

San Diego Jobs Impact Analysis | Technical Appendix

Prepared for the City of San Diego by:

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Residential New Construction Analysis

Methodology: Near-Term Impacts on Residential Building Construction Jobs

To estimate the near-term impacts to residential building construction jobs from a potential Reach Code policy for new construction, the Building Electrification Institute (BEI) and Inclusive Economics team took the following steps:

1. Sourced the total number of new residential units projected to be constructed from 2023 (when a Reach Code is projected to go into effect) through 2035, based on projections from the San Diego Association of Governments (SANDAG).
 - SANDAG provided these projections to the City’s Climate Action Plan (CAP) team, who shared it with BEI. According to the City’s CAP team, this is the same projection data that is used for the City’s CAP update.
 - The SANDAG projection included “single-family attached” and “single-family detached” homes, which were combined for this analysis, and multifamily units, which were separated into small multifamily and large multifamily unit projections using the assumption that 25% of the total units would be small multifamily, and 75% of the total units would be large multifamily. This assumption is based on internal expertise and analysis.
 - Additionally, because the SANDAG projection was broken out into 5-year increments (2020-2025, 2025-2030, and 2030-2035), but our analysis began in 2023, we took two-fifths of the 2020-2025 total estimation to equate the 2023-2025 construction projection, which assumed an equal rate of construction across each year within the 5-year period.
 - Final residential unit projections used in this analysis are included in **Table 1** below.
2. Used labor-specific cost data from Energy and Environmental Economics, Inc. (E3)’s report, [“Residential Building Electrification in California,”](#) to calculate the work hours by trade needed to build new all-electric residential units.
 - Note that E3’s data did not include San Diego’s climate zone, so the team used Climate Zone 6 (Santa Barbara/Santa Monica/Long Beach) since it was the most similar in climate.
3. Used labor-specific cost data from E3’s report, [“Residential Building Electrification in California,”](#) to calculate the work hours by trade needed to build new mixed fuel residential units.
 - The team then sourced gas saturation data by end use (heating, hot water, cooking, etc.) from the [2019 CA Residential Appliance Saturation Study \(RASS\)](#) to calculate a “business-as-usual” scenario for San Diego mixed fuel residential new construction.

4. Calculated the difference in work hours by trade between constructing new, all-electric residential buildings versus new mixed fuel residential buildings. The resulting projected average work hours per residential unit built are included in **Table 2** below.
5. Multiplied the total residential units projected to be built in San Diego through 2035 by the difference in labor hours between constructing mixed fuel versus all-electric units to find the annual change in residential building construction jobs by trade.
 - This methodology assumed that 100% of residential units would be built mixed fuel without the Reach Code policy. Note however that this may be an unrealistic assumption, especially given that the state of California’s proposed updates to the Title 24 Energy Code will strongly encourage (but not require) all-electric new construction beginning in 2023. This means that the results of this analysis may be overestimating the job loss impacts.
 - This methodology assumed 2,000 annual work hours for a full time equivalent (FTE) new construction worker. A higher average number of annual hours was assumed for new construction workers as compared to retrofit workers because there tends to be fewer downtime hours associated with new construction projects.
 - Results included the annual number of residential building construction jobs impacted by trade. The trades included:
 - Plumbing
 - Electrical
 - General Construction
 - Mechanical / HVAC

Notes on Near-term Impacts on Commercial Construction Jobs

The BEI/Inclusive Economics team did not conduct a quantitative assessment of the impacts on commercial construction jobs from a Reach Code. This is because:

- Based on internal BEI and Inclusive Economics analysis, significant cost shifts between capital and labor costs are not expected for new all-electric commercial buildings versus mixed fuel commercial buildings, which indicates there will be minimal labor impacts from the Reach Code for commercial construction workers.
- Additionally, local labor partners reported that the installation of electric heating, ventilation, and air conditioning (HVAC) equipment is already underway and has not caused a discernible change in work hours in commercial construction.
 - This conclusion is supported by a [2014 market assessment](#) of commercial building systems in California completed for the California Public Utilities Commission (CPUC), which finds that nearly 60% of existing commercial building heating systems in SDG&E territory are electric resistance or heat pump systems, while less than 30% of commercial heating systems are gas heating systems.

Methodology: Near-Term Impacts on SDG&E Gas Utility Employees

To develop the near-term impacts on San Diego Gas and Electric (SDG&E) gas utility employees from the Reach Code policy for new construction, the BEI and Inclusive Economics team took the following steps:

- **For Union-Represented SDG&E Gas Utility Employees:**
 1. The International Brotherhood of Electrical Workers (IBEW) 465, the local union that represents SDG&E employees, shared their full list of gas utility workers employed by SDG&E with the BEI/Inclusive Economics team.
 2. The BEI and Inclusive Economics team reviewed this list and identified which gas utility workers could face impacts from reduced demand for new gas infrastructure that could result from a Reach Code. Impacted workers included in the results were:
 - Gas underground technicians
 - Service technicians
 - Laborer underground technicians
 - Working foremen
 - Gas pipe welders
- **For Non-Union Represented SDG&E Gas Utility Employees:**
 1. SDG&E shared their list of non-represented gas utility employees with the BEI/Inclusive Economics team.
 2. The BEI/Inclusive Economics team estimated that none of these workers (who are largely management positions) would face near-term risks from the Reach Code, given that these professions are unlikely to see any meaningful reduction in their work hours from reduced demand for new gas infrastructure.

Methodology: Near-Term Impacts on Gas Infrastructure Workers

To develop the near-term impacts from the Reach Code policy on the broader gas infrastructure workforce, the BEI and Inclusive Economics team took the following steps:

- **For Gas Infrastructure Workers Contracted-out by SDG&E**
 - SDG&E did not share exact data on their contracted-out gas workers, so the BEI/Inclusive Economics team estimated the size of this workforce using two different methods and reported the results as a range.
 - For estimate #1, the BEI/Inclusive Economics team:
 1. Used cost data from the [2020 SDG&E Supplier Diversity Annual Report](#) to calculate the dollars spent per in-house gas services job.
 2. Divided the total dollars spent on contracted-out gas services by the dollars spent per in-house gas services job to calculate the estimated number of contracted-out gas services jobs (700 jobs).
 - This methodology assumes that the dollars spent per in-house SDG&E job approximates the dollars spent per contracted out SDG&E job.
 - For estimate #2, the BEI/Inclusive Economics team:
 1. Used 2019 IMPLAN data to calculate the total dollars spent per gas infrastructure job in San Diego County.
 - IMPLAN is an input-output economic model that uses economic data from government surveys, multipliers, and demographic statistics to map industry spending, employment, economic

transactions and other impacts in the local economy. This analysis uses IMPLAN's underlying "study area data" for its findings.

2. Divided the total SDG&E spending on contracted-out gas services (reported in the [2020 SDG&E Supplier Diversity Annual Report](#)) by the total dollars spent per gas infrastructure job to calculate our second estimate of the number of contracted-out gas services jobs (900 jobs).
- Within this 700-900 range of contracted-out gas workers, the team estimated that a small group of workers focus directly on new construction and could face near-term impacts from a Reach Code. This is for several reasons:
 - During local labor interviews, stakeholders said that SDG&E contracts out roughly 90% of their work related to new gas infrastructure construction. These workers are represented by unions including United Association of Plumbers, Steamfitters & HVAC/R (UA) Local 230 and the Laborers' International Union of North America (LIUNA) Local 89.
 - The workers who could face near-term risks from a Reach Code include workers that focus on pipefitting, trenching, and excavation.
 - More data is needed to more clearly identify these contracted-out workers and to assess both near-term and long-term risks.

Existing Buildings Analysis – Municipal Energy Implementation Plan

Methodology: Near-Term Impacts on Building Retrofit Jobs

To develop the near-term impacts on building retrofit jobs from the Municipal Energy Implementation Plan, the BEI and Inclusive Economics team took the following steps:

1. Identified the total number of municipal buildings and total square footage of these buildings, separated out by small buildings (<25k sq. ft.) and large buildings (>25k sq. ft.), which was data provided directly by the City of San Diego.
 - The dataset excluded buildings smaller than 1,000 square feet under the assumption that major retrofits would not occur on these facilities (these are mostly pump stations, small guard shacks, and Parks facilities), and many of these facilities are already all-electric.
2. Used the City's retrofit policy goals from the Municipal Energy Implementation Plan to develop the energy efficiency and electrification targets to be included in the modeling.
 - This analysis assumed that the City would achieve their policy goal of increasing energy efficiency and fully electrifying all municipal buildings between 2022 – 2035.
3. Input the municipal building stock data and energy efficiency and electrification assumptions into a proprietary model developed by Inclusive Economics.
 - The proprietary model included key modeling assumptions that were initially sourced from the [California Commercial End Use Survey](#) (CUES) developed for the California

Energy Commission (CEC). These assumptions were then checked with City of San Diego Facilities staff, who adjusted many of them based on analysis of the municipal building stock and the goals of the Municipal Energy Implementation Plan. A list of key assumptions used in this analysis are included in **Table 3** below.

- Overarching assumption categories included in this modeling:
 - Market potential (current gas use, panel upgrades needed, energy efficiency potential, and more)
 - Decarbonization technology pathways and costs
 - Job Multipliers (Sourced from IMPLAN 2019)
- 4. The modeling output the total building retrofit work hours gained by trade and by year.
 - This methodology assumed 1,800 annual work hours for a full time equivalent (FTE) worker for retrofits. A higher average number of annual hours was assumed for new construction workers because there tends to be fewer downtime hours associated with new construction projects.
 - Results included annual job impacts for building retrofit workers, by trade. The trades included:
 - Plumbing
 - Electrical
 - General Construction Laborers + Carpenters
 - Mechanical / HVAC
 - Engineers / Analysts
 - Management / Administrative / Professional

Notes on Near-term Impacts for Gas Utility and Gas Infrastructure Workers

The BEI/Inclusive Economics team found that there is unlikely to be any near-term impacts on gas utility and gas infrastructure jobs from the Municipal Energy Implementation Plan. This is because:

- Municipal buildings currently account for only 1.3% of citywide gas usage, meaning that eliminating gas usage in these buildings by 2035 would reduce citywide gas use by only one-tenth of one percent annually.

Long-Term Impacts on County-Wide Gas Infrastructure Workforce

Methodology: Total Gas Infrastructure Workforce

To understand the total gas infrastructure workforce that could face long-term impacts from a broader building decarbonization effort, the BEI/Inclusive Economics team took the following steps:

1. Sourced the current total county-wide gas infrastructure workforce for San Diego County from IMPLAN 2019.
2. Assessed all occupations within this data set and identified four key occupation categories that would likely face the most barriers to finding re-employment over the long-term. These were further analyzed for workers where type of work is more specialized to the gas industry and the skills associated might not be as easily transferable to non-gas positions or industries.

- Four key occupation categories most at-risk over the long-term:
 - Installation, Maintenance, and Repair Occupations
 - Production Occupations
 - Construction + Extraction Occupations
 - Transportation Occupations
- Within these four categories, the specific occupations identified as most at-risk due to specialized skill sets include:
 - Control and Valve Installers and Repairers, Except Mechanical Door
 - First-Line Supervisors of Mechanics, Installers, and Repairers
 - Industrial Machinery Mechanics
 - Gas Plant Operators
 - Power Plant Operators
 - Power Distributors and Dispatchers
 - Petroleum Pump System Operators, Refinery Operators, and Gaugers
 - Plant and System Operators
 - Plumbers, Pipefitters, and Steamfitters
 - Service Unit Operators, Oil and Gas
 - Pipelayers
 - Roustabouts, Oil and Gas
 - Gas Compressor and Gas Pumping Station Operators

Methodology: Total Gas Utility Workforce

To understand the gas utility employees who could face long-term impacts from the broader building decarbonization effort, the BEI/Inclusive Economics team took the following steps:

1. Identified the total current gas utility workforce, both directly employed by SDG&E and contracted out by SDG&E. These workers are a subset of the total gas infrastructure workforce. The team assessed that all of these occupations could face risks from a long-term building decarbonization effort. To identify this workforce, the team:
 - Identified the total workforce of directly-employed SDG&E gas workers.
 - There are a rounded total of 600 union-represented workers directly employed by SDG&E. This total was sourced from data provided by IBEW 465.
 - There are a rounded total of 200 non-represented workers directly employed by SDG&E. This total was sourced from SDG&E.
 - Estimated the total workforce of SDG&E contracted-out gas workers.
 - There is an estimated range of 700-900 gas workers that SDG&E contracts out to. For more details on our team's methodology to estimate this range, see the above section titled, "Methodology: Near-Term Impacts on Gas Infrastructure Workers."

Supporting Tables

Table 1: Projected Residential Unit Construction in San Diego (2023-2035)

Source: SANDAG

Total Projected Residential Units (SANDAG)	Units
Single Family	5,200
Small Multi-Family	23,000
Large Multi-Family	69,000

*Results are rounded to the nearest 100.

Table 2: Projected Work Hours per Residential Unit Constructed

Source: E3 and SANDAG

Average Work Hours Per Residential Unit	Mixed Fuel	All-Electric	Difference
Single Family	100	60	40
Small Multi-Family	60	50	10
Large Multi-Family	60	45	15
Total Hours per Unit	220	155	65

*Results are rounded to the nearest 5.

Table 3: Municipal Energy Implementation Plan, Key Assumptions

Source: CUES and City of San Diego

Key Assumptions for Municipal Buildings	Small Buildings (<25k sq. ft.)	Large Buildings (>25k sq. ft.)
Number of Buildings	250 buildings	50 Buildings
Total Square Footage	2 million sq. ft.	4.5 million sq. ft.
Percent in Need of Efficiency Improvements	95%	95%
Average Efficiency Improvement	15-30%	15-30%
Percent in Need of Panel Upgrade	70%	50%
Percent with Space Heating	92%	82%
Percent of Total with District Heat (for Space Heating)	0%	0%
Percent of Total Using Fossil Fuels for Primary Space Heat	90%	85%
Percent with Water Heating	100%	100%
Percent of Total with District Heat (for Water Heating)	0%	0%
Percent of Total Using Fossil Fuels for Water Heating	80%	85%
Percent with Cooking	35%	15%
Percent of Total Using Gas for Cooking	35%	15%