trip mile estimates are calculated based on roundtrips from the origins and to the destinations of warehoused goods: port facilities, other warehouses, intermodal facilities, airports, and retail stores.

Figure 24: Distribution of Truck Trips between Warehouses and Other Logistics Nodes



Source: South Coast Air Quality Management District. Economic Roundtable design; images from openclipart.org, under the Creative Commons Zero 1.0 License.

The types of origins and destinations of the truck trip generated by large warehouses are broken out in *Figure 24*. The Ports of Los Angeles and Long Beach account for one-third (34 percent) of truck trips

Freight rail intermodal yards account for over one-quarter (27 percent) of trips.³⁴ Other warehouses account for over one-fifth (22 percent) of trips.

Local retail stores account for 14 percent of trips, and cargo airports³⁵ account for three percent of trips.³⁶

Ton-miles of Truck Travel

The impact of trucks on roads and the environment can be measured by converting trip mileage to ton-miles. Ton-miles are calculated by multiplying the weight of a truck in tons by the distance it travels. For example, a 40,000-pound truck traveling one mile represents 20 ton-miles. We estimated the ton-weight per truck using the following factors:

- Cargo weight per 40' container 13.15 tons³⁷
- Empty 40' container 4.13 tons³⁸
- Tractor truck 17 tons³⁹
- Empty trailer chassis 3.3 tons⁴⁰

Diesel truck trips in our analysis are divided equally between empty and full trips. This assumption that flows of goods are always one-way, single-stop drop offs produces conservative ton-mileage estimates. Averaging the loaded and empty weights below we get an average trip weight of 31 tons.

- Loaded: Tractor + Chassis + Container + Cargo = 37.6 tons
- Empty: Tractor + Chassis + Container = 24.4 tons

The greater number of ton-miles is linked to large warehouses in San Bernardino and Los Angeles Counties, while the average truck ton-miles per large warehouse is highest in Riverside and San Bernardino Counties, as shown in *Table 5*.

Table 5: Truck Ton-Miles to and from Large Warehouses in the Four-County Region

County	Annual Truck Ton-Miles	Percent	Number of Large Warehouses	Average Ton-Miles per Warehouse
Los Angeles	6,251,549,358	24%	1,626	3,844,741
Orange	1,786,836,889	7%	388	4,605,250
Riverside	5,720,040,528	22%	402	14,228,957
San Bernardino	12,011,137,814	47%	875	13,727,015
<i>Region Total</i>	<i>25,769,564,589</i>	<i>100%</i>	<i>3,291</i>	<i>7,830,314</i>

Source: Economic Roundtable analysis; 2022 SCAQMD Rule 2305 Packet, Appendix C; SCAG Regional Data Platform and Parcel Locator; U.S. Census Bureau. 2019. TIGER/Line Shapefiles; and other sources.

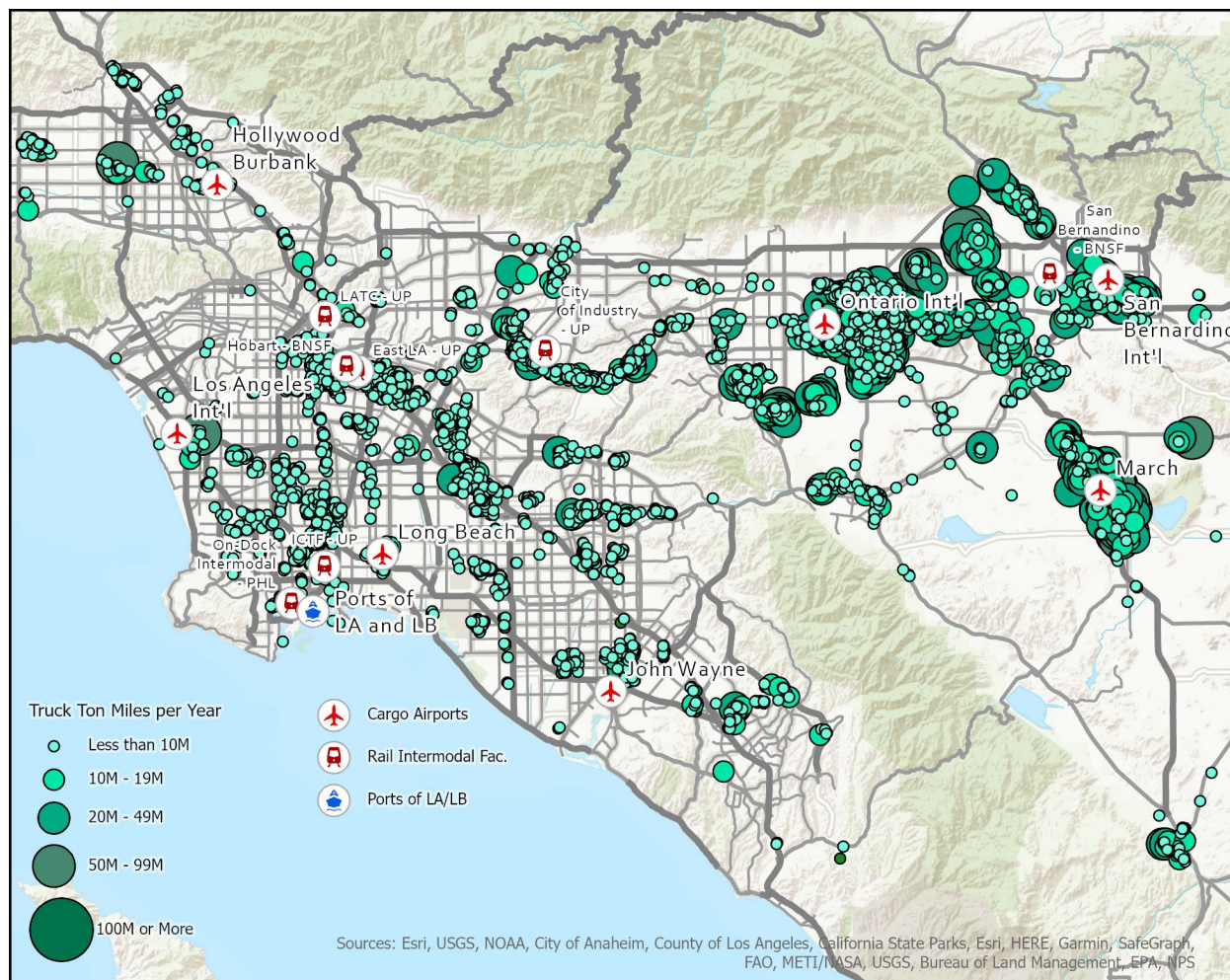
The scale of diesel truck ton-mileage attributable to each warehouse is shown in *Figure 25*. Bigger circles in the map represent more ton-mileage. The largest clusters of large circles are in the Inland Empire, along with the crescent-shaped cluster along the Union Pacific rail lines that runs through the City of Industry.

Uncompensated Public Costs from Warehouse Truck Trips

Moving goods by truck creates uncompensated public costs that include wear and tear on roads and bridges; delays caused by traffic congestion; injuries, fatalities, and property damage from accidents; and harmful effects from exhaust emissions. These costs are proportionate to the diesel truck mileage attributable to warehouses:

- 36,065 truck trips daily
- 11,495,607 truck trips annually
- 415,516,440 truck trip miles traveled annually
- 25,769,564,589 ton-miles of truck travel annually
- 5,993,583 tons of CO₂, the primary greenhouse gas component

Figure 25: Truck Ton-Miles Generated by Large Warehouses, Annually, by Warehouse Location



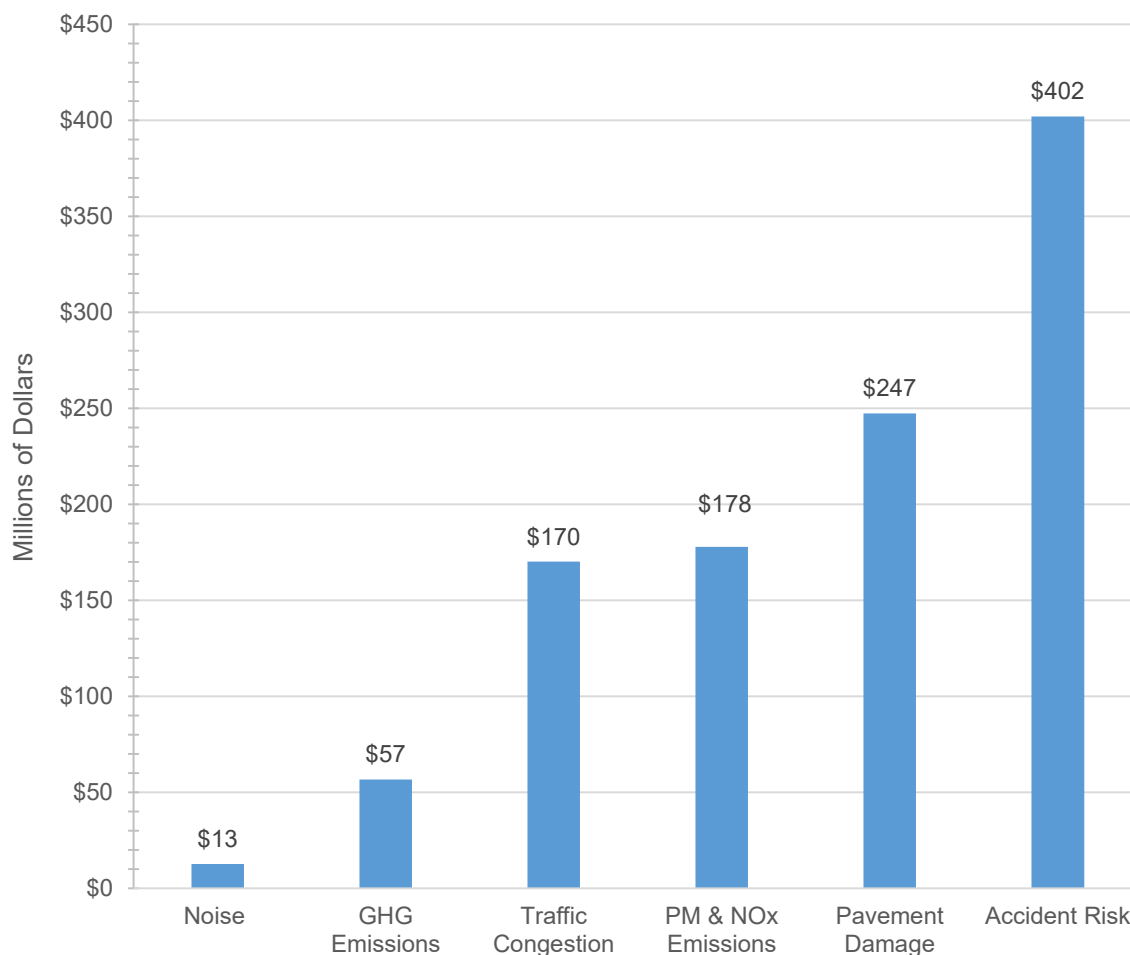
Source: Economic Roundtable analysis; 2022 SCAQMD Rule 2305 Packet, Appendix C; SCAG Regional Data Platform and Parcel Locator; U.S. Census Bureau. 2019. TIGER/Line Shapefiles; and other sources.

The uncompensated costs to the public per ton-mile that are not covered by taxes or fees that trucks pay have been estimated by the Congressional Budget Office to be:⁴¹

- Pavement Damage \$0.0096
- Traffic Congestion \$0.0066
- Accident Risk \$0.0156
- Particulate Matter and Nitrogen Oxide Emissions \$0.0069
- Greenhouse Gas Emissions \$0.0022
- Noise (cost per mile) \$0.0304

Based on these cost factors, large warehouses' trucking operations in the four-county region in 2023 are creating an estimated \$1.07 billion in uncompensated public costs, as shown in Figure 26.

Figure 26: Uncompensated Public Costs from Diesel Trips to and from Large Warehouses in the Four-County Region (in millions)



Source: Economic Roundtable Analysis; 2022 SCAQMD Rule 2305 Packet, Appendix C; SCAG Regional Data Platform and Parcel Locator; U.S. Census Bureau. 2019. TIGER/Line Shapefiles; and other sources. U.S. Congressional Budget estimates of uncompensated public costs per mile traveled.

The \$1.07 billion in uncompensated public costs from warehouse diesel trips includes:

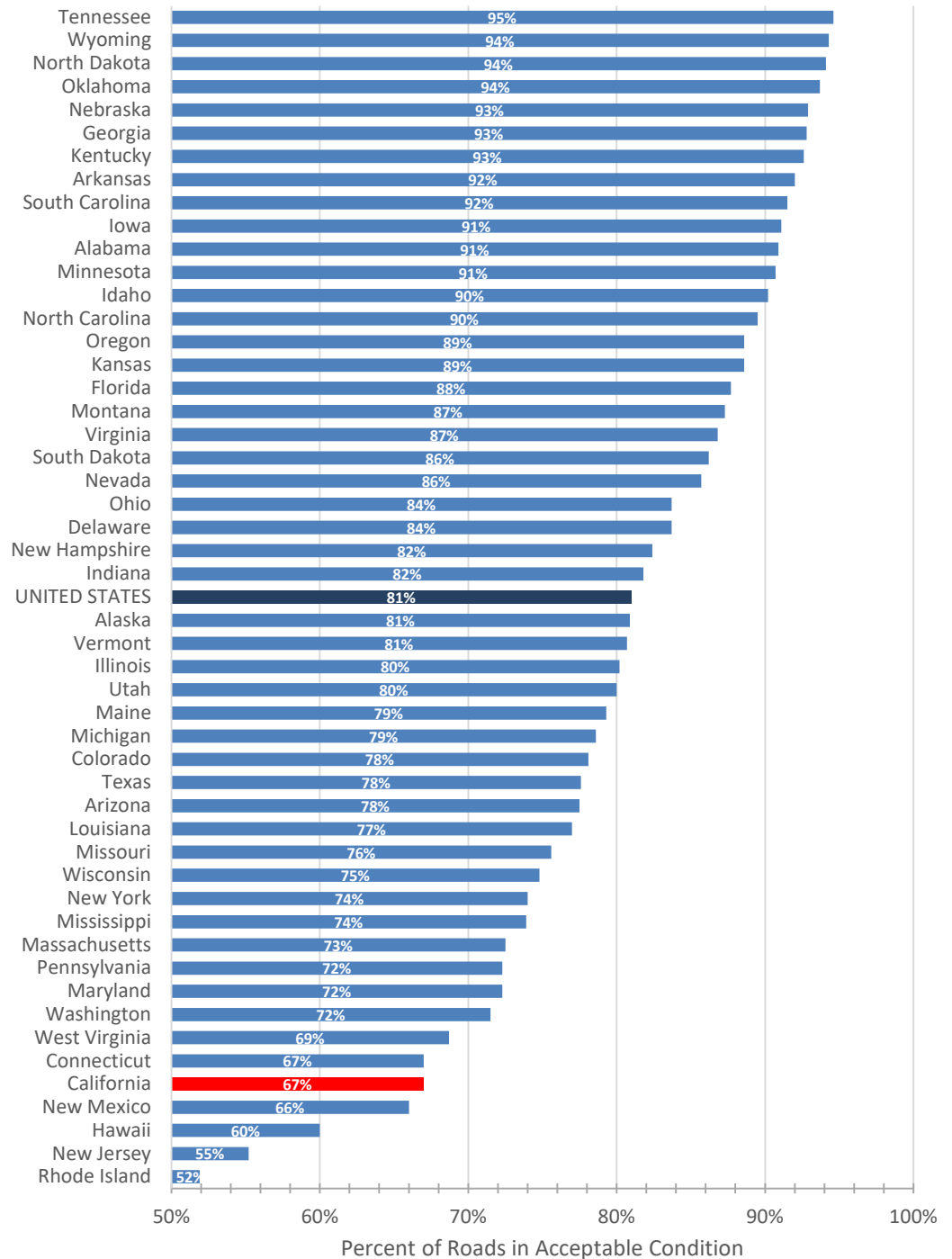
- \$402 million in injuries, fatalities and property damage from accidents.
- \$247 million from wear and tear on roads and bridges.
- \$178 million in harmful effects from exhaust emissions of particulate matter and nitrogen oxides.
- \$170 million in delays caused by traffic congestion
- \$57 million in climate impacts from CO₂ greenhouse gas emissions
- \$13 million in loss of value caused by truck-related noise for adjacent properties.

These uncompensated costs are shouldered by residents of the four counties in the form of higher taxes for infrastructure repairs, impaired road conditions because of damaged and unrepaired infrastructure, as well as harmful health effects from diesel emissions.

Unacceptable Road Conditions

The U.S. Highway Trust Fund continues to spend more on designated highway improvements and maintenance nationally each year than it collects. In 2022, the national fund received \$41.9 billion from fuel and

Figure 27: Acceptable Road Conditions, by State



Source: Economic Roundtable Analysis; U.S. Department of Transportation, Bureau of Transportation Statistics. 2023. State Transportation Statistics: Road Condition.

vehicle taxes but had highway maintenance outlays of \$46.4 billion, a \$4.5 billion shortfall for taxpayers to cover.⁴²

At the state level, California has been much less successful than other states at maintaining roads in acceptable condition. California ranks 46th among the 50 states in the share of its roads that are in acceptable condition, as shown in *Figure 27*.

The uncompensated wear and tear of heavy trucks on California roads – the ton-miles of which are rising each year – increases the state’s road maintenance deficit and increases the likelihood that it will remain fifth from the bottom in the nation in terms of the quality of its roads.⁴³

Public Health Costs

To measure the potential for electric trucks to reduce air pollution in the South Coast Basin, and in doing so improve public health and wellbeing, we calculated emissions generated by the current diesel-powered, heavy trucks travelling to and from just under 3,300 large warehouses. The 11.5 million annual heavy-truck trips produce an estimated:

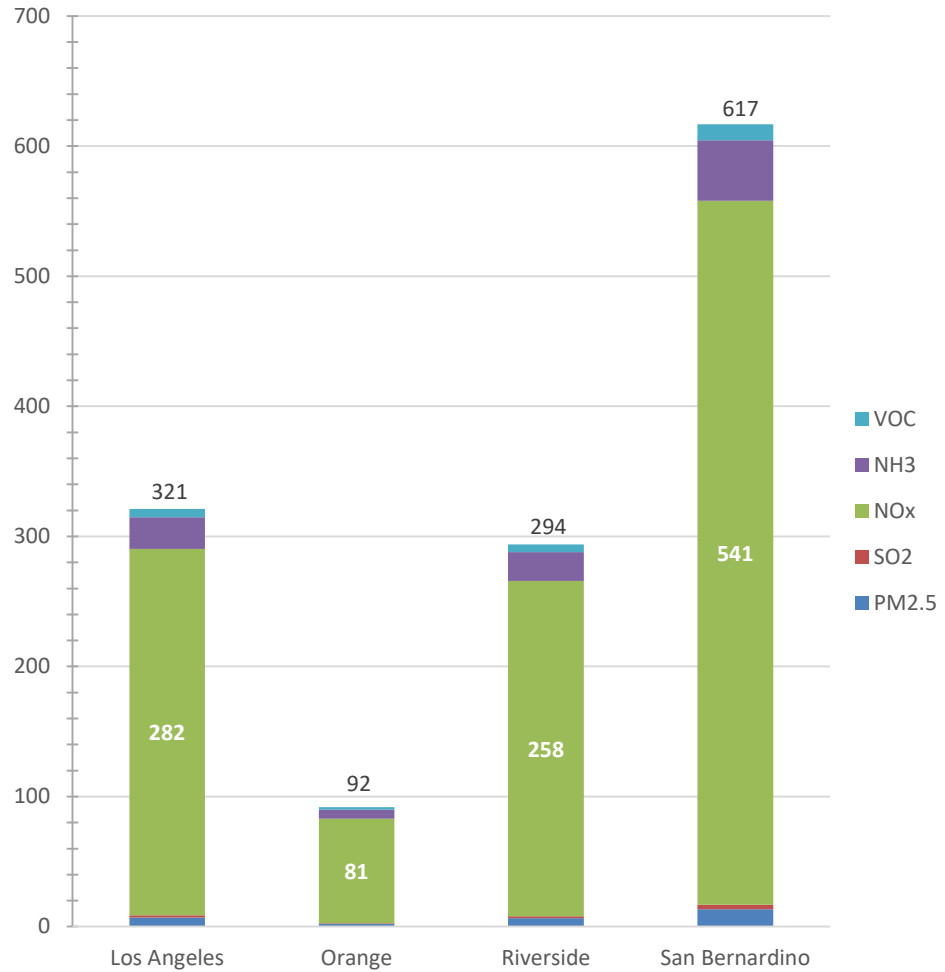
- **29 tons of PM_{2.5}**, fine particulate matter 2.5 microns or less, which is associated with increased bronchitis and asthma attacks.
- **7 tons of SO₂**, sulfur dioxide, a highly reactive gas that severely irritates breathing passages, eyes, and skin.
- **1,161 tons of NO_x**, nitric oxides and dioxides, which can irritate sensory organs, cause shortness of breath, and fluid build-up in the lungs.
- **100 tons of NH₃**, ammonia, high levels of which can irritate and burn the skin, mouth, throat, lungs, and eyes.
- **26 tons of VOCs**, volatile organic compounds, which can cause damage to the liver, kidney, or central nervous system.

These diesel truck emissions are calculated using the most recent California Air Resources Board fleet factors database and applying these factors to the number of miles travelled for trips to and from large warehouses in the four-county region.⁴⁴

The tons of heavy truck emissions appear in *Figure 28*, broken out by county. San Bernardino County stands out due to its large number of warehouses, their large square footage and the distance from the seaports. This is estimated to result in 617 tons of five health-impacting emissions, including 541 tons of Nitrous Oxides (NO_x).

Los Angeles and Riverside Counties make up the next largest shares, 321 and 294 tons respectively, which includes 282 and 258 tons of nitrous oxides, respectively. This parity stands out given that Riverside County

Figure 28: Tons of Diesel Truck Emissions by County



Source: Economic Roundtable Analysis; California Air Resources Board. 2021. EMFAC2021 v1.0.2 CA ARB Emission Factors (EMFAC) model; 2022 SCAQMD Rule 2305 Packet, Appendix C; SCAG Regional Data Platform and Parcel Locator; and other sources. Total tons of criteria emissions in each county are shown above each column in the chart.

only has a quarter as many large warehouses as Los Angeles County has, and only 42 percent of the latter’s square footage. They have similar quantities of criteria emissions because trucks travel a greater distance to and from warehouses in Riverside County.

Orange County, with its smaller number of large warehouses, their smaller square footage, and shorter trip distances to the seaports, have the lowest volume of criteria emissions, 92 tons, including 81 tons of nitrous oxides.

The local health impacts on residents from current diesel truck emissions, and, conversely, the health benefits from having electric trucks move cargo instead of diesel trucks, are shown in *Table 6*. Health costs for different health conditions range from \$74 million up to \$166 million.⁴⁵

Potential health benefits from electric trucks include reductions of: 6 to 13 deaths annually, 10 acute bronchitis diagnoses, 187 upper and 131 lower-

respiratory disorders, 194 asthma attacks, and 983 lost workdays – all tied to current diesel emissions.

Table 6: Local Residents’ Health Impacts from Diesel Truck Trips to and from Large Warehouses in the Four-County Region

	Incidence (annual cases)		Monetary Value (annual dollars)	
	Low	High	Low	High
Mortality *	5.867	13.279	\$64,201,139	\$145,310,590
Nonfatal Heart Attacks *	0.235	2.180	\$35,320	\$328,165
Infant Mortality	0.029	0.029	\$356,900	\$356,900
Hospital Admits, All Respiratory	1.338	1.338	\$52,465	\$52,465
Hospital Admits, Cardiovascular **	1.120	1.120	\$57,080	\$57,080
Acute Bronchitis	10.327	10.327	\$6,373	\$6,373
Upper Respiratory Symptoms	187.053	187.053	\$7,992	\$7,992
Lower Respiratory Symptoms	131.377	131.377	\$3,548	\$3,548
Emergency Room Visits, Asthma	2.379	2.379	\$1,341	\$1,341
Asthma Exacerbation	194.84	194.84	\$14,458	\$14,458
Minor Restricted Activity Days	5,783.90	5,783.90	\$507,045	\$507,045
Work Loss Days	982.83	982.83	\$196,749	\$196,749
Total Health Effects			\$65,440,408	\$146,842,704

Source: Economic Roundtable analysis; U.S. Environmental Protection Agency. 2023. CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA); 2022 SCAQMD Rule 2305 Packet, Appendix C; SCAG Regional Data Platform and Parcel Locator; California Air Resources Board. 2021. EMFAC2021 v1.0.2 CARB Emission Factors (EMFAC) model; and other sources. Notes: * indicates that the Low and High values represent differences in the methods used to estimate some of the health impacts in COBRA. For example, high and low results for avoided premature mortality are based on two different epidemiological studies of the impacts of PM2.5 on mortality in the United States. ** indicates that heart attacks are excluded from the data for cardiovascular hospital admissions.

Emissions produced in the South Coast Air Basin spill over into other parts of California and have additional adverse health impacts outside of the four-county region. The statewide health impacts of current emissions of diesel truck trips linked to warehouses in the four-county region are shown in Table 7.

The statewide public health costs for different medical conditions range from \$74 million to \$166 million. This is 13 percent more than costs in just the four-county region.

Statewide health benefits from converting warehouse-linked diesel trucks to electric trucks include reductions of: 7 to 15 deaths annually, 12 acute bronchitis diagnoses, 211 upper and 148 lower-respiratory disorders, 220 asthma attacks, and over 1,103 lost workdays – all attributed to diesel emissions.

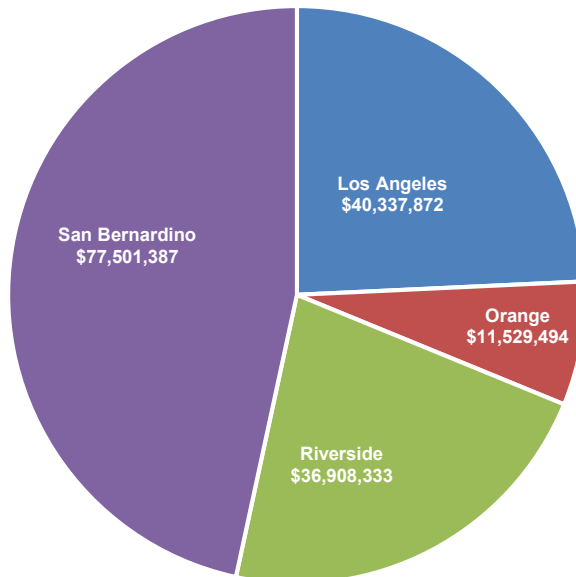
Table 7: California Residents’ Statewide Health Impacts from Diesel Truck Trips to and from Large Warehouses in the Four-County Region

	Change in Incidence (annual cases)		Change in Monetary Value (annual dollars)	
	Low	High	Low	High
Mortality *	6.639	15.028	\$72,652,573	\$164,446,723
Nonfatal Heart Attacks *	0.329	3.059	\$50,204	\$466,453
Infant Mortality	0.033	0.033	\$408,554	\$408,554
Hospital Admits, All Respiratory	1.528	1.528	\$59,573	\$59,573
Hospital Admits, Cardiovascular **	1.328	1.328	\$67,756	\$67,756
Acute Bronchitis	11.661	11.661	\$7,195	\$7,195
Upper Respiratory Symptoms	211.15	211.15	\$9,021	\$9,021
Lower Respiratory Symptoms	148.32	148.32	\$4,005	\$4,005
Emergency Room Visits, Asthma	2.861	2.861	\$1,612	\$1,612
Asthma Exacerbation	219.99	219.99	\$16,325	\$16,325
Minor Restricted Activity Days	6,490.54	6,490.54	\$568,992	\$568,992
Work Loss Days	1,103.35	1,103.35	\$220,877	\$220,877
Total Health Effects			\$74,066,687	\$166,277,086

Source: Economic Roundtable analysis and sources shown for Table 6.

The public health costs of current diesel truck emissions by county appear in *Figure 29*, highlighting the uneven burden put on the residents of less populous San Bernardino and Riverside Counties.

Figure 29: Public Health Costs of Diesel Truck Emissions by County



Source: Economic Roundtable analysis; U.S. Environmental Protection Agency. 2023. CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA);

An important caveat is that this data is based on the location of large warehouses, however the truck trips to and from these warehouses pass through many communities. The health impacts from diesel truck drayage are really a shared *regional* burden.

These public health impacts represent opportunities for public health improvements and cost savings as the South Coast AQMD implements and enforces Rule 2305, the Warehouse Indirect Source Rule. In the absence of enforcement, the pollutants emitted in Southern California communities will increase, because the region continues to build more warehouses and, by extension, experiences a continuing increase in truck trips.



Community Profile: Ralph Sistos, Teamster

Ralph Sistos (60) is a longtime resident of the Inland Empire, whose Mexican family has lived in this region for generations before it was even considered the United States. He currently lives in Redlands with his wife and daughters.

Ralph is a lifelong labor movement leader and truck driver who held a shop steward position for over 20 years with the Teamsters. Ralph retired some years ago from working at Sysco but still works at Costco as a truck driver. Ralph has dedicated his career to improving the workplace conditions at different companies for himself and his coworkers.

Ralph started working at a young age at Budweiser and was successful in organizing his coworkers to vote down a contract proposal because he

knew they could win a better contract. He then moved to work at Sysco Los Angeles where he was a shop steward for over ten years, helping secure contract language for route autonomy, wages, and safety conditions. At Sysco Riverside, where he ended his career, Ralph helped strengthen the contract language and worked every position he could at the company.

I've always said that respect allows you to go a long way. And that's what happened at my job at Sysco. As a worker, I had the right to make my point and call out when there were grievances. Management didn't always like the grievances we brought up, but they respected us enough to fix it. I was a shop steward for more than 25 years. I always tell our members - we are a union house, we fought for it and you are entitled to these rights.

You have to learn to fight for yourself. When you win, you get respect. It was my job to look out for my coworkers and communicate to the union and the company. My sole focus has always been our members. However, I have always thought that the big picture is the labor movement and not just my house."

What is your relationship to the logistics industry? How does it show up in your life? Or in your neighborhood?

My parents live in Highland, so when the growth at the San Bernardino International Airport happened, I got involved with the local Teamsters because of how it was going to impact my family. I feel I have an obligation as a Teamster to help and participate in these fights in our community. I try to push people to get involved. It is a part of me that I was born with.

I grew up in Beaumont. The property value was low, and there was a lot of vacant land. So it was a perfect location for our family. But in the past ten years, Beaumont has exploded with warehouses. It has taken all the beautiful scenery that we had. And we know who did it - the council people! They are allowing this to happen! It all goes back to the people in power. These people have allowed the destruction of their own community. All you see is these eye-sores.

Also the air! Who knows the particles in the air that we are breathing in? I drive a diesel truck now at Costco but I used to drive a liquefied natural gas (LNG) truck at Sysco. The problem with the LNG truck was that it couldn't go very far because we didn't have enough reliable fueling stations. Perhaps in the inner city it would be fine, but not for long distances. I was pulling 53-foot container and the truck had the same power as the diesel.

What can be done differently?

I think the truck routes are very important for us to focus on. From the 60 Freeway to Redlands, there is a road along the mountain called San Mateo that is used by cyclists, commuters and people running. This is a curvy road that you often see trucks driving on. This is dangerous! Drivers can be reckless.

Some places like Riverside have put restrictions on truck routes. I think this makes it safer for drivers and community members. It also should be the responsibility of the companies to ensure that the trucks do not go on these routes!

I also think air purifiers and air filters are important! There should be rebates and tax reimbursements for these things! Better window panes too! If you live close to any polluting industry, the companies should be obligated to provide them, whether it is a home, school or business. I think that city council members should not sell out their neighbors!

Do you think electric warehouses and electric trucks could be a solution?

I think eventually it will be the solution but we still have to work out the kinks and bugs such as charging all of these vehicles. I am afraid of the charging. How will we charge these trucks? Sometimes we have to make trips to San Luis Obispo or San Francisco. We would have to get a hotel room and spend the night if we had to wait more than six hours to charge.

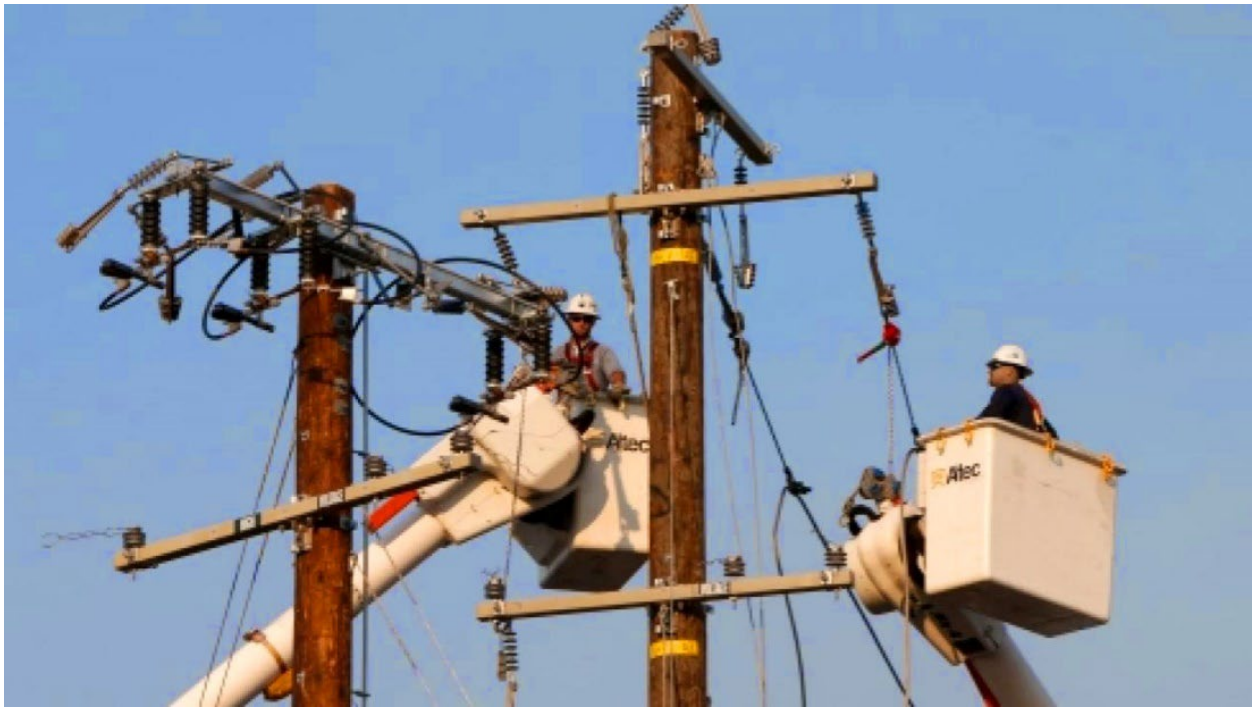
We need more training too, so we can operate the equipment correctly. We cannot stop progress. It is inevitable and technology is always going to change. About two years ago, Sysco ordered 30 electric trucks and built out the solar panels and charging stations for them.

“I think that technology is always getting better. I am grateful for the advocates who care about the future for others and get us involved.

What is our biggest strength in this fight?

I believe that we need regulation and accountability from warehouses and trucking companies. Residents should be given the ability to protect their own health and hold companies accountable to the community. These companies should be contributing to a community. And this needs to happen now and not get lost in legislation.

I think the biggest strength in our fight is that we have lots of people on our side. The problem is that most people don't see what's going on and need to hear the right messages.



5. Workers and Jobs

*Electrical construction,
Photo credit: IBEW Local 6*

Overview

Jobs in the Electricity Sector

One job is created for every \$111,512 spent annually on electrical infrastructure. Some of the jobs are from *direct* employment in electrical construction, other *indirect* jobs are industries that provide supplies and services for electrical construction, and additional *induced* jobs are created when workers in construction and supplier industries spend their wages.

Employment in the four counties of Los Angeles, Orange, Riverside and San Bernardino in industries that build electrical utility infrastructure and install electrical wiring and equipment in commercial buildings has grown by 749 jobs a year since 2004. This growth will accelerate with the conversion to electric trucks and the electrification of logistics infrastructure.

The electricity sector provides high-pay, living-wage jobs. The average hourly wage for all frontline electrical construction workers is \$35 an hour.

Jobs in Warehouses

The introduction of new technology in warehouses and the rapid movement of goods passing through them has made warehouse jobs more complex. However, the wages paid to warehouse workers in the four-county region decreased an average of \$13 dollars each year from 2001 to 2022, when adjusted for inflation.

The average wage in 2022 for warehouse workers in the five largest frontline occupations was \$18.95 an hour. This is less than half of a living wage.

Conclusions

The jobs to electrify the logistics chain that brings goods to warehouses are much better than the jobs inside warehouses. This includes jobs expanding the electrical transmission infrastructure, building recharging station for electric trucks and installing solar panels at warehouses.

Electrical construction jobs are growing and have strong multiplier impacts in the supplier chain as well as the consumer sector. Every 10 jobs in electrical construction create 7 additional jobs in other industries.

Skill requirements for jobs in warehouses have increased over the past 20 years, but pay in real dollars has decreased. Consumer costs are lower and warehouse corporation profits are higher at the expense of under-paying warehouse workers.

Jobs Created Building Electrical Infrastructure

Jobs will be created by building charging stations and electrical infrastructure for zero-emission electric trucks, as well as by cleaning up the emissions footprint of warehouses through installation of on-site solar panels.

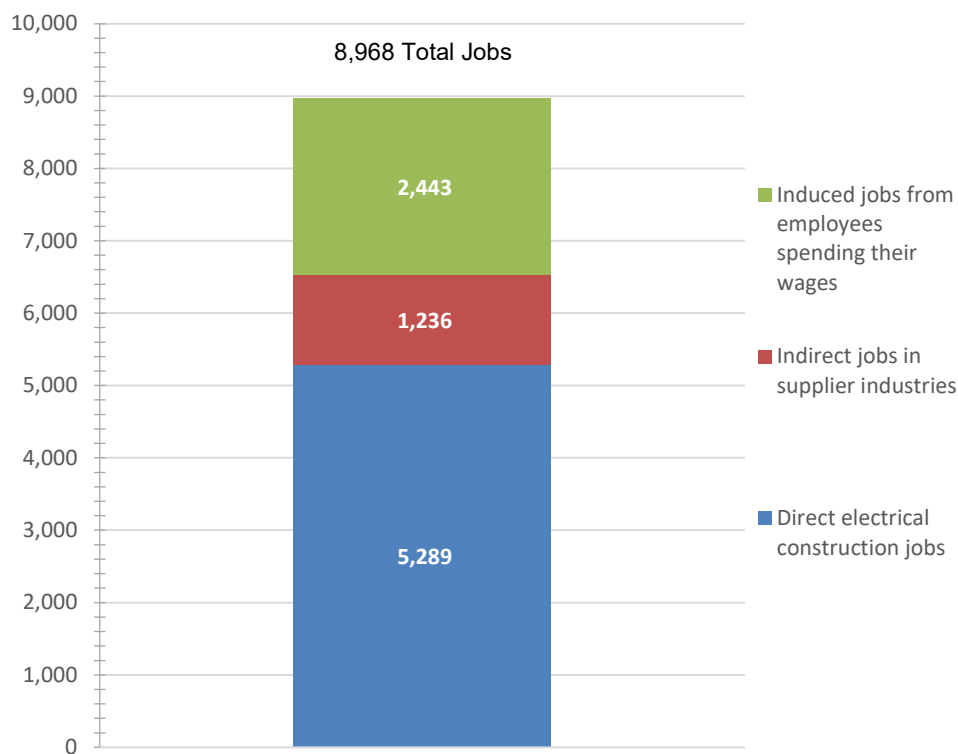
One job is created for every \$111,512 spent annually on building electrical infrastructure.⁴⁶ Some of the jobs are from *direct* employment in electrical construction, other *indirect* jobs are in industries that provide supplies and services for electrical construction, and additional *induced* jobs are created when workers in electrical construction and supplier industries spend their wages. The jobs created by \$1 billion in revenue for electrical construction are shown in *Figure 30*.

Over half of the jobs (59 percent) are in the electrical construction industry, 14 percent are in supplier industries, and one-quarter (27 percent) are in the communities where these employees spend their wages.

Supplier Industries for Electrical Construction

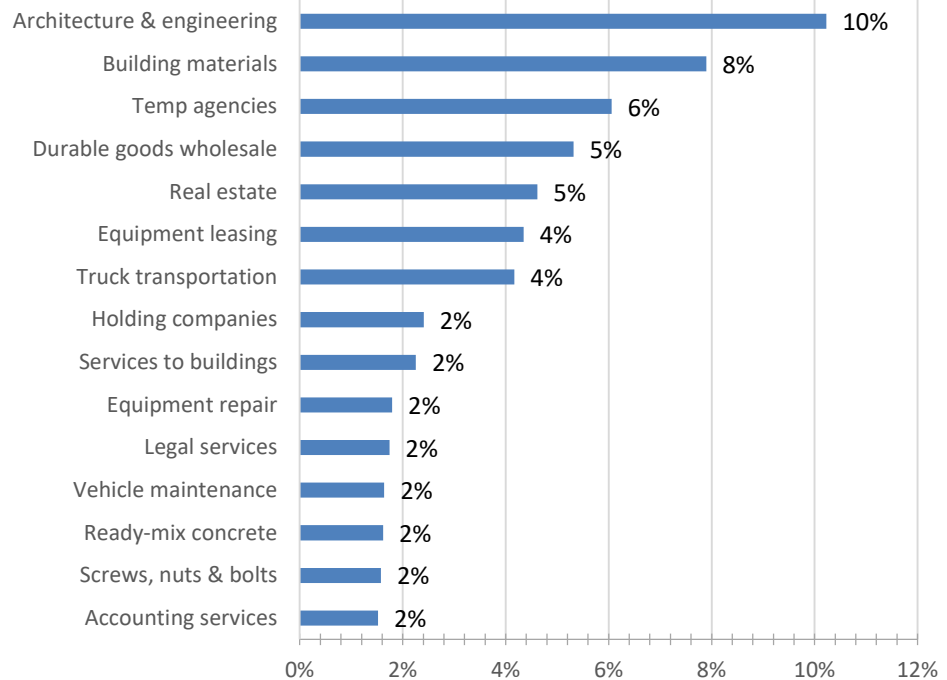
The supplier industries for electrical construction provide more services than goods, as shown in *Figure 31*. Architects and engineers are the leading

Figure 30: Jobs Created by \$1 Billion in Revenue for Electrical Construction



Source: IMPLAN 2019 model for construction of new power and communication structures in California with dollars adjusted to 2023 values.

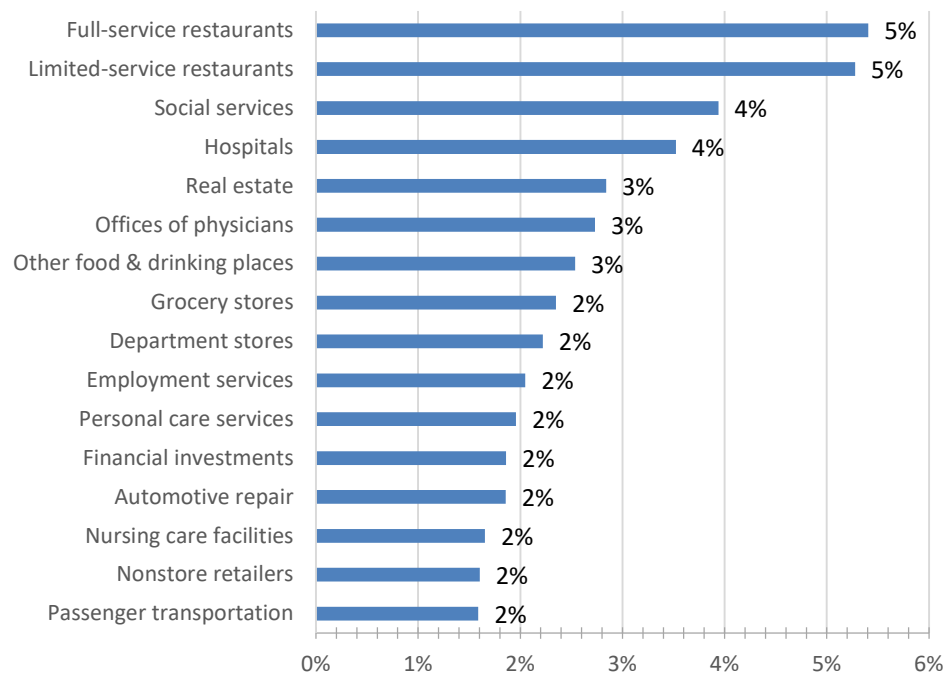
Figure 31: Indirect Jobs in Supplier Industries for Electrical Construction



Source: IMPLAN 2019 model for construction of new power and communication structures in California. Smaller supplier industries that account for 43 percent of goods and services purchased for electrical construction are not shown in this chart.

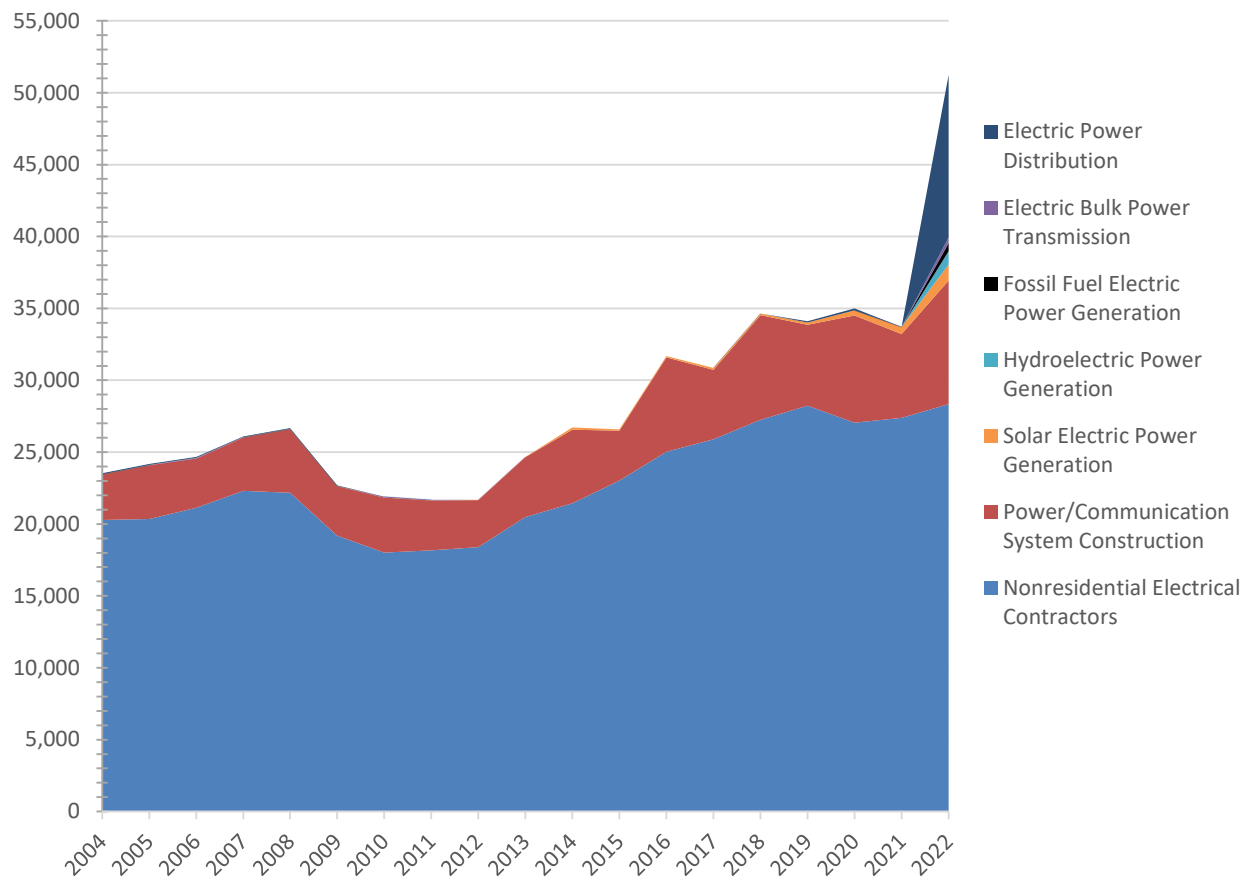
supplier, followed by building material companies, temporary employment agencies, wholesalers, and real estate services.

Figure 32: Induced Jobs from Employees Spending their Wages



Source: IMPLAN 2019 model for construction of new power and communication structures in California. Smaller supplier industries that account for 57 percent of goods and services purchased by workers are not shown in this chart.

Figure 33: Electrical Construction and Power Generation Jobs in Los Angeles, Orange, Riverside and San Bernardino Counties



Source: California Employment Development Department, Quarterly Census of Employment and Wages, 2004 to 2022.

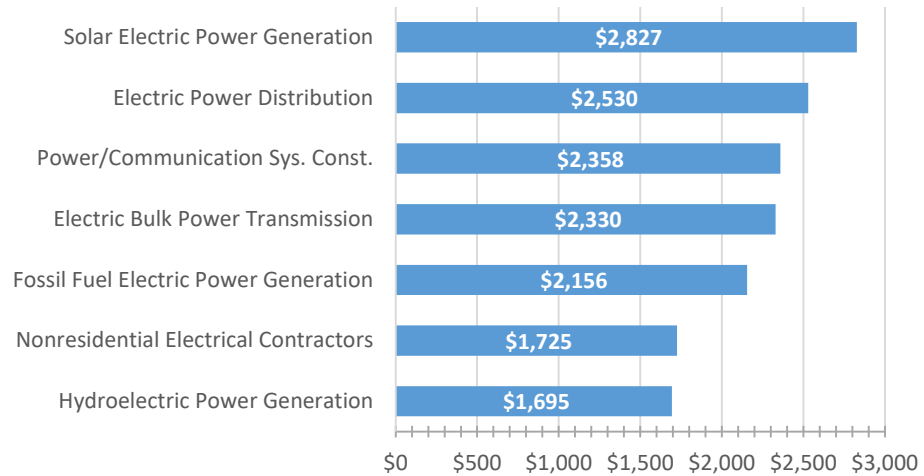
Industries that Meet the Consumer Needs of Workers

Every industry that helps fulfill consumer needs receives a share of the wages spent by workers in electrical construction and its supplier industries, as shown in *Figure 32*. Restaurants are the largest beneficiaries, followed by social services, health care, real estate, and retail stores. As shown earlier, these consumer industries create 27 percent of the jobs that result from investments in building electrical infrastructure.

Job Growth in Electrical Construction and Power Generation

Employment in industries that build electrical utility infrastructure and install electrical wiring and equipment in commercial buildings in the four-county region has grown by 749 jobs a year since 2004, as be seen in *Figure 33*. These construction jobs accounted for almost three-quarters (72 percent) of all jobs in the electricity sector in 2022. This sector includes building electrical infrastructure, generating electricity, distributing electric

Figure 34: Weekly Wages in 2022 in Electricity Sector Industries

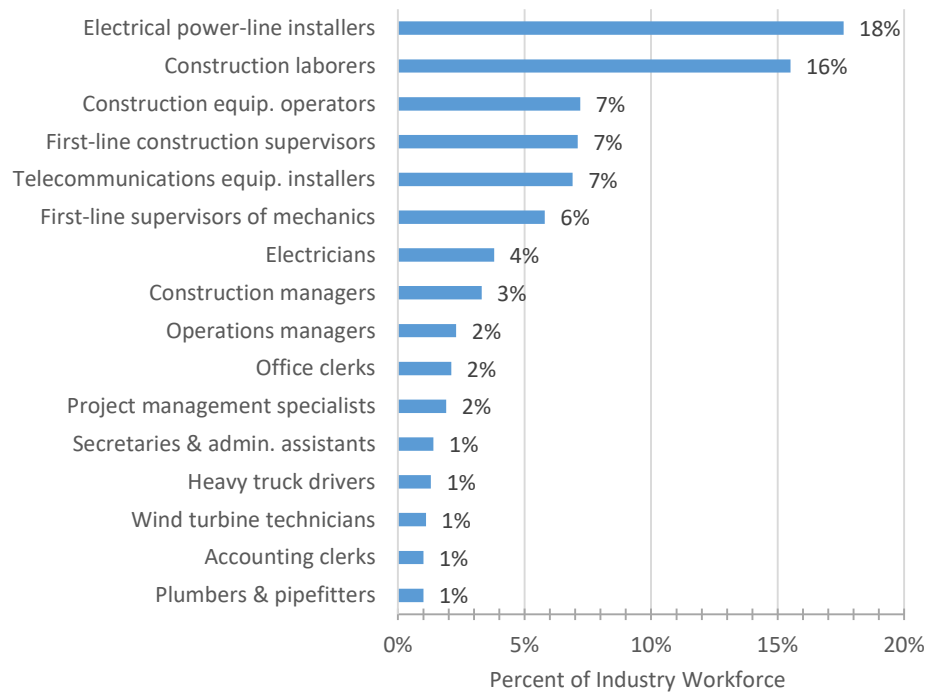


Source: California Employment Development Department, Quarterly Census of Employment and Wages. Wages are a weighted average of weekly earnings in 2022 in Los Angeles, Orange, Riverside, and San Bernardino Counties.

power, and installing electrical wiring and equipment in nonresidential buildings.

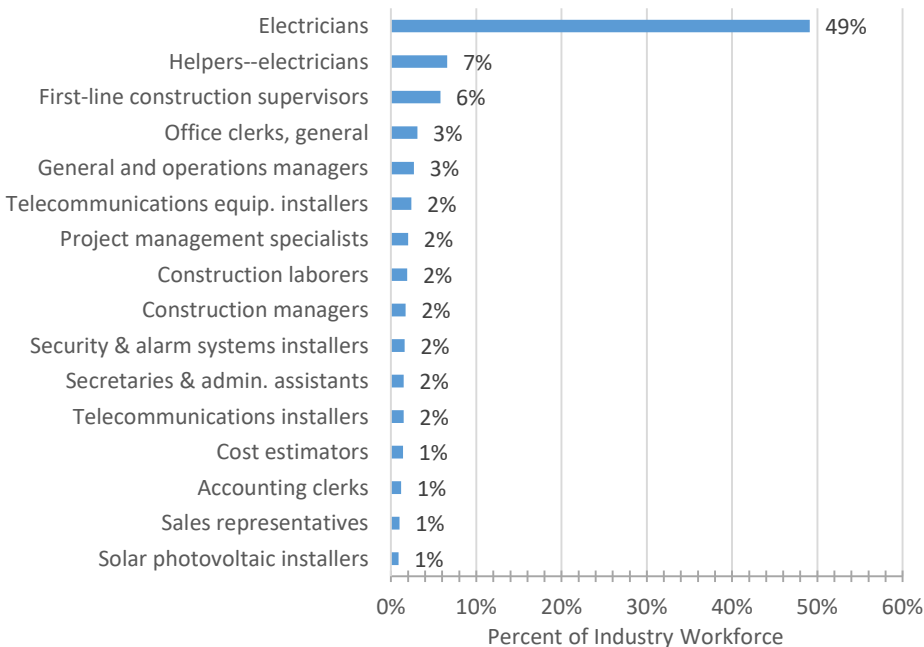
Generating electricity is the most essential component of the electricity sector, but in 2022, it accounted for only six percent of jobs in the electricity sector in the four counties. Solar electric and hydroelectric power generation each accounted for two percent of jobs.

Figure 35: Largest Occupations Employed for Building Electric Utility Infrastructure



Source: U.S. Bureau of Labor Statistics occupational matrix for NAICS 237130, the power and communication system construction industry. Smaller occupations that account for 21 percent of employment are not shown in the chart.

Figure 36: Largest Occupations of Electric Wiring and Equipment Installation Workers



Source: U.S. Bureau of Labor Statistics occupational matrix for NAICS 238210, the electrical contractor industry. Smaller occupations that account for 16 percent of employment are not shown in the chart.

The number of jobs in the four counties in electric power distribution surged in 2022, growing to account for 22 percent of employment in the electricity sector. This industry operates the lines, poles, meters, and wiring that transfer electricity to consumers. Most of the growth was in Los Angeles County, where Southern California Edison and the City of Los Angeles Department of Water and Power are the largest electric utilities.

Wages in Electricity Sector Industries

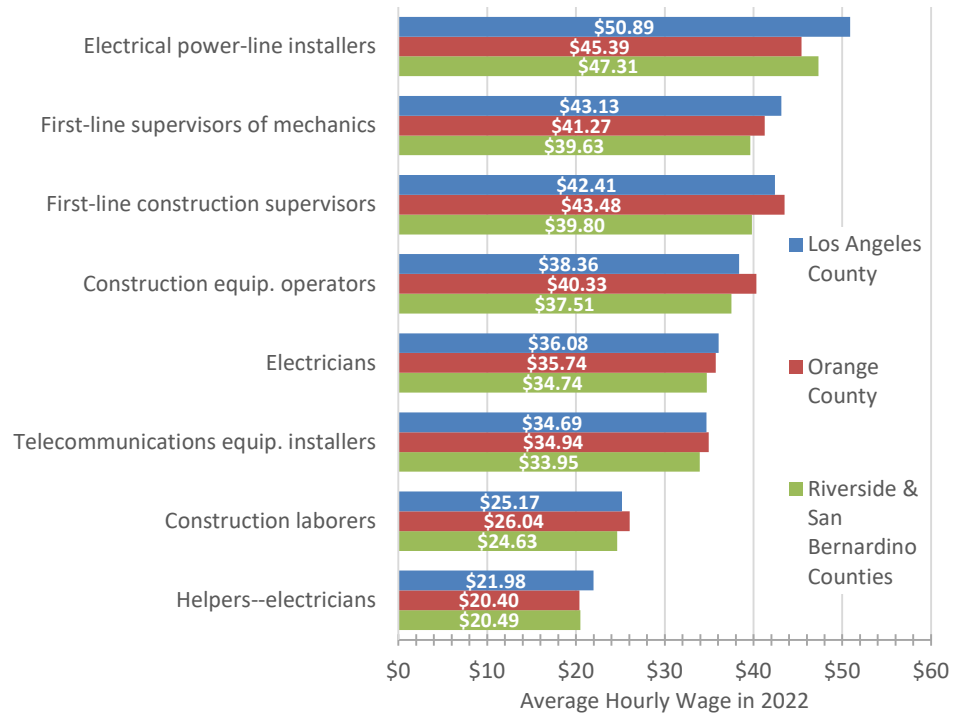
The solar electric power generation industry is deploying the newest technology in the electricity sector and pays the highest wages, as shown earlier in *Figure 34*. However, the entire electricity sector provides high-paying jobs.

These wages are the average of all occupations employed in an industry, ranging from managers and professional specialists to frontline workers. They are an indication of job quality. If workers are employed full-time and year-round, average annual wages range from \$88,120 in hydroelectric power generation to \$147,030 in solar electric power generation.

Occupations Employed in Electrical Construction

The occupations of workers who build electric power lines, towers and generating facilities are shown in *Figure 35*. And the occupations of

Figure 37: Average Hourly Wage of Frontline Electrical Construction Workers in 2022



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

workers employed to install electrical wire and equipment in buildings are shown in *Figure 36*.

Workers who build the electric utility infrastructure are largely employed to build the distribution systems. This includes electrical power line installers (18 percent), construction laborers (16 percent), and construction equipment operators (seven percent).

Workers who install wiring and electrical equipment in buildings are largely electricians (49 percent), and electrician helpers who assist them (seven percent).

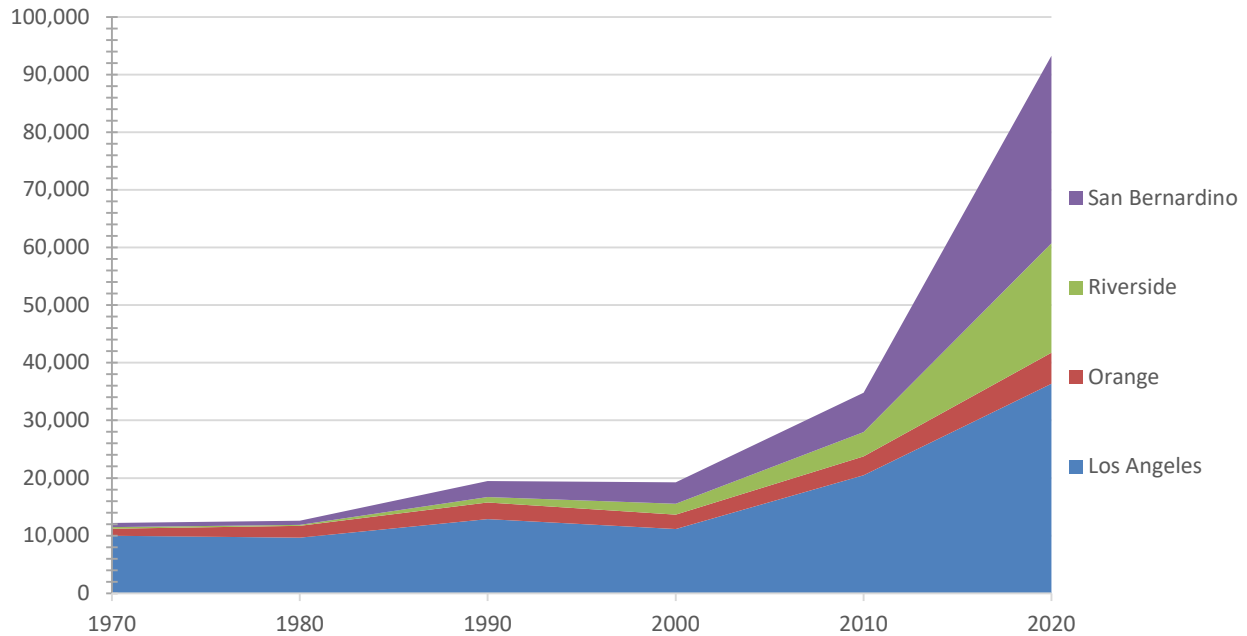
Wages in Electrical Construction Occupations

Frontline electrical construction occupations pay living wages. All of the eight largest frontline occupations pay over \$20 an hour, including the less-skilled helper and laborer occupations. Higher skilled occupations pay from \$33 to \$50 an hour, as shown in *Figure 37*.

The highest-paid occupation – and the largest occupation for building electrical infrastructure – is electrical power-line installer, which pays from \$47 to \$50 an hour, depending on the county where the job is located.

The average hourly wage for all frontline electrical construction workers employed in Los Angeles County is \$35.60 an hour. In Orange County, it is \$35.26, and in Riverside and San Bernardino Counties, it is \$33.64.

Figure 38: Residential Distribution of Warehouse Workers by County 1970-2020

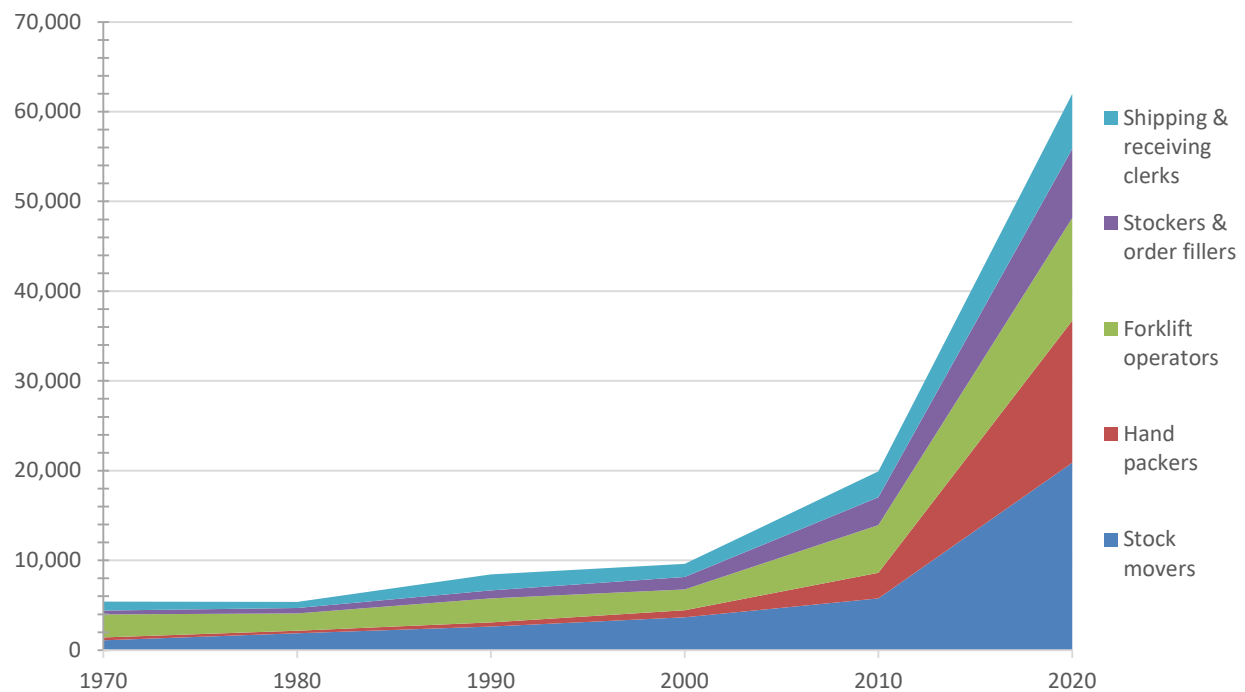


Source: U.S. Census Bureau, Decennial Census Public Use Microdata records for 1970, 1980, 1990, 2000, 2010, and 2020.

Warehouse Labor Force

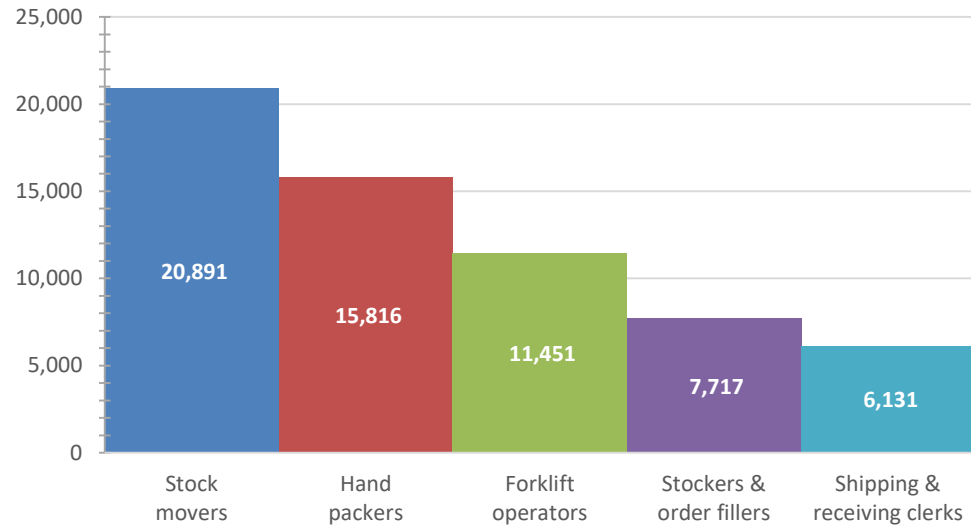
In 1970, 82 percent of warehouse workers in the four-county region lived in Los Angeles County, as shown in *Figure 38*. Ten percent lived in

Figure 39: Employment in Five Largest Frontline Warehouse Occupations 1970-2020



Source: U.S. Census Bureau, Decennial Census Public Use Microdata records for 1970, 1980, 1990, 2000, 2010, and 2020.

Figure 40: Employment in Five Largest Frontline Warehouse Occupations in 2020



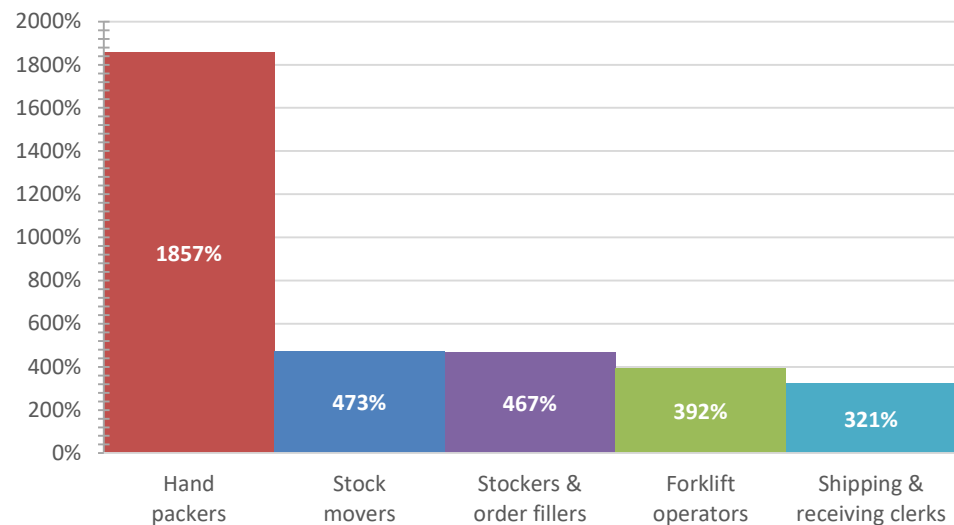
Source: U.S. Census Bureau, 2016 to 2020 Public Use Microdata Sample for Los Angeles, Orange, Riverside, and San Bernardino Counties.

Orange County, two percent in Riverside County and six percent in San Bernardino County.

After modest growth from 1970 to 2000, the number of warehouse workers grew 81 percent from 2000 to 2010, and then increased even more rapidly from 2010 to 2020, with 168 percent growth.

Altogether, the number of warehouse workers in the four-county region increased by 665 percent from 1970 to 2020, with explosive growth in the Inland Empire. The number of warehouse workers increased 4,548 percent in San Bernardino County and 6,224 percent in Riverside County.

Figure 41: Growth in Five Largest Frontline Warehouse Occupations from 2000 to 2020



Source: U.S. Census Bureau, 2010 and 2016 to 2020 Public Use Microdata Sample for Los Angeles, Orange, Riverside, and San Bernardino Counties.

Occupations of Frontline Warehouse Workers

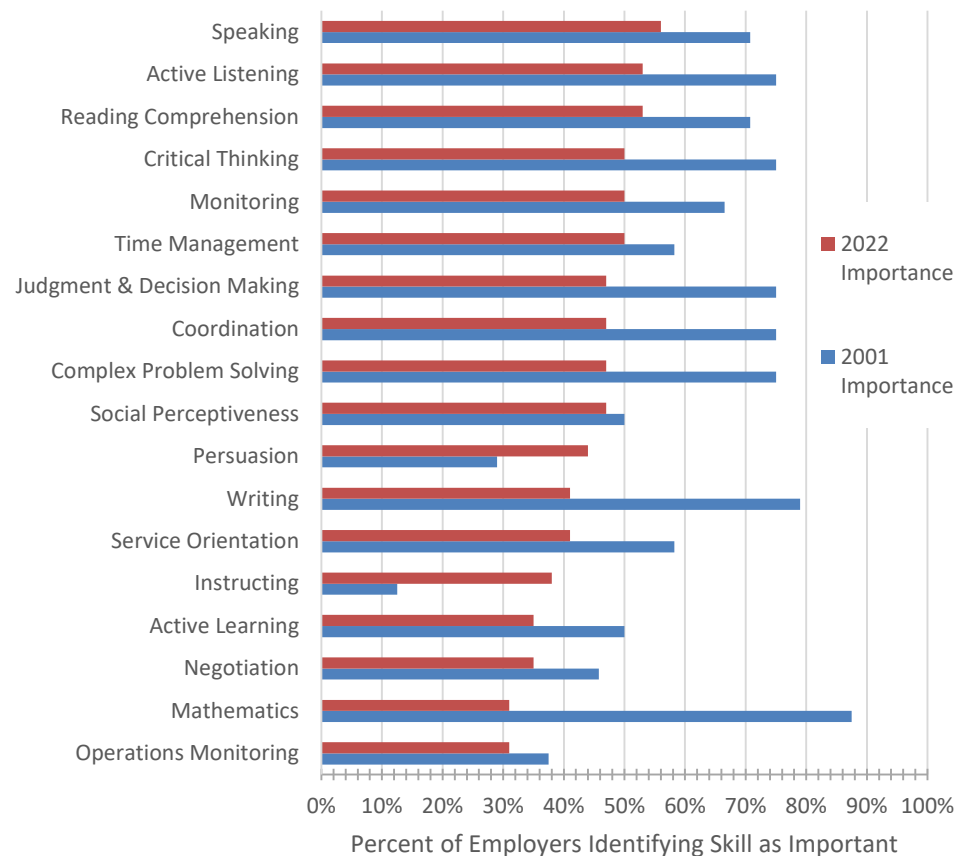
The largest frontline warehouse occupation since 2000 has been *stock movers*, as shown in *Figure 39*.⁴⁷ In the preceding 30 years, from 1970 through 1990, *forklift operators* were the largest occupation. Simpler moving equipment, such as pallet jacks, as well as the development of semi-automated conveyor systems, have reduced reliance on larger and more powerful forklifts that are hazardous in the hands of unskilled operators.

There are 20,891 *stock movers* working in warehouses in the four-county region, as shown in *Figure 40*. The second largest occupation is *hand packers*, with 15,816 workers.

The greatest growth over the past 20 years has been among *hand packers*, who have increased by 1,857 percent, as shown in *Figure 41*. These workers, for example, pick up, move, sort and pack the goods for an Amazon order, mark and label the package, and seal it.

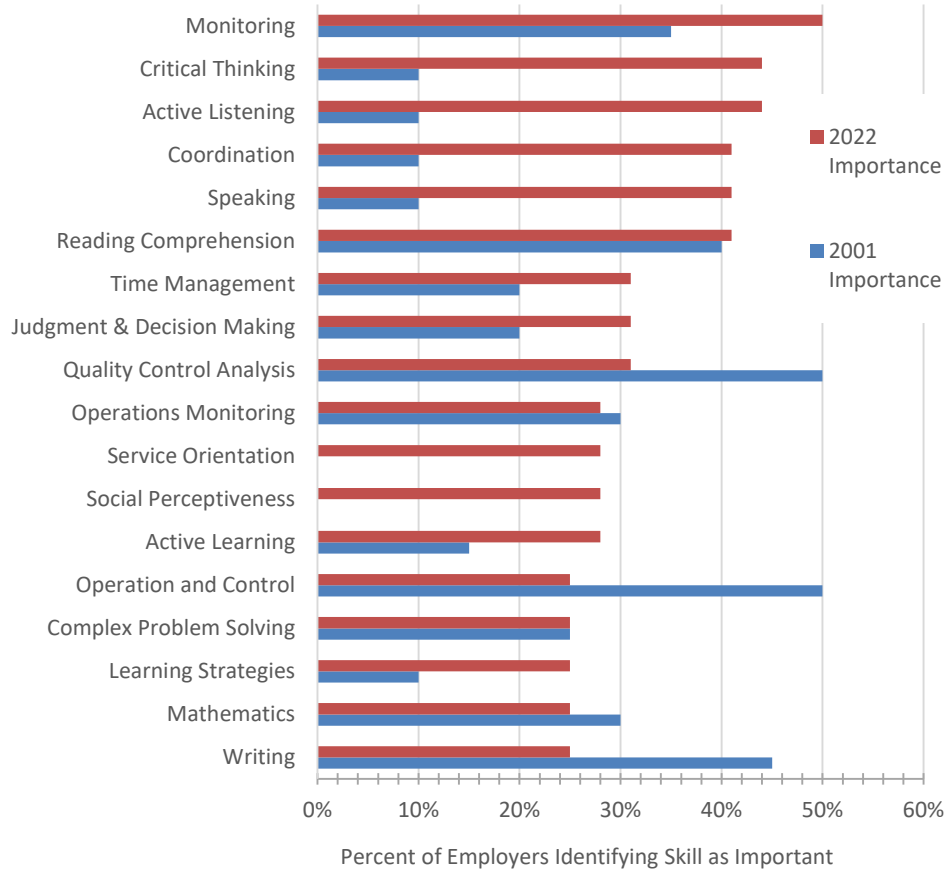
The least growth has been among *shipping and receiving clerks*, who verify and maintain inventory records for incoming and outgoing shipments. Bar code reading equipment has automated their work.

Figure 42: Job De-Skilling for Shipping and Receiving Clerks from 2001 to 2022



Source: U.S. Dept. of Labor, Employment and Training Administration, O*NET versions 1.0 and 28.0, SOC 43-5071.

Figure 43: Job Up-Skilling for Hand Packers and Packagers from 2001 to 2022



Source: U.S. Dept. of Labor, Employment and Training Administration, O*NET versions 1.0 and 28.0, SOC 53-7064.

Change in Skill Requirements for Warehouse Jobs

The skills, knowledge and abilities that workers need to perform their job can change over time, as technological innovation changes their tools and tasks. This simplifies some jobs and makes other jobs more complex.

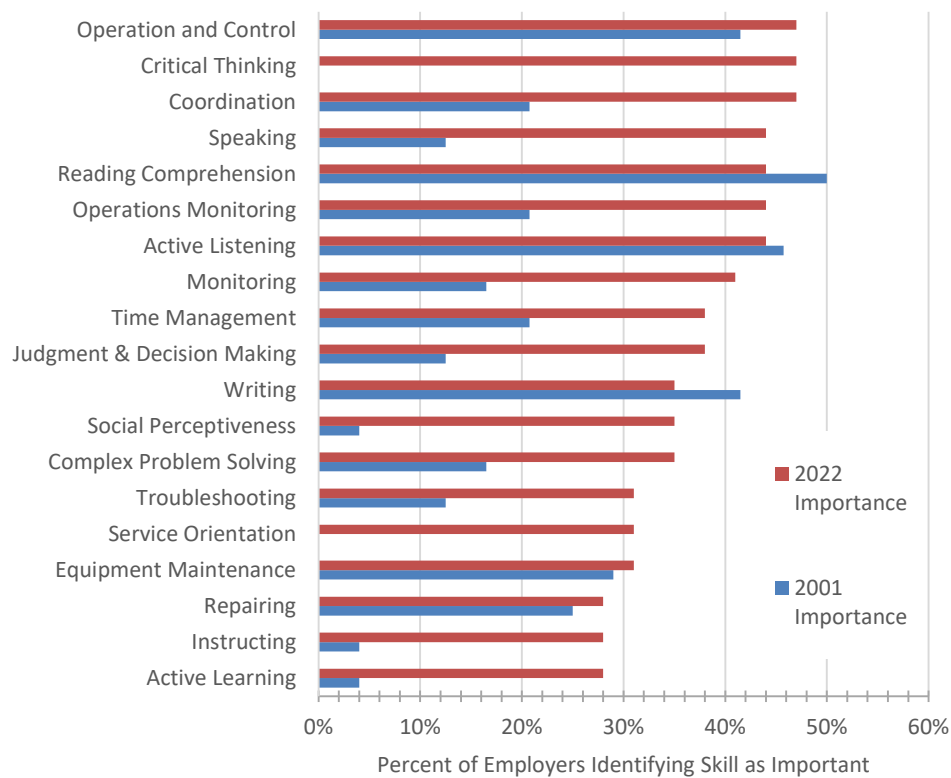
Shipping, Receiving and Inventory Clerks – De-Skilled

The work of *shipping and receiving clerks* has been de-skilled by bar code readers, as can be seen in *Figure 42*.⁴⁸ In 2001, 88 percent of employers said that mathematical skills were important for this job. Twenty-one years later, in 2022, only 31 percent of employers say that this skill is important.

Of the 18 skills shown for *shipping and receiving clerks* in *Figure 42*, only two have become more important – persuasion and instructing. These are social rather than intellectual tasks. The intellectual tasks have been automated.

The average importance of the skills for *shipping and receiving clerks* shown in *Figure 42* decreased from 61 percent in 2001 to 44 percent in 2022.

Figure 44: Job Up-Skilling for Hand Laborers and Freight, Stock, and Material Movers from 2001 to 2022



Source: U.S. Dept. of Labor, Employment and Training Administration, O*NET versions 1.0 and 28.0, SOC 53-7062.

Hand Packers and Packers – Up-Skilled

In contrast, the skill requirements for *hand packers* have increased over the past two decades, as shown in *Figure 43*. Even though employers give less importance to the skills of *hand packers* than the *skills of shipping and receiving clerks* (i.e., fewer employers identify their skills as being important), the average importance of the skills shown in *Figure 43* increased from 23 percent in 2001 to 33 percent in 2022.

For example, in 2001, only 10 percent of employers said that critical thinking and active listening were important. By 2022, the share of employers saying that these skills are important had increased to 44 percent. Mental engagement, collaboration and communication have become more important for doing this job.

Hand Laborers and Freight, Stock and Material Movers – Up-Skilled

The importance of critical thinking, coordination with other workers, speaking, monitoring operations, judgement and decision making, social perceptiveness, troubleshooting, instructing and active learning for *stock movers* has more than doubled over the past 21 years, as shown in *Figure 44*.

These workers move stock manually in warehouses. They have to identify and categorize the goods, recognize differences or similarities, and detecting changes in the work environment.

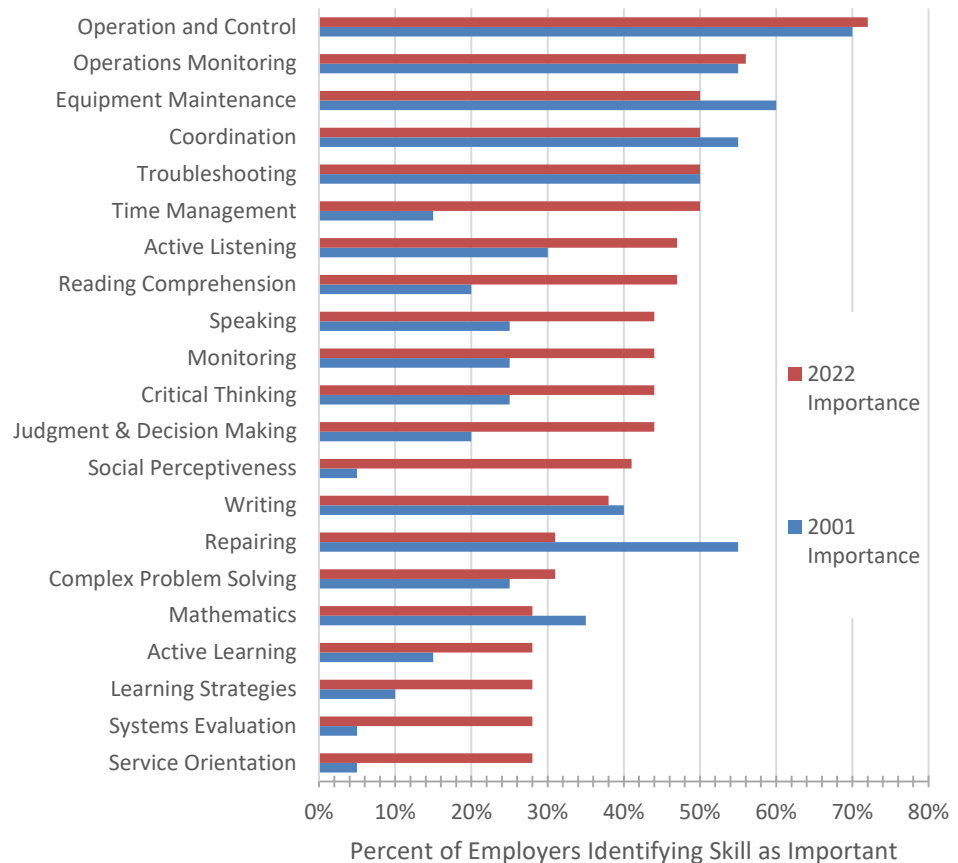
The introduction of new technology in warehouses and the rapid turnover of goods has made their job more complex. The average importance of skills shown in *Figure 44* for *material movers* increased from 20 percent in 2001 to 35 percent in 2022.

Industrial Truck and Tractor (Forklift) Operators - Up-Skilled

The importance of social perceptiveness, time management, reading comprehension, judgment and decision-making, service orientation, and systems evaluation for *forklift operators* has more than doubled over the past 21 years, as shown in *Figure 45*.

These workers operate lifting devices, such as forklifts, to load, unload, transport, or stack material. Increasingly, they use electronic software to inspect loads for accuracy and safely move loads around the warehouse to ensure timely and complete delivery.

Figure 45: Job Up-Skilling for Industrial Truck and Tractor (Forklift) Operators from 2001 to 2022



Source: U.S. Dept. of Labor, Employment and Training Administration, O*NET versions 1.0 and 28.0, SOC 53-7051.

The introduction of new technology in warehouses and the rapid turnover of goods has made their job more complex. The average importance of skills shown in *Figure 45* for *forklift operators* increased from 31 percent in 2001 to 42 percent in 2022.

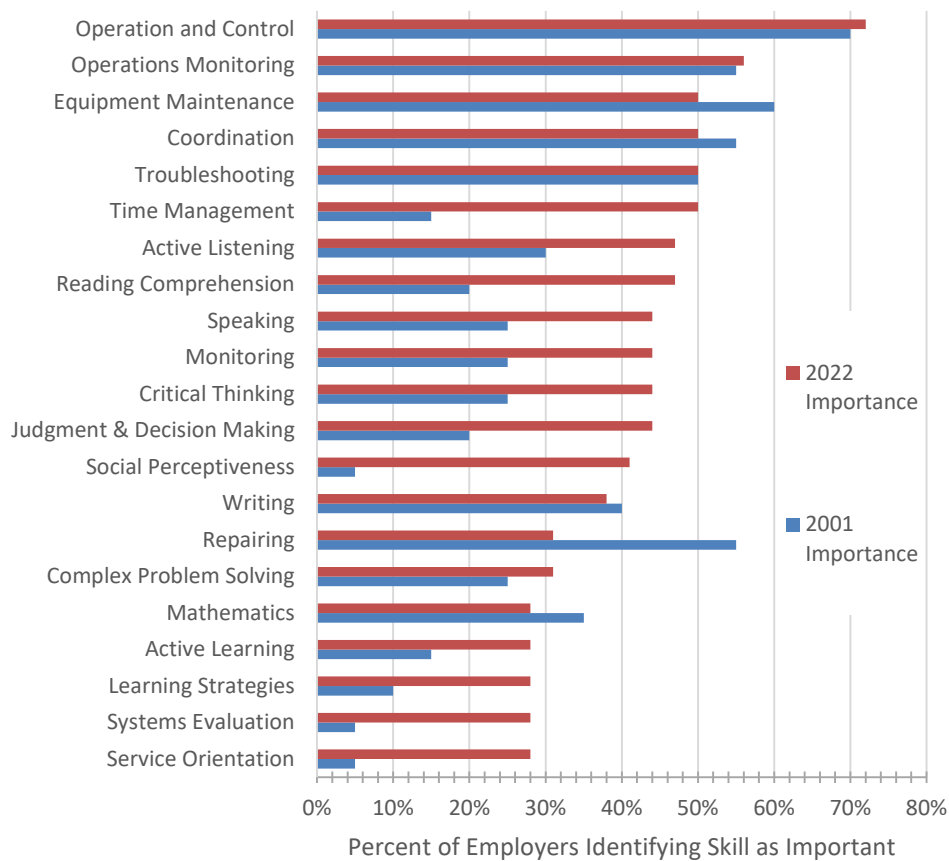
Stock Clerks - Stockers and Order Fillers – Up-Skilled

The importance of personnel management, time management, monitoring, social perceptiveness, persuasion, and instructing for *stock clerks* has doubled, or nearly doubled, from 2001 to 2022, as shown in *Figure 46*.

These workers answer questions about merchandise, transfer the goods for an order to coworkers who complete the next step for shipping the order, read orders to ascertain catalog numbers, sizes, colors, and quantities of goods keep records of out-going orders, attach labels to goods, and organize new goods.

The introduction of new technology in warehouses and the rapid turnover of goods has made their job more complex. The average importance of

Figure 46: Job Up-Skilling for Stockers and Order Fillers – Stock Clerks from 2001 to 2022



Source: U.S. Dept. of Labor, Employment and Training Administration, O*NET versions 1.0 and 28.0, SOC 53-7065.

skills shown in *Figure 46* for *stock clerks* increased from 33 percent in 2001 to 39 percent in 2022.

Wages of Frontline Warehouse Workers

Workers' pay determines their economic well-being and reveals economic inequities within industries. Despite providing the energy and effort that produces large profits in a growing industry, warehouse workers do not receive a living wage, as shown in *Figure 47*.

The average wage in 2022 for warehouse workers in the five largest frontline occupations was \$18.95 an hour. This is less than half of a living wage.

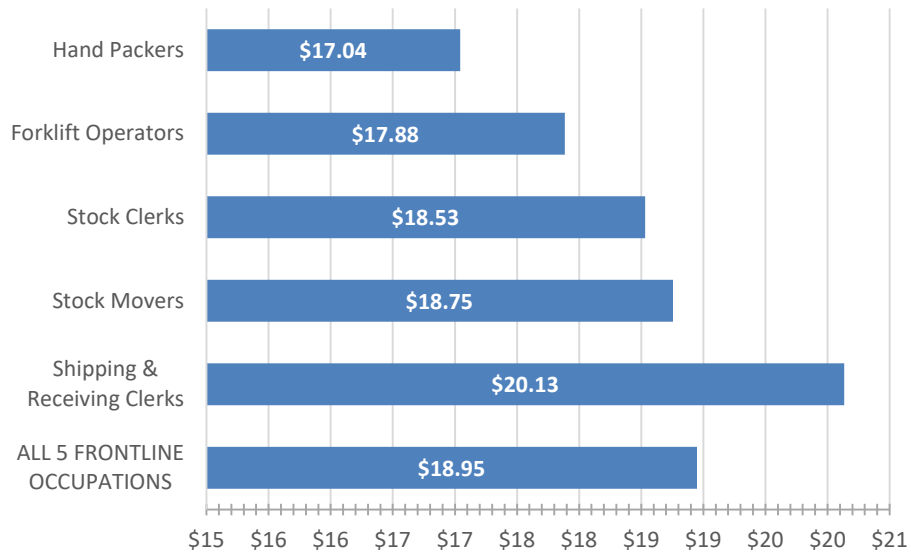
A living wage for workers in households with two working adults and two children is \$45.22 in Los Angeles County, \$47.78 in Orange County, \$41.77 in both Riverside and San Bernardino Counties.⁴⁹

Wages range from \$17.04 an hour for *hand packers* to \$20.13 an hour for *shipping and receiving clerks*.

These low wages do not compensate for increased skill requirements, or corresponding increases in worker productivity, for frontline warehouse workers. There have been large increases in skill requirements for four of the five frontline occupations.

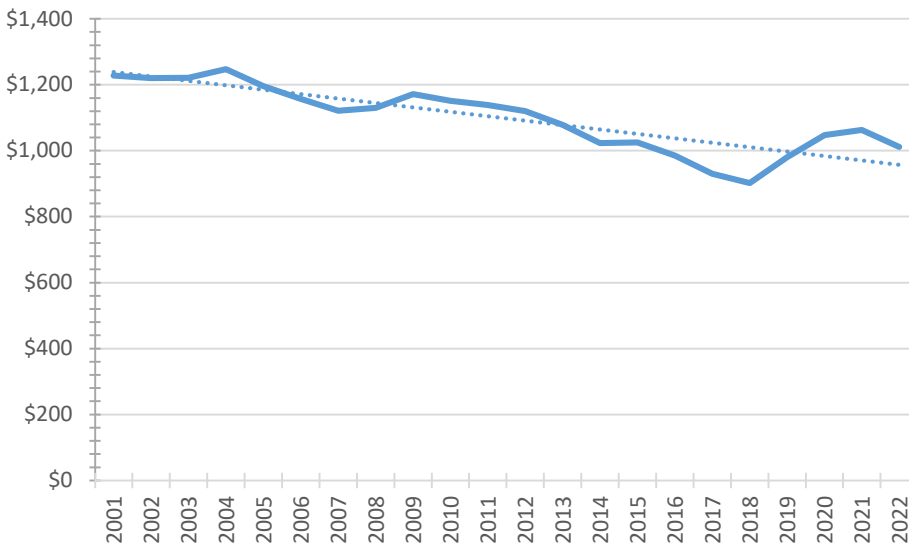
Warehouses bring in \$106,709 in revenue each year for every worker. Six percent of this revenue is profit. This means that there is \$6,005 in annual corporate profit for each worker.⁵⁰

Figure 47: Average Hourly Wage for Frontline Warehouse Workers in the 4-County Region in 2022



Source: California Employment Development Department, Occupational Employment and Wage Statistics (OEWS) survey, Los Angeles, Orange, Riverside, and San Bernardino Counties.

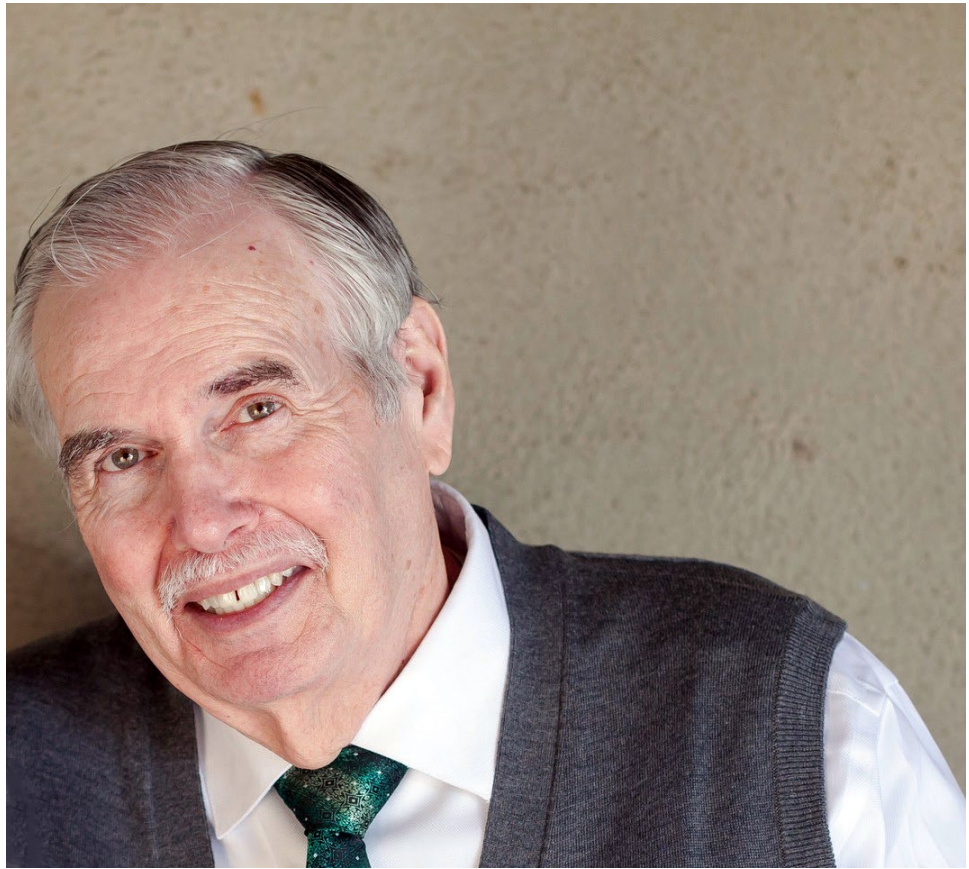
Figure 48: Average Weekly Pay for All Warehouse Workers in the 4-County Region, 2001 to 2022



Source: US Bureau of Labor Statistics, *Quarterly Census of Employment and Wages*, Los Angeles, Orange, Riverside, and San Bernardino Counties. Wages are adjusted to 2022 dollars based on the CPI for the Los Angeles region.

The wages paid to warehouse workers in the four-county decreased an average of \$13 dollars each year from 2001 to 2022, when adjusted to constant dollars, as shown in *Figure 48*. Workers’ pay was 18 percent less in 2022 than it was in 2001. Workers who are increasingly skilled and productive are being paid less and less.

The warehouse industry pays bottom-feeder wages to warehouse workers who assemble, package and send out goods that often have high value to consumers throughout Southern California who are preponderantly affluent. This is an uncompensated transfer of wealth from under-paid workers to corporate warehouses and affluent consumers.



Community Profile: George Hauge, Environmental Advocate

George Hauge grew up in the Pacific Northwest but has spent the majority of his life in the Inland Empire. In 1976 George moved to Moreno Valley to be a school teacher. During that time the population was around 25,000 and Ironwood Ave was not developed.

People would tend sheep up and down the road. Moreno Valley was extremely rural, a different landscape from what you find today with the influx of housing and warehouses.

George mentions that the shift from rural to town happened in the early 1980s to 90s, when elected officials' motto was: "build the housing and we'll guarantee you'll have the jobs."

It wasn't until 2005 when George saw the first multi-million square foot warehouse approved and began to challenge these projects more seriously in the following years.

George mentions the multi-million Skechers warehouse that was approved in 2008. It was one of the first to cause relocation. The school district had already purchased the site and had been approved by the city for a new

High School, but the school was not built to make room for the warehouse project. They never found another site for the high school.

Battles to stop these multi-million hubs became the normal, voluntary way that George spends his days. To this day, George's schedule involves litigation calls four to five times a week. George mentions that the hardest part about fighting these logistic projects in a pro-warehouse city is not that you can't stop them or remove a warehouse, but the litigation cases.

If it's a CEQA (California Environmental Quality Act) lawsuit, the most one can do is mitigate and the developers usually claim to do that. They show mitigations for the CEQA requirements, go back to the city council and get their million square foot warehouses approved.

George says that in some cases developers are willing to improve their plans, but the planning commission and planning staff aren't requiring anything at all. Then, mitigation of adverse impacts is eventually added after litigation. That means for a project, that could have solar included as a mitigation requirement by the planning commissions, this improvement is not even brought up until the litigation is settled. The city and developers leave it to volunteers like George to sue for improvements like solar panels that are essential for the environment.

George is currently working on four law suits. In one, a warehouse shares the backyard of a home. In the second, a warehouse is 19 feet away from homes. In the third, a warehouse is across the street from homes. And in the fourth, another warehouse is across the street from homes.

He says that Moreno Valley just keeps approving warehouse projects. "We might get some change but don't know yet." The developer is offering an 18 acre furnished and landscaped sports park, a million dollars in improvements and pavement that have nothing to do with the project, and funds for the city council.

George says that many of these projects are not making it better for those who live nearby, but making it a "nice package for the city council." George explains how one project, the Moreno Valley Trade Center, was in planning as the same time that the city approved its general plan in June of 2021. The proposed location of the project site was shown in the general plan that was approved as being zoned for residential land use.

The developer of the project bought residential land cheaply, then put forward the project forward and asked the city to amend the general plan and rezone the land the as industrial.

George explains that the developer has been in hearings for 17 months trying to get project approved and has been told what changes are needed to mitigate the adverse impacts of the project.

The developer claims that these components of the project cannot get changed and the project must be approved based on overriding considerations about the benefits it will provide. Three of the four negative impacts of the project that the developer wants to override are air quality, greenhouse gas emissions and aesthetics.

George mentions his personal relationship with logistics are air quality and traffic impacts, they impact his life because he is continuing to fight while others are traveling, he doesn't mind actively fighting. It has given him relationships with good attorneys. "Fortunately, we have a couple of lawyers who care."

"We are up against pollution, traffic impacts, truck lanes, and low-paying warehouse jobs. Open space that should be set aside is being consumed for job producing lands that produce very few jobs per square foot. Now with automation and robotics, there will be less jobs per square foot than there are now."

Every warehouse they build means looking for employment outside since warehousing will rely on automation and robotics. George recommends that warehouses should only build on industrial lands, ideally 500 meters or more from sensitive community or open-space sites.

Logistics needs to move away from fossil fuels as much as possible. We need to get HVAC systems installed throughout the community and all-electric buildings There should be auxiliary power units for truckers so that they don't have to leave their engines running and a cooling center for truckers. And solar panels should be installed on warehouses to reduce their environmental footprint.



6. Impacts of Warehouses on Frontline Families

*Photo credit:
Economic Roundtable*

Overview

Homes

There are just under 365,000 residential parcels located within 2,000 feet of large warehouses, across the four-county region. Three-quarters are single-family homes, and almost another quarter are multi-family properties.

Single-family homes usually hold multiple family members and apartment buildings hold multiple families. There are over 2.1 million residents within 2,000 feet of a large warehouse.

Warehouses and the logistics networks that they support degrade the habitability of neighborhoods. Factors that diminish the desirability and cost of housing in these neighborhoods include freeways, heavy traffic, truck-train intermodal facilities, cargo airports, truck depots, and warehouses.

Poverty

Many families live near warehouses out of economic necessity, settling on less desirable neighborhoods and inadequate housing within those neighborhoods because rents are lower. Data on families living near large warehouses shows an elevated likelihood of poverty throughout the four-county region. In addition to economic distress, these families have long-term exposure to air pollution, as well as traffic noise and congestion that make it difficult to get the peace and quiet needed for a healthy life.

The median income within a 2,000-foot perimeter of large warehouses is 18 percent lower than in the four-county region, and the poverty rate is 22 percent higher than outside the perimeter.

When families cannot afford to rent an apartment that meets minimum standards of space and privacy for household members, they often rent a smaller unit where more than one person is crowded into each room in order to reduce their rent. The rate of overcrowded housing is 38 percent higher within the 2,000 perimeter of large warehouses than in the region as a whole.

Households living within 2,000 feet of a large warehouse are 10 percent more likely to have children, 23 percent more likely to be a female-headed household, and 40 percent more likely to be Latino than in the overall four-county region.

Incompatible Development

Large warehouses of 100,000 square feet or more, and sometime more than one-million square feet, are being developed in existing neighborhoods, sometimes just across the street from people's homes. The impacts of cargo handling spillover onto resident who live in close proximity to large warehouses and the diesel trucks that come and go create emissions, noise, congestion and traffic risks.

Homes Near Warehouses

Large warehouses are important logistics nodes for transporting goods from manufacturers to end consumers. In the four-county region, the presence of this global flow of goods includes truck – and sometimes train – trips between large warehouses, the Los Angeles and Long Beach Ports, cargo airports, intermodal truck-train yards, other warehouses, and retail stores.

The impacts of large warehouse on their neighborhoods are directly measurable. There are just under 365,000 residential parcels located within 2,000 feet of a large warehouse. Almost two-thirds (64 percent) are located in Los Angeles County, followed by Orange, then San Bernardino and Riverside Counties, as shown in *Figure 49*.



Photo credit: Economic Roundtable

Nineteen thousand parcels are next door, or almost next door to warehouses. In San Bernardino and Los Angeles Counties, 0.5 percent of all residential parcels are located within 300 feet of large warehouses, while Riverside County has 0.4 percent and Orange County 0.2 percent are within 300 feet, as shown in *Figure 50*.

Figure 49: Number of Housing Parcels Near Large Warehouses

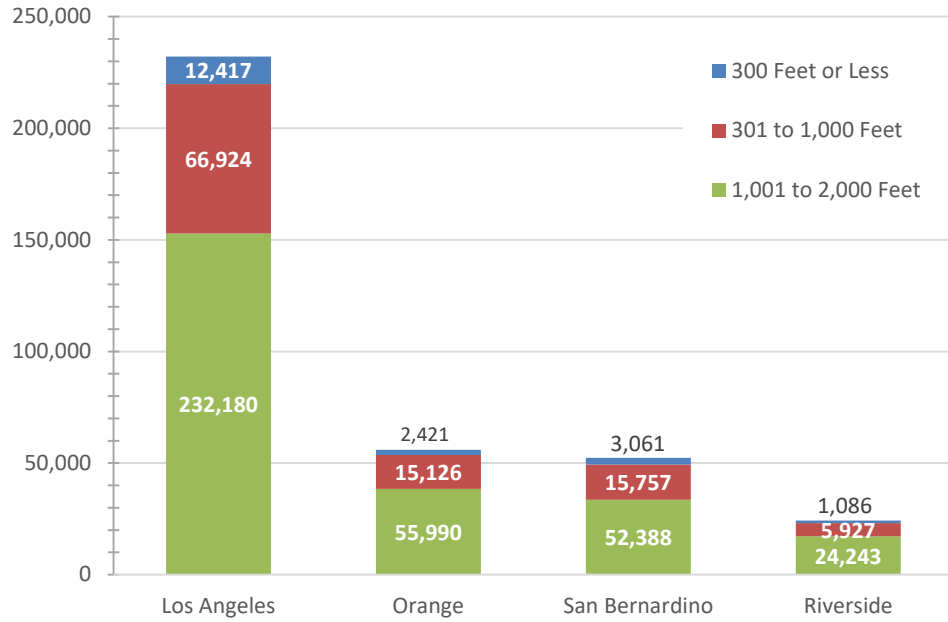
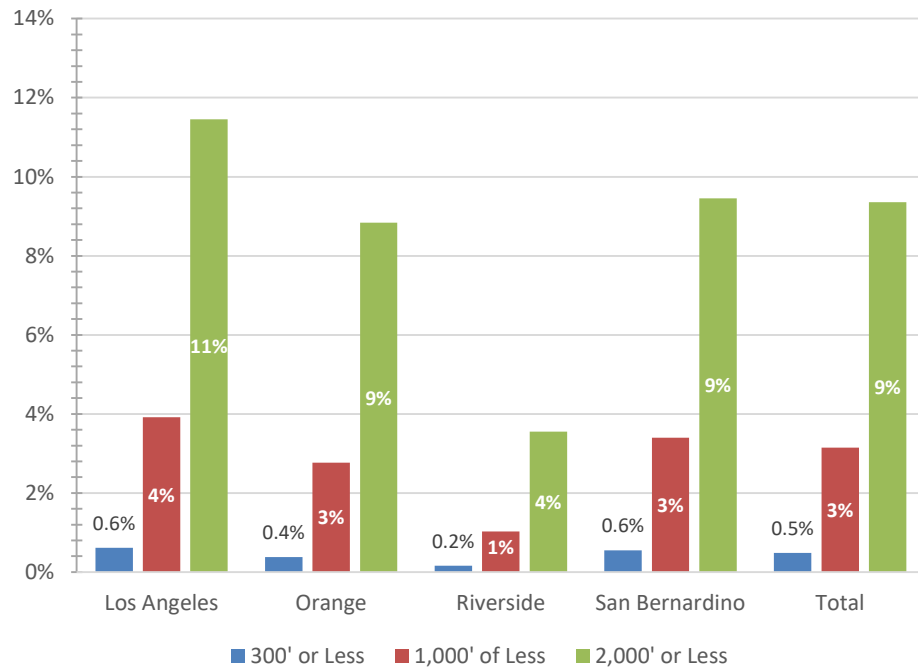
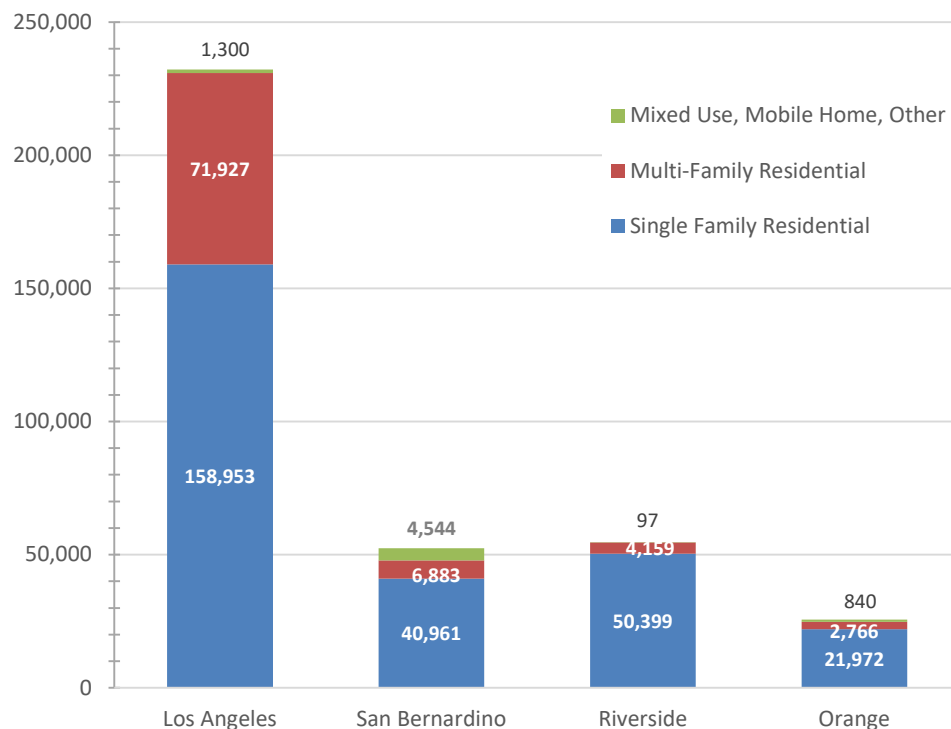


Figure 50: Cumulative Percent of Housing Parcels Near Large Warehouses



Sources: Economic Roundtable GIS analysis; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C; Southern California Association of Governments (SCAG) Regional Data Platform and Parcel Locator; U.S. Census Bureau. 2019. TIGER/Line Shapefiles; and other sources.

Figure 51: Types of Housing Units within 2,000 Feet of Large Warehouses



Sources: Economic Roundtable GIS analysis; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C; Southern California Association of Governments (SCAG) Regional Data Platform and Parcel Locator; U.S. Census Bureau. 2019. TIGER/Line Shapefiles; and other sources.

Single family homes are the type of residential unit that is most often close to a large warehouse, as shown in *Figure 51*. Apartment buildings are near warehouses almost as often as single family homes in Los Angeles County, but not in the other three counties. Mobile home parks are more frequent neighbors of warehouses in Riverside County.

Across the four-county region, 75 percent of properties within 2,000 feet large warehouses are single family homes, another 23 percent are multi-family properties, and two percent are mobile home parks, with a smattering of other types of dwellings.

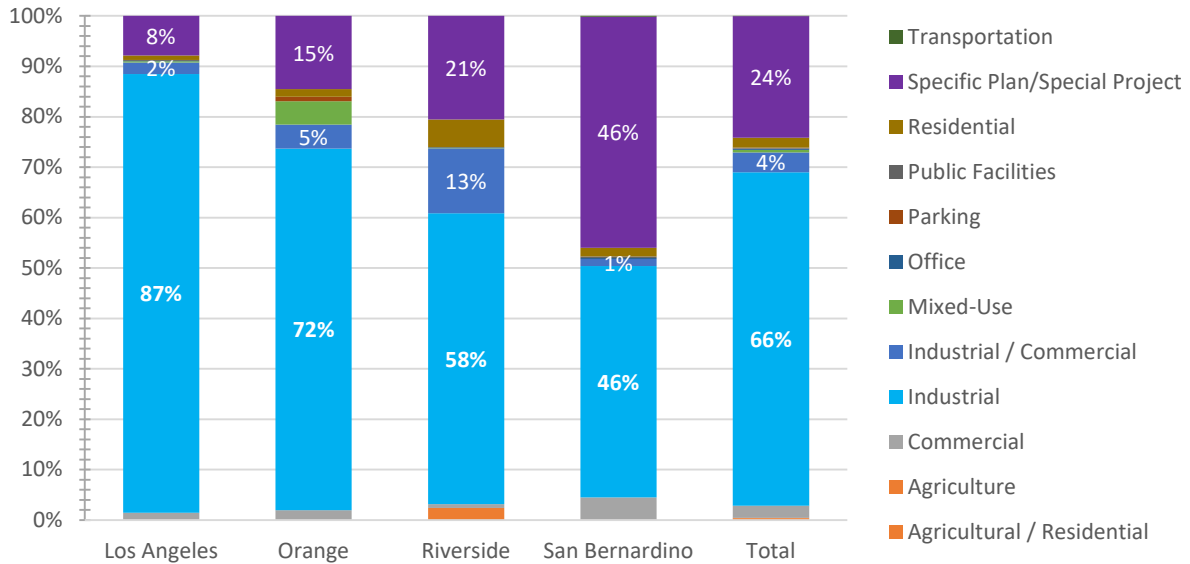
Zoning for Warehouses

Large warehouses in Southern California are predominately zoned as *industrial*, *industrial / commercial* or *specific plan/project* as shown in *Figure 52*.

In Riverside County, six percent of large warehouses are zoned residential and two percent agricultural, indicating that zoning changes after land uses materialize, rather than providing a framework for authorizing land uses.

Large warehouses are often constructed on land that was previously zoned for housing or agriculture, especially in Inland Empire communities.

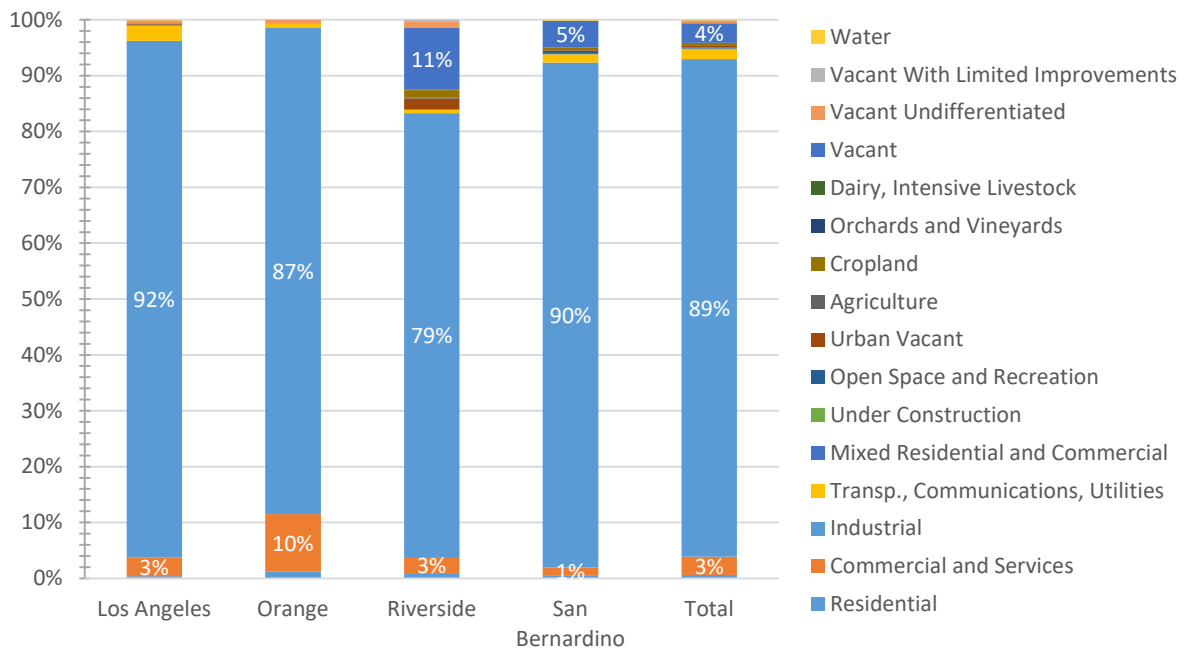
Figure 52: Municipal Zoning of Existing Large Warehouses, by Square Footage



Sources: Economic Roundtable GIS analysis; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C; Southern California Association of Governments (SCAG) Regional Data Platform and Parcel Locator.

Although the most common land use designation for large warehouses is *industrial*, some warehouse parcels are classified as *vacant* or *commercial and services*, as shown in Figure 53. A small number of warehouses in each county are on parcels classified as *transportation, communications and utilities* uses.

Figure 53: County Land Use Classifications of Large Warehouses, by Square Footage



Sources: Economic Roundtable GIS analysis; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C; Southern California Association of Governments (SCAG) Regional Data Platform and Parcel Locator.

Residents Living Near Large Warehouse

Within the housing units just described, there are almost 110,000 people living on residential blocks within 300 feet of large warehouses across the four counties, just over 730,000 living within 1,000 feet, and over 2.1 million residents within 2,000 feet, as shown in *Table 8*.⁵¹

Table 8 Population Living Near Large Warehouses

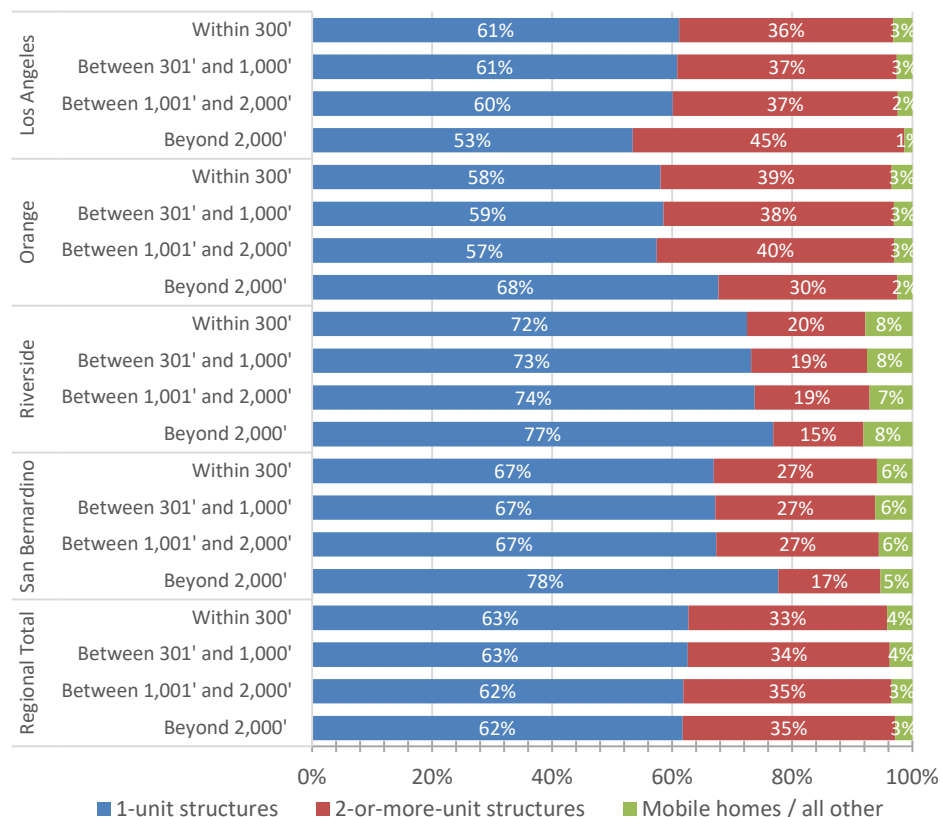
County	Population County Total	Population Within 300'	Population Within 1,000'	Population Within 2,000'
Los Angeles	10,013,759	69,453	471,277	1,375,776
Orange	3,186,941	15,994	114,826	351,509
Riverside	2,418,119	6,974	46,219	142,014
San Bernardino	2,181,580	17,520	97,903	266,630
Region Total	17,800,399	109,941	730,226	2,135,930

Source: Economic Roundtable analysis; U.S. Census Bureau, 2020 Census National Redistricting Data (P.L. 94-171) Summary File, Table P1. Released 2021; U.S. Census Bureau, TIGER/Line Shapefiles. Block-level decennial data.

Housing Characteristics

It is more common for apartment buildings to be near warehouses in Los Angeles and Orange Counties than in the Inland Empire, where single-family homes and mobile homes are more common, as shown in *Figure 54*.

Figure 54: Number of Households by Type of Building and Proximity to Warehouses



Source: Economic Roundtable analysis; U.S. Census Bureau, 2021 American Community Survey 5-Year, Tables: B11011

Household Structure

Family households⁵² are more common close to large warehouses than in household located more than 2,000 feet from a large warehouse. This is particularly true in Los Angeles and Riverside Counties, as shown in *Figure 55*.

Across the region, family households make up 74 percent of those living within 2,000 feet of warehouses, and 67 percent beyond 2,000 feet.

Figure 55: Percent of Households with Families, by Proximity to Large Warehouses

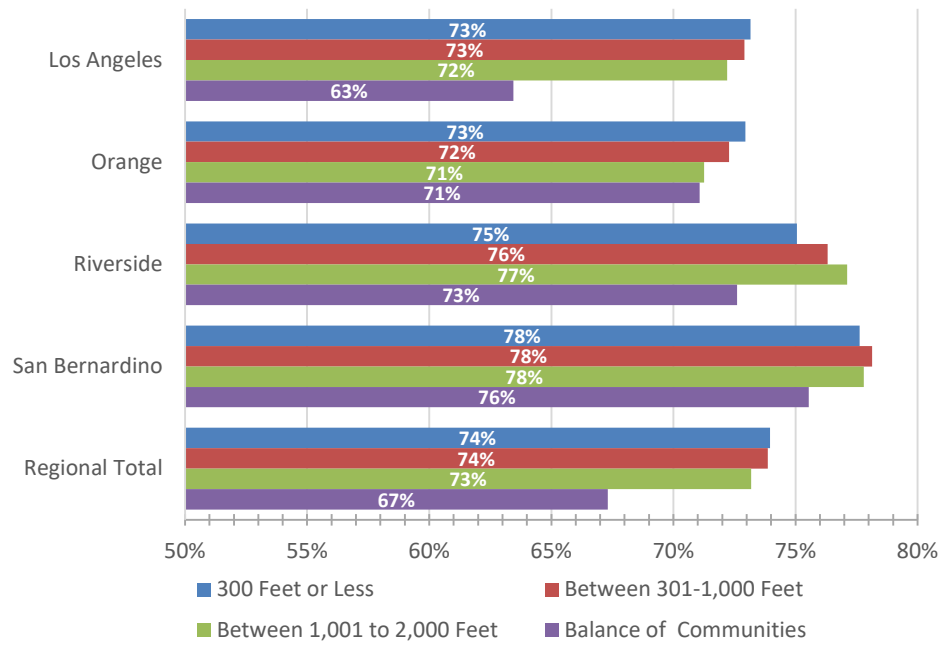
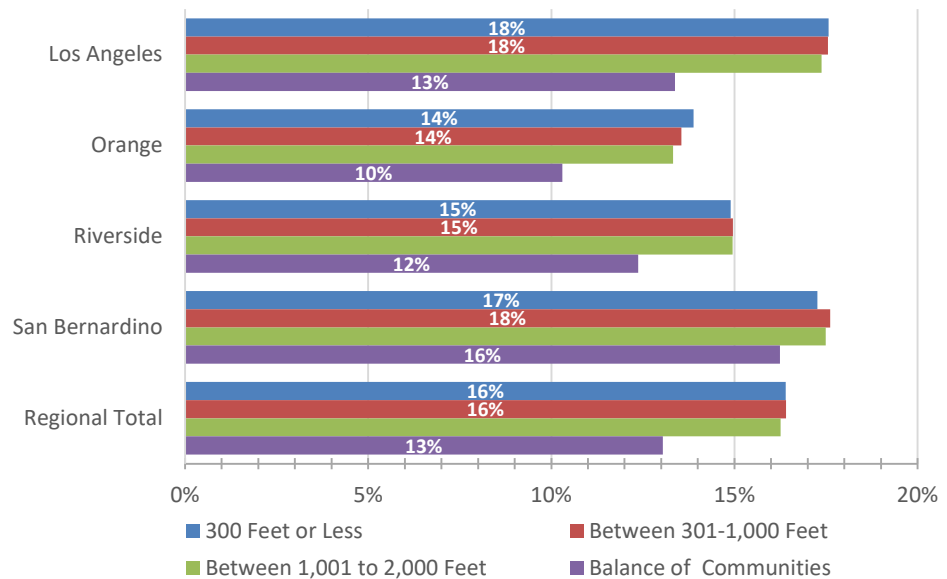


Figure 56: Percent of Female-Headed Households, by Proximity to Large Warehouses



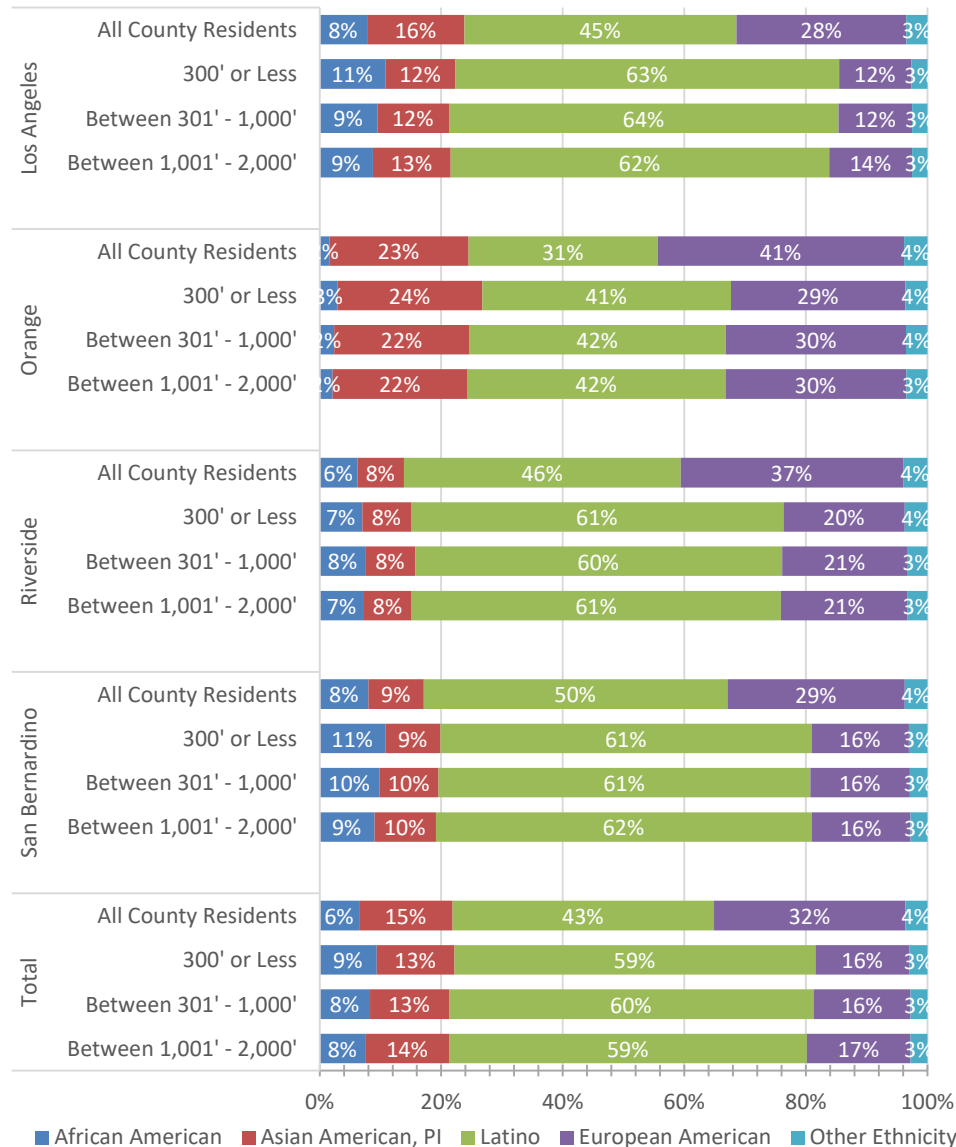
Source: Economic Roundtable analysis; U.S. Census Bureau, 2021 American Community Survey 5-Year, Detailed Tables: B11011 Household Type by Units in Structure. Released December 2022. Census Tracts.

Female-headed families⁵³ are also more common closer to large warehouses than outside the 2,000-foot perimeter, as shown in *Figure 56*. Households headed by women make up 16 percent of households within 2,000 feet of large warehouses, compared 13 percent of households outside of the 2,000-foot perimeter.⁵⁴ This reflects the reality that households headed by women often have low incomes and fewer housing choices.

Ethnicity

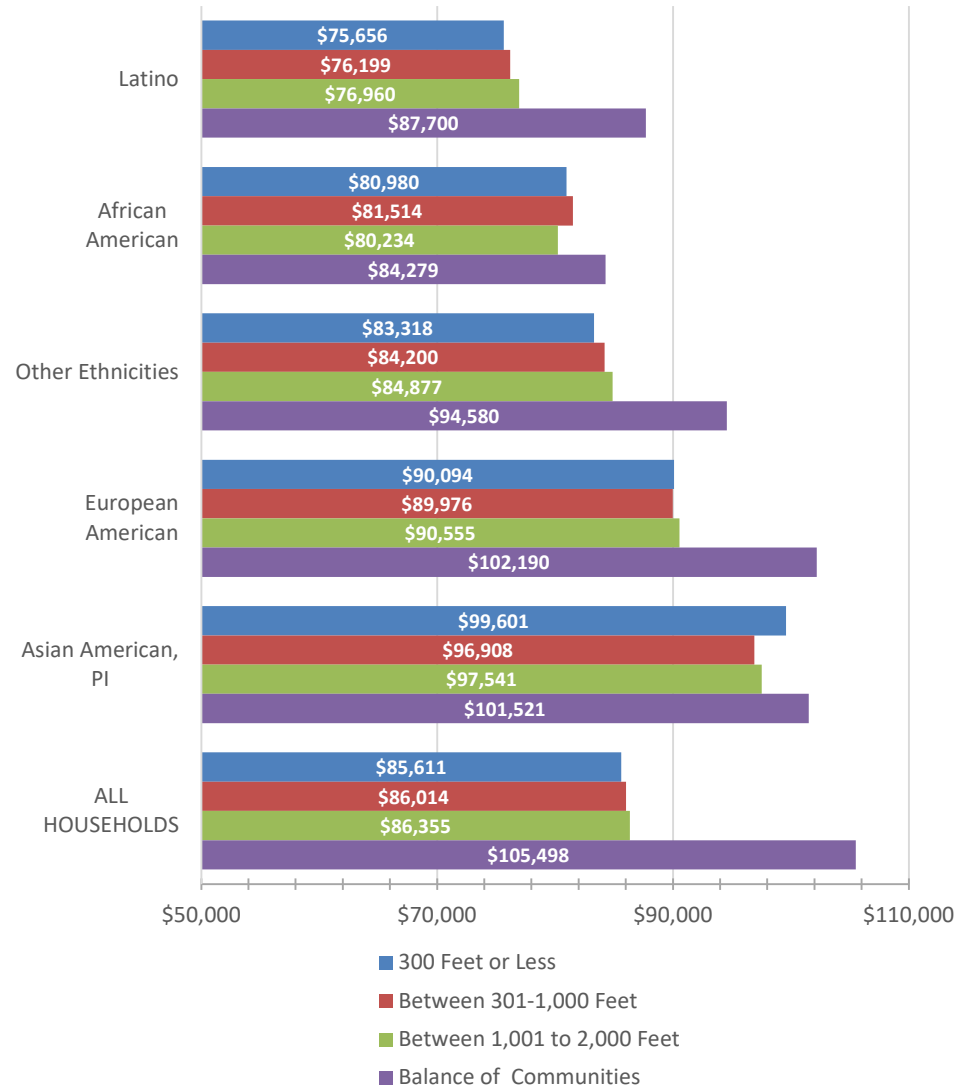
People living near large warehouses are more likely to be Latino and less likely to be European American than in the rest of the four-county region, as shown in *Figure 57*.

Figure 57: Race/Ethnicity by Proximity to Large Warehouses, by County



Source: Economic Roundtable analysis; U.S. Census Bureau, 2020 Census National Redistricting Data (P.L. 94-171 block-level) Summary File, Table P4 (Age 18+). Released 2021; U.S. Census Bureau, TIGER/Line Shapefiles.

Figure 58: Median Income of Households Near Warehouses, by Ethnicity



Source: Economic Roundtable analysis; U.S. Census Bureau, 2021 American Community Survey 5-Year, Detailed Tables: S1903 Median Income Past 12 Months (In 2021 Inflation-Adjusted Dollars) Released December 2022. Census Tracts.

Latinos make up 59 percent of residents living within 2,000 feet of a warehouse, but only 43 percent of the total population in the four-county region. This reflects economic inequity in the four-county region and the unfair reality that many Latino workers are paid wages that are insufficient to pay for rent in neighborhoods that are not impacted by trucking and warehouses.

Median Income

Incomes are lower and poverty rates are higher among people living near warehouses. Median annual household incomes⁵⁵ within 2,000 feet of large warehouses are \$86,000, compared to \$105,000 in the balance of the 4-county region, as shown in *Figure 58*.

Incomes vary based on ethnicity among households with homes near warehouses. Incomes are lowest for *Latinos*, who make up a majority of households near warehouses and have median incomes of \$76,000.

African American households near warehouses are next lowest, with median annual incomes of \$80,000.

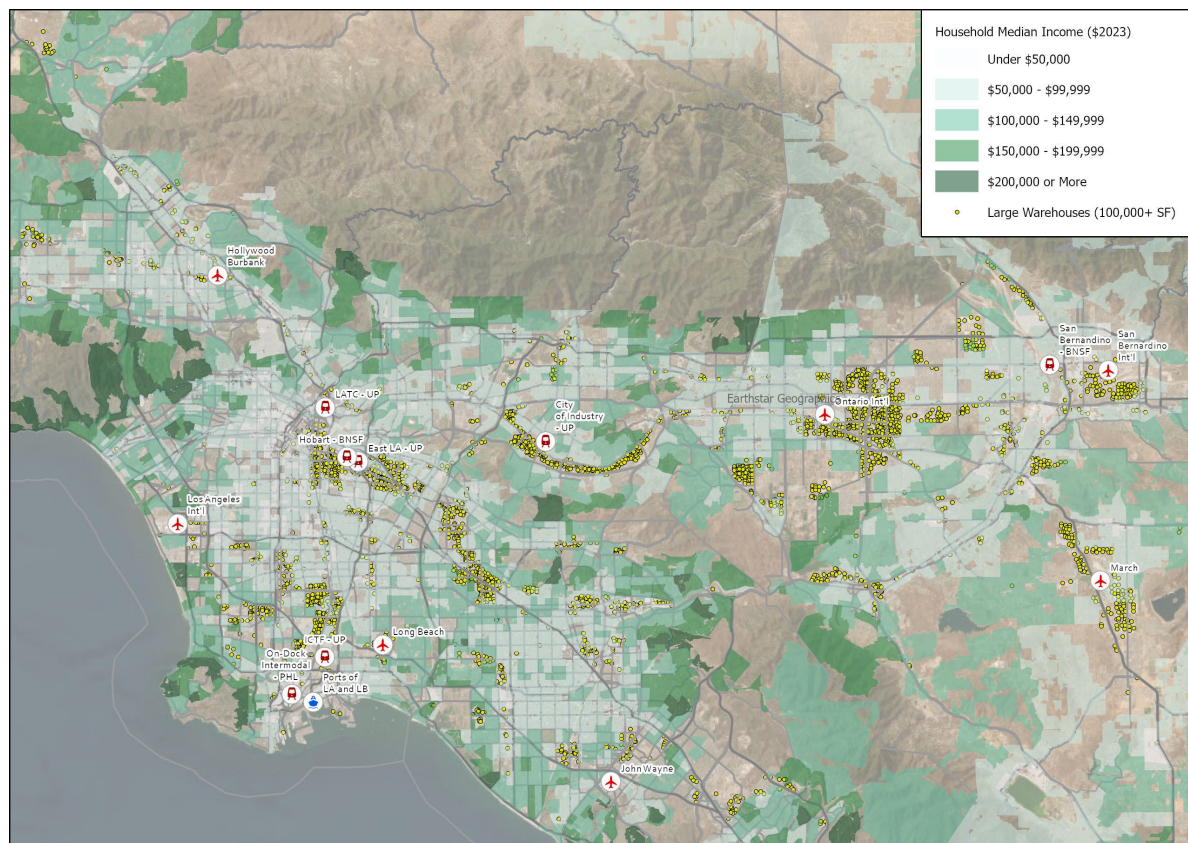
Households near warehouses that are grouped under “*other ethnicities*,” who are primarily individuals identifying with two or more ethnicities, have median annual incomes of \$84,000.

European American household near warehouses have the second highest median income, \$90,000 a year.

Asian American and Pacific Islander households living near warehouses have the highest median income, \$97,000 a year.

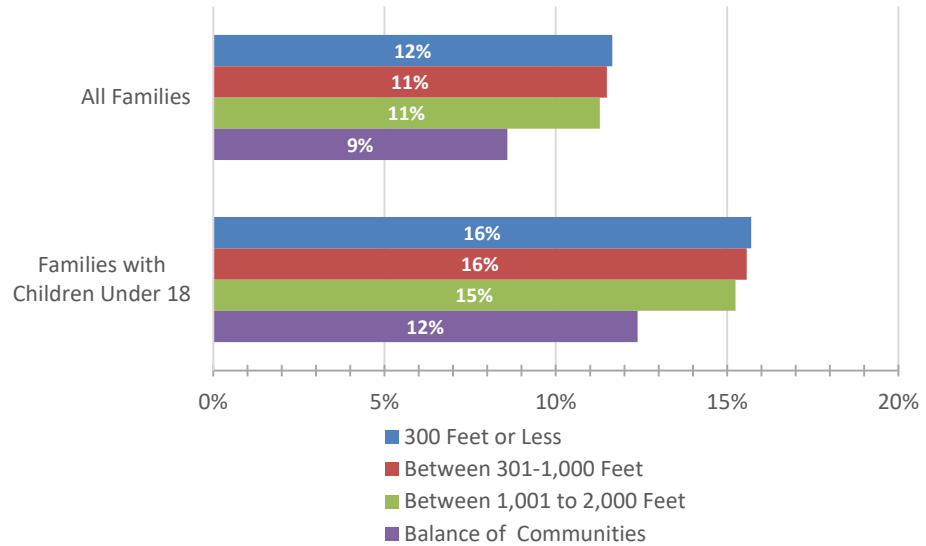
Across all four counties, neighborhoods closest to large warehouses have lower median incomes, as can be seen in the map in *Figure 59*. Factors that diminish the desirability of these neighborhoods, and therefore the cost of housing, include freeways, heavy traffic, seaports, rail intermodal facilities, cargo airports, truck depots, and warehouses.

Figure 59: Median Income of Households, with Proximity to Large Warehouses



Source: Economic Roundtable analysis; U.S. Census Bureau, 2021 American Community Survey 5-Year, Detailed Tables: S1903 Median Income Past 12 Months (In 2021 Inflation-Adjusted Dollars) Released December 2022. Census Tracts.

Figure 60: Families Below the Poverty Threshold, by Proximity to Large Warehouses



Source: Economic Roundtable analysis; U.S. Census Bureau, 2021 American Community Survey 5-Year, Detailed Tables: S1702 Poverty Status Past 12 Months of Families. Released December 2022. Census Tracts.

Examples of neighborhoods near warehouse clusters where incomes are low include the East Highlands, Northwest Redlands, North Norton and Riverview neighborhoods surrounding the San Bernardino International Airport. Other examples include the Ontario and Upland neighborhoods northwest of Ontario International Airport; the Los Angeles East Yard, Vermont Square, South Park, Huntington Park and Maywood; the South Los Angeles communities of Compton, Carson, Willowbrook, West Athens, and Rancho Dominguez.

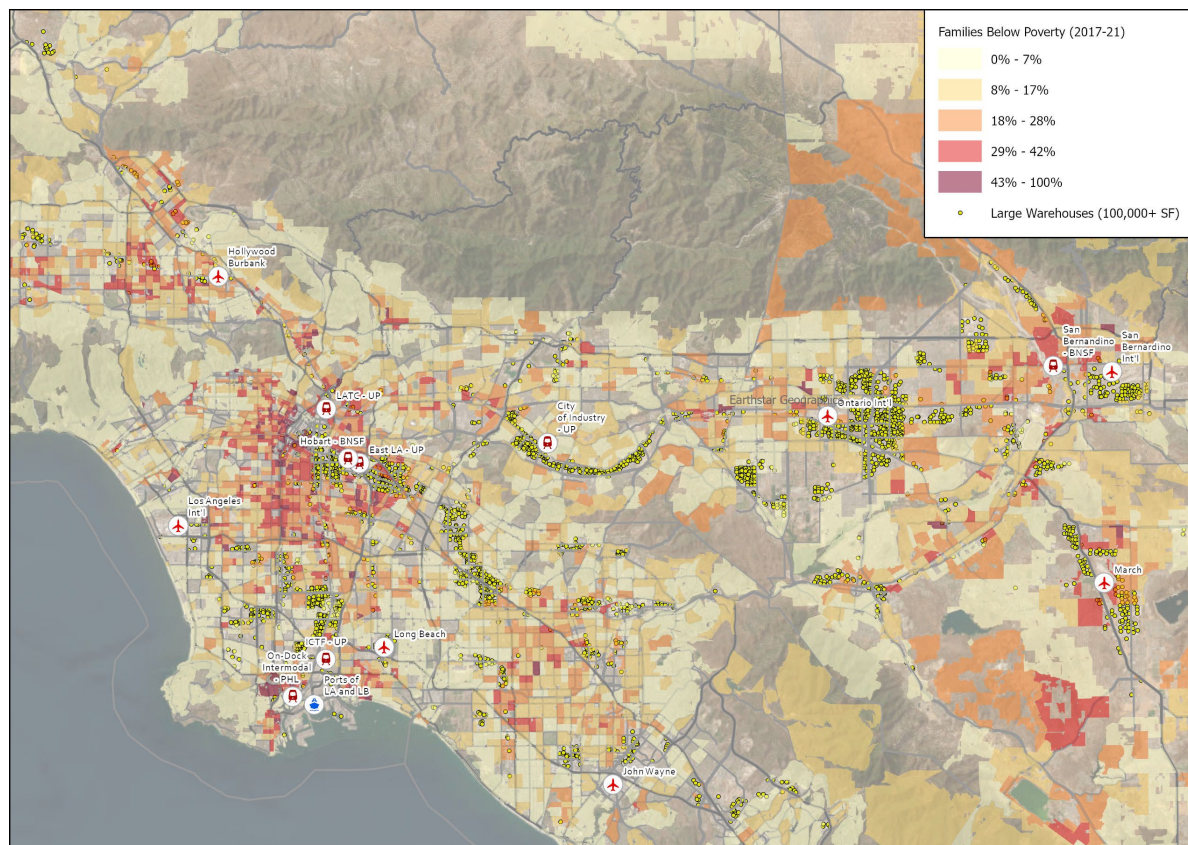
Families in Poverty

The *median income* of households in an area is one measure of socioeconomic wellbeing, but it reports the income of just the “middle” household in that area. The percent of families living below the annually-adjusted *poverty threshold* reveals the degree of acute economic distress in a community.⁵⁶ Eleven percent of families living close to large warehouses are living in poverty compared to nine percent of families in the entire four-county region, as shown in *Figure 60*.

The poverty rate for families living near warehouses who have children under 18 years of age is even higher – 16 percent. In comparison, families with children in the balance of the region have a poverty rate of 12 percent.

The poverty rate among families is mapped in *Figure 61*. Neighborhoods in *Riverside County* that are near large warehouses and have high family poverty rates include the Home Gardens, Eastside (City of Riverside), and Mead Valley.

Figure 61: Families Below the Poverty Threshold, with Proximity to Large Warehouses



Source: Economic Roundtable analysis; U.S. Census Bureau, 2021 American Community Survey 5-Year, Detailed Tables: S1903 Median Income Past 12 Months (In 2021 Inflation-Adjusted Dollars) Released December 2022. Census Tracts.

San Bernardino County neighborhoods that are near warehouses and have high family poverty rates include Perris Hills, Delman / Mt. Vernon, and eastern Upland.

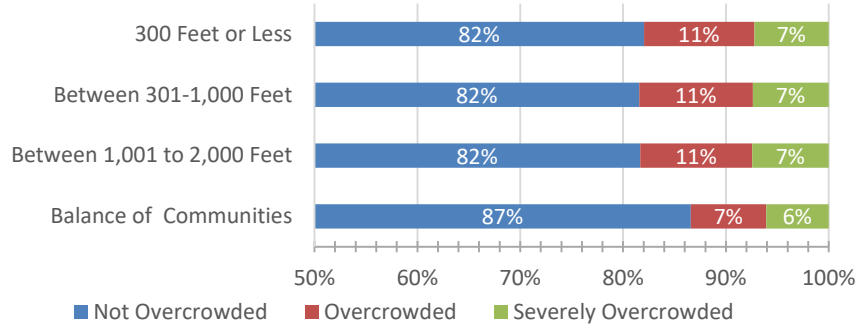
Orange County neighborhoods that are near warehouses and have high family poverty rates include Rustic Lane, Midway City (City of Westminster) and Pico-Lowell / Wilshire Square (City of Santa Ana).

Families living near large warehouses have an elevated risk of poverty throughout the four-county region. In addition to economic distress, these families have long-term exposure to air pollution, as well as traffic noise and congestion that make it difficult to get the peace and quiet needed for a healthy life.

Housing Conditions

Living in overcrowded housing is detrimental to human wellbeing.⁵⁷ Overcrowding is the result of economic desperation. Families cannot afford to rent an apartment that meets minimum standards of space and privacy

Figure 62: Rental Household Overcrowding, by Proximity to Large Warehouses



Source: Economic Roundtable analysis; U.S. Census Bureau, 2021 American Community Survey 5-Year, Detailed Tables: B25014 Tenure by Occupants per Room. Released December 2022. Universe: Occupied Housing Units. Census Tracts.

for household members, so they rent a smaller unit where more than one person is crowded into each room in order to reduce their rent.⁵⁸

Renter households situated closest to Southern California’s large warehouses have a higher percentage of residents living in overcrowded housing – 18 percent, compared to 13 percent in the balance of the four-county region, as shown in *Figure 62*.



Photo credit:
Economic
Roundtable



Community Profile: Cynthia Ayala, Amazon Air Worker, San Bernardino Airport

Cynthia Ayala is an Amazon Air worker at the San Bernardino Airport and has been living in the Inland Empire for the past two and a half years. Cynthia has experienced logistics directly as a worker at the Amazon Air in San Bernardino, as an organizer with her peers, and as a resident of two cities that are huge warehouse hubs: Moreno Valley and Fontana.

For Cynthia, warehouse was a word she knew early on, as her Dad was a warehouse manager for an online clothing store in Commerce, California. Yet her experience working in logistics and her father's are completely different. The warehouse her father worked in was not the 100 million square feet hubs we see in the Inland Empire but a smaller scale online store.

Cynthia started working at the Amazon Air Hub over two years ago. She had no idea that she would be dealing with jet fuel impacts daily, as she

now works directly with airplanes. She is outside all day. Whether it is raining or more than 100 degrees, she is loading and unloading, dealing with migraines, back pain, and brain fog coming from direct exposure to the jet fuel.

Workers like Cynthia argue that the effects of jet fuel have to be studied more carefully. She has noticed symptoms of brain fog and migraines beginning and increasing during with her time at Amazon.

Many workers are punished for making mistakes with machinery they were not trained on but just assumed to know how to handle. Some have been fired instead of being provided with correct training.

A management culture of negligence and favoritism is part of the safety problem. Older workers, for example, cannot get reasonable accommodation for handling heavy items or machinery unless they have a medical note. This is unjust because many Amazon workers do not have access to health insurance or medical doctors.

Cynthia has seen warehouses impact people in their neighborhoods as well as at work. Cynthia met a family whose home was displaced so that a warehouse could be built. Only one home in that neighborhood was saved.

Warehouses create infrastructure issues from potholes to congestion of traffic. She and many others must take surface streets to get home because the freeways are too congested.

Cynthia says she can feel a drastic difference in her health and breathing when she visits the coast compared to the constant air quality issues in the Inland Empire. She urges elected officials to get involved in preventing pollution from getting worse, and trying to reverse the decline.

Cynthia knows there are ways to alleviate the harmful impacts of warehouses. She mentions zero-emissions trucks, eliminating Amazon Air and warehouses from the area, creating more parks and green areas, and building warehouses in Beverly Hills or areas most dependent on Amazon.

She says there should be bypass routes that keep heavy-duty trucks away from people's homes. And they need to stop building warehouses in the Inland Empire. Enough is enough. Warehouses need to focus on lowering air pollution and being good neighbors. This means lowering the noise volume at the facilities. Logistic hubs need to pay livable wages so workers can afford health care.



7. Respiratory Distress

*Looking at Riverside from
Mount Rubidoux*
Photo credit:
[John Ko](#) on [Upsplash](#)

Overview

Criteria Emissions

The direct pollutants from diesel truck trips to and from large warehouses, as well as the indirect pollutants attributable to the electricity and natural gas these buildings consume onsite, affect public health. Residents of the four-county region have elevated rates of respiratory disease.

Large swaths of the Inland Empire are in the highest quintile of the pollution burden index, meaning they have the highest exposure to criteria air pollutants, including ground level ozone, carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, and different varieties of particulate matter.

Diesel trucks driving to and from large warehouses release criteria emissions each mile, including elemental carbon, which is the primary component of PM 2.5 fine particulates. These pollutants are unhealthy even when low levels are in the air.

High Pollution Burden

Many single- and multi-family homes near the large warehouse cluster abutting *Ontario International Airport* experience the highest concentrations of elemental carbon in their air, extending far beyond just the residential blocks adjacent and across the street.

Similarly, people living near *San Bernardino International Airport*, and the adjacent cluster of large warehouses, are exposed to the highest levels of elemental carbon concentrations.

Residents near the cluster of large warehouses growing around *March Air Reserve Base* in Riverside, and extending up to the junction of the US 215 and CA 60 freeways, are breathing air with moderate or higher levels of elemental carbon.

As developers continue building large warehouses across the Inland Empire, the associated diesel truck trip emissions will add further pollutants to the already unhealthy air.

Asthma Attacks

The rate of emergency department visits for asthma attacks reflects the location of manufacturing and logistics land uses. South Los Angeles, City of Industry, Ontario and San Bernardino have elevated rates of emergency department visits as well as the largest concentrations of logistics activity.

Health Conditions Requiring In-Patient Hospitalization

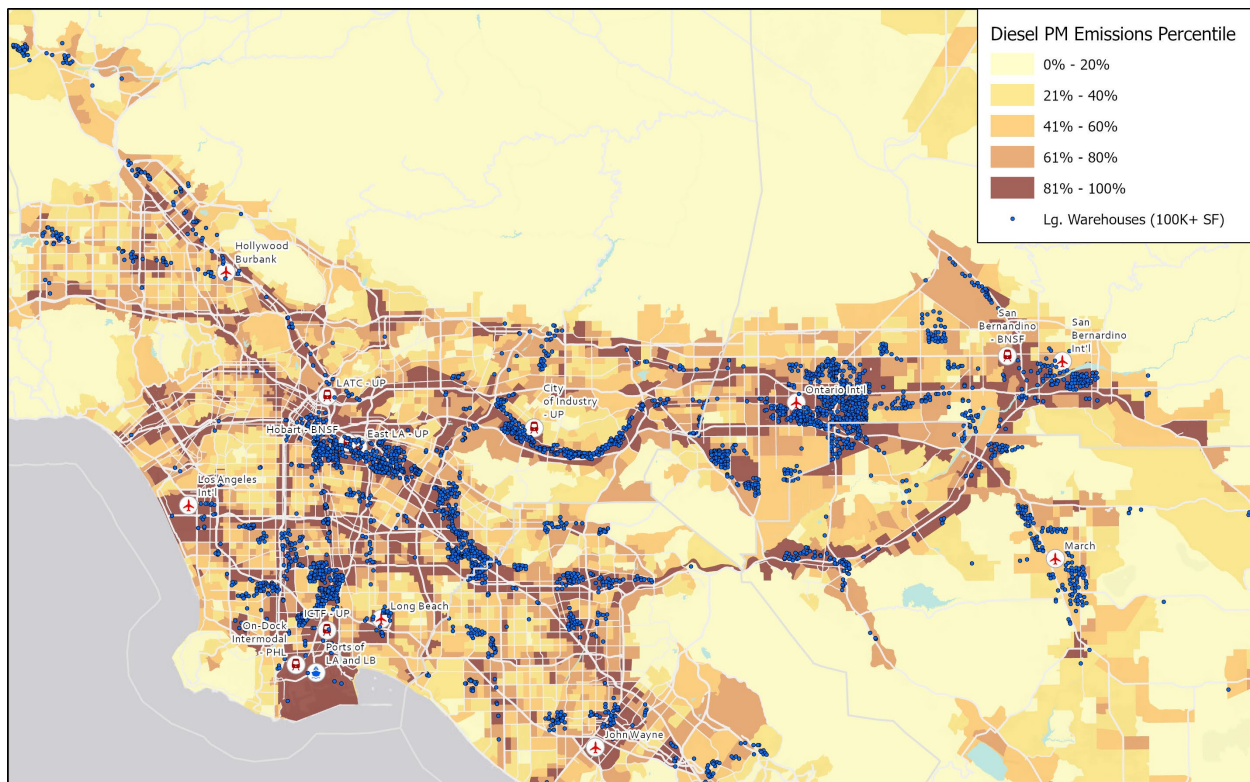
The direct pollutants from diesel truck trips to and from large warehouses, as well as the indirect pollutants attributable to the electricity and natural gas these buildings consume onsite, affect public health. Residents of the region reflect this in their rates of respiratory disease.⁵⁹ Pollution together with socioeconomic factors such as limited income and overcrowded housing make frontline families living near warehouses vulnerable to health risks from pollution caused by warehouses.

Diesel Particulate Matter (PM) Emissions

Freight trucks are an important source of diesel particulate matter. Diesel particulate matter is most concentrated near hubs of trucking activity, as shown in *Figure 63*. This includes the San Pedro Bay Ports, airports, rail yards and warehouses.

The transformation of the Inland Empire from small communities dominated by agriculture into a warehouse logistics hub for goods consumed by residents of Southern California and beyond is particularly notable. Few neighborhoods in the Inland Empire are untouched by diesel

Figure 63: Diesel Particulate Matter and Large Warehouses



Source: Economic Roundtable analysis; California Office of Environmental Health Hazard Assessment (OEHHA), CalEnviroScreen 4.0: Diesel PM. Released: November 2021; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C and other sources. Note: Includes diesel particulate matter (PM) from on-road and non-road sources. <https://oehha.ca.gov/calenviroscreen>. Percentile ranking is for the State of California.

particulate matter. Residents' and workers' continued exposure to this pollutant has numerous adverse health effects including irritation to the eyes, throat and nose, cardiovascular and pulmonary disease, and lung cancer.⁶⁰

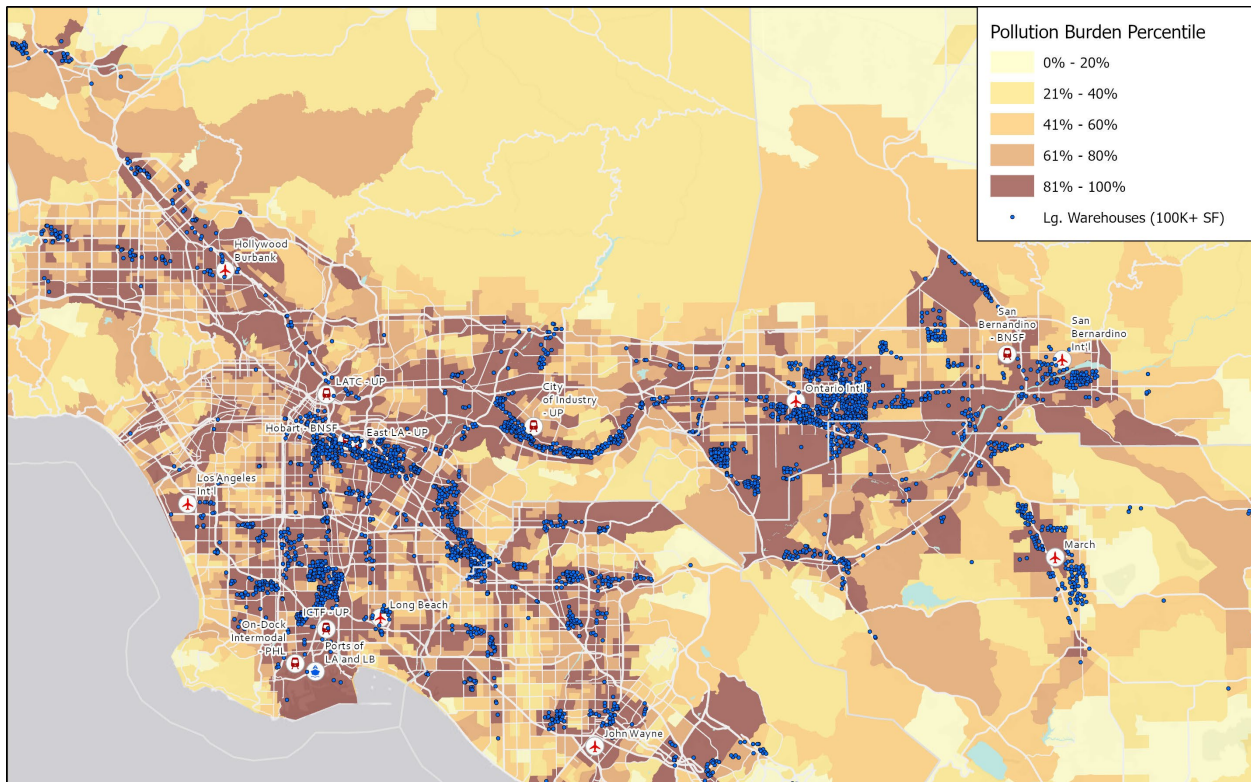
Uneven Pollution Burden

Diesel particulate matter combines with other pollutants to create a cumulative impact on residents and workers that is more harmful than any single component. A pollution burden index showing the combined harmful exposures to toxic chemicals and the environmental effects of pollution in each community in the four-county region is shown in *Figure 64*.⁶¹

Large swaths of the Inland Empire are in the highest quintile of the pollution burden index, meaning they have the highest exposure to criteria air pollutants, including ground level ozone, carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, and different varieties of particulate matter.

While it is expected that large warehouses are built on land zoned for industrial uses such as factories and utility facilities, the enormous size of

Figure 64: Pollution Burden and Large Warehouses



Source: Economic Roundtable analysis; California Office of Environmental Health Hazard Assessment (OEHHA), CalEnviroScreen 4.0: Pollution Burden. Released: November 2021; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C and other sources. Note: Includes diesel particulate matter (PM) from on-road and non-road sources. <https://oehha.ca.gov/calenviroscreen>. Percentile ranking is for the state of California.

large warehouses increases the pollution burden for nearby communities, where homes, schools, parks, churches and shopping centers are sometimes immediately next to warehouses.

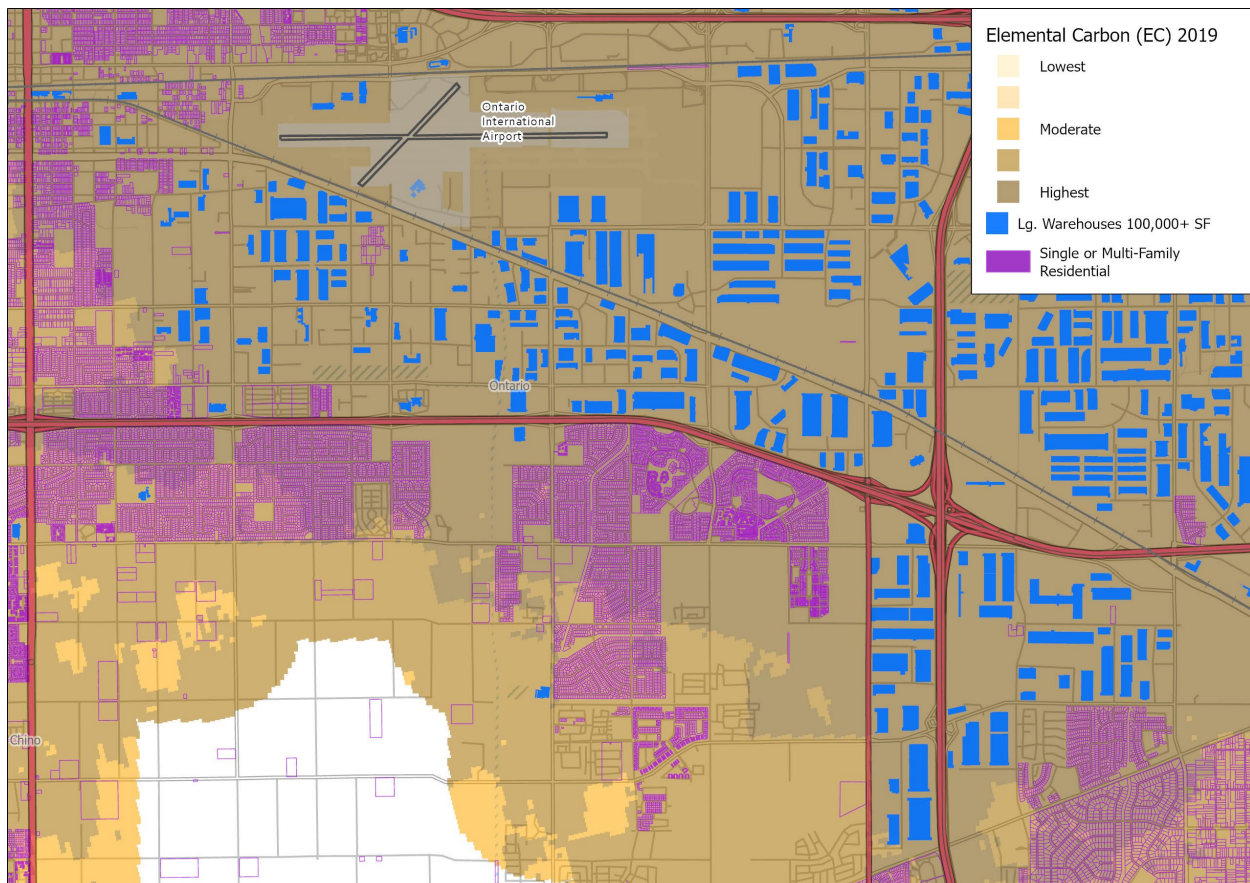
PM 2.5 Spillover into Surrounding Neighborhoods

Poor air quality from industrial land uses has a spillover effect into surrounding neighborhoods, beyond what was previously known. Diesel trucks driving to and from large warehouses release criteria emissions each mile, including fine particulates (PM 2.5), which are unhealthy even when the level in the air is low.

The predicted extent of elemental carbon, a principal component of PM 2.5 and mainly emitted from truck traffic, at 50-meter resolution is shown for different communities in *Figures 65, 66, and 67*.⁶²

Many single- and multi-family homes near the large warehouse cluster abutting *Ontario International Airport* experience the highest concentrations

Figure 65: Elemental Carbon Concentrations around Ontario Warehouse Cluster



Source: Economic Roundtable analysis; Amini, H. et al. 2023. Annual Mean PM2.5 Components (EC, NH4, NO3, OC, SO4) 50m Urban and 1km Non-Urban Area Grids for Contiguous U.S., 2000-2019 v1. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC). <https://doi.org/10.7927/7wj3-en73>. Accessed March 7, 2023.; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, Appendix C and other sources.

of elemental carbon in their air, extending far beyond just the adjacent residential blocks, as shown in *Figure 65*.

Figure 66: Elemental Carbon Concentrations around San Bernardino Airport Warehouse Cluster

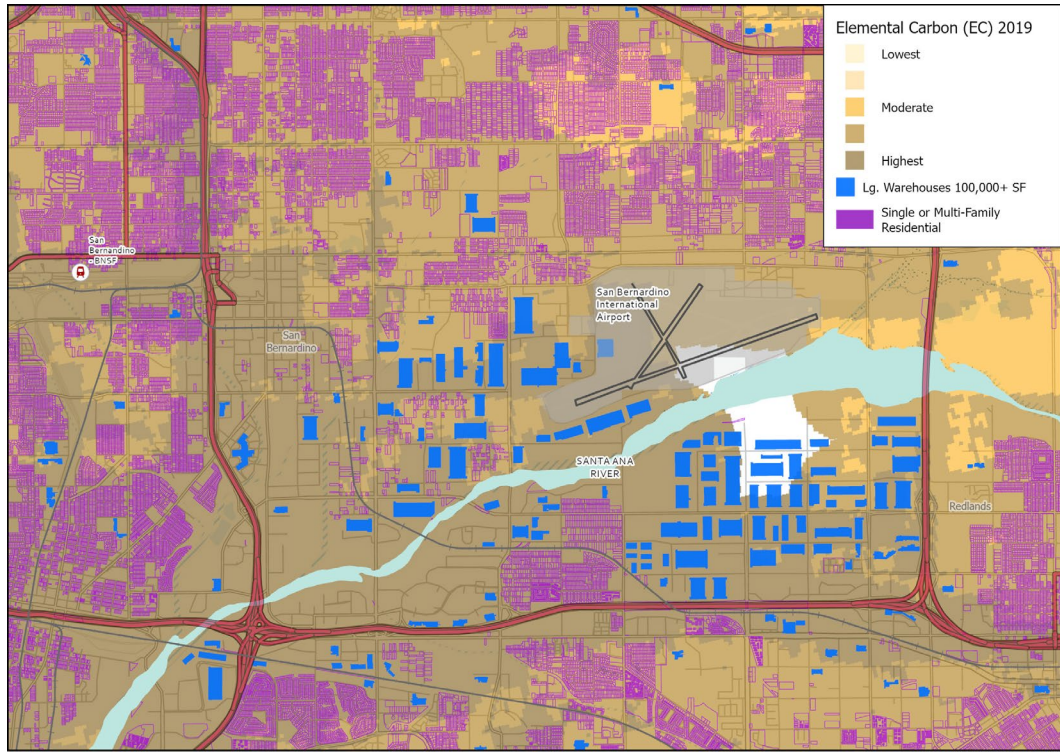
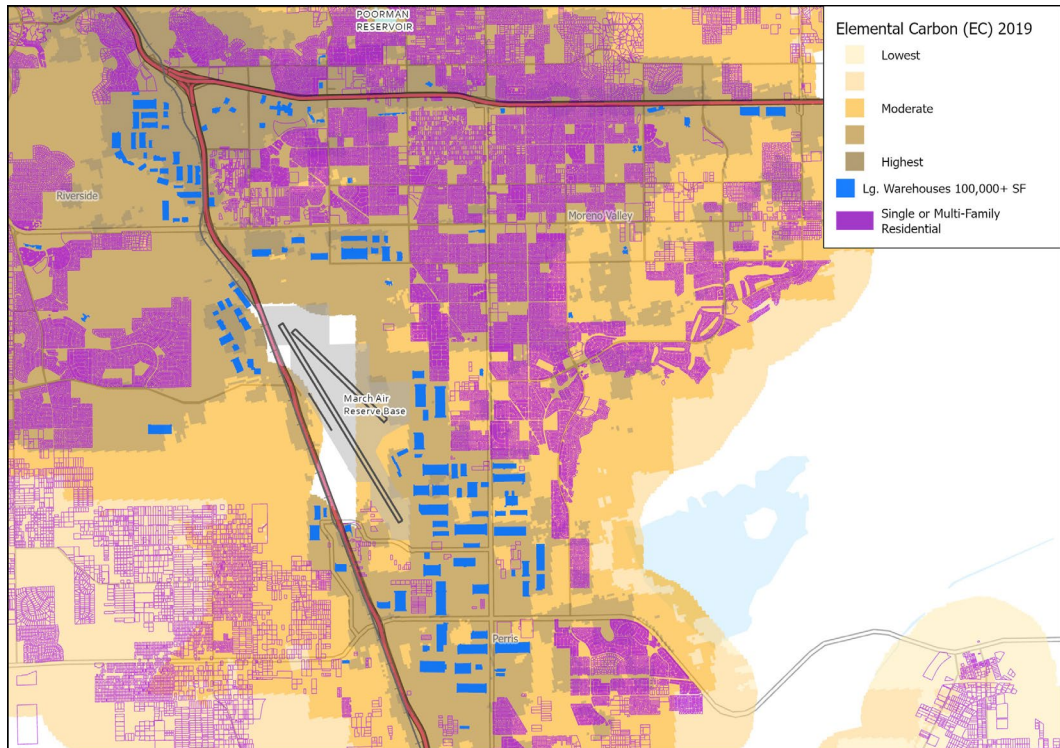


Figure 67: Elemental Carbon Concentrations around March ARB Warehouse Cluster



Source: Amini, H. et al. 2023. Annual Mean PM_{2.5} Components (EC, NH₄, NO₃, OC, SO₄) 50m Urban and 1km Non-Urban Area Grids for Contiguous U.S., 2000-2019 v1. Palisades, New York: NASA Socioeconomic Data and Applications Center.

When residents breathe in unhealthy levels of PM 2.5 components daily over many years, it can increase their risk of heart disease, asthma, and low birth weight, among other health problems. People living near *San Bernardino International Airport*, and the adjacent cluster of large warehouses, are exposed to the highest levels of elemental carbon concentrations, as shown in *Figure 66*.

Residents near the cluster of large warehouses growing around *March Air Reserve Base* in Riverside, and extending up to the junction of the US 215 and CA 60 freeways, are breathing air with moderate or higher levels of elemental carbon, as shown in *Figure 67*.

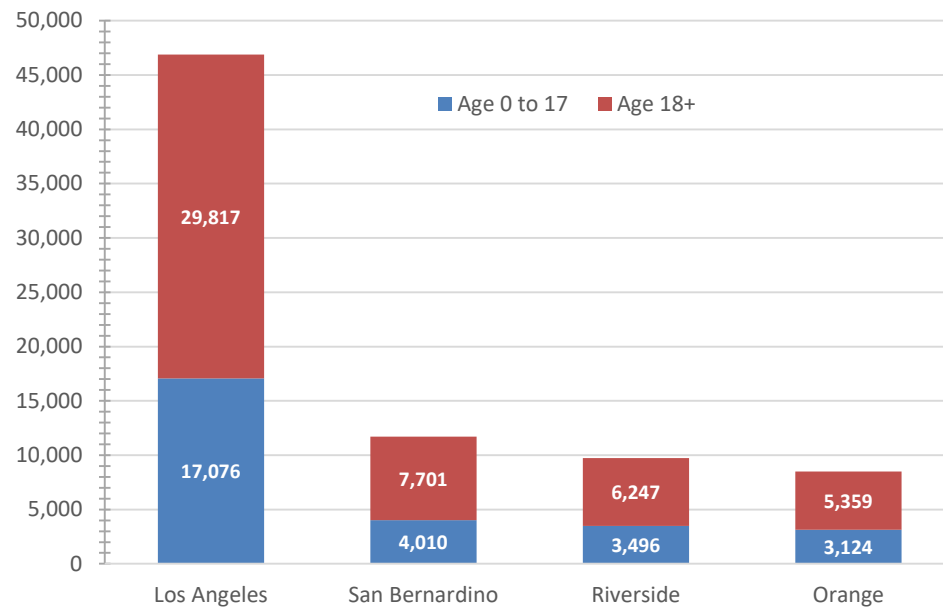
As developers continue building large warehouses across the Inland Empire, the associated diesel truck trip emissions will add further pollutants to the already unhealthy air.

Chronic Respiratory Disease Exacerbated by Air Pollution

In addition to air pollution directly causing *new* health problems among nearby residents, those with *existing* chronic obstructive pulmonary disease (COPD) – a family of diseases that cause breathing-related problems and blockages, such as asthma, emphysema and chronic bronchitis – are also negatively affected.⁶³

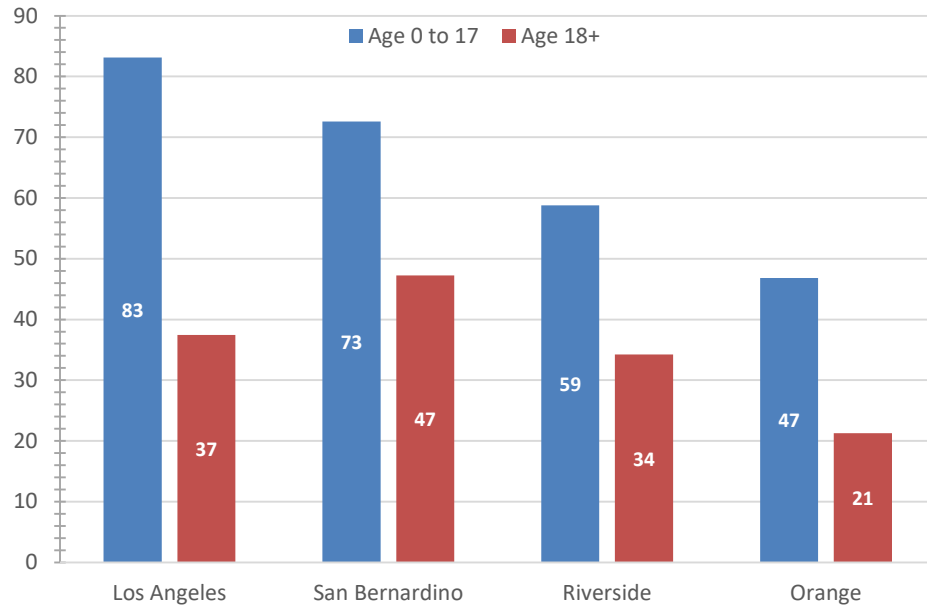
People with asthma are generally considered to be sensitive to the effects of air pollution. Across California, just under 2.7 million adults currently have

Figure 68: Number of Asthma Emergency Department Visits by County



Source: Economic Roundtable analysis; California Department of Public Health. 2022. Asthma Emergency Department Visit Rates, 2019. <https://data.ca.gov/dataset/asthma-emergency-department-visit-rates>

Figure 69: Asthma Emergency Department Visits per 10,000 Residents, 2019



Source: Economic Roundtable analysis; California Department of Public Health. 2022. Asthma Emergency Department Visit Rates, 2019. <https://data.ca.gov/dataset/asthma-emergency-department-visit-rates> Note: Age Adjusted Rate = (Cases in Age Group x Total Population in Age Group) * 10,000.

asthma, many more have had it at some point in their lives, and it is the leading cause of over 350 annual deaths in California.⁶⁴ Children, the elderly and low-income Californians suffer disproportionately from asthma.⁶⁵

Exposure to air pollutants, including criteria emissions associated with large warehouses' diesel truck trips and indirect onsite energy consumption, can trigger episodic asthma attacks of breathlessness, wheezing, coughing, and chest tightness.⁶⁶ Such attacks can be a life-threatening and require emergency department visits, which number in the tens of thousands in the four-county region, as shown in *Figure 68*.

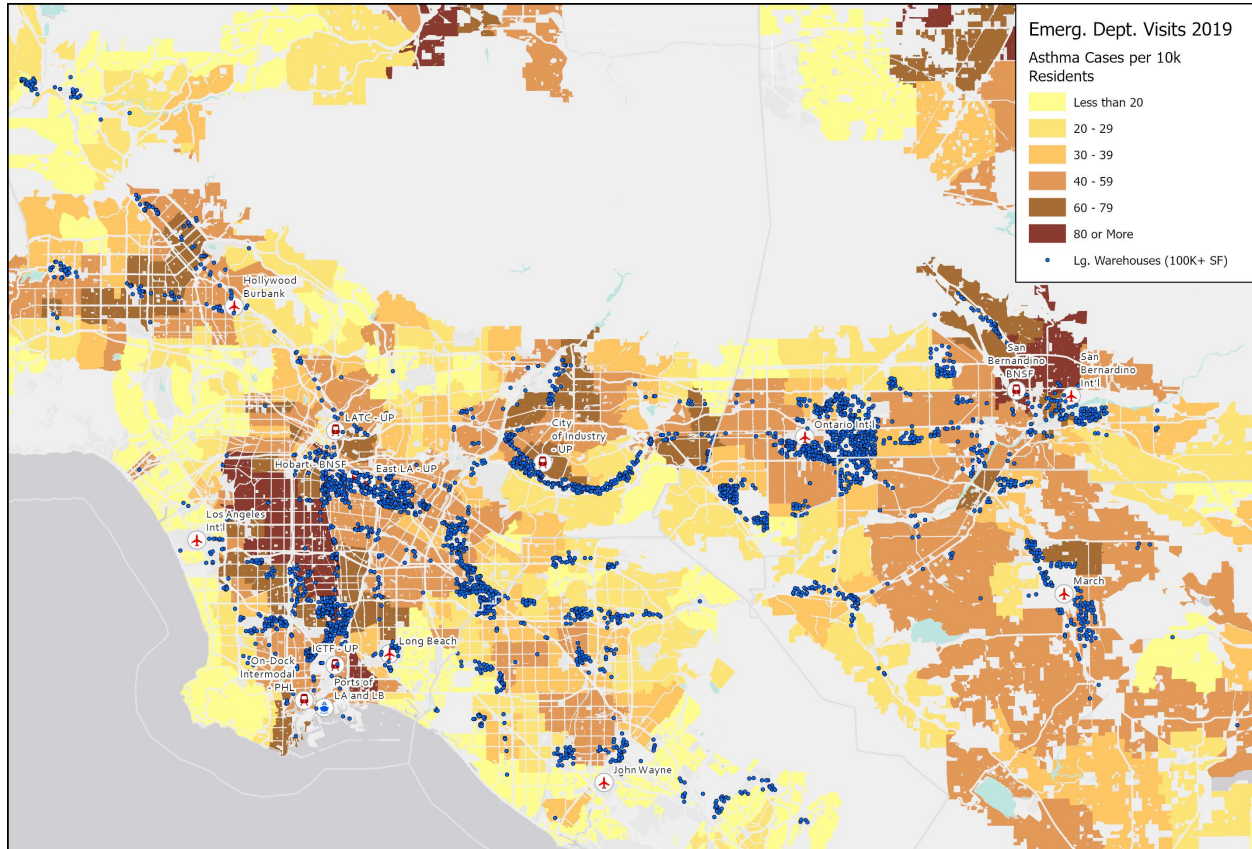
Los Angeles County, with its much larger population and expansive industrial economy has the highest number of asthma emergency department visits –just under 30,000 by adults and just over 17,000 for children under age 18.

San Bernardino County, with just a quarter of Los Angeles County's population, had 7,701 adult visits to emergency departments for asthma and 4,010 visits by children.

The *rate* of asthma emergency department visits per 10,000 residents reveals greater parity among counties. Los Angeles has the highest rate of visits to emergency rooms by children with asthma attacks, followed closely by San Bernardino, Riverside and Orange, as shown in *Figure 69*.

San Bernardino has the highest rate of emergency department visits for adult asthma attacks, followed by Los Angeles, Riverside and Orange.

Figure 70: Asthma Emergency Department Visits per 10,000 Residents, 2019



Source: Economic Roundtable analysis; California Department of Public Health. 2022. Asthma Emergency Department Visit Rates, 2019. <https://data.ca.gov/dataset/asthma-emergency-department-visit-rates>; 2022 South Coast Air Quality Management District (SCAQMD) Rule 2305 Packet, App. C and other sources. Notes: Age Adjusted Rate = (Cases in Age Group x Total Population in Age Group) * 10,000. Data by ZCTA ZIP Code.

Poor air quality creates costs for patients, the care provider, medical insurers, and tax payers, even when it is not the direct cause of chronic conditions such as asthma.

The rate of emergency department visits for asthma attacks reflects the location of manufacturing and logistics land uses. South Los Angeles, City of Industry, Ontario and San Bernardino have elevated rates of emergency department visits as well as the largest concentrations of logistics activity, as shown in *Figure 70*.



Community Profile: Henry James Vasquez, Indigenous and Mexican Elder

Henry James Vasquez (73) is an Indigenous/Mexican elder in the Colton and greater San Bernardino community. He has lived in the Inland Empire for over 50 years. Henry grew up in San Bernardino but has generations of relatives that have lived in the Colton community, where he now resides.

He is a retired school teacher who spends most of his time uplifting and supporting the cultural and historical preservation of native history as the Chair of the Native American Community Council of San Bernardino and Riverside. He is also on the Board of the Future Leaders Program which supports Latinx youth as they navigate school and early adulthood; and is part of the Old Spanish Trail Association that has been fighting to preserve the Agua Mansa Settlement which has been a target for warehouse development for the past two decades. Henry is an active member of his

community, fighting for the rights of mother nature, native sovereignty and environmental justice.

What is your relationship to the logistics industry?

The Agua Mansa Settlement is almost covered in warehouses now. It was one of the first settlements that Mexican people made in this region. Protecting Agua Mansa is important to me because my cousins are from a family that lived in the original settlement. The idea of paving over the area is insulting. It is also right across the street from the Agua Mansa Cemetery.

When I was a child we could see open land from there to the Santa Ana River. The Santa Ana River is important to us and it is a Native American legacy of the Inland Empire. It is criminal to be covering everything up with warehouses.

I fight against these warehouses because I am fighting for the respect we should have, as people living here and for the families that have lived in South Colton for decades. It's all about making money and it's incredibly disrespectful.

I have been in opposition to the warehousing and trucking industry for a long time. I have worked with people in Colton, Riverside, San Bernardino and other cities to show up at different commission meetings and planning meetings to oppose these developments. In the City of Colton, we have been able to win a moratorium against warehouses for almost two years, but it is not enough. We need a real solution to all the warehouse proposals.

Is there any way the warehousing industry could be better neighbors?

It would be best if they stayed away from us. I am disgusted by the idea they pick lower income neighborhoods to put their stuff in and disrespect us. They could use smaller trucks and electric vehicles that don't put out as much pollution. That would be some accommodation. But even with those accommodations, they are still taking away all of the beauty and taking up all the land. Seeing open land is not ugly, it is nature, it is beautiful. A developer sees it as 'aha this is a place we can put a warehouse or trucking – cha-ching making money.'

All these warehouses impact our health. This area used to have us breathing in an old cement plant and that was hurting us. But now it is replaced with diesel trucks and rail yards which are even more toxic and cause even more noise and traffic than we had before.

I remember going on a field trip with a botany professor in the 60s and he told us as he picked up some earth, this is the most fertile earth of all of this region.

We love the land, we love the landscape, we love the trees, we love the mountains, the river but everything is being torn up for people that don't live here to make money and it just hurts.

How do you think politicians deal with this?

Generally speaking, if you go back to the 1940s and 1950s when Colton was controlled by the Anglo politicians, they gave lip service to caring about South Colton, but they always voted in favor of North Colton. When Chicano politicians started getting involved in politics, for the first few years they fought for the rights of the people. But now it's almost like the Anglo politicians are back even though they are Chicano members. they vote against our favor and vote in favor of the industry. Some of the current politicians are even related to our families but they still vote for destroying our heritage. I know some politicians are pushing back, but it is not the majority right now.

What will happen if development continues the way it is?

I think people will be forced to move out. I think the warehouse industry will make people offers and buy up their lands. We are already seeing it in places like Bloomington. People are getting pushed away by the warehousing industry and housing prices continue to go up. We are being left with astronomically high priced housing.

What gives you hope about our future?

Networking with others likeminded people, the Native American community and other community groups are what help me feel hopeful. We are all fighting for justice. When we work together, we give each other hope. There are people that are always going to fight us - always.

What is our biggest strength in this fight?

That we are fighting together. It encourages me to see people proud of their history and their lifestyle. We are teaching bird singing, our languages, our histories, we are reviving mariachi music. We might not be professional yet but our cultural is not dying and people are proud of their identity.



8. Onsite Warehouse Emissions

Photo credit:
[Pickawood on Unsplash](#)

Overview

Warehouses are the most common type of commercial building in the United States. On-site warehouse operations have environmental impacts from upstream emissions that result from consumption of electricity, and water, and from on-site combustion of natural gas.

Large warehouses in the four-county region consume 15.5 terajoules of electricity onsite annually.

Electricity consumed by large warehouses in the four-county region is accountable for upstream releases of over one-million metric tons of greenhouse gas (carbon dioxide) into the atmosphere annually.

Criterion emissions attributable to electricity consumption by large warehouses in the four-county region add up to 1,028 metric tons of nitrogen dioxide and 75 metric tons of sulfur dioxide annually.

Natural gas provides 34 percent of the energy that warehouses consume.

Natural gas combustion at large warehouses produces 1.6 billion pounds of greenhouse gas emissions annually.

A total of 101,603 pounds of very fine-sized particulate matter is estimated to be released annually into the region's air by natural gas combustion at large warehouses.

Large warehouses in Southern California consume an estimated 2.7 billion gallons of water annually.

Energy Consumption from On-Site Operations

Warehouses are the most common type of commercial building in the United States.⁶⁷ Activities inside each warehouse have environmental impacts from upstream emissions that result from consumption of electricity and water, and from on-site combustion of natural gas.

Large warehouses in the four-county region consume significant amounts of electricity onsite, approximately 15.5 terajoules annually (*Table 9*).

Warehouses in Los Angeles County use the most electricity, just over 6 terajoules per year, while the growing warehouse inventory in San Bernardino County is close behind, consuming 5.7 terajoules

Warehouses use electricity to operate heating, ventilation, and air conditioning systems, water heating, lighting, security systems, employee monitoring systems, refrigeration, and material moving equipment such as conveyors for bins and containers, automated and semi-automated packaging equipment, and forklifts and pallet movers.

Table 9 Annual Electricity Consumption of Large Warehouses

County	Large Warehouse Square Feet	Electricity Consumption (kWh)	Electricity Consumption (Terajoules)
Los Angeles	315,772,032	1,670,280,021	6,013
Orange	75,633,453	394,489,145	1,420
Riverside	131,212,586	695,426,705	2,504
San Bernardino	283,677,944	1,591,637,075	5,730
<i>Region Total</i>	<i>806,296,015</i>	<i>4,351,832,946</i>	<i>15,667</i>

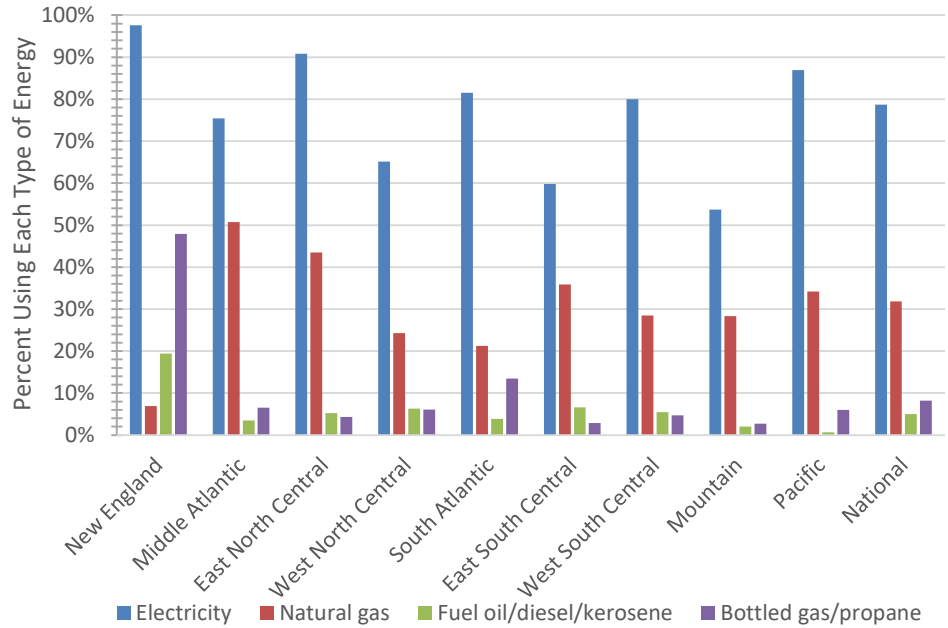
Source: Economic Roundtable analysis; U.S. Energy Information Administration. Commercial Buildings Energy Consumption Survey (CBECS) Table C22. "Electricity consumption totals and conditional intensities by building activity subcategories, 2018." Release date: December 2022: <https://www.eia.gov/consumption/commercial/reports/2012/water/>

Electricity is the primary source of energy for warehouses in the four-county region.⁶⁸ This is true for commercial buildings in general in Southern California, which draw 87 percent of their energy from electricity.⁶⁹

Warehouses use over twice as much electricity to meet their energy needs as the next largest source, natural gas. Natural gas provides 34 percent of the energy that warehouses consume, as shown in *Figure 71*.

Other forms of gas, including bottled gas, liquefied petroleum gas (LPG) and propane provide just over eight percent of the energy used by warehouses.

Figure 71: Energy Mix for Warehouses by U.S. Region (multiple types per warehouse)



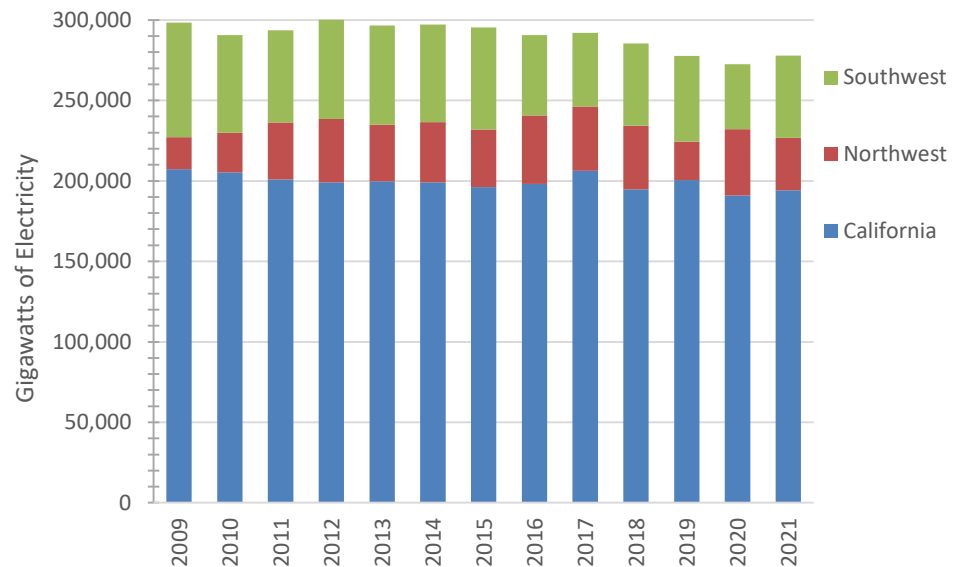
Source: Economic Roundtable analysis; U.S. Energy Information Administration. Commercial Buildings Energy Consumption Survey Public Use Microdata, 2018, for non-refrigerated warehouses. Buildings use multiple types of energy.

Less than one percent of the on-site energy used by warehouses comes in the form of petroleum products such as fuel oil, diesel or kerosene.

How and Where Locally-Consumed Electricity is Generated

California generates three-quarters (78 percent) electricity of the electricity it uses within the state. We purchase 18 percent our electricity from other

Figure 72: Location where Electricity Consumed in California is Generated



Source: Economic Roundtable analysis; U.S. Energy Information Administration. Commercial Buildings Energy Consumption Survey (CBECS) Public Use Microdata, 2018.

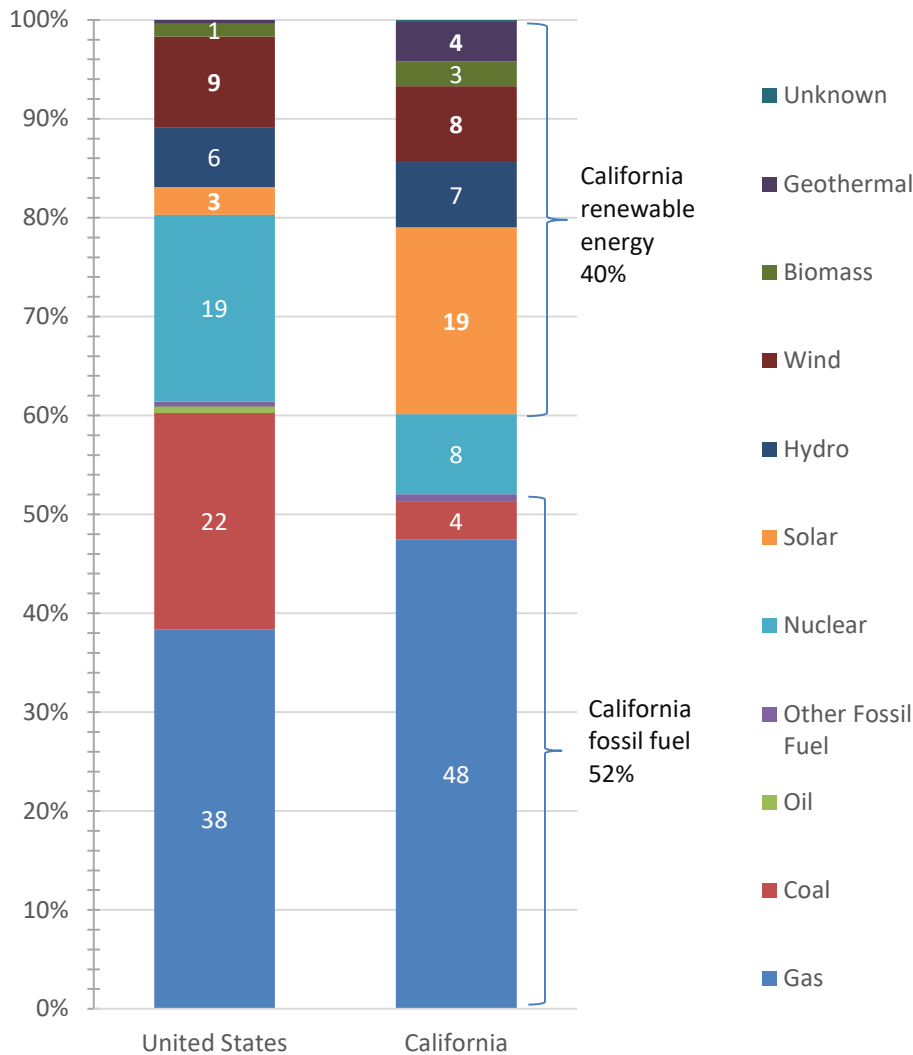
states in the Southwest region. The remaining 12 percent is imported from Northwest states.⁷⁰

This balance among California’s sources of electricity has held relatively steady for over a decade, as shown in *Figure 72*. Roughly two-thirds of the environmental impacts of electricity generation are within California and one-third in adjacent states.

California’s mix of energy sources used to generate electricity includes natural gas and other fossil fuels, as shown in *Figure 73*. Fossil fuel combustion releases planet-warming greenhouse gases and criteria emissions that cause life-harming respiratory illness.

Electricity production was the source of 25 percent the United States’ greenhouse gas emissions in 2021.⁷¹

Figure 73: Energy Sources for Generating Electricity in California and the United States



Sources: Economic Roundtable 2021 data from the Emissions & Generation Resource Integrated Database (eGRID) released January 30, 2023. <https://www.epa.gov/egrid/power-profiler#/CAMX>

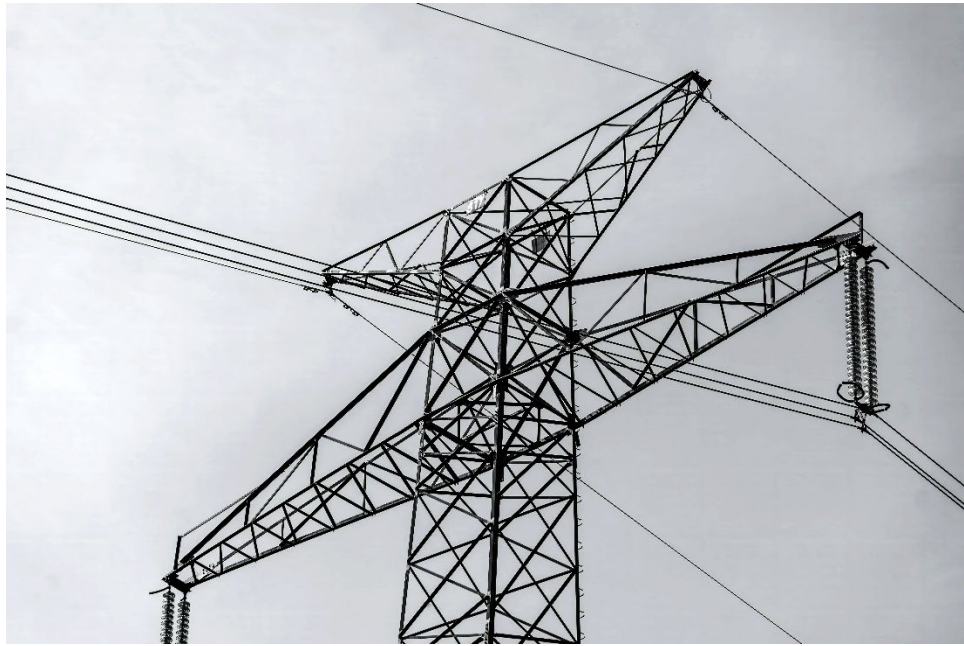


Photo credit:
[Cole Patrick on Unsplash](#)

California uses renewable energy to generate twice as much of its electricity as the nation as a whole – 40 percent versus 20 percent. This supports a cleaner environmental footprint for electricity generated within the state than for energy imported from other states.

This is largely because California uses solar energy to generate more of its electricity than other states – 19 percent versus 3 percent.

However, 52 percent of the electricity generated within California is generated using fossil fuels. This is smaller than the 61 percent share of electricity from other states that is generated using fossil fuels, but it still has large environmental impacts.

California generates less of its electricity using nuclear power than other states – 8 percent compared to 19 percent.

Reducing the amount of electricity that warehouses draw from the utility grid and increasing the amount that is generated from renewable sources, such as on-site solar panel arrays, will help shrink the environmental footprint of warehouses.

Metric Tons of GHG Emissions from On-Site Energy Consumption

Carbon dioxide (CO₂) makes up the vast majority of greenhouse gas emissions from electricity production nationwide, but smaller amounts of methane (CH₄) and nitrous oxide (N₂O) are also emitted.⁷²

Electricity consumed by large warehouses in the four-county region is accountable for releasing over one-million metric tons of greenhouse gas (carbon dioxide) into the atmosphere annually, as shown in in *Table 10*.

Table 10 Metric Tons of Greenhouse Gas Emissions from Electricity Consumed by Large Warehouses

County	Large Warehouse Square Feet	Carbon Dioxide CO ₂ Emissions (MT)	Methane CH ₄ Emissions (MT)	Nitrous Oxide N ₂ O Emissions (MT)
Los Angeles	315,772,032	403,676	23.5	3.0
Orange	75,633,453	95,341	5.6	0.7
Riverside	131,212,586	168,072	9.8	1.3
San Bernardino	283,677,944	384,670	22.4	2.9
<i>Region Total</i>	<i>806,296,015</i>	<i>1,051,759</i>	<i>61.3</i>	<i>7.9</i>

Source: Economic Roundtable analysis; U.S. Environmental Protection Agency, Center for Corporate Climate Leadership. 2023 “Emissions & Generation Resource Integrated Database (eGRID) - Emission Factors for Greenhouse Gas Inventories. Table 6. Electricity. <https://www.epa.gov/egrid/download-data>

Warehouses in Los Angeles County are responsible for 38 percent of these greenhouse gas emissions and those in San Bernardino County are responsible for 37 percent.

Warehouses in Riverside and Orange Counties are responsible for 16 percent and 9 percent, respectively, of upstream emissions from generating electricity.

The four counties share the same distribution of responsibility for the 61 metric tons of *methane (CH₄)* and the 8 metric tons of *nitrous oxide (N₂O)* that are released annual because of electricity consumed by large warehouses.

Criteria Emissions from On-Site Activities

Air pollution harms people’s health and is also harmful for pets, vegetation and buildings. National ambient air quality standards for the most common air pollutants – known as “criteria pollutants” – include nitrogen dioxide and sulfur dioxide.

Criterion emissions attributable to electricity consumption by large warehouses in the four-county region add up to 1,028 metric tons of nitrogen dioxide and 75 metric tons of sulfur dioxide annually, as shown in *Table 11*. The highest levels of criteria emissions are attributable to large warehouses in Los Angeles and San Bernardino Counties.

Emissions linked to large warehouses will change as diesel trucks are replaced by electric trucks for warehouse drayage. There will be an overall

reduction in emissions, but some increase in upstream emissions because of electricity consumed by charging stations.

Table 11 Metric Tons of GHG Emissions from Electricity Consumption of Large Warehouses

County	Large Warehouse Square Feet	CO ₂ e Emissions (MT)	NO _x Emissions (MT)	SO ₂ Emissions (MT)
Los Angeles	315,772,032	405,119	394.8	28.9
Orange	75,633,453	95,682	93.2	6.8
Riverside	131,212,586	168,673	164.4	12.0
San Bernardino	283,677,944	386,044	376.2	27.5
Region Total	806,296,015	1,055,517	1,028.6	75.2

Source: Economic Roundtable analysis; U.S. Environmental Protection Agency, Center for Corporate Climate Leadership. 2023 “Emissions & Generation Resource Integrated Database (eGRID) - Emission Factors for Greenhouse Gas Inventories. Table 6. Electricity. <https://www.epa.gov/egrid/download-data>

Warehouses may add more solar electric panels to their roofs to increase the amount of renewable energy in their power fuel mix. This will provide credits under the South Coast Air Quality Management District’s Rule 2305 – the Warehouse Actions and Investments to Reduce Emissions (WAIRE) Program.

On-Site Natural Gas Consumption

Warehouses use natural gas for space heating.⁷³ The environmental impact report for a large warehouse in San Bernardino County identifies the annual amounts of natural gas consumer per square foot, as shown in *Table 12*.

Table 12 Large Warehouses Natural Gas Consumption per Square Foot

Warehouse Type	Natural Gas Btu Consumed per Cubic Square Foot per Year
Non-Refrigerated	19,063
Refrigerated	27,580

Source: Economic Roundtable analysis; Urban Crossroads. 2022 Nevada Street Warehouse, Appendix F: Energy Analysis, County of San Bernardino, pages 9, 37; Southern California Gas Company. 2017. SoCalGas Natural Gas Quality Standards 1-Sheet. Natural gas standard heating values are in British thermal units (Btu) per Standard Cubic Foot (SCF).

The global warming and air pollution effects of onsite space heating in large warehouse are shown in *Tables 13*. In natural gas combustion, 99.9 percent of the fuel is converted to carbon dioxide.⁷⁴ This produces 1.6 billion pounds of greenhouse gas emissions annually.

Criteria emissions are also shown in *Table 13*, including particulate matter, which causes adverse health effects among children, people with asthma and older adults with chronic cardiovascular and pulmonary diseases.⁷⁵

Table 13 Annual Emissions from Onsite Natural Gas Combustion at Large Warehouses

	Los Angeles	Orange	Riverside	San Bernardino	Total
Large Warehouse SF:	315,772,032	75,633,453	131,212,586	283,677,944	806,296,015
Emissions:					
CO ₂	626,890,307	148,059,857	261,007,888	568,299,372	1,604,257,424
NH ₄	12,015	2,838	5,003	10,892	30,748
N ₂ O*	11,493	2,714	4,785	10,419	29,411
N ₂ O**	3,343	790	1,392	3,031	8,556
SO ₂	3,134	740	1,305	2,841	8,021
PM (Total)	39,703	9,377	16,530	35,992	101,603
PM (Condensable)	29,777	7,033	12,398	26,994	76,202
PM (Filterable)	9,926	2,344	4,133	8,998	25,401
Lead	2.612	0.617	1.088	2.368	6.684
Volatile OCs	28,732	6,786	11,963	26,047	73,528
Total OCs	57,465	13,572	23,926	52,094	147,057

Source: *Economic Roundtable analysis; Urban Crossroads. 2022 Nevada Street Warehouse, Appendix F: Energy Analysis, County of San Bernardino, pages 9, 37; Southern California Gas Company. 2017. SoCalGas Natural Gas Quality Standards 1-Sheet; U.S. Environmental Protection Agency. 1998. AP 42, Compilation of Air Pollutant Emission Factors: Table 1.4-2. Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion.*

Notes: Nitrous oxide (N₂O) is split into Uncontrolled (*) and Controlled-low-NOX burner (**).

Particulate matter from natural gas combustion is estimated to be smaller than one micron. The volume of particulate matter that is emitted increases if there are improper fuel-to-air mixing ratios because, for example, of poor maintenance of heating systems.⁷⁶



Photo credit:
[Martin Martz](#) on [Unsplash](#)

A total of 101,603 pounds of this very fine-sized particulate matter is estimated to be released annually into the region’s air by large warehouses.

On-Site Water Consumption

Large warehouses have relatively low water usage, compared to other large commercial buildings.⁷⁷ However, new California regulations, amidst historic drought and emerging climate change, aim to curb water use at commercial properties across the state as urban residents and rural farmers are already mandated to cut their water use.⁷⁸

Large warehouses in the four-county region consume an estimated 2.7 billion gallons of water annually, or 7.4 million gallons per day (Table 14).

Warehouses in Los Angeles and San Bernardino Counties consume the most water, 1.07 billion and 0.97 billion gallons annually.

Table 14 On-Site Water Consumption of Large Warehouses

County	Large Warehouse Square Feet	On-Site Water Consumption, Annual (Gallons)	On-Site Water Consumption, Daily (Gallons)
Los Angeles	315,772,032	1,071,500,391	2,930,869
Orange	75,633,453	253,068,508	692,217
Riverside	131,212,586	446,122,792	1,220,277
San Bernardino	283,677,944	965,989,480	2,642,265
Region Total	806,296,015	2,736,681,171	7,485,628

Source: Economic Roundtable analysis; U.S. Energy Information Administration. 2017. Commercial Buildings Energy Consumption Survey (CBECS). Table W1. Water consumption in large commercial buildings, 2012. <https://www.eia.gov/consumption/commercial/reports/2012/water/>



Photo by [Martin Martz](#) on [Unsplash](#)



9. Data Appendix and Methodology

*Photo credit:
Economic Roundtable*

List of Large Warehouses by City

San Bernardino County

City or CDP	Warehouse Sites	Square Feet	Employment
Bloomington	16	6,093,244	571
Chino	117	35,220,833	3,308
Chino Hills	3	382,180	36
Colton	22	6,516,848	611
Eastvale	1	171,112	16
Fontana	140	49,122,306	4,612
Grand Terrace	1	130,695	12
Mentone	2	431,466	40
Montclair	3	389,247	36
Ontario	289	81,755,360	7,616
Rancho Cucamonga	107	25,149,893	2,367
Redlands	56	23,691,172	2,220
Rialto	47	25,697,104	2,404
Riverside	2	1,130,721	106
San Bernardino	76	27,476,992	2,583
Upland	3	318,773	30
County Total	885	283,677,944	26,570

Riverside County

City or CDP	Warehouse Sites	Square Feet	Employment
Banning	1	173,101	23
Beaumont	7	3,013,628	396
Coachella	3	448,476	59
Corona	65	11,154,994	1,467
Desert Hot Springs	1	77,662	10
Eastvale	22	9,201,729	1,208
Hemet	1	126,611	17
Indio	2	209,161	27
Jurupa Valley	80	22,049,074	2,896
March Air Reserve Base	13	5,642,754	741
Mira Loma	3	1,213,565	159
Moreno Valley	48	26,635,719	3,497
Murrieta	3	307,852	40
Norco	2	284,664	37
Nuevo	1	105,833	14
Palm Springs	1	116,497	15
Perris	45	24,715,608	3,251
Riverside	80	21,314,528	2,798
San Jacinto	1	72,308	10
Temecula	23	4,108,079	541

Thermal	2	240,742	32
Grand Total	404	131,212,586	17,238

Los Angeles County

City or CDP	Warehouse Sites	Square Feet	Employment
Alhambra.....	4	411,713	30
Arcadia.....	4	1,046,486	56
Azusa.....	13	1,708,497	124
Baldwin Park.....	4	472,983	42
Bell	15	3,107,155	179
Bell Gardens	2	698,629	36
Burbank	5	737,700	40
Calabasas	1	111,945	10
Canoga Park.....	7	938,764	72
Carson.....	119	22,173,745	1,357
Cerritos	33	5,177,116	349
Chatsworth.....	20	3,479,363	230
City of Industry	197	48,803,707	2,788
Commerce	121	24,645,773	1,484
Compton.....	80	12,872,746	873
Cudahy	1	88,966	10
Diamond Bar.....	1	104,780	10
Downey	9	2,139,819	109
Duarte.....	3	312,601	30
El Monte.....	11	2,551,025	151
El Segundo.....	6	2,041,733	110
Gardena.....	30	3,967,840	303
Glendora	1	119,875	10
Hacienda Heights	4	568,537	40
Hawthorne	14	4,275,451	228
Huntington Park	4	431,679	40
Inglewood	4	568,013	40
Irwindale	20	5,585,245	318
La Mirada.....	40	9,039,564	528
La Puente	3	423,135	30
La Verne	1	113,070	10
Long Beach	50	10,895,592	678
Los Angeles	165	30,943,289	1,980
Lynwood.....	10	2,360,065	126
Monrovia	1	290,914	15
Montebello.....	24	4,098,538	278
North Hills.....	3	396,640	30
North Hollywood	8	1,299,374	87
Northridge	3	527,201	27
Norwalk.....	7	787,295	70

Pacoima.....	9	1,056,289	84
Panorama City.....	6	1,033,418	70
Paramount.....	8	1,820,676	105
Pasadena.....	1	106,000	10
Pico Rivera.....	27	4,860,155	285
Pomona.....	41	7,874,276	462
Rancho Dominguez.....	35	5,355,937	363
Redondo Beach.....	7	1,322,758	74
Rowland Heights.....	1	112,536	10
San Dimas.....	3	396,830	30
San Fernando.....	5	752,606	50
San Pedro.....	5	1,987,882	102
Santa Clarita.....	5	2,134,685	117
Santa Fe Springs.....	126	25,731,687	1,578
Santa Monica.....	1	150,212	10
Signal Hill.....	2	420,807	26
South El Monte.....	3	394,082	30
South Gate.....	27	3,449,912	279
Sun Valley.....	11	1,499,734	110
Sunland.....	1	79,907	10
Sylmar.....	22	2,992,894	227
Torrance.....	61	10,811,063	681
Valencia.....	40	5,380,176	404
Van Nuys.....	12	3,435,490	201
Vernon.....	96	15,640,039	1,034
Walnut.....	17	3,281,456	202
West Covina.....	1	147,530	10
Whittier.....	8	1,337,124	84
Wilmington.....	7	1,006,218	71
Woodland Hills.....	2	647,906	35
Grand Total.....	1,638	315,536,848	19,686

Orange County

City or CDP	Warehouse Sites	Square Feet	Employment
Aliso Viejo.....	1	307,425	10
Anaheim.....	75	14,456,068	767
Brea.....	22	3,577,177	222
Buena Park.....	37	7,149,647	378
Costa Mesa.....	5	1,036,786	51
Cypress.....	16	2,950,770	165
Foothill Ranch.....	12	2,364,811	110
Fountain Valley.....	4	561,912	40
Fullerton.....	51	9,821,033	519
Garden Grove.....	16	2,834,824	160
Huntington Beach.....	18	3,436,316	180

Irvine	47	10,231,521	497
La Habra	3	1,340,437	42
La Palma.....	6	1,400,941	65
Lake Forest.....	5	946,746	50
Los Alamitos.....	3	349,135	30
Orange	12	2,048,008	120
Placentia.....	3	478,145	30
Rancho Santa Margarita	4	651,943	40
San Juan Capistrano.....	2	397,526	20
Santa Ana	42	6,718,461	419
Seal Beach.....	3	376,871	30
Stanton.....	1	118,059	10
Tustin.....	8	1,351,219	86
Westminster	2	360,706	20
Yorba Linda	1	110,238	10
Grand Total	399	75,376,724	4,071

Note: CDP stands for Census Designated Place. These are established unincorporated communities for which the U.S. Census Bureau provides statistics about population and housing.

Methodology for Building Database of Large Warehouses

The methodology used in this report for estimating employment in large warehouses shown in Chapter 2, is as follows: 1) Employment for ALL warehouse industry workers is estimated from the U.S. Census' 5-Year American Community Survey 2020 PUMS data. Data were filtered by:

- NAICS Industry (NAICSP) 493 (TRN-Warehouse and Storage)
- Employment Status Recode (ESR) is limited to "Civilian Employed, at Work"
- Total person's earnings (PERNP, adj. to 2020 dollars) at least \$500 annually
- Class of worker (COW) = Employee of a private for-profit business ('1')

County	Employed Warehouse Industry Workers, ALL Warehouses (A)	Percent of Warehouse Workers (ACS PUMS) (B)
Los Angeles County	36,349	39%
Orange County	5,410	6%
Riverside County	18,973	20%
San Bernardino County	32,539	35%
Region Total	93,271	100%

Dataset: US Census. American Community survey (ACS) 5-Year Estimates Public Use Microdata Sample (PUMS), 2016-2020.

These county-level employment estimate for ALL warehouse industry workers is used as the denominator for creating county-level ratios of square feet of warehouse per warehouse-industry employee.

2) Square footage of ALL Warehouses by county comes from the Southern California Association of Governments (SCAG) 2018 report "Industrial Warehousing in the SCAG Region," Table 2.1 from the "Inventory" section of the report. These data were updated to 2023 by using a warehouse square feet growth factor of 23.96%, calculated from the increase in large warehouse properties the Economic Roundtable analyzed in databases for this study:

County	Total Occupied Space (SF), ALL Warehouses (2014) (C)	Total Occupied Space (SF), ALL Warehouses in 2023 (D)	Square Feet of Warehouse per Employee Ratio (E=D/A)
Los Angeles County	568,958,384	705,284,271	19,403
Orange County	134,440,969	166,653,842	30,805
Riverside County	116,588,283	144,523,544	7,617
San Bernardino County	280,317,848	347,483,708	10,679
Region Total	1,100,305,484	1,363,945,366	14,623

Dataset: Southern California Association of Governments (SCAG) 2018 report "Industrial Warehousing in the SCAG Region," Table 2.1 from the "Inventory" section of the report.

The ratio derived from data about ALL warehouses (column E) is then applied to the data about LARGE warehouses:

County	No. of Large Warehouses (2023) (F)	SF of Large Warehouses (G)	Employment Estimate (H)	Percent of Employment (I)
Los Angeles County	1,626	314,911,990	19,686	29%
Orange County	389	74,175,185	4,071	6%
Riverside County	402	131,212,586	17,238	26%
San Bernardino County	876	283,029,002	26,570	39%
Region Total	3,293	803,328,763	67,565	100%

Our employment estimate (column H) adds up to 67,565 warehouse industry workers employed in properties of 100,000 square feet or more, spread across various occupations discussed in Chapter 2, “Occupations and Wages of Warehouse Workers,” and in Chapter 5, “Occupations of Frontline Warehouse Workers.”

Methodology for Calculating Annual Truck Trips and Mileage

In Chapter 4, we estimate the number of trucks trips bringing goods to and from each large warehouse in the four-county region – trips to and from seaports, intermodal facilities, cargo airports, other warehouses, and retail stores – based upon the based upon the square footage of each warehouse.

We then adjust our estimates using the 2021-22 Gate Move Analysis data from the Port of Los Angeles’ and Long Beach’s Clean Truck Program, to account for the portion of the trips between large warehouses and these seaports.

This portion of truck trips, adding up to 4,579,934 over 12 months, accounts for 34 percent of the total truck trips to and from large warehouses. (See *Figure 24: Distribution of Truck Trips between Warehouses and Other Logistics Nodes*, and endnote 33, referencing the *South Coast Air Quality Management District (SCAQMD) warehouse survey*.)

We use the Seaports’ Gate Move Analysis data in proportion to the overall distribution of warehouses’ truck trip origin and destinations, as follows:

	<u>Percent</u>	<u>Trips</u>
Seaports Combined.....	34%.....	4,579,934
Port of Long Beach	17%.....	2,321,687
Port of Los Angeles.....	17%.....	2,258,248
SoCal Cargo Airports.....	3%.....	408,938
Rail Intermodal Yards.....	27%.....	3,654,122
Other Warehouses	22%.....	2,967,689
Retail Stores (4-Co).....	14%.....	1,929,900
Local Total	100%.....	13,540,583

Based on this estimation method, 13,540,583 annual truck trips to and from all warehouses in four-county region occur annually. The portion of these trips to and from the region’s large warehouses is 84.90 percent of those total – based upon our earlier comparison of total to large warehouse occupied square footage and employment. This yields an estimated

11,495,607 annual truck trips to and from large warehouses in four-county region.



10. Endnotes

¹ The Economic Roundtable used the list published by the South Coast Air Quality Management District (SCAQMD) for rule 2305 this list as a starting point for creating an inventory of all large warehouses that fall under the rule’s jurisdiction. Warehouse property data sources used in this study include:

South Coast AQMD address list of the largest 3,321 warehouse buildings that are over 100,000 square feet in size and likely subject to Rule 2305 (Appendix C pages 144-171) across the four-county SCAQMD region. SCAQMD staff confirmed these data came from CoStar. <http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2021/2021-May7-027.pdf?sfvrsn=10>

Southern California Association of Governments’ (SCAG) 2019 Annual Land Use Dataset which includes buildings’ square footage of improvements. SCAG data is assembled from county-level assessor databases, and from municipal planning agencies. These data are part of SCAG’s Regional Data Platform: <https://scag.ca.gov/regional-data-platform>

Microsoft’s open source JSON file of building footprints from all 50 U.S. states to identify *all* individual buildings greater than 100,000 SF, alongside other data sources. These data come from LandSat imagery. <https://www.microsoft.com/en-us/maps/building-footprints>

² Rose Institute, “San Bernardino: Two Years into Bankruptcy,” (December 1, 2014), <https://roseinstitute.org/san-bernardino-two-years-bankruptcy/>.

³ Paloma Esquivel, “After five long years, San Bernardino is officially out of bankruptcy. What’s next?” Los Angeles Times, (June 22, 2017), <https://www.latimes.com/local/la-me-ln-san-bernardino-bankruptcy-end-20170621-htmlstory.html>

⁴ City of Carson, General Plan (October 11, 2004), <https://ci.carson.ca.us/content/files/pdfs/planning/cityofcarsongeneralplan.pdf>.

⁵ This estimate was derived from the Consumer Expenditure Survey, U.S. Bureau of Labor Statistics, September, 2018, Table 1203, “Income before taxes: Annual expenditure means, shares, standard errors, and coefficients of variation.” This table breaks households out into nine income groups and provides expenditure amounts for a detailed list of items purchased by households in each income group. Retail items in this list were flagged and totaled for each income group. These expenditures by income group were then applied to census-tract-level breakouts of household income, and then adjusted proportionately for each census tract so that the total for all four counties equaled the estimated total of \$31,045,901,815 in retail sales in the region.

⁶ U.S. Census Bureau, 2020 5-Year American Community Survey (ACS) Public Use Microdata Sample (PUMS). Filtering includes NAICS Industry (NAICSP) 493 (TRN-Warehouse and Storage), Employment Status Recode (ESR) is limited to “Civilian Employed, at Work” with at least \$500 annual earnings.

⁷ Daniel Flaming and Patrick Burns, Economic Roundtable, *Someone Else’s Ocean: Dockworkers, Foreign Shippers and Economic Outcomes*, (2022), p. 29, <https://economicrt.org/publication/someone-elses-ocean/>.

⁸ The profile of trucking companies is derived from a random sample of 304 trucking companies registered with the Ports of Los Angeles and Long Beach. Data about number of drivers and annual mileage is from the U.S. Department of Transportation FMCSA Safety and Fitness Electronic Records System, with data extracted for each of the 304 companies: <https://safer.fmcsa.dot.gov/saferhelp.aspx#General>.

⁹ Port of Los Angeles, “Clean Truck Program Gate Move Analysis, (June 2023), <https://kentico.portoflosangeles.org/getmedia/452bad8c-4e16-490f-bab6-155b061866bb/POLA-Monthly-Gate-Move-Analysis>.

¹⁰ A. R. Ravishankara, John S. Daniel, and Robert W. Portmann, Chemical Sciences Division, Earth System Research Laboratory, National Oceanic and Atmospheric Administration, “Nitrous Oxide (N₂O): The Dominant Ozone-Depleting Substance Emitted in the 21st Century,” (August 2009), <https://www.science.org/cms/asset/48f20a35-fe6d-4d0d-8bc4-fc605aea13b7/pap.pdf>

¹¹ Emissions from electric trucks were calculated based on kilowatts of electricity consumed per ton-mile of movement by heavy-duty trucks, and then identifying the emissions produced by generating a kilowatt of electricity.

Heavy-duty trucks consume 2.07 kilowatts of electricity per mile, according to the California Air Resources Board, EMFAC2021 Volume III Technical Document, (March 31, 2021), https://ww2.arb.ca.gov/sites/default/files/2021-03/emfac2021_volume_3_technical_document.pdf.

Given that the average load of trucks moving cargo from the ports is 19 tons, 0.11 kilowatts of electricity are consumed per ton-mile.

The U.S. Energy Information Administration identified the following pounds of emissions per kilowatt of electricity generated by electric utilities:

Sulfur dioxide	0.0006
Nitrogen oxide	0.0007
Carbon dioxide	0.8856

Annual Electric Generator Report, (2021), https://www.eia.gov/electricity/state/unitedstates/state_tables.php

¹² Center for Disease Control, Agency for Toxic Substances and Disease Registry, (April 2002), <https://www.atsdr.cdc.gov/toxfaqs/tfacts175.pdf>.

¹³ California Air Resources Board, Carbon Monoxide and Health, <https://ww2.arb.ca.gov/resources/carbon-monoxide-and-health>.

¹⁴ United States Environmental Protection Agency, “Health and Environmental Effects of Particulate Matter (PM),” <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>.

¹⁵ National Park Service, Sulfur Dioxide Effects on Health, (February 27, 2023), <https://www.nps.gov/subjects/air/humanhealth-sulfur.htm>.

¹⁶ U.S. Department of Transportation, Federal Railroad Administration, “Railroad Energy Intensity and Criteria Air Pollutant Emissions,” (October 2018), https://railroads.dot.gov/sites/fra.dot.gov/files/fra_net/18212/Railroad%20Energy%20Intensity%20and%20Criteria%20Pollutant%20Emissions.pdf.

¹⁷ Port of Los Angeles, “Clean Truck Program (CTP) Gate Move Analysis,” (November 2022), <https://kentico.portoflosangeles.org/getmedia/452bad8c-4e16-490f-bab6-155b061866bb/POLA-Monthly-Gate-Move-Analysis>. Only 84.9 percent of truck trips at the ports are estimated to be linked to large warehouses; other trips include small warehouses. This estimate of trip origins and destinations is based on the South Coast Air Quality Management District’s “Warehouse Truck Trip Origin and Destination Data,” (2014), <https://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/high-cube-warehouse>.

¹⁸ TransportPolicy.net, “US Heavy-duty Emissions Transport Policy,” <https://www.transportpolicy.net/standard/us-heavy-duty-emissions/>.

- ¹⁹ California Air Resources Board, Emissions Inventory, South Coast AQMD (2023), <https://arb.ca.gov/emfac/emissions-inventory/28ffaed607e86fec45648960f1f041ede7baa441>.
- ²⁰ David Austin, Congressional Budget Office, Pricing Freight Transport to Account for External Costs, (March 2015), <https://www.cbo.gov/publication/50049>.
- ²¹ California Air Resources Board, “Advanced Clean Fleets Regulation Summary,” <https://ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-fleets-regulation-summary>.
- ²² John Kingston, “19 states target EPA waiver for California’s Advanced Clean Trucks rule,” Freight Waves, (June 8, 2023), <https://www.freightwaves.com/news/19-states-target-epa-waiver-for-californias-advanced-clean-trucks-rule>.
- ²³ South Coast Air Quality Management District, Agenda Item 27, Board Meeting May 7, 2021, <http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2021/2021-May7-027.pdf?sfvrsn=10>.
- ²⁴ Latham & Watkins LLP, “US Warehouse Regulation Lawsuit Reaches Critical Stage,” (April 21, 2023) <https://www.jdsupra.com/legalnews/us-warehouse-regulation-lawsuit-reaches-3820942/#>.
- ²⁵ The availability of these trucks was documented through site visits by the Economic Roundtable to truck dealerships and also by: Gladstein, Neandross & Associates, *2021 Feasibility Assessment for Drayage Trucks*, (February 2023), <https://www.gladstein.org/research/2021-feasibility-assessment-for-drayage-trucks/>.
- ²⁶ 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>.
- ²⁷ Port of Los Angeles, “Port of Los Angeles Awards \$6 Million to Fund 22 Zero-Emission Trucks,” (December 20, 2022), https://www.portoflosangeles.org/references/2022-news-releases/news_122022_ze_truck_grants.
- ²⁸ California Air Resources Board, *Proposed Fiscal Year 2022-23 Funding Plan for Clean Transportation Incentives*, (October 12, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-10/proposed_fy2022_23_funding_plan_final.pdf.
- ²⁹ South Coast Air Quality Management District, “Incentives,” <https://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/facility-based-mobile-source-measures/incentives>.
- ³⁰ Evconnect, “SCE Ready Charge Program,” <https://www.evconnect.com/charge-ready-2>.
- ³¹ Southern California Edison, “Electric Vehicle (EV) Infrastructure Rule 29,” [https://www.sce.com/sites/default/files/2022-07/EV%20Rule%2029%20Fact%20Sheet%200622_WCAG%20\(V2\).pdf](https://www.sce.com/sites/default/files/2022-07/EV%20Rule%2029%20Fact%20Sheet%200622_WCAG%20(V2).pdf).
- ³² Southern California Edison, “Southern California Edison Comments on California Energy Commission Interconnection Workshops,” (May 23, 2023), <https://www.energy.ca.gov/event/workshop/2023-05/commissioner-workshop-clean-energy-interconnection-electric-distribution>

³³ Method for estimating truck trip miles is drawn from the South Coast Air Quality Management District’s “High Cube Warehouse Trip Rate Study for Air Quality Analysis” survey project, carried out 2012-14. The truck trips to and from a sample of high cube warehouses in SCAQMD region were identified by their origin/destination:

<u>Local</u>	<u>Origin</u>	<u>Destination</u>	<u>O-D Avg.</u>	<u>Local Share</u>
Sea Ports (POLA/POLB)	52%	5%	29%	34%
Port of Long Beach	27%	3%	15%	17%
Port of Los Angeles	26%	3%	14%	17%
SoCal Cargo Airports	0%	5%	3%	3%
Rail Intermodal Yards	9%	37%	23%	27%
Other Warehouses	27%	10%	19%	22%
Local Stores (SoCal)	2%	22%	12%	<u>14%</u>
Local Total				100%
<u>Non-local</u>				
Out of state	10%	13%	11%	
Non-local stores (non-SoCal)	0%	8%	4%	
Port of San Diego	0%	0%	0%	
Port of Hueneme	0%	0%	<u>0%</u>	
Local + Non-Local Total			100%	

Source: South Coast Air Quality Management District (SCAQMD). 2014. *High Cube Warehouse Trip Rate Study for Air Quality Analysis* <https://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/high-cube-warehouse>

³⁴ The distance from large warehouses to their nearest intermodal freight rail facility was calculated, to / from the following:

- Intermodal Container Transfer Facility (ICTF), Long Beach, CA 90810
- LA Transportation Center – Union Pacific, Los Angeles, CA 90031
- East LA Intermodal Facility – Union Pacific, City of Commerce, CA 90023
- Hobart Yard – Burlington Northern Santa Fe, Los Angeles, CA 90023
- Pacific Harbor Line (PHL) On-Dock Intermodal Facility, Wilmington, CA 90744
- City of Industry Intermodal Terminal – Union Pacific, Industry, CA 91748
- San Bernardino Intermodal Facility – Burlington Northern Santa Fe, San Bernardino, CA 92411

³⁵ The distance from large warehouses to their nearest cargo airport was calculated, to / from the following:

- John Wayne Airport (SNA), Santa Ana, CA 92707
- Long Beach Airport Daugherty Field (LGB), Long Beach, CA 90806
- Los Angeles International Airport (LAX), Los Angeles, CA 90045
- Ontario International Airport (ONT), Ontario, CA 91761
- San Bernardino International Airport (SBD), San Bernardino, CA 92408
- Hollywood Burbank Airport (BUR), Burbank, CA 91505
- March Air Reserve Base (RIV), Riverside, CA 92518

³⁶ Non-local destinations, such as retail stores outside of Southern California and outside of the state, are also among the destinations of truck from large warehouses, but are omitted in this analysis because the length of those trips are unknown and most of their diesel emission impacts are non-local.

³⁷ The average contents weight of a loaded 40-foot container is 13.15083383 tons, based upon the U.S. DoT Maritime Administration’s data on waterborne containers by U.S. Customs Port. For the pre-pandemic year 2017, our estimate converts TEU’s to 40-foot

container equivalents, and Metric Tons to US Tons, in order to get an average import tons per 40-foot container. We blend the average weight of 40-foot containers entering the ports of Long Beach (13.79593112) and Los Angeles (12.61791991) to get the weight of containers' contents driven to and from large warehouses in the 4- county region.

	Imports in Twenty-Foot Equivalent Units (TEUs), 2017	Imports in 40' Container Units (TEUs/2), 2017	Imports (in Metric Tons) 2017	Imports (in US Tons) 2017	Import Tons per 40' Container 2017
Port of LB, CA	3,792,165	1,896,083	23,730,349	26,158,224	13.8
Port of LA, CA	4,590,451	2,295,226	26,272,961	28,960,974	12.6
Sum / Average	8,382,617	4,191,308	50,003,310	55,119,198	13.2

Source: U.S. Department of Transportation, Maritime Administration, 2000 - 2017 U.S. Waterborne Container Trade by U.S. Customs Port, columns 1 and 3. (Columns 2, 4 and 5 calculated by the Economic Roundtable.) <https://www.maritime.dot.gov/data-reports/data-statistics/us-waterborne-foreign-container-trade-us-customs-ports-2000-%E2%80%93-2017>

³⁸ The weight of an empty 40-foot container is 4.1336625 tons in our estimates, converted from the metric weight 3,750 kg using a 1 Kilogram = 0.00110231 US tons conversion rate. "A 40-foot container's empty weight is 3,750 kg (4.1336625 tons, using a 1 Kilogram = 0.00110231 US tons) and can be loaded to a maximum overall weight of 29 tons (26,300kg). But the amount of cargo you can load would depend in large on possible restrictions and/or limitations of the shipping line, the nature of the cargo and specific details of the shipment. Use our cubic meter calculator and discover the exact volume of your cargo." Source: <https://www.icontainers.com/help/40-foot-container/>

³⁹ The weight of a semi-tractor cab, in which the engine sits and is separate from the trailer chassis or enclosed trailer usually attached to it, can have a range of weights. In this research, we use the weight 34,000 pounds, or 17 tons.

⁴⁰ The weight of a tractor truck chassis, the base frame that holds a 40-foot container (or two 20-foot containers) and is connected to – and pulled by – the semi-tractor cab, has a tare (empty) weight of 6,600 pounds, or 3.3 tons. Source: <http://www.chassisking.com/products/40-foot-container-chassis/40-foot-straight-frame-container-chassis/>

⁴¹ Uncompensated public costs from truck travel are costs that exceed the revenue collected from heavy-vehicle use tax, tax on tires, fuel tax, and vehicle registration fees for trucks and trailers. Austin, David (March 2015), Congressional Budget Office, "Pricing Freight Transportation to Account for External Costs," Working Paper 2015-03, <https://www.cbo.gov/publication/50049>. Uncompensated public costs from truck noise are from U.S. Department of Transportation, Federal Highway Administration, (May 2000) "Addendum to the 1997 Federal Highway Cost Allocation Study Final Report," <https://www.fhwa.dot.gov/policy/hcas/addendum.cfm>

⁴² U.S. Congressional Budget Office (May 2023) *Baseline Projections: Highway Trust Fund Accounts*, page 1: "The fund records inflows from revenues collected through excise taxes on the sale of motor fuels, trucks and trailers, and truck tires; taxes on the use of certain kinds of vehicles; and interest credited to the fund." <https://www.cbo.gov/system/files?file=2023-05/51300-2023-05-highwaytrustfund.pdf>

⁴³ U.S. Department of Transportation, Bureau of Transportation Statistics. 2023. State Transportation Statistics: Road Condition. Accessed April 2023: <https://www.bts.gov/road-condition>

⁴⁴ California Air Resources Board. 2021. *EMFAC2021 v1.0.2 CA ARB Emission Factors (EMFAC) model*. Notes: ARB’s Fleet Database provides data generated from the 2021 vehicle registrations. For our research, we used ARD’s Air District; Region: South Coast AQMD dataset for calendar year 2023 (Annual), and used emissions factors for EMFAC202x Categories “T7 ... Class 8” trucks, a weighted average by VMT. Source: <https://arb.ca.gov/emfac/emissions-inventory/28ffaed607e86fec45648960f1f041ede7baa441>

⁴⁵ U.S. Environmental Protection Agency. 2023. CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA). <https://cobra.epa.gov/> Economic Roundtable estimated truck trips, ton miles were used to calculate annual tons of diesel truck emissions (PM2.5, SO2, NOx, NH3 and VOCs), using the California Air Resources Board. 2021. EMFAC2021 v1.0.2 CA ARB Emission Factors (EMFAC) model, which are the inputs to the COBRA model. The COBRA sectors selected are *Highway Vehicles > Diesel Fuel > Heavy Duty* trucks.

⁴⁶ 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 and maintenance buildings and structures.

⁴⁷ Share of total U.S. warehouse employment in the five largest frontline occupations:

SOC Code	Title of Occupation	Percent
43-5071	Shipping, Receiving, and Inventory Clerks	5%
53-7051	Industrial Truck and Tractor (Forklift) Operators	16%
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	25%
53-7064	Packers and Packagers, Hand	5%
53-7065	Stock Clerks - Stockers and Order Fillers	15%

U.S. Bureau of Labor Statistics, Department of Labor, Occupational Employment Statistics (OES) Survey, (May 2019), www.bls.gov/oes.

⁴⁸ Skill requirement information is from the U.S. Department of Labor, Employment and Training Administration, O*NET, which is a database of detailed job descriptions, including measurements of required levels of skills and knowledge. The first O*NET database, version 1.0, was released in 2001. Skill requirements identified in that database are compared to requirements in the most recent database, version 28.0. O*NET information can be accessed at: <https://www.onetonline.org/>.

⁴⁹ MIT Living Wage Calculator, Counties and Metropolitan Statistical Areas in California, (accessed July 23, 2023), <https://livingwage.mit.edu/states/06/locations>.

⁵⁰ Industry revenue and profit are from the 2019 IMPLAN model for California, sector 422, warehousing and storage. Dollars have been adjusted to 2022 values.

⁵¹ Economic Roundtable analysis; U.S. Census Bureau, 2020 Census National Redistricting Data (P.L. 94-171) Summary File, Table P1. Released 2021; U.S. Census Bureau, TIGER/Line Shapefiles. <https://www.census.gov/programs-surveys/decennial-census/about/rdo/summary-files.html>

⁵² Definitions of a family and non-family households, from the U.S. Census Bureau’s “American Community Survey and Puerto Rico Community Survey 2021 Subject

Definitions “ <https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html>”

- “**Household** – A household includes all the people who occupy a housing unit. (People not living in households are classified as living in group quarters.) ... The occupants may be a single family, one person living alone, two or more families living together, or any other group of related or unrelated people who share living arrangements.” Page 80.
- “**Family Households** – A family consists of a householder (sometimes referred to as the “head of household”) and one or more other people living in the same household who are related to the householder by birth, marriage, or adoption. All people in a household who are related to the householder are regarded as members of his or her family.” Page 82
- “**Nonfamily Household** – A householder living alone or with nonrelatives only. Unmarried couples households, whether opposite-sex or same-sex, with no relatives of the householder present are tabulated in nonfamily households.” Page 84

⁵³ Female-headed families are defined by the U.S. Census Bureau as “**Female Householder, No Spouse Present** – A family with a female householder and no spouse of the householder present.” Other family household types in these data include “**Male Householder, No Spouse Present**” and “**Married-Couple Family** – A family in which the householder and his or her spouse are listed as members of the same household. ... Family households and married-couple families include same-sex married couples, beginning with the 2013 data.” U.S. Census Bureau “American Community Survey and Puerto Rico Community Survey 2021 Subject Definitions “ <https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html>”

⁵⁴ U.S. Census Bureau, 2021 American Community Survey 5-Year, Detailed Tables: B11011 Household Type by Units in Structure. Released December 2022. Universe Occupied Households, Geography: Census Tracts.

⁵⁵ The median income is that of the middle household, when all households are rank-order sorted from highest to lowest income households.

⁵⁶ The Census Bureau “uses a set of money income thresholds that vary by family size and composition to determine who is in poverty. If a family’s total income is less than the family’s threshold, then that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically, but they are updated for inflation using the national Consumer Price Index (CPI-U). The official poverty definition uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps).” Read more information about How the Census Bureau Measures Poverty here: <http://www.census.gov/topics/income-poverty/poverty/guidance/poverty-measures.html>

Poverty Thresholds for 2022 by Size of Family and Number of Related Children < 18 (In dollars)

Size of family unit	Related children under 18 years								
	None	One	Two	Three	Four	Five	Six	Seven	Eight+
1 person:									
Under 65	15,225								
65+	14,036								
2 people:									
Under 65	19,597	20,172							
65+	17,689	20,095							
3 people	22,892	23,556	23,578						
4 people	30,186	30,679	29,678	29,782					

5 people	36,402	36,932	35,801	34,926	34,391				
6 people	41,869	42,035	41,169	40,339	39,104	38,373			
7 people	48,176	48,477	47,440	46,717	45,371	43,800	42,076		
8 people	53,881	54,357	53,378	52,521	51,304	49,760	48,153	47,745	
9 people+	64,815	65,129	64,263	63,536	62,342	60,699	59,213	58,845	56,578

Source: U.S. Census Bureau, 2023. Note: The source of the weighted average thresholds is the 2023 Current Population Survey Annual Social and Economic Supplement (CPS ASEC).
<https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html>

⁵⁷ Econometrica, Inc. (2007), Measuring Overcrowding in Housing, prepared for the U.S. Department of Housing and Urban Development Office of Policy Development and Research.

⁵⁸ The three categories of occupants per room are:

- Not Crowded: A rental housing unit is considered adequate or not crowded when the number of rooms per unit corresponds with or exceeds the number of people in the household (≤ 1.0 persons /room).
- Overcrowded: A rental housing unit is considered crowded when the number of people in the household corresponds with or exceeds the number of rooms per unit (1.01 - 1.50 persons/room). A 5-person household that occupies a 1-bedroom apartment with a living room and kitchen (3 rooms) is considered to be living in overcrowded conditions.
- Severely Overcrowded: This is a further threshold of overcrowding, comparable to having 3 or more occupants living in a studio apartment with a kitchen (2 rooms) and 5 or more occupants in 1-bedroom apartment with a living room and kitchen (3 rooms) (> 1.5 persons /room). A 6-person household that occupies a 1-bedroom apartment with a living room and kitchen (3 rooms) is living in severely overcrowded conditions

⁵⁹ This section utilizes CalEnviroScreen and other public health data to highlight communities most affected by pollution. CalEnviroScreen data are compiled by the California Office of Environmental Health Hazard Assessment (OEHHA). Version 4.0 of CalEnviroScreen was released in November 2021. “CalEnviroScreen ranks census tracts in California based on potential exposures to pollutants, adverse environmental conditions, socioeconomic factors and the prevalence of certain health conditions. Data used in the CalEnviroScreen model come from national and state sources.”
<https://oehha.ca.gov/calenviroscreen>

⁶⁰ Zeise, Lauren (OEHHA) and Jared Blumfield (California EPA). CalEnviroScreen 4.0, October 2021. Published by OEHHA, California Environmental Protection Agency. Page 47. <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40> Further information available online at:
<https://oehha.ca.gov/media/downloads/calenviroscreen/report/cireport123110.pdf>

⁶¹ The CalEnviroScreen 4.0 “Pollution Burden” is calculated from the following data:

Pollution Burden: *Exposure Indicators*

- Air Quality: Ozone
- Air Quality: PM2.5
- Diesel Particulate Matter
- Drinking Water Contaminants
- Children’s Lead Risk from Housing
- Pesticide Use
- Toxic Releases from Facilities
- Traffic Impacts

Pollution Burden: *Environmental Effects Indicators*

- Cleanup Sites
- Groundwater Threats
- Hazardous Waste Generators and Facilities
- Impaired Water Bodies
- Solid Waste Sites and Facilities
- Scores for Pollution Burden
- Asthma

Source: Zeise, Lauren (OEHHA) and Jared Blumfield (California EPA). CalEnviroScreen 4.0, October 2021. Published by OEHHA, California Environmental

Protection Agency. Page 47. <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>

⁶² Amini, H., M. Danesh-Yazdi, Q. Di, W. Requia, Y. Wei, Y. AbuAwad, L. Shi, M. Franklin, C.-M. Kang, J. M. Wolfson, P. James, R. Habre, Q. Zhu, J. S. Apte, Z. J. Andersen, X. Xing, C. Hultquist, I. Kloog, F. Dominici, P. Koutrakis, and J. Schwartz. 2023. *Annual Mean PM2.5 Components (EC, NH4, NO3, OC, SO4) 50m Urban and 1km Non-Urban Area Grids for Contiguous U.S., 2000-2019 v1*. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC). <https://doi.org/10.7927/7wj3-en73>. Accessed March 7, 2023.

Additional methodology paper: Amini, H., M. Danesh-Yazdi, Q. Di, W. Requia, Y. Wei, Y. AbuAwad, L. Shi, M. Franklin, C.-M. Kang, J. M. Wolfson, P. James, R. Habre, Q. Zhu, J. S. Apte, Z. J. Andersen, X. Xing, C. Hultquist, I. Kloog, F. Dominici, P. Koutrakis, and J. Schwartz. 2022. *Hyperlocal super-learned PM2.5 components across the contiguous US*. *Research Square*. <https://doi.org/10.21203/rs.3.rs-1745433/v2>.

Elemental Carbon (EC) data come from the 2019 National Urban Dataset for All PM2.5 Components (EC, OC, Nitrate, Sulfate and Ammonium), extracted for Southern California and shared by Sina Hasheminassab, Ph.D., Science Systems Engineer, Jet Propulsion Laboratory, California Institute of Technology. Sincere thanks to Heresh and Sina for their time sharing access to, and insights into, these newly available and high spatiotemporal resolution data.

⁶³ Concerning *pre-existing* Chronic Obstructive Pulmonary Disease (COPD) conditions which are aggravated by harmful diesel emissions, “[t]he main cause of COPD in developed countries is tobacco smoking. In the developing world, COPD often occurs in people exposed to fumes from burning fuel for cooking and heating in poorly ventilated homes. Only some chronic smokers develop clinically apparent COPD, although many smokers with long smoking histories may develop reduced lung function. Some smokers develop less common lung conditions. They may be misdiagnosed as having COPD until a more thorough evaluation is performed.” Source: Mayo Clinic. 2023. *Diseases & Conditions: COPD*. <https://www.mayoclinic.org/diseases-conditions/copd/symptoms-causes/syc-20353679> Accessed online July 13, 2023.

⁶⁴ U.S. Department of Health & Human Services, National Center for Environmental Health. 2023. Most Recent Asthma State or Territory (2021): Adult Prevalence / Mortality: California. https://www.cdc.gov/asthma/most_recent_data_states.htm Accessed online July 13, 2023.

⁶⁵ Wolstein, Joelle, PhD, MPP, MA, Ying-Ying Meng, DrPH, Susan H. Babey, PhD. 2010. *Policy Research Report: Income Disparities in Asthma Burden and Care in California*. UCLA Fielding School of Public Health, Center for Health Policy Research. <https://healthpolicy.ucla.edu/publications/search/pages/detail.aspx?PubID=45> Accessed online July 14, 2023.

⁶⁶ Babey SH, Meng YY, Brown ER, Hastert TA. Nearly six million Californians suffer from asthma symptoms or asthma-like breathing problems. *Policy Brief UCLA Cent Health Policy Res.* 2006 Oct;(PB2006-5):1-7. PMID: 17051690. <https://pubmed.ncbi.nlm.nih.gov/17051690/>

⁶⁷ U.S. Energy Information Administration. 2021. *Today in Energy: Warehouses were the most common U.S. commercial building type as of 2018*. Released November 30, 2021. <https://www.eia.gov/todayinenergy/detail.php?id=50496> Accessed online August 1, 2023.

⁶⁸ Energy consumption data is for non-refrigerated warehouses.

- ⁶⁹ U.S. Energy Information Administration. Commercial Buildings Energy Consumption Survey (CBECS) Table C22. “Electricity consumption totals and conditional intensities by building activity subcategories, 2018.” (December 2022), <https://www.eia.gov/consumption/commercial/reports/2012/water/>
- ⁷⁰ CA Energy Commission. “2009-2021 Total System Electric Generation (Spreadsheet)” <https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2021-total-system-electric-generation>
- ⁷¹ U.S. Environmental Protection Agency. 2023. “Sources of Greenhouse Gas Emissions: Overview” <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>
- ⁷² U.S. Environmental Protection Agency. 2023. “Sources of Greenhouse Gas Emissions: Electric Power Sector Emissions” <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>
- ⁷³ U.S. Energy Information Administration. Commercial Buildings Energy Consumption Survey (CBECS) Public Use Microdata, 2018. Note: Buildings can use 1+ types of energy.
US Energy Administration 2018 CBECS commercial building microdata: Energy Sources of Warehouses vs all Buildings, by Census Region.
<https://www.eia.gov/consumption/commercial/data/2018/>
- ⁷⁴ U.S. Environmental Protection Agency. 1998. AP 42, Compilation of Air Pollutant Emission Factors: Section 1.4 Natural Gas, Final Section - Supplement D, July 1998. https://www.epa.gov/sites/production/files/2020-09/documents/1.4_natural_gas_combustion.pdf
- ⁷⁵ California Air Resources Board (CARB). 2023. “Resources: Inhalable Particulate Matter and Health (PM2.5 and PM10).” <https://ww2.arb.ca.gov/resources/inhalable-particulate-matter-and-health> Accessed on July 31, 2023.
- ⁷⁶ U.S. Environmental Protection Agency. 1998. AP 42, Compilation of Air Pollutant Emission Factors: Section 1.4 Natural Gas, Final Section - Supplement D, July 1998. See page 3. https://www.epa.gov/sites/production/files/2020-09/documents/1.4_natural_gas_combustion.pdf
- ⁷⁷ U.S. Energy Information Administration. 2017. Commercial Buildings Energy Consumption Survey (CBECS). Table W1. Water consumption in large commercial buildings, 2012. <https://www.eia.gov/consumption/commercial/reports/2012/water/>
- ⁷⁸ California Natural Resources Agency, California Environmental Protection Agency. 2022. “Press Release: State Enlists Commercial, Industrial Sector in Water Conservation Efforts” <https://calepa.ca.gov/2022/06/07/press-release-state-enlists-commercial-industrial-sector-in-water-conservation-efforts-6-7-2022/>