SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft Socioeconomic Impact Assessment For Proposed Amended Rule 1146.2 – Control of Oxides of Nitrogen from Large Water Heaters, Small Boilers and Process Heaters

May 2024

Deputy Executive Officer
Planning, Rule Development, and Implementation
Sarah L. Rees, Ph.D.

Assistant Deputy Executive Officer
Planning, Rule Development, and Implementation
Michael Krause

Planning and Rules Manager
Planning, Rule Development, and Implementation
Barbara Radlein

Authors:	Xian-Liang (Tony) Tian, Ph.D. – Program Supervisor Shah Dabirian, Ph.D. – Consultant Daniel Penoyer – Air Quality Specialist Chris Yu – Assistant Air Quality Specialist
Contributors:	Yanrong Zhu – Program Supervisor Peter Campbell – Air Quality Specialist Emily Yen – Assistant Air Quality Specialist Valerie Rivera – Assistant Air Quality Specialist
Reviewed By:	Barbara Radlein – Planning and Rules Manager Ruby Laity – Principal Deputy District Counsel Josephine Lee – Senior Deputy District Counsel

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
GOVERNING BOARD

CHAIR: VANESSA DELGADO
Senator (Ret.)
Senate Rules Committee Appointee

VICE CHAIR: MICHAEL A. CACCIOTTI
Councilmember, South Pasadena
Cities of Los Angeles County/Eastern Region

MEMBERS:

ANDREW DO
Supervisor, First District
County of Orange

CURT HAGMAN
Supervisor, Fourth District
County of San Bernardino

GIDEON KRACOV
Governor's Appointee

PATRICIA LOCK DAWSON
Mayor, Riverside
Cities of Riverside County Representative

LARRY MCCALLON
Mayor, Highland
Cities of San Bernardino County

HOLLY J. MITCHELL
Supervisor, Second District
County of Los Angeles

VERONICA PADILLA-CAMPOS
Speaker of the Assembly Appointee

V. MANUEL PEREZ
Supervisor, Fourth District
County of Riverside

NITHYA RAMAN
Councilmember, Fourth District
City of Los Angeles Representative

CARLOS RODRIGUEZ
Councilmember, Yorba Linda
Cities of Orange County

JOSE LUIS SOLACHE
Councilmember, Lynwood
Cities of Los Angeles County/Western Region

EXECUTIVE OFFICER:

WAYNE NASTRI

TABLE OF CONTENTS

EXECUTIVE SUMMARY

On March 17, 1989, the South Coast Air Quality Management District (South Coast AQMD) Governing Board adopted a resolution which requires an analysis of the economic impacts associated with adopting and amending rules and regulations. In addition, Health and Safety Code Section 40440.8 requires a socioeconomic impact assessment for any proposed rule, rule amendment, or rule repeal which "will significantly affect air quality or emissions limitations." Lastly, Health and Safety Code Section 40920.6 requires an incremental cost-effectiveness analysis for a proposed rule or amendment which imposes Best Available Retrofit Control Technology (BARCT) or "all feasible measures" requirements relating to emissions of ozone, carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOC), and their precursors.

Proposed Amended Rule (PAR) 1146.2– Control of Oxides of Nitrogen from Large Water Heaters, Small Boilers and Process Heaters was developed to seek further emission reductions of NOx from natural gas-fired equipment within the South Coast AQMD's jurisdiction and implement the 2022 Air Quality Management Plan (AQMP) Control Measure C-CMB-01: Emission Reductions from Replacement with Zero-emission or Low NOx Appliances – Commercial Water Heating. Upon full implementation, PAR 1146.2 is expected to reduce NOx emissions by 5.6 tons per day (tpd).

A socioeconomic impact assessment has been conducted to assess the cost impacts of PAR 1146.2 and the following presents a summary of the analysis and findings.

Key Elements of PAR 1146.2

PAR 1146.2 requires zero-emission technologies at future effective dates for natural gas-fired large water heaters, small boilers, and process heaters with a heat input greater than 75,000 British thermal units per hour (Btu/hr) and less than or equal to 2 million Btu per hour (MMBtu/hr).

Affected Facilities and Industries

PAR 1146.2 is applicable to manufacturers, distributors, retailers, resellers, installers, owners, and operators of natural gas-fired large water heaters, small boilers, and process heaters with a heat input rating between 75,000 Btu/hr and 2 MMBtu/hr. PAR 1146.2 does not regulate residential gas-fired tank type water heaters rated less than 75,000 Btu/hr heat input. However, residential instantaneous water heaters and pool heaters are regulated by Rule 1146.2 due to higher Btu ratings of those type of units. The PAR 1146.2 universe is comprised of approximately 1,070,000 units of water heaters, high temperature units and pool heaters, which are used in residential, commercial, or light industrial settings. Nearly all industries will be affected by PAR 1146.2. Specifically, the warehousing and storage sector (NAICS 493) will be most affected by PAR 1146.2, followed by sectors of nursing and residential care facilities (NAICS 623) and museums, historical sites, and similar institutions (NAICS 712). Prior analyses in South Coast AQMD indicate that most of the facilities in these sectors do not qualify as a small business pursuant to South Coast AQMD Rule 102 – Definition of Terms. Due to insufficient data on the universe of the facilities affected by PAR 1146.2, a full-blown small business impact analysis is not feasible for this socioeconomic impact assessment.

Assumptions for the Analysis

Most of the compliance costs of PAR 1146.2 are related to the transition from gas-fired to zero-emission water heating equipment. Cost estimation involves an estimated universe of 1,070,000 units of Type 1 and Type 2 units, tank type or instantaneous water heaters, high temperature units and pool heaters, 90 percent (%) of which are assumed to be replacement of old gas-fired units in existing commercial, residential, or light industrial buildings, while the remaining 10% are first-time installations in new buildings for the applicable category pursuant to PAR 1146.2 paragraph (d)(2) on and after the applicable PAR 1146.2 compliance dates.

The analysis assumed the unit age of all existing units is uniformly distributed over a period of their full useful life, implying that implementing PAR 1146.2 at the existing buildings will be a linear, phased-in process. After the phase-in is completed, all of the old gas-fired units will have been replaced by zero-emission units. In addition, PAR 1146.2 provides an implementation grace period for existing buildings, that is, the first year of implementation is allowed to occur three or four years later than what is required for new buildings. Equipment replacement occurring in existing buildings may involve an electric panel upgrade cost, while installing zero-emission units in new buildings has no such upgrade cost.

To estimate the fuel switching cost/saving of transitioning from natural gas to zero-emission water heating technologies that use electricity, this analysis considered the anticipated energy demand and forecasted prices in the future for both natural gas and electricity. The source of the forecasted energy prices is the 2023 California Energy Commission (CEC) Integrated Energy Policy Report (IEPR). For Type 1 pool heaters and instantaneous water heaters, residential utility rates are applied, while commercial utility rates are applied for all the other categories of units. In addition, the CEC IEPR considers three different scenarios: a baseline scenario, a high energy demand scenario and a low energy demand scenario. The analysis in this report applied the electricity price forecast from the baseline scenario.

Compliance Costs

The average annual compliance costs of PAR 1146.2 are estimated to range from $48.99 million to $96.77 million, depending on the real interest rate assumed (1% to 4%). The estimated annual costs are expected to be incurred by nearly all the industries in the South Coast AQMD region.

The following table presents the summary of the average annual cost of PAR 1146.2 by equipment category. Except for instantaneous water heaters, all the equipment categories exhibit a cost savings in their recurring fuel-switching cost. With one-time and recurring costs combined, about 32% of the total annual compliance cost is attributed to

Type 2 water heaters being replaced with two split heat pumps, followed by instantaneous water heaters which would be about 21% of the total annual cost.

Average Annual Compliance Costs (2026-2057)

Cost Categories	1% Real Interest Rate	4% Real Interest Rate
One-Time Cost		
Type 1 Water Heater replaced by heat pump	$16,289,888	$19,728,126
Type 1 High Temperature Unit replaced by heat pump	$8,260,714	$11,309,575
Type 2 Water Heater - Scenario with replacement by two split heat pumps	$32,344,304	$44,281,929
Type 2 High Temperature Unit replaced by heat pump	$6,294,343	$8,617,457
Type 1 Pool Heater replaced by heat pump	$121,291,936	$146,892,519
Instantaneous Water Heater replaced by heat pump	$3,847,000	$5,266,850
Recurring Costs		
Type 1 Water Heater replaced by heat pump	($2,671,829)	($2,671,829)
Type 1 High Temperature Unit replaced by heat pump	($4,376,038)	($4,376,038)
Type 2 Water Heater - Scenario with replacement by two split heat pumps	($12,786,700)	($12,786,700)
Type 2 High Temperature Unit replaced by heat pump	($4,819,582)	($4,819,582)
Type 1 Pool Heater replaced by heat pump	($129,540,284)	($129,540,284)
Instantaneous Water Heater replaced by heat pump	$14,865,970	$14,865,970
Total	**$48,999,721**	**$96,767,993**

Job Impacts

Direct effects of the proposed project are used as inputs to the REMI model in order for the model to assess secondary/induced impacts for all the industries in the four-county economy on an annual basis and across a user-defined horizon.

When the compliance cost is annualized using a 4% real interest rate, it is projected that an annual average of 1,074 net jobs will be foregone from 2026 to 2057. The 1,074 annual jobs foregone represents approximately 0.0084% of total annual jobs in the four-county area.

In 2031, about 600 additional jobs are projected to be added to the economy due to the compliance expenditures and additional spending associated with the installation of zero-emission water heaters. These additional jobs are expected to come from sectors such as retail (NAICS 44-45), fabricated metal product manufacturing (NAICS 332), and wholesale trade (NAICS 42).

However, as affected facilities continue to bear the amortized capital expenditures of zero-emission water heaters, a gradual reduction in the positive job impacts from earlier years is expected to occur. Consequently, this reduction would lead to jobs foregone in the subsequent years following the initial implementation.

The construction sector (NAICS 23) is anticipated to bear the largest share of average annual jobs foregone, with an estimated 173 jobs foregone.

Competitiveness

The overall impacts of the PAR 1146.2 on the production costs and delivered prices in the region is not expected to be significant. According to the REMI Model, PAR 1146.2 is projected to increase the cost of production of all the industries in South Coast AQMD's jurisdiction by 0.002% and increase the relative delivered price of the goods provided by those industries by 0.002% in 2032, when PAR 1146.2 has the greatest impacts upon cost of production and relative delivered price in affected industries.

INTRODUCTION

Rule 1146.2– Control of Oxides of Nitrogen from Large Water Heaters, Small Boilers and Process Heaters, regulates NOx emissions from natural gas-fired large water heaters, small boilers, and process heaters with a heat input greater than 75,000 Btu/hr and less than or equal to 2 MMBtu/hr. Rule 1146.2 was adopted in January 1998 and last amended in 2018.

Proposed Amended Rule (PAR) 1146.2 seeks further NOx emission reductions from natural gas-fired equipment in South Coast AQMD's jurisdiction and implements the 2022 AQMP Control Measure C-CMB-01: Emission Reductions from Replacement with Zero-emission or Low NOx Appliances – Commercial Water Heating. Upon full implementation, PAR 1146.2 is expected to reduce NOx emissions by 5.6 tpd.

The provisions of PAR 1146.2 are applicable to manufacturers, distributors, retailers, resellers installers, owners, and operators of natural gas-fired large water heaters, small boilers, and process heaters less than or equal to 2 MMBtu/hr. PAR 1146.2 does not regulate residential gas-fired tank type water heaters less than 75,000 Btu/hr heat input which are regulated under South Coast AQMD Rule 1121 – Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters (Rule 1121); however, residential instantaneous (tankless) water heaters and pool heaters are regulated by Rule 1146.2 due to the higher Btu ratings of those type of units. Units used in recreational vehicles are exempt from the requirements of Rule 1146.2.

PAR 1146.2 will affect approximately 1,070,000 units in the South Coast AQMD, including approximately 710,000 pool heaters, 300,000 instantaneous water heaters, and 60,000 other Type 1 and Type 2 units. Type 1 units are the units with rated heat input capacity less than or equal to 400,000 Btu/hr, and Type 2 units are the ones sized greater than 400,000 Btu/hr and less than or equal to 2,000,000 Btu/hr.

LEGISLATIVE MANDATES

The legal mandates directly related to the assessment of PAR 1146.2 include South Coast AQMD Governing Board resolutions and various sections of the Health and Safety Code.

South Coast AQMD Governing Board Resolution

On March 17, 1989, the South Coast AQMD Governing Board adopted a resolution that calls for an economic analysis associated with adopting and amending rules and regulations that considers all of the following elements:

- Affected industries
- Range of probable costs
- Cost-effectiveness of control alternatives
- Public health benefits

Health and Safety Code Requirements

The state legislature adopted legislation which reinforces and expands the South Coast AQMD Governing Board resolution requiring socioeconomic impact assessments for rule development projects. Health and Safety Code Section 40440.8, which went into effect on January 1, 1991, requires a socioeconomic impact assessment for any proposed rule, rule amendment, or rule repeal which "will significantly affect air quality or emissions limitations."

To satisfy the requirements in Health and Safety Code Section 40440.8, the scope of the socioeconomic impact assessment should include all of the following information:

- Type of affected industries;
- Impact on employment and the regional economy;
- Range of probable costs, including those to industry;
- Availability and cost-effectiveness of alternatives to the rule;
- Emission reduction potential; and
- Necessity of adopting, amending, or repealing the rule in order to attain state and federal ambient air quality standards.

Health and Safety Code Section 40728.5, which went into effect on January 1, 1992, requires the South Coast AQMD Governing Board to: 1) actively consider the socioeconomic impacts of regulations; 2) make a good faith effort to minimize adverse socioeconomic impacts; and 3) include small business impacts. To satisfy the requirements in Health and Safety Code Section 40728.5, the socioeconomic impact assessment should include the following information:

- Type of industries or business affected, including small businesses; and
- Range of probable costs, including costs to industry or business, including small business.

Finally, Health and Safety Code Section 40920.6, which went into effect on January 1, 1996, requires an incremental cost-effectiveness analysis for a proposed rule or amendment which imposes Best Available Retrofit Control Technology (BARCT) or “all feasible measures” requirements relating to emissions of ozone, carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx), VOC, and their precursors. The BARCT and cost-effectiveness analyses for PAR 1146.2 were conducted and are located in Chapter 2 of the Draft Staff Report.

AFFECTED FACILITIES AND INDUSTRIES

Water heaters, boilers, and pool heaters which are subject to PAR 1146.2 requirements can be used in residential as well as commercial and light industrial settings. Since residences are not facilities, the universe of PAR 1146.2 is based on the number of affected units (e.g., water heaters, boilers and pool heaters), instead of affected facilities. The affected units are split into two categories: Type 1 units with a rated heat input capacity less than or equal to 400,000 Btu/hr, and Type 2 units whose rated heat input capacity is greater than 400,000 Btu/hr but less than or equal to 2,000,000 Btu/hr. The total PAR 1146.2 universe is comprised of approximately 1,070,000 units, with approximately 710,000 pool heaters, 300,000 instantaneous water heaters, and 60,000 other units.

The 2019 Residential Appliance Saturation Study (RASS) finds that 7% of homes in the region where SoCalGas is the natural gas provider have gas-heated spas and 5% have pools with gas

heaters.[1] There are approximately 5.9 million homes in the South Coast AQMD region based on the U.S. Census' 2021 American Housing Survey. Thus, staff conservatively estimated that there are approximately 710,000 (calculated as 5,900,00 x 12%) Type 1 pool heaters operating at residences in the South Coast AQMD region.

The 2006 rule amendment also relied on data provided by SoCalGas which estimated that there were 40,000 and 22,000 units of Type 1 and Type 2 water heaters and boilers, respectively, in the South Coast AQMD jurisdiction at the time. For the PAR 1146.2 analysis, the analysis assumed 60,000 total units for these categories in the region. Meanwhile, the proportions of Type 1 and Type 2 units in the universe that are not Type 1 pool heaters or instantaneous water heaters was also updated utilizing the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) certifications data.

Recently, the deployment of residential instantaneous water heaters has increased in response to federal and state energy efficiency regulations. Using the 2019 California Residential Appliance Saturation Study (RASS) from the CEC and the Residential Energy Consumption Survey (RECS) from the U.S. Energy Information Administration, there are approximately 300,000 instantaneous water heaters in the South Coast AQMD jurisdiction.[2]

Affected Industries and Small Business

PAR 1146.2 is applicable to manufacturers, distributors, retailers, installers, and operators of natural gas-fired large water heaters, small high temperature units, and process heaters less than or equal to 2 MMBtu/hr. Staff estimated a universe of 1,070,000 units of tank type/instantaneous water heaters, pool heaters, and other units. The majority of the instantaneous water heaters and pool heaters are used in residential buildings while the rest are primarily used in commercial or light industrial installations. For rental properties, the transition from gas-fired units to zero-emission equipment will increase operation costs of commercial buildings, which then could be passed on to tenants through raised rents. Nearly all industries that will be affected by PAR 1146.2 rent office space. Table 1 presents the ratio of the value of real estate usage to total output for various industries[3]; this ratio can be used as a proxy for the extent that the industries will be affected by increased rents due to the implementation of PAR 1146.2. As shown in Table 1, the warehousing and storage sector (NAICS 493) will be the most affected by PAR 1146.2, followed by the nursing and residential care facilities sector (NAICS 623) and the museums, historical sites, and similar institutions sector (NAICS 712). Prior analyses conducted in South Coast AQMD show that most of the facilities in these sectors do not qualify as a small business pursuant to South Coast AQMD Rule 102. However, due to the lack of data on the universe of the affected facilities and the broad scope of the proposed project, a more robust small business impact analysis is not feasible for this socioeconomic impact assessment.

[1] California Energy Commission, 2019 California Residential Appliance Saturation Study, https://www.energy.ca.gov/publications/2021/2019-california-residential-appliance-saturation-study-rass (please refer to Table ES-3 in Page 11)

[2] U.S. Energy Information Administration, 2020 Residential Energy Consumption Survey Data, https://www.eia.gov/consumption/residential/data/2020/

[3] The input-output (IO) table in 2024 REMI v3 model was relied upon to prepare Table 1.

Table 1
Value of Real Estate Usage as a Proportion of Output Across Industries

NAICS Code	Industry	Ratio of Real Estate Usage to Output
493	Warehousing and storage	12.54%
623	Nursing and residential care facilities	11.35%
712	Museums, historical sites, and similar institutions	10.78%
61	Educational services; private	10.28%
624	Social assistance	10.08%
812	Personal and laundry services	8.41%
722	Food services and drinking places	7.95%
44-45	Retail trade	7.91%
713	Amusement, gambling, and recreation industries	7.76%
813	Religious, grantmaking, civic, professional, and similar organizations	7.51%
621	Ambulatory health care services	5.61%
55	Management of companies and enterprises	4.99%
622	Hospitals; private	4.55%
531	Real estate	4.11%
512	Motion picture and sound recording industries	3.91%
42	Wholesale trade	3.75%
523, 525	Securities, commodity contracts, other investments; Funds, trusts, other financial vehicles	3.70%
54	Professional, scientific, and technical services	3.45%
711	Performing arts, spectator sports, and related industries	3.38%
517	Telecommunications	2.99%
811	Repair and maintenance	2.97%
532, 533	Rental and leasing services; Lessors of nonfinancial intangible assets	2.97%
521, 522	Monetary authorities - central bank; Credit intermediation and related activities	2.58%
524	Insurance carriers and related activities	2.43%
518, 519	Data processing, hosting, and related services; Other information services	2.41%
721	Accommodation	2.32%
562	Waste management and remediation services	2.27%
561	Administrative and support services	2.25%
511	Publishing industries, except Internet	2.08%
323	Printing and related support activities	1.82%
485	Transit and ground passenger transportation	1.79%
492	Couriers and messengers	1.61%

Table 1 (continued)
Value of Real Estate Usage as a Proportion of Output Across Industries

NAICS Code	Industry	Ratio of Real Estate Usage to Output
487-488	Scenic and sightseeing transportation; Support activities for transportation	1.56%
484	Truck transportation	1.44%
23	Construction	1.21%
337	Furniture and related product manufacturing	1.18%
332	Fabricated metal product manufacturing	1.07%
3364-3369	Other transportation equipment manufacturing	1.07%
486	Pipeline transportation	0.95%
326	Plastics and rubber products manufacturing	0.85%
313-314	Textile mills; Textile product mills	0.79%
22	Utilities	0.79%
515	Broadcasting, except Internet	0.78%
483	Water transportation	0.65%
321	Wood product manufacturing	0.65%
339	Miscellaneous manufacturing	0.61%
322	Paper manufacturing	0.61%
211	Oil and gas extraction	0.59%
327	Nonmetallic mineral product manufacturing	0.52%
325	Chemical manufacturing	0.51%
312	Beverage and tobacco product manufacturing	0.44%
315-316	Apparel manufacturing; Leather and allied product manufacturing	0.39%
333	Machinery manufacturing	0.38%
481	Air transportation	0.33%
334	Computer and electronic product manufacturing	0.32%
335	Electrical equipment, appliance, and component manufacturing	0.28%
482	Rail transportation	0.27%
814	Private households	0.24%
311	Food manufacturing	0.24%
213	Support activities for mining	0.23%
3361-3363	Motor vehicles, bodies and trailers, and parts manufacturing	0.22%
331	Primary metal manufacturing	0.18%
113-114	Forestry and Logging; Fishing, hunting and trapping	0.17%
212	Mining (except oil and gas)	0.11%
324	Petroleum and coal products manufacturing	0.03%
115	Support activities for agriculture and forestry	0.01%

COMPLIANCE COSTS

Most of compliance costs associated with implementing PAR 1146.2 are related to the transition from gas-fired to zero-emission water heating equipment. The cost estimate relies on the estimated universe of 1,070,000 units of tank type/instantaneous water heaters, high temperature units, pool heaters, and other Type 1 and Type 2 units, 90% of which are assumed to be replacements of old gas-fired units in existing commercial or residential buildings, while the remaining 10%t are first-time installations to new buildings on and after the applicable PAR 1146.2 compliance dates.

The analysis assumed the unit age of all existing units is uniformly distributed over a period of their full useful life, implying that implementing PAR 1146.2 at the existing buildings will be a linear, phased-in process. After the phase-in is completed, all of the old gas-fired units will have been replaced by zero-emission units. The analysis assumed new buildings will be built up gradually, and thus also assumed a linear phased-in process of rule implementation over the full useful life of equipment for the new buildings. In addition, PAR 1146.2 provides an implementation grace period for existing buildings, that is, the first year of implementation is allowed to occur three or four years later than what is required for new buildings. Equipment replacement occurring in existing buildings may involve an electric panel upgrade cost, while installing zero-emission units in new buildings has no such upgrade cost.

Water Heaters

Type 1 Water Heater Replaced by Heat Pump

Type 1 water heaters are gas-fired units with a heat input capacity rated less than or equal to 400,000 Btu/hr, which are expected to be replaced with zero-emission heat pump water heaters. Based on estimates in the May 2006 Final Staff Report for Rule 1146.2, on average, the purchase price of a gas-fired Type 1 water heater was approximately $7,000 in 2023 US dollars.[4] [5] For a comparable zero-emission heat pump water heater, this analysis assumed a purchase price of $13,200 and a panel upgrade cost of $2,500 based on manufacturer quotes, which yields an incremental cost of $8,700 to upgrade a Type 1 water heater in an existing building. Since no panel upgrade costs will be required in new buildings, the installation of Type 1 heat pump water heaters as part of new construction will have a lower incremental cost at $6,200. Based on the U.S. Department of Energy (DOE) estimates and the parameters previously relied upon in Socioeconomic Impact Assessment for the 2022 AQMP, a useful life of 15 years is assumed for the heat pump water heater. The first compliance dates for new and existing buildings are January 1, 2026 and January 1, 2029, respectively.

Type 2 Water Heater Replaced with Two Split System Heat Pumps

Type 2 water heaters have a higher heat input capacity, rated between 400,000 and 2,000,000 Btu/hr. Per a manufacturer's recommendation, a 500,000 Btu/hr Type 2 natural gas water heater will be replaced by two split system heat pump water heaters with a 400-gallon tank and an estimated useful life of 25 years. Based on the May 2006 Final Staff Report for Rule 1146.2, the purchase price for a comparable high-efficiency natural gas-fired commercial tank-type unit was

[4] Unless specified otherwise, all of the dollar amounts presented in this report will be in 2023 US dollars.

[5] South Coast Air Quality Management District, 2006 Final Staff Report for Proposed Rule 1146.2, http://www3.aqmd.gov/hb/2006/May/060535a.html

approximately $14,000 in 2023 dollars. In contrast, the anticipated capital cost for the two split system heat pumps is approximately $84,000 with a panel upgrade cost of $4,200, according to manufacturer quotes. Thus, the incremental capital cost per unit for this replacement is $74,200 for existing buildings. Because no panel upgrade will be needed, the installation of Type 2 two split heat pump water heater has a lower incremental cost of $70,000. The compliance dates for new and existing buildings are January 1, 2028 and January 1, 2031, respectively.

High Temperature Units

Type 1 High Temperature Unit Replaced by Heat Pump

Type 1 and Type 2 high temperature units are defined by the same heat input capacity criteria as the preceding Type 1 and Type 2 water heaters but are designed specifically for higher temperature applications. The incremental capital cost for Type 1 high temperature unit replacement estimate was based on a manufacturers' quotes of $24,000 for a 399,000 Btu/hr natural gas-fired Type 1 high temperature unit, and $222,000 for a comparable 365,000 Btu/hr heat pump unit with a $4,200 panel upgrade cost, which yields a per-unit incremental capital cost of $202,200 for existing buildings. Because no panel upgrade will be needed, the installation of a Type 1 heat pump high temperature unit in new buildings has a lower incremental cost of $198,000. In addition, based on information provided by manufacturers, the analysis assumed a useful life of 25 years for the Type 1 heat pump unit. The compliance dates for new and existing buildings are January 1, 2029 and January 1, 2033, respectively.

Type 2 High Temperature Unit Replaced by Heat Pump

Manufacturer quotes were provided for a Type 2 natural gas fired high temperature unit and a comparable Type 2 heat pump unit at $32,500 and $336,000, respectively. The estimated panel upgrade cost for the heat pump unit is $4,200, yielding a per-unit incremental capital cost of $307,700 for existing buildings. Because no panel upgrade will be needed, the installation of Type 2 heat pump high temperature unit has a lower incremental cost at $303,500 for new buildings. Again, the analysis assumed a useful life of 25 years for the Type 2 high-temperature heat pump unit. The compliance dates for new and existing buildings are January 1, 2029 and January 1, 2033, respectively.

Instantaneous Water Heater and Pool Heater Replaced with Heat Pump

Instantaneous Water Heater Replaced with Heat Pump

Instantaneous water heaters are tankless units. Based on the estimated universe of 300,000 natural gas fired instantaneous water heaters that would need to be replaced by zero-emission heat pump tank-type units, the analysis considered the replacement of a typical 150,000 Btu/hr gas-fired tankless water heater with a 65-gallon tank-type heat pump for residential applications. According to an Energy and Environmental Economics (E3) study, a 150,000 Btu/hr tankless water heater costs approximately $2,775, while a comparable tank-type heat pump costs approximately $2,400

based on internet quotes, resulting in potential cost savings in the purchase price.[6, 7] However, after including the estimated panel upgrade cost of $1,050, the per-unit incremental capital cost will be $675 for existing buildings. In new buildings without panel upgrades, the installation of instantaneous heat pump water heater is expected to yield a per-unit cost saving at $375 for new buildings. The analysis assumes the heat pump tank-type units have a useful life of 25 years. The compliance dates for new and existing buildings are January 1, 2026 and January 1, 2029, respectively.

Type 1 Pool Heater Replaced with Heat Pump

The last category of natural gas fired units subject to PAR 1146.2 are Type 1 pool heaters, which are specially used for heating the water in swimming pools and usually have a heat input capacity rating of less than or equal to 400,000 Btu/hr. Online quotes for pool heaters indicate that a zero-emission heat pump and a comparable traditional gas-fired heater cost $4,920 and $1,800, respectively. With an estimated panel upgrade cost of $625, the per-unit incremental capital cost will be $3,745 for existing buildings. Because no panel upgrade will be needed, the installation of a Type 1 heat pump pool heater will have a lower incremental cost at $3,120 for new buildings. In accordance with DOE estimates, the analysis assumed a useful life of 15 years for heat pump pool heaters[8]. The compliance dates for Type 1 pool heaters are January 1, 2028 and January 1, 2031, respectively, for new and existing old buildings.

Fuel Switching Cost

The only recurring cost incurred by PAR 1146.2 is a fuel switching cost, due to the transition from natural gas fired units to zero-emission electric ones. In general, electricity is more expensive to use than natural gas; however, the higher electricity cost can be offset to some extent by the increased heating efficiency of the heat pump units.

To estimate the fuel switching cost/saving of transition from natural gas to electric water heating, the analysis considered the anticipated energy demand and forecasted prices in the future for both natural gas and electricity. The forecasted energy prices are sourced from the 2023 California Energy Commission (CEC) Integrated Energy Policy Report (IEPR).[9] Note that CEC has a separate electricity price forecast for both the Los Angeles Department of Water and Power (LADWP) and Southern California Edison (SCE) planning areas. The analysis relied upon an average of the two forecasted prices weighted by population. Specifically, as LADWP serves

[6] Energy and Environmental Economics, 2019 Residential Building Electrification in California, https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf. (please refer to Figure 2-7, Page 32)

[7] Energy Star by U.S. EPA provided information on a 64-gallon storage volume heat pump with a Uniform Energy Factor of 3.64, which has a capital cost of around $2,000 from internet search. Energy Star provides 178 therms per year for instantaneous and 1,233 kwh for an equivalent heat pump. Adding an additional 20% to the zero-emission unit cost to address installation cost results in $2,400 for the zero-emission unit.

[8] Energy Saver, 2024 Heat Pump Swimming Pool Heaters, https://www.energy.gov/energysaver/heat-pump-swimming-pool-heaters.

[9] California Energy Commission, 2022 Integrated Energy Policy Update, Docket 22-IEPR-03 – Electricity Forecast, CEDU Baseline Forecast – LADWP, https://efiling.energy.ca.gov/GetDocument.aspx?tn=248381&DocumentContentId=82804, accessed February 27, 2024.

roughly 23% of the population in the region, it is assigned a weight of 0.23, while the weight of SCE is specified as 0.77. For natural gas, the analysis solely relied on Southern California Gas (SCG) company forecast, since it is the primary gas utility in the South Coast AQMD region. For Type 1 pool heaters and instantaneous water heaters, residential utility rates are used, while commercial utility rates are used for all the other categories of units. For each category of units, the steps used to estimate the recurring fuel switching cost/saving due to the transition to zero-emission units are summarized as follows:

1. Estimate daily electricity demand from the electric heat pump units;
2. Estimate daily natural gas demand of the to-be-replaced natural gas fired units;
3. Estimate annual demand of natural gas and electricity via multiplying respective daily demand by the number of operating days in a year;
4. Calculate the average price forecast for natural gas and electricity over the period 2024-2035, which is CEC forecast period;
5. Estimate annual cost of natural gas and electricity via multiplying respective annual demand by the average price forecast;
6. For each category of units, calculate annual cost difference in Step 5.

Table 2 presents annual demand and price forecast of natural gas/electricity, and calculated annual fuel switching cost/saving for each category. For a detailed description of the methods used to estimate energy inputs, please refer to Chapter 2 of the PAR 1146.2 Draft Staff Report.

Table 2
Annual Per-Unit Fuel Switching Cost or Saving

Equipment Type	Annual Natural Gas Demand (therms)	Annual Electricity Demand (kWh)	Forecasted Natural Gas Price ($/therm)	Forecasted Electricity Rate ($/kWh)	Annual Fuel Switching Cost (+) or Savings (-)
Type 1 Water Heater Replaced by Heat Pump	1,431.72	9,488.63	$1.78	$0.26	-$97.82
Type 1 High Temperature Unit Replaced by Heat Pump	7,516.56	33,211	$1.78	$0.26	-$4,795.66
Type 2 Water Heater Replaced by Two Split Heat Pumps	9,419.25	59,860	$1.78	$0.26	-$1,305.18
Type 2 High Temperature Unit Replaced by Heat Pump	18,838	88,877	$1.78	$0.26	-$10,563.47
Type 1 Pool Heater Replaced by Heat Pump	262.8	1135.15	$2.40	$0.31	-$278.81
Instantaneous Water Heater Replaced by Heat Pump	177	1,646	$2.40	$0.31	$85.71

It is important to note that forecasted energy prices listed in Table 2 will differ from actual observed prices. The latter are determined by many factors, including geopolitical factors, supply and demand shocks, and other unforeseeable events. In comparison, the CEC forecast is based on a rigorous modeling process that takes into account factors specific to the California utility market and reflects best available expectation of energy prices in the future.

Total Compliance Cost of PAR 1146.2

The compliance cost analysis covers the period 2026-2057. Staff first amortized one-time capital cost over the period, and then added the amortized capital cost to the recurring cost in each year to estimate annual compliance cost of PAR 1146.2. As presented in Table 3, the total present value of all the annual compliance costs is estimated at $2,445.94 million and $1,260.37 million, respectively, depending on the discount rate assumed (1% and 4%).[10] The average annual compliance costs of PAR 1146.2 from 2026-2057 are estimated to range from $48.99 million to

[10] In 1987, South Coast AQMD staff began to calculate cost-effectiveness of control measures and rules using the Discounted Cash Flow method with a discount rate of 4%. Although not formally documented, the discount rate is based on the 1987 real interest rate on 10-year Treasury Notes and Bonds, which was 3.8%. The maturity of 10 years was chosen because a typical control equipment life is 10 years; however, a longer equipment life would not have corresponded to a much higher rate-- the 1987 real interest rate on 30-year Treasury Notes and Bonds was 4.4%. Since 1987, the 4% discount rate has been used by South Coast AQMD staff for all cost-effectiveness calculations, including BACT analysis, for the purpose of consistency.

$96.77 million, depending on specific real interest rate assumed (1% to 4%). Except for instantaneous water heaters replaced by heat pumps, all the other equipment categories have recurring cost saving in the transition from natural-gas fired to zero-emission units.

Table 3
Total Present Worth and Average Annual Estimated Costs of PAR 1146.2

Cost Categories	Present Worth Value (2024)		Annual Average (2026-2057)	
	1% Discount Rate	4% Discount Rate	1% Real Interest Rate	4% Real Interest Rate
One-Time Cost				
Type 1 Water Heater replaced by heat pump	$505,536,016	$271,721,985	$16,289,888	$19,728,126
Type 1 High Temperature Unit replaced by heat pump	$283,372,800	$142,137,215	$8,260,714	$11,309,575
Type 2 Water Heater - Scenario with replacement by two split heat pumps	$1,115,954,641	$570,642,859	$32,344,304	$44,281,929
Type 2 High Temperature Unit replaced by heat pump	$215,934,464	$108,337,694	$6,294,343	$8,617,457
Type 1 Pool Heater replaced by heat pump	$3,730,214,053	$1,944,962,454	$121,291,936	$146,892,519
Instantaneous Water Heater replaced by heat pump	$131,332,077	$64,443,857	$3,847,000	$5,266,850

Table 3 (continued)
Total Present Worth and Average Annual Estimated Costs of PAR 1146.2

Cost Categories	Present Worth Value (2024)		Annual Average (2026-2057)	
	1% Discount Rate	4% Discount Rate	1% Real Interest Rate	4% Real Interest Rate
Recurring Costs/Savings				
Type 1 Water Heater replaced by heat pump	($68,584,256)	($37,093,924)	($2,671,829)	($2,671,829)
Type 1 High Temperature Unit replaced by heat pump	($109,668,789)	($55,048,647)	($4,376,038)	($4,376,038)
Type 2 Water Heater - Scenario with replacement by two split heat pumps	($322,404,166)	($165,155,913)	($12,786,700)	($12,786,700)
Type 2 High Temperature Unit replaced by heat pump	($120,784,537)	($60,628,237)	($4,819,582)	($4,819,582)
Type 1 Pool Heater replaced by heat pump	($3,292,841,837)	($1,723,007,745)	($129,540,284)	($129,540,284)
Instantaneous Water Heater replaced by heat pump	$377,878,553	$199,053,588	$14,865,970	$14,865,970
Total	**$2,445,939,019**	**$1,260,365,184**	**$48,999,721**	**$96,767,993**

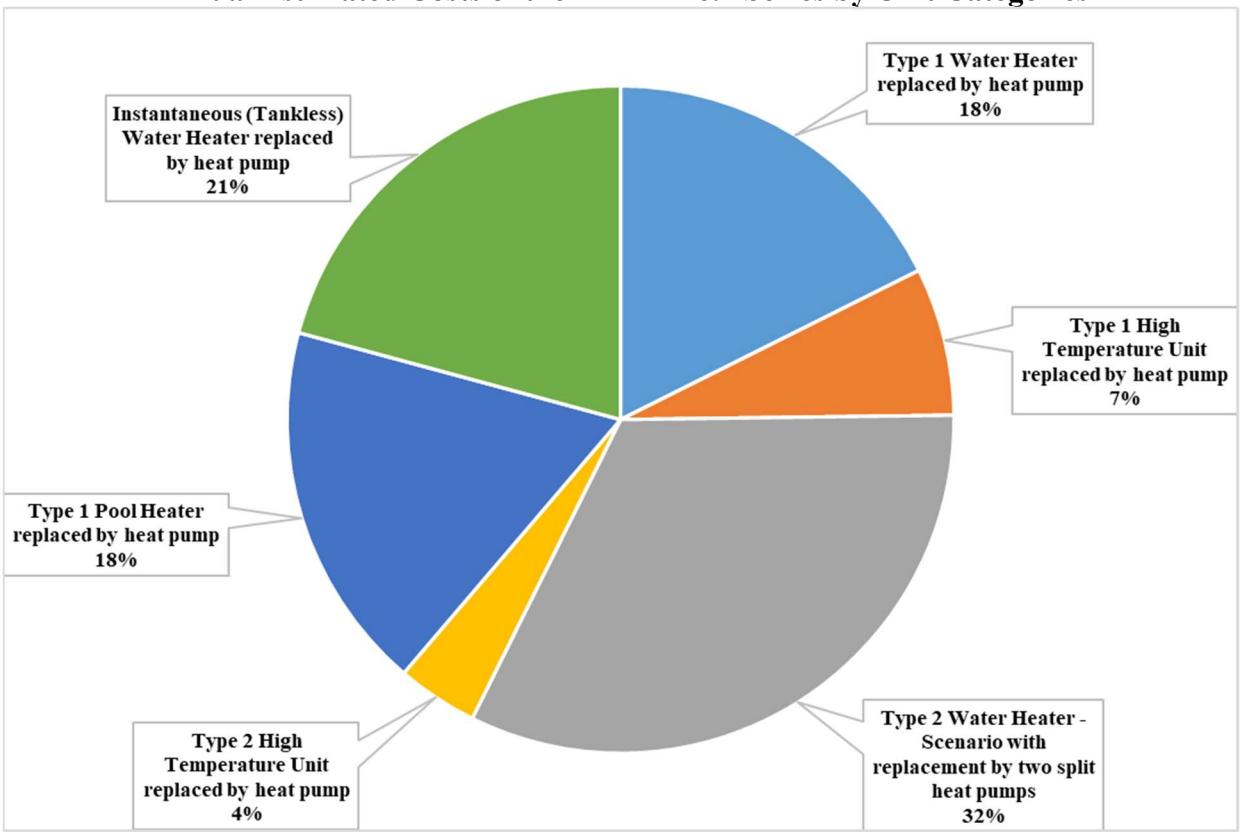
Table 4 presents estimated annual compliance costs for existing and new buildings, separately. Compared with existing buildings, new buildings incur lower compliance costs as only 10% of the universe of units will be installed in the new buildings. New buildings will incur the cost earlier because of earlier compliance dates. Annual costs will also be lower for new construction due to the lack of panel upgrade costs. For example, although existing buildings incur positive annual costs for the replacement of Type 1 pool heaters, new buildings can enjoy annual cost saving due to the lack of panel upgrade cost in the installation.

Table 4
Annual and Average Annual Costs for Different Building/Unit Categories

Categories of Units	Building Type	2026	2031	2036	2057	Annual Average (2026-2057)
Type 1 Water Heater replaced by heat pump	*Existing*	$0	$4,477,242	$11,939,311	$22,386,208	$15,390,518
Type 1 High Temperature Unit replaced by heat pump	*Existing*	$0	$0	$2,203,127	$13,769,541	$5,593,876
Type 2 Water Heater - Scenario with replacement by two split heat pumps	*Existing*	$0	$2,231,089	$13,386,533	$55,777,222	$26,145,573
Type 2 High Temperature Unit replaced by heat pump	*Existing*	$0	$0	$1,206,066	$7,537,912	$3,062,277
Type 1 Pool Heater replaced by heat pump	*Existing*	$0	$1,914,503	$11,487,019	$28,717,548	$17,948,468
Instantaneous Water Heater replaced by heat pump	*Existing*	$0	$4,123,222	$10,995,258	$34,360,180	$18,253,846
Type 1 Water Heater replaced by heat pump	*New*	$1,665,779	$1,665,779	$1,665,779	$1,665,779	$1,665,779
Type 1 High Temperature Unit replaced by heat pump	*New*	$0	$1,478,247	$1,478,247	$1,478,247	$1,339,661
Type 2 Water Heater - Scenario with replacement by two split heat pumps	*New*	$0	$5,706,300	$5,706,300	$5,706,300	$5,349,657
Type 2 High Temperature Unit replaced by heat pump	*New*	$0	$811,695	$811,695	$811,695	$735,598
Type 1 Pool Heater replaced by heat pump	*New*	$0	($635,982)	($635,982)	($635,982)	($596,233)
Instantaneous Water Heater replaced by heat pump	*New*	$1,878,974	$1,878,974	$1,878,974	$1,878,974	$1,878,974
Total		**$3,544,753**	**$23,651,068**	**$62,122,327**	**$173,453,624**	**$96,767,993**

Figure 1 presents the estimated annual compliance costs of the PAR 1146.2 by unit category. For each category, the figure presents the sum of the total amortized capital costs and recurring cost or savings during the period 2026-2057, for both existing and new buildings. As shown in Figure 1, Type 2 water heater replacement with two split heat pumps will incur the biggest share of average annual compliance costs (32%), followed by instantaneous water heaters (21%), Type 1 water heaters, and pool heaters (18% for each).

Figure 1
Annual Estimated Costs of the PAR 1146.2 Series by Unit Categories



MACROECONOMIC IMPACTS ON THE REGIONAL ECONOMY

The Regional Economic Model (REMI, PI+ v3) was used to assess the total socioeconomic impacts of the anticipated policy change (i.e., the proposed rule).[11, 12] The model links the economic activities in the counties of Los Angeles, Orange, Riverside, and San Bernardino, and for each county, it is comprised of five interrelated blocks: 1) output and demand; 2) labor and capital; 3) population and labor force; 4) wages, prices and costs; and 5) market shares.[13]

It should be noted that the REMI model is not designed to assess impacts on individual operations. The model was used to assess the impacts of the proposed project on various industries that make up the local economy. Cost impacts on individual operations were assessed outside of the REMI model and used as inputs into the REMI model.

Impact of Proposed Amendments

The assessment herein is performed relative to a baseline ("business as usual") forecast where the proposed amendments would not be implemented. It is assumed that affected facilities/households would finance the capital and installation costs of control equipment, or more specifically, these one-time costs are assumed to be amortized and incurred over the equipment life. The proposed project is assumed to be the implementation of PAR 1146.2, which would create a policy scenario under which the affected facilities/households would incur an average annual compliance cost of approximately $96.77 million when costs are annualized using a 4% real interest rate, or $48.99 million when evaluated using a 1% real interest rate from the year 2026 onwards when all controls are assumed to have been installed.

Direct effects of the proposed project are used as inputs to the REMI model in order for the model to assess secondary and induced impacts for all the industries in the four-county economy on an annual basis and across a user-defined horizon: 2026 (the first year when the affected facilities/households are assumed to incur compliance costs due to PAR 1146.2 implementation) to 2057 (the final year in which new equipment is fully amortized). Direct effects of PAR 1146.2 include:

1) Additional costs that facilities would incur by installing and operating zero-emission water heaters: Because the implementation of PAR 1146.2 will affect nearly all the industries in the four-county region, all the replacement/installation and recurring costs were allocated across different industries by their value of real estate usage.[14] The costs are also allocated across the

[11] Regional Economic Modeling Inc. (REMI). Policy Insight® for the South Coast Area (70-sector model). Version 3. 2023.

[12] REMI v3 has been updated based on The U.S. Economic Outlook for 2022-2024 from the University of Michigan's Research Seminar in Quantitative Economics (RSQE) release on May 19, 2023, The Long-Term Economic Projections from CBO (supplementing CBO's March 2023 report, The 2023 Long-Term Budget Outlook).

[13] Within each county, producers are made up of 156 private non-farm industries and sectors, three government sectors, and a farm sector. Trade flows are captured between sectors as well as across the four counties and the rest of U.S. Market shares of industries are dependent upon their product prices, access to production inputs, and local infrastructure. The demographic/migration component has 160 ages/gender/race/ethnicity cohorts and captures population changes in births, deaths, and migration. (For details, please refer to REMI online documentation at http://www.remi.com/products/pi.)

[14] Specifically, the value of real estate usage for each industry is estimated by the output value of the industry in the 4-county region multiplied by its value of real estate usage as a proportion of output in Table 1.

four counties by their value of total real estate usage.

2) Incremental costs related to replacement/installation of residential pool heaters and instantaneous water heaters which will translate into the decrease of households' disposable income: An income decrease will then have negative impact upon the local economy. This cost is allocated across the four counties by their population.

3) Extra demand for zero-emission water heater manufacturers and distributors, induced by the expenditure on installation and panel upgrade: In accordance with recommendations provided by representatives of REMI Inc., the induced demand is allocated to sectors of Machinery Manufacturing (NAICS 333, 40%), Fabricated Metal Product Manufacturing (NAICS 332, 20%), Miscellaneous Manufacturing (NAICS 339, 20%), Wholesale Trade (NAICS 42, 12%) and Retail Trade (NAICS 44-45, 8%).

4) Recurring fuel-switching cost savings, which will reduce the revenue for utility services in South Coast AQMD region.

Finally, the net increase in demand is distributed across the four counties based on their population. Table 5 summarizes the preceding setup for the REMI simulation.

Table 5
Compliance Costs and Induced Demand (Benefits) Across Industries in REMI Model

	Affected Sectors	Distribution Across Industries
Compliance Costs	All Industries	Distributed by the Value of Industries' Real Estate Usage
	Private Households	N/A
Demand Induced by:		
One-time Capital Cost	Machinery Manufacturing (NAICS 333)	40%
	Fabricated Metal Product Manufacturing (NAICS 332)	20%
	Miscellaneous Manufacturing (NAICS 339)	20%
	Wholesale Trade (NAICS 42)	12%
	Retail Trade (NAICS 44-45)	8%
Recurring Cost*	Utilities (NAICS 22)	N/A

*Recurring cost savings for PAR 1146.2.

To summarize, the direct effects of implementing PAR 1146.2 that will benefit local economy include: 1) induced demand for control equipment manufacturers and distributors; and 2) recurring cost saving of affected facilities. The direct effects that are detrimental to local economy include: 1) increased production costs of affected facilities due to installation of control equipment; 2) decreased consumption by private households; and 3) decreased demand for the Utilities sector

(NAICS 22). After that, a series of indirect or ripple effects will happen in the local economy, all of which collaboratively affect job market and competitiveness in the South Coast AQMD region, as described in the following section.

Regional Job Impacts

When the compliance cost is annualized using a 4% real interest rate, an annual average of 1,074 net jobs foregone is projected to occur from 2026 to 2057. The 1,074 annual jobs foregone represents approximately 0.0084% of total annual jobs in the four-county area.

The implementation of PAR 1146.2 is expected to have both positive and negative job impacts on the regional economy over time. In 2031, about 600 additional jobs are expected to be added to the economy due to compliance expenditures and additional spending associated with the installation of zero-emission water heaters. These additional jobs are expected to come from sectors such as retail, fabricated metal product manufacturing, and wholesale trade.

However, as affected facilities continue to bear the costs of capital expenditures, including the subsequent installation of zero-emission water heaters, the accelerated job growth due to the initial effects of equipment installation is projected to slow down, eventually leading to jobs foregone. The construction sector (NAICS 23) is anticipated to bear the largest share of average annual jobs foregone, with an estimated 173 jobs foregone. This sector is among the sectors that are expected to incur the majority of the compliance costs associated with PAR 1146.2.

The reduction in disposable income resulting from the overall jobs foregone is expected to dampen the demand for goods and services in the local economy. This, in turn, would contribute to jobs foregone in sectors such as food services and drinking places, retail trade, and ambulatory health care services. While the negative job impacts are projected to be relatively minor, several major sectors of the regional economy could experience these effects from the secondary and induced consequences of PAR 1146.2 implementation.

It is important to note that these job impact projections are based on assumptions and analysis using the REMI model. The actual job impacts may vary depending on various factors and uncertainties in the economy and industry dynamics. As presented in Table 6, many major sectors of the regional economy would experience negative job impacts in later years from the secondary and induced effects of PAR 1146.2 implementation.

Table 6
Projected Job Impacts of PAR 1146.2 for Select Industries by Year

Industry Name	2026	2031	2038	2044	2050	2057	Average Annual (2026-2057)	Baseline Average Annual (2026-2057)	Change from Baseline
Construction (23)	1	-4	-207	-282	-240	-171	-173	574,284	-0.0301%
Professional, scientific, and technical services (54)	0	19	-68	-145	-200	-216	-108	1,011,432	-0.0107%
Ambulatory health care services (621)	-3	13	-74	-127	-157	-176	-95	773,424	-0.0123%
State and Local Government (92)	0	15	-40	-117	-185	-202	-91	1,037,144	-0.0087%
Utilities (22)	2	-23	-82	-121	-119	-108	-82	19,936	-0.4127%
Food services and drinking places (722)	-1	10	-45	-99	-144	-166	-78	815,289	-0.0096%
Administrative and support services (561)	0	33	-43	-97	-132	-140	-70	897,913	-0.0078%
Real estate (531)	-1	20	-35	-78	-113	-129	-60	658,534	-0.0092%
Retail trade (44-45)	-1	125	8	-78	-150	-161	-51	918,930	-0.0056%
Apparel manufacturing; Leather and allied product manufacturing (315-316)	0	0	-2	-1	1	1	0	33,715	-0.0009%
Petroleum and coal products manufacturing (324)	0	0	0	-1	-1	-1	0	5,316	-0.0064%
Wholesale trade (42)	0	71	33	-2	-41	-52	0	437,427	0.0000%
Primary metal manufacturing (331)	0	7	6	4	0	-1	3	11,859	0.0247%
Machinery manufacturing (333)	0	48	44	32	7	-3	22	21,617	0.1041%

Table 6 (continued)
Projected Job Impacts of PAR 1146.2 for Select Industries by Year

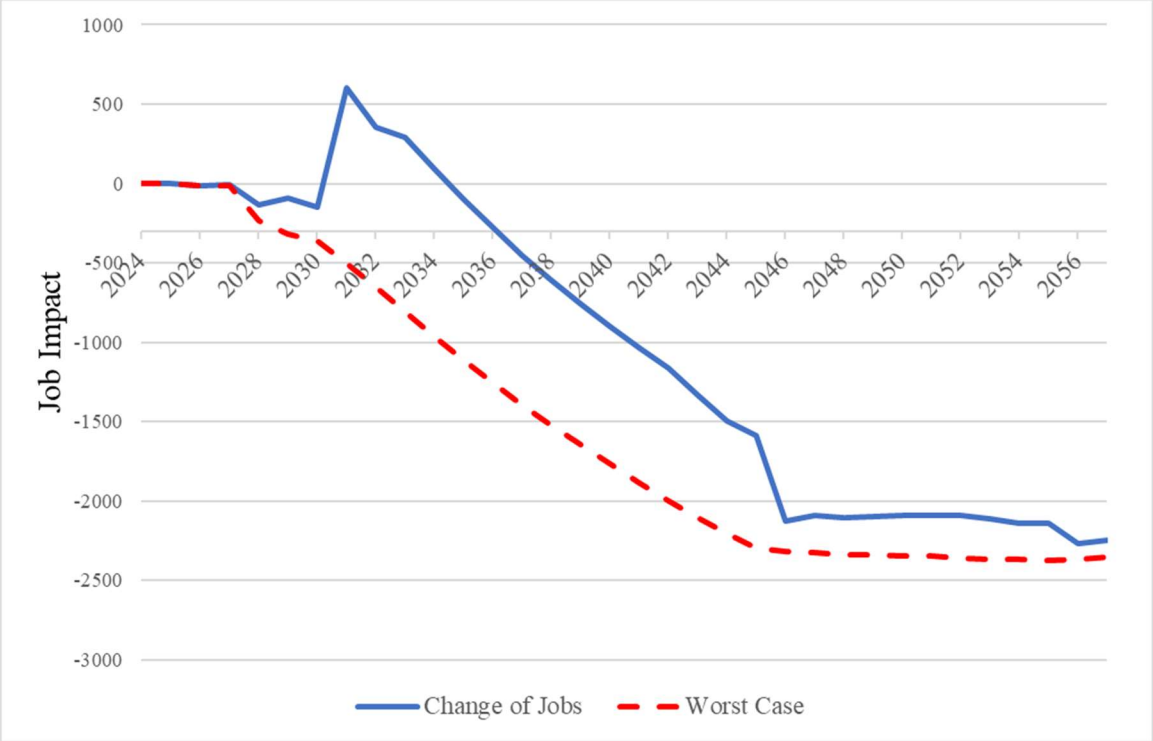
Industry Name	2026	2031	2038	2044	2050	2057	Average Annual (2026-2057)	Baseline Average Annual (2026-2057)	Change from Baseline
Miscellaneous manufacturing (339)	0	59	53	40	9	-3	28	67,318	0.0410%
Fabricated metal product manufacturing (332)	0	111	101	75	16	-5	52	75,941	0.0687%
All Industries	**-11**	**600**	**-611**	**-1,494**	**-2,093**	**-2,245**	**-1,074**	**12,757,201**	**-0.0084%**

Figure 2 presents a projected time series of job impacts over the 2026 - 2057 period. Based on Abt Associate's 2014 recommendation to enhance socioeconomic analysis by conducting scenario analysis on major assumptions, staff has analyzed an alternative scenario (worst case) where the affected facilities would not purchase any control equipment or services from providers within the South Coast AQMD jurisdiction.[15] This is a hypothetical scenario in order to test the sensitivity of the previously discussed scenarios where the analyses rely on REMI's embedded assumptions about how the capital and O&M spending would be distributed inside and outside the region. In reality, increased manufacturing jobs related to zero-emission water heater production are likely to be offered by local equipment manufacturers.

This worst-case scenario would result in an annual average of approximately 1,602 jobs foregone. The 1,602 jobs foregone represents roughly 0.013% of total jobs in the South Coast AQMD region.

[15] Abt Associates, Inc., 2014 Review of the SCAQMD Socioeconomic Assessments. Prepared for South Coast Air Quality Management District, http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgtplan/socioeconomic-analysis.

Figure 2
Projected Regional Job Impact, 2026-2057



Competitiveness

The additional cost brought on by PAR 1146.2 would increase the cost of services rendered by the affected industries in the region. The magnitude of the impact depends on the size, diversification, and infrastructure in a local economy as well as interactions among industries. A large, diversified, and resourceful economy would absorb the impact described above with relative ease.

Changes in production/service costs would affect prices of goods produced locally. The relative delivered price of a good is based on its production cost and the transportation cost of delivering the good to where it is consumed or used. The average price of a good at the place of use reflects prices of the good produced locally and imported elsewhere.

The overall impacts of PAR 1146.2 on the production costs and delivered prices in the South Coast AQMD region are not expected to be significant. According to the REMI Model, PAR 1146.2 is projected to increase the cost of production of all industries in the South Coast AQMD region by 0.002% and increase the relative delivered price of goods provided by those industries by 0.002% in 2032.

REFERENCES

Abt Associates, Inc., 2014 Review of the SCAQMD Socioeconomic Assessments. Prepared for South Coast Air Quality Management District, http://www.aqmd.gov/home/library/clean-air-plans/air-quality-mgtplan/socioeconomic-analysis.

California Energy Commission, 2022 Integrated Energy Policy Update, Docket 22-IEPR-03 – Electricity Forecast, CEDU Baseline Forecast – LADWP, https://efiling.energy.ca.gov/GetDocument.aspx?tn=248381&DocumentContentId=82804, accessed February 27, 2024.

Energy and Environmental Economics. Residential Building Electrification in California, https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf. 2019.

Energy Saver. Heat Pump Swimming Pool Heaters, https://www.energy.gov/energysaver/heat-pump-swimming-pool-heaters. 2024.

Regional Economic Modeling Inc. (REMI). Policy Insight® for the South Coast Area (70-sector model). Version 3, 2024.

South Coast Air Quality Management District. Final Staff Report for Proposed Rule 1146.2. 2006.

South Coast Air Quality Management District. Draft Staff Report for Proposed Amended Rule 1146.2. 2024.

U.S. Energy Information Administration. Residential Energy Consumption Survey Data, https://www.eia.gov/consumption/residential/data/2020/. 2020.