SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft Socioeconomic Impact Assessment for Proposed Amended Rule 1134 - Emissions of Oxides of Nitrogen from Stationary Gas Turbines

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EXECUTIVE SUMMARY

A socioeconomic analysis was conducted to assess the potential impacts of Proposed Amended Rule (PAR) 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines on the four-county region of Los Angeles, Orange, Riverside, and San Bernardino. A summary of the analysis and findings is presented below.

Elements of Proposed Amendments	PAR 1134 applies to RECLAIM and non-RECLAIM stationary gas turbines that are not subject to SCAQMD Rule 1135 - Emissions of Oxides of Nitrogen from Electricity Generating Facilities or located at petroleum refineries, landfills, or publicly owned treatment works. PAR 1134 would: (1) expand its applicability to include stationary gas turbines that were not previously required to comply with Rule 1134; (2) update the NOx and ammonia emission limits for stationary gas turbines to comply with Best Available Retrofit Control Technology (BARCT); (3) update monitoring, reporting, and recordkeeping requirements (MRR); (4) establish new exemptions for low-use equipment, certain existing combined cycle gas turbines, and emergency standby gas turbines; (5) provide relief from having to comply with ammonia requirements for turbines that do not use ammonia for controlling NOx emissions; and (6) revise existing exemptions to remove obsolete provisions. Implementation of the proposed amendments is estimated to reduce NOx emissions by 2.8 tons per day after implementation of the BARCT limits, which is expected to be achieved by retrofitting existing stationary gas turbines with air pollution control equipment (e.g., selective catalytic reduction (SCR) technology/systems installation), or repowering or replacing existing stationary gas turbines.
Affected Facilities and Industries	There are 35 facilities that are potentially impacted by PAR 1134. There are 73 turbines at these 35 facilities: 6 turbines already operate at the proposed emissions limits, 23 would be exempt, and 11 would qualify for the low-use provisions. The remaining 33 turbines will need to be replaced, repowered, or retrofitted to come into compliance with PAR 1134. These 33 turbines are located across 19 facilities. Among the 19 affected facilities, four are in the coal gasification at mine site sector (NAICS 211111), four are in the electric power generation, fossil fuel (e.g., coal, oil, gas) sector (NAICS 221112), two are in booster pumping station, natural gas transportation sector (NAICS 486210), two are in the academies, college or university sector (NAICS 611310), two are classified as private hospitals (NAICS 622110), two are state and local government facilities (NAICS 921190), and there is a single facility located in aircraft hangar rental (NAICS 488119), absorbent paper stock manufacturing (NAICS 322121), and adrenal medicinal manufacturing (NAICS 325412).

	Of these 19 facilities, 11 (with 20 turbines) are located in Los Angeles County, three (with four turbines) are in Orange County, two (with five turbines) is in Riverside County, and the remaining three facilities (with four turbines) are located in San Bernardino County.
Assumptions of Analysis	The main requirements of PAR 1134 for affected facilities include one-time costs and annual recurring costs. The one-time costs would include capital costs of SCR retrofits and one-time permit modifications. Annual recurring cost estimates include the annual operating costs of SCRs including reagent, catalyst replacement, electricity, and maintenance costs. Staff has used the U.S. EPA Air Pollution Control Cost Manual to estimate costs of capital, installation, and operating and maintenance of SCRs. Total one-time capital costs for an SCR retrofit include direct and indirect costs associated with purchasing and installing SCR equipment. These costs include the equipment cost for the SCR system itself, the cost of auxiliary equipment, direct and indirect installation costs, and additional costs due to installation such as asbestos removal. The size and costs of the SCR are based primarily on the boiler size or heat input, the type of fuel burned, the required level of NOx reduction, reagent consumption rate, and catalyst costs. In addition, all 19 affected facilities will incur a one-time cost to have their permits modified. Total annual costs include the purchase of reagent and electrical power, as well as operating and supervisory labor cost, maintenance cost, and catalyst replacement cost. ▪ The annual maintenance labor and material cost is assumed to be 0.5% of the total capital costs in dollars. ▪ The annual cost of reagent purchases is estimated using the reagent volume flow rate, the operating time per year, and the cost of reagent in dollars per gallon. ▪ Electrical power consumption is estimated for SCR equipment, ammonia vaporization, water vaporization, and additional fan power. ▪ Annual catalyst replacement cost is based on estimating the total volume of catalyst, the total number of catalyst layers, and the number of layers replaced annually.
Compliance Costs	The average annual total cost of PAR 1134 is projected to be \$4.8 - \$5.8 million (in 2018 dollars) between 2019 and 2045, for the 1% and 4% real interest rate scenarios, respectively. Average annual capital cost is estimated to be \$2.8 - \$3.8 million per year across all affected facilities. Per unit capital costs are broken down as follows: ▪ Capital costs associated with SCR retrofits range from \$470,000 - \$12.7 million per unit. ▪ One-time permit fees are assumed to be \$24,000 per unit.

<table>
<tr><td></td><td>Average annual operating and maintenance cost is projected to be $2.0 million across all affected facilities. Per unit annual costs are broken down as follows:

▪ Annual maintenance costs range from $2,400 - $31,000 per unit.
▪ Annual reagent costs from $1,000 - $124,000 per unit.
▪ Estimates for the annual electricity costs range from $1,000 - $68,000 per unit.
▪ Annual per unit catalyst replacement costs range from $1,000 - $21,000.

The majority of the overall annual compliance costs are expected to be incurred by the coal gasification at mine site sector (38%), electric power generation - fossil fuel (e.g., coal, oil, gas) (17%), booster pumping station - natural gas transportation (15%), absorbent paper stock manufacturing (322121) (8%), academies, college or university sector (7%), state and local government (5%), and private hospitals (4%).</td></tr>
<tr><td>Jobs and Other Socioeconomic Impacts</td><td>Based on the assumptions outlined above, the compliance cost of PAR 1134, and the application of the Regional Economic Models, Inc. (REMI) model, it is projected that 28 - 38 jobs will be forgone annually, on average, between 2019 and 2045. The projected job loss impacts represent 0.00025% – 0.00034% of total employment in the four-county region.

Early in the time horizon, the REMI modeling analysis projects positive job impacts from the expenditures made by the affected facilities. The engine, turbine, and power transmission equipment manufacturing sector (NAICS 3336) and the management, scientific, and technical consulting services sector (NAICS 5416) are projected to gain jobs from additional demand for equipment installation from the affected facilities on average.

In subsequent years, the direct costs of compliance lead to jobs foregone in the educational services - private sector (NAICS 621), the oil and gas extraction sector (NAICS 211), state and local government (NAICS 92), and the electric power generation, transmission and distribution sector (NAICS 2211). The reduction in disposable income would dampen the demand for goods and services in the local economy, thus resulting in a relatively large number of jobs forgone projected in sectors such as construction (NAICS 23), transportation and warehousing (NAICS 48,492-493), administrative, support, waste management, and remediation services (NAICS 56), and retail trade (NAICS 44 - 45).</td></tr>
<tr><td>Competitiveness</td><td>The additional cost brought on by PAR 1134 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.</td></tr>
</table>

	It is projected that the oil and gas extraction sector (NAICS 211), which includes four affected facilities (with nine turbines), would experience a rise in its relative cost of production of 0.039% in 2025 for the 4% real interest rate scenario. The oil and gas extraction sector is also expected to experience an increase in its delivered price by 0.010% in 2025 for the 4% real interest rate scenario. In the pipeline transportation sector (NAICS 486), which includes two affected facilities (with seven turbines), the relative cost of production and relative delivered price are expected to increase by 0.172% and 0.048% in 2025, respectively. Finally, the electric power generation, transmission, and distribution sector (NAICS 2211), which includes four affected facilities (with four turbines), the relative cost of production and relative delivered price are expected to increase by 0.015% and 0.005% in 2025, respectively.
CEQA Alternatives	There are three CEQA alternatives associated with the proposed amendments to PAR 1134. Alternative A, the no project alternative, means that the current version of Rule 1134 would remain in effect. Under Alternative B, the requirements would be equivalent to the proposed project but the compliance date for meeting the NOx and ammonia emission limits would be one year earlier, December 31, 2022, which would allow three years to comply with PAR 1134. Under Alternative C, the requirements would be equivalent to the proposed project, but the compliance dates for meeting the NOx and ammonia emission limits would vary depending on fuel type, as follows: (1) liquid fuel (outer continental shelf): December 31, 2023, (2) natural gas (combined cycle): June 30, 2023; (3) natural gas (compressor gas turbine): December 31, 2023; (4) natural gas (simple cycle): December 31, 2022; (5) produced gas: December 31, 2023; (6) produced gas (outer continental shelf): December 31, 2023; and (7) Other: December 31, 2023. Assuming a 4% real interest rate, average annual compliance costs for the CEQA alternatives range from \$6.0 - \$6.1 million between 2019 and 2045. Average annual jobs forgone for the CEQA alternatives range from 40 - 42 between 2019 and 2045.
Potential NOx RTC Market Impacts	If PAR 1134 is adopted, 18 facilities are expected to receive an initial determination notification because, according to staff's evaluation, all of their permitted RECLAIM NOx source equipment will be subject to these rules once adopted. Facilities that received initial determination notifications and meet the proposed criteria to exit, would not receive a final determination notification to exit RECLAIM until key elements such as NSR and permitting are resolved. However, these facilities may request to opt-out of RECLAIM before these key elements are resolved, upon meeting specific conditions specified in subdivision (g) of Rule 2001. The 18 facilities currently account for 4.4% of annual NOx emissions and 2.1% of the NOx RTC holdings in the NOx RECLAIM universe for compliance year 2019. The simultaneous transition of the 18 facilities out of the NOx RECLAIM program would have a very small impact, if any, on the

	demand and supply of NOx RTC market. Specifically, the transition of these facilities is unlikely to result in large price fluctuations in the NOx RTC market, nor is the transition expected to significantly affect the remaining NOx RECLAIM facilities that are not yet ready to exit.

INTRODUCTION

Control measure CMB-05 from the SCAQMD's 2016 Air Quality Management Plan (AQMP) and its adoption resolution establish a timeline to transition facilities from NOx RECLAIM to a command-and-control regulatory structure. Additionally, California State Assembly Bill (AB) 617, approved by the Governor on July 26, 2017, requires air districts to develop an expedited schedule for the implementation of Best Available Retrofit Control Technology (BARCT) no later than December 31, 2023 for facilities that are in the state greenhouse gas cap-and-trade program. PAR 1134 applies to RECLAIM and non-RECLAIM stationary gas turbines that are not subject to SCAQMD Rule 1135 - Emissions of Oxides of Nitrogen from Electricity Generating Facilities or located at petroleum refineries, landfills, or publicly owned treatment works.

PAR 1134 is proposing to: 1) expand its applicability to include stationary gas turbines that were not previously required to comply with Rule 1134; 2) update the NOx and ammonia emission limits for stationary gas turbines to comply with BARCT; 3) update monitoring, reporting, and recordkeeping requirements (MRR)[1]; 4) establish new exemptions for low-use equipment, certain existing combined cycle gas turbines, and emergency standby gas turbines; 5) provide relief from having to comply with ammonia requirements for turbines that do not use ammonia for controlling NOx emissions; and 6) revise existing exemptions to remove obsolete provisions.

Implementation of the proposed amendments is estimated to reduce NOx emissions by 2.8 tons per day after implementation of the BARCT limits, which is expected to be achieved by retrofitting existing stationary gas turbines with air pollution control equipment (e.g., selective catalytic reduction (SCR) technology/systems installation), or repowering or replacing existing stationary gas.

LEGISLATIVE MANDATES

The socioeconomic impact assessments at SCAQMD have evolved over time to reflect the benefits and costs of regulations. The legal mandates directly related to the assessment of the proposed amended rule include the SCAQMD Governing Board resolutions and various sections of the California Health & Safety Code.

SCAQMD Governing Board Resolutions

On March 17, 1989 the SCAQMD Governing Board adopted a resolution that calls for an economic analysis of regulatory impacts that includes the following elements:

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

[1] SCAQMD staff is working on a new Proposed Rule 113 - MRR Requirements for NOx and SOx Sources. If PR 113 is adopted by the Board, then reporting requirements for PAR 1134 facilities will be transitioned to PR 113.

Health & Safety Code Requirements

The state legislature adopted legislation that reinforces and expands the Governing Board resolutions for socioeconomic impact assessments. Health and Safety Code sections 40440.8(a) and (b), which became effective on January 1, 1991, require a socioeconomic analysis be prepared for any proposed rule or rule amendment that "will significantly affect air quality or emissions limitations."

Specifically, the scope of the analysis should include:

- 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
- 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 became effective on January 1, 1992, requires the SCAQMD Governing Board to actively consider the socioeconomic impacts of regulations and make a good faith effort to minimize adverse socioeconomic impacts. It also expands socioeconomic impact assessments to include small business impacts, specifically:

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

Finally, Health and Safety Code section 40920.6, which became effective on January 1, 1996, requires incremental cost-effectiveness be performed for a proposed rule or amendment that imposes BARCT or “all feasible measures” requirements relating to ozone, carbon monoxide (CO), oxides of sulfur (SOx), oxides of nitrogen (NOx), and their precursors.

Incremental cost-effectiveness is defined as the difference in costs divided by the difference in emission reductions between a control alternative and the next more stringent control alternative. The necessity analysis and the analysis of control alternatives and their incremental cost-effectiveness are presented in the Staff Report prepared for the proposed amendments.

REGULATORY HISTORY

Rule 1134 was adopted in 1989. The rule applied to stationary gas turbines rated at 0.3 MW and larger that were issued a permit to operate by the SCAQMD prior to August 4, 1989. The origin of the rule can be traced to a 1979 United States Environmental Protection Agency (EPA) New Source Performance Standard for Stationary Gas Turbines. In 1981, the California Air Resources Board (CARB) adopted a Suggested Control Measure for this same equipment.

Rule 1134 was subsequently amended three times; each to provide regulatory flexibility. In December 1995, Rule 1134 was amended to exempt gas turbines located on San Clemente Island and the South East Desert Air Basin. In April 1997, Rule 1134 was amended to increase the NOx concentration limit for turbines utilizing sewage digester gas. In August 1997, Rule 1134 was amended to clarify the need for continuous emission monitoring systems (CEMS) on turbines with a power output of 2.9 MW or larger. EPA approved Rule 1134 into the State Implementation Plan (SIP) on August 1, 2000.

Stationary Gas Turbines and RECLAIM

Beginning in 1994, a large number of utilities and third-party-owned cogenerators were included in the RECLAIM program and as such were not required to meet the NOx concentration limits imposed by Rule 1134. However, gas turbines permitted prior to August 4, 1989 and used at publicly-owned treatment works, landfills, hospitals and other public facilities, and sources which were not covered under RECLAIM, were still required to meet the concentration limits in Rule 1134 through application of various control technologies. New turbines installed at non-RECLAIM facilities after August 4, 1989 are not subject to Rule 1134. PAR 1134 will apply to all stationary gas turbines located at non-RECLAIM and RECLAIM facilities (excluding those subject to Rule 1135 or located at a petroleum refinery, landfill, or sewage treatment facility), regardless of the date they were permitted.

AFFECTED INDUSTRIES

There are 35 facilities that are potentially impacted by Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (PAR 1134). Of these 35 facilities, 19 are currently in the NOx RECLAIM program. The remaining facilities are not in the RECLAIM program; 8 are currently subject to SCAQMD Rule 1134. Eight facilities are not subject to RECLAIM or Rule 1134 because of applicability requirement of RECLAIM and the turbines were built after 1989.

There are 73 turbines at these 35 facilities: 6 turbines are at the proposed emissions limits, 23 would be exempt, and 11 would qualify for the low-use provisions. The remaining 33 turbines will need to be replaced, repowered, or retrofitted to come into compliance with PAR 1134. These 33 turbines are located across 19 facilities. Among these 33 turbines, 10 are natural gas (combined cycle), 13 are natural gas (simple cycle), four are natural gas (compressor gas turbine), and six are produced gas. There are 7 turbines that already utilize SCR but will increase their ammonia usage by an estimated 30% to meet the proposed emissions limits. Twenty-six turbines do not currently utilize SCR.

Among the 19 affected facilities, four are in the coal gasification at mine site sector (NAICS 211111), four are in the electric power generation, fossil fuel (e.g., coal, oil, gas) sector (NAICS 221112), two facilities are in the booster pumping station, natural gas transportation sector (NAICS 486210), two are in the academies, college or university sector (NAICS 611310), two are classified as private hospitals (NAICS 622110), two are state and local government facilities (NAICS 921190), and there is a single facility located in aircraft hangar rental (NAICS 488119), absorbent paper stock manufacturing (NAICS 322121), and adrenal medicinal manufacturing (NAICS 325412).

Of these 19 facilities, 11 (with 20 turbines) are located in Los Angeles County, three (with four turbines) are in Orange County, two (with five turbines) is in Riverside County, and the remaining three facilities (with four turbines) are located in San Bernardino County.

Small Businesses

SCAQMD defines a “small business” in Rules 102 and 301, for purposes of fees, as one which employs 10 or fewer persons and which earns less than $500,000 in gross annual receipts. SCAQMD also defines “small business” for the purpose of qualifying for access to services from SCAQMD’s Small Business Assistance Office as a business with an annual receipt of $5.0 million or less, or with 100 or fewer employees.

In addition to SCAQMD's definition of a small business, the federal Clean Air Act Amendments (CAAA) of 1990 and the federal Small Business Administration (SBA) also provide definitions of a small business. The CAAA classifies a business as a “small business stationary source” if it: (1) is owned or operated by a person who employs 100 or fewer individuals; (2) is a small business as defined under the federal Small Business Act (15 U.S.C. Sec. 631, et seq.); and (3) emits less than 10 tons per year of any single pollutant and less than 20 tons per year of all pollutants. The SBA definitions of small businesses vary by six-digit North American Industrial Classification System (NAICS) codes. In general terms, a small business must have no more than 500 employees for most manufacturing industries, and no more than $7.0 million in average annual receipts for most nonmanufacturing industries.[2] For example, a business classified in the fossil fuel electric power generation sector (NAICS 221112) with fewer than 750 employees is considered a small business by SBA. A private hospital (NAICS 621111) with revenue less than $11 million is classified as a small business by the SBA.

Revenue and employee data was available for 15 of the 19 affected facilities in the Dun and Bradstreet Enterprise Database.[3] Under SCAQMD’s more restrictive definition of a small business (Rule 102), there are three small businesses potentially affected by PAR 1134. Under SCAQMD’s less restrictive definition of a small business (Small Business Assistance Office), there are six small businesses potentially affected by PAR 1134. Using the sector-specific SBA definitions, 12 of the facilities are classified as small businesses. Under the CAAA definition of small business, eight of the facilities are considered small businesses.

COMPLIANCE COST

The main requirements of PAR 1134 for affected facilities include one-time costs and annual recurring costs. The one-time costs would include capital costs of SCR retrofits and one-time

[2] The latest SBA definition of small businesses by industry can be found at http://www.sba.gov/content/table-small-business-size-standards.
[3] Dun & Bradstreet Enterprise Database, 2019.

permit modifications.[4] Annual recurring cost estimates include the annual operating costs of SCRs including reagent, catalyst replacement, electricity, and maintenance costs.

Staff has used the U.S. EPA Air Pollution Control Cost Manual to estimate costs of capital, installation, and operating and maintenance of SCRs.[5,6] Required modifications (and associated costs) to facilities in order to meet the updated BARCT NOx concentration limits in PAR 1134 are detailed below.

Total one-time capital costs for an SCR retrofit include direct and indirect costs associated with purchasing and installing SCR equipment. These costs include the equipment cost for the SCR system itself, the cost of auxiliary equipment, direct and indirect installation costs, and additional costs due to installation such as asbestos removal. The size and costs of the SCR are based primarily on the boiler size or heat input, the type of fuel burned, the required level of NOx reduction, reagent consumption rate, and catalyst costs. For the 27 natural gas turbines affected by PAR 1134, total capital costs associated with SCR retrofits range from $470,000 - $12.7 million. For the six affected produced gas turbines, total capital costs are $930,000 per unit.

In addition, all 19 affected facilities will be required to have their permits modified as a result of PAR 1134. Permit fees for each piece of equipment will result in a one-time cost ranging from $3,000 - $24,000. For this cost analysis, we assume all affected units incur a one-time permit cost of $24,000 in Year 2024.

Total annual costs account for purchase of reagent and electrical power, as well as operating and supervisory labor cost, maintenance cost, and catalyst replacement cost. In general, operation of an SCR system requires only minimal, operating or supervisory labor.

The annual maintenance labor and material cost is assumed to be 0.5% of the total capital costs in dollars. Annual maintenance costs range from $2,400 - $31,000 for natural gas turbines. For produced gas turbines, annual maintenance cost is $4,600 per unit.

The annual cost of reagent purchases is estimated using the reagent volume flow rate, the operating time per year, and the cost of reagent in dollars per gallon. Annual reagent costs for natural gas turbines range from $1,000 - $124,000, and from $1,000 - $7,000 for produced gas turbines.

Electrical power consumption is estimated for SCR equipment, ammonia vaporization, water vaporization, and additional fan power. Estimates for the annual electricity costs for natural gas turbines range from $1,000 - $68,000. Annual electricity costs for produced gas turbines range from $1,000 - $4,000.

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[4] Retrofit of SCR on an existing unit has higher capital costs than SCR installed on a new system.

[5] U.S. EPA Air Pollution Control Cost Manual, Selective Catalytic Reduction available at: https://www.epa.gov/sites/production/files/201712/documents/scrcostmanualchapter7thedition_2016revisions2017.pdf

[6] SCR cost calculation spreadsheet available at: https://www3.epa.gov/ttn/ecas/docs/scr_cost_manual_spreadsheet_2016_vf.xlsm

Annual catalyst replacement cost is based on estimating the total volume of catalyst, the total number of catalyst layers, and the number of layers replaced annually. Annual catalyst replacement costs for natural gas turbines range from $1,000 - $21,000. For produced gas turbines affected by 1134, annual catalyst replacement costs are estimated to be $1,000 per unit.

Table 1:
Annual Estimated Costs of PAR 1134 Series by Industry

Industry (NAICS)	Number of Facilities	Present Worth Value		Average Annual Cost	
		1% Discount Rate	4% Discount Rate	1% Real Interest Rate	4% Real Interest Rate
Coal gasification at mine site (211111)	4	$43,952,135	$33,615,710	$1,840,815	$2,195,831
Electric power generation, fossil fuel (e.g., coal, oil, gas) (221112)	4	$18,490,473	$15,026,326	$757,932	$971,173
Absorbent paper stock manufacturing (322121)	1	$9,382,882	$7,249,173	$390,041	$473,855
Adrenal medicinal manufacturing (325412)	1	$2,660,553	$2,165,150	$109,013	$139,894
Booster pumping station, natural gas transportation (486210)	2	$18,043,247	$13,588,807	$755,124	$893,496
Aircraft hangar rental (488119)	1	$4,599,491	$3,504,491	$191,907	$229,809
Academies, college or university sector (611310)	2	$8,290,414	$6,355,976	$345,338	$416,203
Hospitals; private (622110)	2	$4,279,455	$3,321,182	$177,679	$216,873
State and local government (921190)	2	$5,614,032	$4,482,075	$231,280	$290,820
Total	**19**	**$115,312,682**	**$89,308,890**	**$4,799,129**	**$5,827,953**

The average annual total cost of PAR 1134 is estimated to be $4.8 - $5.8 million (in 2018 dollars) between 2019 and 2045, for the 1% and 4% real interest rate scenarios, respectively.[7] Table 1 presents a breakdown of total costs by industry. The majority of the overall annual compliance costs is expected to be incurred by the coal gasification at mine site sector (38%), electric power generation, fossil fuel (e.g., coal, oil, gas) (17%), booster pumping station, natural gas transportation (15%), booster pumping station, natural gas transportation (8%), academies, college or university sector (7%), state and local government (5%), and hospitals; private (4%).

Figure 1 and Table 2 present the distribution of the overall costs by selected cost categories. The majority of costs of PAR 1134 ($3.8 million annually) stem from the capital costs associated with SCR retrofits (65%). The additional capital costs for permit modifications are estimated to cost $57,000 annually (or 1% of total average annual costs). The recurring costs total $2.0 million

[7] SCAQMD uses both 1% and 4% real interest rates to provide a range of potential compliance cost estimates for the proposed amendments.

annually, comprised of the annual costs of reagent (14%), maintenance (9%), electricity (8%), and catalyst replacement (3%).

Figure 1:
Average Annual Cost of PAR 1134 by Cost Category

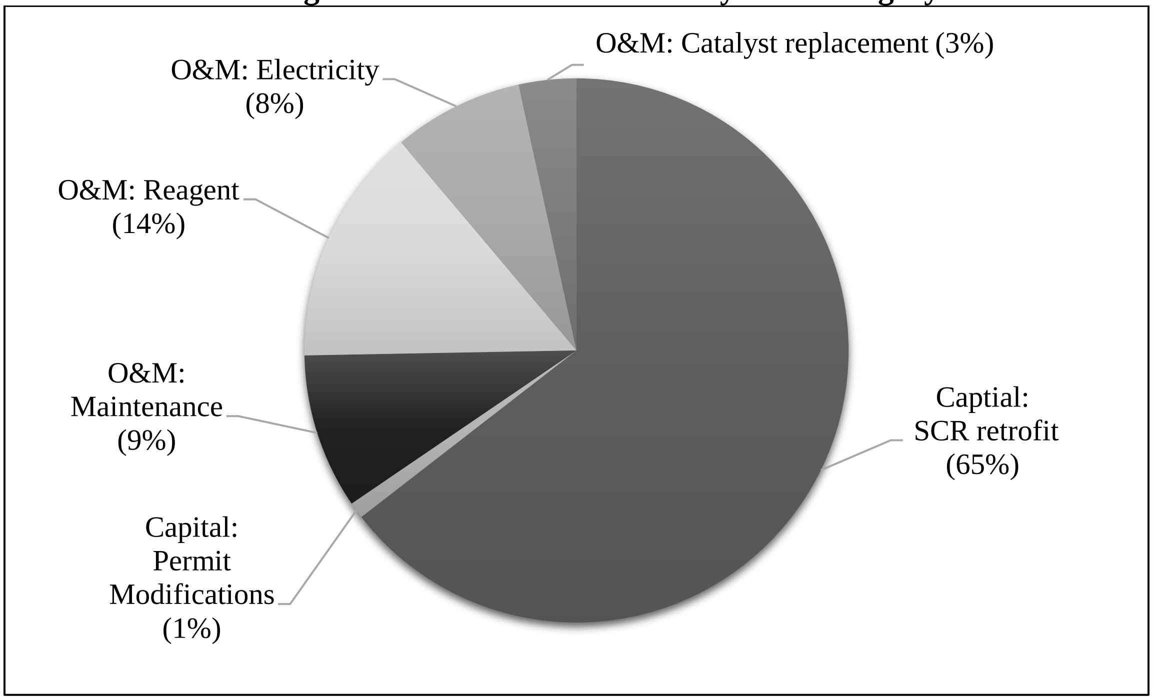


Table 2:
Annual Estimated Costs of the PAR 1134 Series by Cost Categories

	Present Worth Value (2019)		**Annual Average (2019-2045)**	
Cost Categories	**1% Discount Rate**	**4% Discount Rate**	**1% Real Interest Rate**	**4% Real Interest Rate**
One-Time Costs				
SCR retrofit	$68,042,426	$58,924,617	$2,746,189	$3,759,752
Permit modifications	$1,027,297	$887,435	$41,349	$56,610
Recurring Costs				
Maintenance	$12,359,023	$7,887,136	$537,548	$537,548
Reagent	$18,951,798	$12,088,918	$824,409	$824,409
Electricity	$10,359,665	$6,608,193	$450,648	$450,648
Catalyst replacement	$4,572,473	$2,912,592	$198,985	$198,985
Total	**$115,312,682**	**$89,308,890**	**$4,799,129**	**$5,827,953**

JOBS AND OTHER SOCIOECONOMIC IMPACTS

The REMI model (PI+ v2.2.8) was used to assess the total socioeconomic impacts of a regulatory change (i.e., the proposed rule).[8] 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.[9]

The assessment herein is performed relative to a baseline ("business as usual") where the proposed amendments would not be implemented. The proposed amendments would create a regulatory scenario under which the affected facilities would incur an average annual compliance costs totaling $4.8 - $5.8 million. Direct effects of the proposed amendments have to be estimated and used as inputs to the REMI model in order for the model to assess secondary and induced impacts for all actors in the four-county economy on an annual basis and across a user-defined horizon (2019 - 2045). Direct effects of the proposed amendments include additional costs to the affected entities and additional sales, by local vendors, of equipment, devices, or services that would meet the proposed requirements.

While compliance expenditures may increase the cost of doing business for affected facilities, the purchase and installation of additional equipment combined with spending on operating and maintenance, may increase sales in other sectors. Table 3 lists the industry sectors modeled in REMI that would either incur a cost or benefit from the compliance expenditures.

Improved public health due to reduced air pollution emissions may also result in a positive effect on worker productivity and other economic factors; however, public health benefit assessment requires the modeling of air quality improvements at a regional scale. The most recent regional analysis was conducted for the 2016 Air Quality Management Plan (AQMP) which found significant health benefits if federal air quality standards are met. PAR 1134 would result in approximately 2% of the NOx control strategy to meet the 2023 attainment goals in the 2016 AQMP.

On average, PAR 1134 is expected to result in approximately 28 - 38 jobs forgone annually, between 2019 and 2045, depending on the real interest rate assumed (1% - 4%). The projected job loss impacts represent about 0.00025% - 0.00034% of the total employment in the four-county region. Table 4 presents the job impacts across multiple sectors of the regional economy for selected years in the planning horizon.

[8] Regional Economic Modeling Inc. (REMI). Policy Insight® for the South Coast Area (160 sector model). Version 2.2.8, 2018.

[9] Within each county, producers are made up of 156 private non-farm industries, 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.)

Table 3:
Industries Incurring *vs.* Benefitting from Compliance Costs/Spending

Source of Compliance Costs	REMI Industries Incurring Compliance Costs (NAICS)	REMI Industries Benefitting from Compliance Spending (NAICS)
SCR retrofit	Oil and gas extraction (211), Electric power generation, transmission, and distribution (2211), Pulp, paper, and paperboard mills (3221), Pharmaceutical and medicine manufacturing (3254), Scenic and sightseeing transportation and support activities for transportation (487-488), Educational services - private (61), Hospitals; private (622), State and local government (92)	*One-time Capital Cost:* Engine, turbine, and power transmission equipment manufacturing (3336), Construction (23), Management, scientific, and technical consulting services (5416)
Permit modifications		*One-time Capital Cost:* Public administration (92)
Maintenance		*One-time Capital Cost:* Management, scientific, and technical consulting services
Reagent		*One-time Capital Cost:* Basic chemical manufacturing (3251)
Electricity		*Recurring Cost:* Electric power generation, transmission, and distribution (2211)
Catalyst replacement		*Recurring Cost:* Basic chemical manufacturing

Table 4:
Job Impacts of PAR 1134*

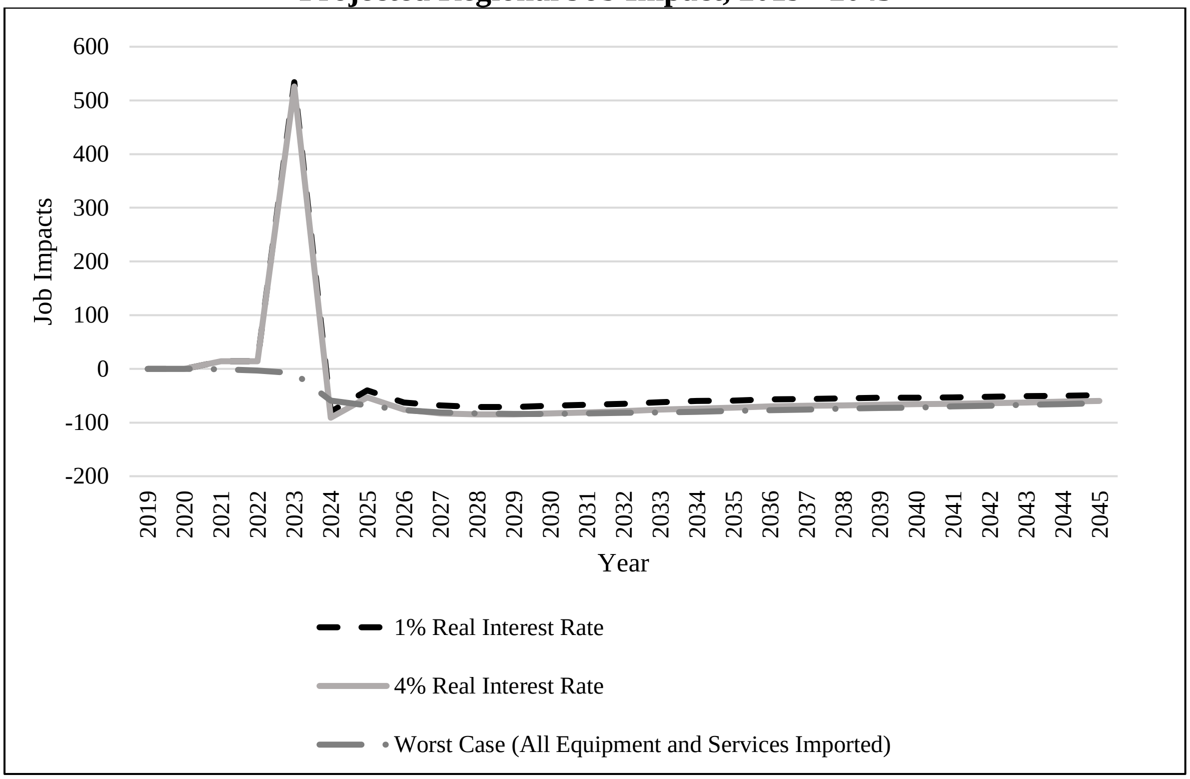
Industry (NAICS)	2023	2025	2030	2035	2045	Average Annual Jobs (2019 - 2045)	Average Annual Baseline (2019 - 2045)	% Change from Baseline Jobs
Construction (23)	155	-15	-19	-11	-5	-4	471,648	-0.00086%
Management, scientific, and technical consulting services (5416)	94	1	1	1	0	4	137,452	0.00315%
Retail trade (44-45)	34	-4	-6	-6	-5	-3	986,426	-0.00035%
Administrative, support, waste management, and remediation services (56)	27	-2	-4	-4	-3	-2	818,786	-0.00026%
State and Local Government (92)	24	-2	-9	-9	-7	-5	908,258	-0.00055%
Food services and drinking places (722)	19	-1	-3	-4	-4	-2	731,231	-0.00029%
Transportation and warehousing (48,492-493)	15	-3	-5	-4	-3	-3	502,311	-0.00054%
Wholesale trade (42)	13	-2	-3	-2	-2	-1	479,144	-0.00028%
Engine, turbine, and power transmission equipment manufacturing (3336)	7	0	0	0	0	0	1,060	0.02445%
Educational services - private (61)	5	-2	-3	-3	-2	-2	271,055	-0.00078%
Electric power generation, transmission and distribution (2211)	0	-1	-1	-1	-1	-1	9,994	-0.00815%
Oil and gas extraction (211)	-1	-5	-7	-7	-5	-5	23,472	-0.02146%
All Other Industries	134	-17	-24	-22	-23	-14	5,952,804	-0.00024%
Total	**526**	**-53**	**-83**	**-72**	**-60**	**-38**	**11,293,642**	**-0.00034%**

* Assumes a 4% real interest rate

In earlier years of the regional simulation positive job impacts from the expenditures made by the affected facilities would more than offset the jobs forgone from the additional cost of doing business. The engine, turbine, and power transmission equipment manufacturing sector (NAICS 3336) and the management, scientific, and technical consulting services sector (NAICS 5416) are projected to gain jobs from additional demand for equipment installation from the affected facilities on average. In 2023, 526 additional jobs are expected to be created as a result of the increased demand.

In subsequent years, the positive impact of increased spending subsides and jobs forgone are expected to begin. Direct costs of compliance lead to jobs foregone in the educational services - private sector (NAICS 621), the oil and gas extraction sector (NAICS 211), state and local government (NAICS 92), and the electric power generation, transmission and distribution sector (NAICS 2211). The remainder of the projected reduction in employment would be across all major sectors of the economy from secondary and induced impacts of the proposed amendments. The reduction in disposable income would dampen the demand for goods and services in the local economy, thus resulting in a relatively large number of jobs forgone projected in sectors such as construction (NAICS 23), transportation and warehousing (NAICS 48,492-493), administrative, support, waste management, and remediation services (NAICS 56), and retail trade (NAICS 44 - 45). A smaller number of jobs foregone are expected in the wholesale trade sector (NAICS 42), and the food services and drinking places sector (NAICS 722).

Figure 2:
Projected Regional Job Impact, 2019 - 2045



Staff has analyzed an alternative scenario (worst case) where the affected facilities would not purchase any control or service from providers within the South Coast Air Basin. This scenario would result in an average of 61 jobs forgone annually. Figure 2 presents a trend of job gain and losses over the 2019 - 2045 time frame for the 1% real interest rate, 4% real interest rate, and the worst case scenarios.

Competitiveness

The additional cost brought on by PAR 1134 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.

It is projected that the oil and gas extraction sector (NAICS 211), which includes four affected facilities (with nine turbines), would experience a rise in its relative cost of production of 0.039% in 2025 for the 4% real interest rate scenario. The oil and gas extraction sector is also expected to experience an increase in its delivered price by 0.010% in 2025 for the 4% real interest rate scenario. In the pipeline transportation sector (NAICS 486), which includes two affected facilities (with seven turbines), the relative cost of production and relative delivered price are expected to increase by 0.172% and 0.048% in 2025, respectively. Finally, the electric power generation, transmission, and distribution sector (NAICS 2211), which includes four affected facilities (with four turbines), the relative cost of production and relative delivered price are expected to increase by 0.015% and 0.005% in 2025, respectively. [10]

Delivered prices that a facility may charge for specific goods or services may increase at a greater rate than predicted, allowing incurred costs to be passed through to downstream industries and end-users. The remaining sectors are likely to experience increases in the relative cost of production and relative delivered price with respect to their counterparts in the rest of the U.S.

CEQA ALTERNATIVES

There are three CEQA alternatives associated with the proposed amendments to PAR 1134. Alternative A, the no project alternative, means that the current version of Rule 1134 would remain in effect. Under Alternative B, the requirements would be equivalent to the proposed project but the compliance date for meeting the NOx and ammonia emission limits would one year earlier, December 31, 2022, which would allow three years to comply with PAR 1134. The earlier compliance date under Alternative B is more stringent than the proposed project. Under Alternative C, the requirements would be equivalent to the proposed project, but the compliance dates for meeting the NOx and ammonia emission limits would vary depending on fuel type, as follows: (1) liquid fuel (outer continental shelf): December 31, 2023, (2) natural gas (combined cycle): June 30, 2023; (3) natural gas (compressor gas turbine): December 31, 2023; (4) natural gas (simple cycle): December 31, 2022; (5) produced gas: December 31, 2023; (6) produced gas (outer continental shelf): December 31, 2023; and (7) Other: December 31, 2023. The earlier

[10] Compliance costs are not equally shared amongst individual facilities within affected industry sectors. Therefore, increases in delivered prices and/or the relative cost of production may differ amongst the facilities within a given sector.

compliance dates for the natural gas - combined cycle and natural gas - simple cycle categories under Alternative C are more stringent than the proposed project but less stringent than Alternative B for the natural gas - combined cycle category.

Assuming a 4% real interest rate, average annual compliance costs for the CEQA alternatives range from $6.0 - $6.1 million between 2019 and 2045, as shown in Table 5. Jobs forgone for the CEQA alternatives range from 40 - 42 between 2019 and 2045.[11]

Table 5:
Average Annual Cost and Job Impacts of CEQA Alternatives*

	Average Annual, 2019 - 2045	
Alternatives	**Cost**	**Job Impacts**
Proposed Amendments	$5,827,953	-38
Alternative A - No Project	-	-
Alternative B - Implementation by December 31, 2022	$6,083,803	-42
Alternative C - Phased Implementation	$5,996,473	-40

* Assumes a 4% real interest rate

UPDATED COST IMPACTS ASSESSMENT FOR COMPLIANCE WITH RULE 2002

Potential Impacts for NOx RECLAIM Facilities Ready to Exit

Rule 2002(f)(10) prohibits a RECLAIM facility from selling any future compliance year NOx RECLAIM Trading Credits (RTCs) upon receipt of a final determination notification that it is ready to exit the NOx RECLAIM program. If PAR 1134 is adopted, 18 facilities are expected to receive an initial determination notification because, according to staff's evaluation, all of their permitted RECLAIM NOx source equipment will be subject to these rules once adopted. Facilities that received initial determination notifications and meet the proposed criteria to exit, would not receive a final determination notification to exit RECLAIM until key elements such as NSR and permitting are resolved. However, these facilities may request to opt-out of RECLAIM before these key elements are resolved, upon meeting specific conditions specified in subdivision (g) of Rule 2001.

[11] Alternative B and Alternative C have the same cost-effectiveness as the proposed amendments and both would achieve the same emission reductions. Even though Alternative B and C have earlier compliance dates the cost-effectiveness evaluation is time neutral.

Thirteen out of the 18 facilities were allocated NOx RTCs (no cost or fee when RTCs were allocated) at the outset of the NOx RECLAIM program. The initial allocations for the 13 facilities amounted to approximately 1.129 tons per day (TPD). Due to past adjustments including reductions in allocations or "shaves," and more importantly, the sale of these initial allocations as infinite-year block (IYB) RTCs to other NOx RECLAIM facilities and brokers/investors, the total NOx RTCs currently held by all 18 facilities is 1.018 TPD for compliance years 2019 and later.[12] At the same time, total NOx emissions from these same facilities declined to 0.868 TPD in 2016.

If these 18 facilities receive final determination notifications in 2019, they will not be able to sell their NOx RTCs for compliance year 2019 and onwards. For the purpose of this analysis, it is assumed that none of the 18 facilities would acquire additional NOx RTCs or sell their current NOx RTC holdings of 1.018 TPD before receiving a final determination notification. However, it is foreseeable that at least some of these NOx RTC holdings may be sold or transferred before they are frozen due to anticipation of receiving a final determination notification. Lastly, as they pertain to SCAQMD, RTCs are not property rights. It is known to all market participants that purchasing RTCs beyond the current compliance year is accompanied by known investment risks that are embedded within the RECLAIM programs.[13]

It is estimated that, out of the total 1.018 TPD of future compliance year NOx RTCs currently held by the 18 facilities, at least 0.122 TPD were acquired by some of the affected facilities in addition to their initial allocations, either through purchases with positive prices or transfers at no cost. If these facilities continue to stay in the NOx RECLAIM program and their NOx emissions remain between 5% above and below their 2016 levels,[14] then 0.071 TPD of these additionally acquired RTCs are estimated to be used for compliance purposes, with the remaining 0.050 TPD being potential surplus RTCs available for sale or transfer.[15] Applying the most recent 12-month rolling average NOx RTC price for compliance year 2017 of $3,786 per ton,[16] the total value of all potential surplus RTCs would be approximately $70,000 in RECLAIM compliance year 2019 and all subsequent RECLAIM compliance years. These facilities can elect to transfer or sell these RTCs prior to receiving a final determination notification. If the facility is holding these RTCs at or after the issuance of a final determination notification they will not be able to sell, use, or transfer the RTCs.

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[12] According to the NOx RTC holdings data as of July 31, 2018 and excluding any transactions that may have occurred after this date.

[13] The risk factors include, but may not be limited to, programmatic allocation shaves, potential RTC trade freezes, and the eventual sunset of either RECLAIM program.

[14] In order to estimate the number of RTCs needed for compliance in future years, it is necessary to project the emissions levels of all affected facilities. We analyze three scenarios; 1) emissions are 5% below 2016 levels; 2) emissions remain at 2016 levels; and 3) emissions are 5% above 2016 levels.

[15] Since there were no costs associated with the initially allocated NOx RTCs for a RECLAIM facility, the facilities would not incur financial losses as a result of complying with Rule 2002(f)(10) if their frozen future compliance year NOx RTC holdings are at or below their respective adjusted initial allocations.

[16] 12-month rolling average of Compliance Year 2018 NOx RTCs, as calculated from Jan 2018 to Jan 2019. See Table I of "Twelve-Month and Three-Month Rolling Average Price of Compliance Years 2018 and 2019 NOx and SOx RTCs," available athttp://www.aqmd.gov/docs/default-source/reclaim/nox-rolling-average-reports/nox-and-sox-rtcs-rolling-avg-price-cy-2018-19-jan-2019.pdf

In addition, 12 facilities are estimated to have insufficient NOx RTC holdings if they were to remain in the NOx RECLAIM program and their NOx emissions remain between 5% above and below their 2016 levels. By exiting the NOx RECLAIM program, these facilities would avoid the need to acquire about 0.449 - 0.529 TPD of NOx RTCs which, if valued at $3,786 per ton, would imply potential total cost-savings worth approximately $620,000 - $730,000 in RECLAIM compliance year 2019 and for all subsequent RECLAIM compliance years.[17,18]

Table 6:
Potential Impacts on NOx RTC Market Demand and Supply

	NOx Emission Scenarios for Future Compliance Years		
	5% Below 2016 NOx Emissions	***Same as 2016 NOx Emissions***	***5% Above 2016 NOx Emissions***
Acquired RTCs potentially for sale if remain (TPD)	0.050	0.050	0.050
Potential RTC sales foregone if exiting	$69,657	$69,657	$69,657
RTCs need for compliance if remain (TPD)	0.449	0.489	0.529
Potential cost-savings by exiting	$620,228	$675,392	$730,556
Net compliance year savings	$550,571	$605,735	$660,899

Table 6 presents potential foregone sales of surplus RTCs, potential cost-savings for those facilities needed to acquire RTCs for compliance purposes, and the net savings for compliance year 2019 and onwards for three emission scenarios. The first scenario assumes future NOx emissions of the 18 facilities would be 5% below their respective 2016 levels; the second scenario assumes the same emission levels as in 2016; and the third scenario assumes their future NOx emissions would be 5% above their respective 2016 levels. These scenarios are consistent with the variations of

[17] Cost savings vary based on the projected emissions in compliance year 2019. The range in cost savings presented represents 5% below/above 2016 emission levels.

[18] The dollar figures for the potential costs and savings for facilities exiting RECLAIM are highly sensitive to the assumed RTC price of $3,786 per ton. In general, RTC prices are highly variable, with prices typically decreasing as their expiration dates approach and during the 60 days after expiration during which they can be traded. This general trend has been repeated every year since 1994 except for compliance years 2000 and 2001 (during the California energy crisis). Prices for NOx RTCs that expired in calendar year 2017 also followed this general trend. The general declining trend of RTC prices nearing and just past expiration indicates there was an adequate supply to meet RTC demand during the final reconciliation period following the end of the compliance years.

overall NOx emissions from the RECLAIM universe, which had a maximum year-over-year difference of approximately 5% during the period of 2011 - 2016.

Potential NOx RTC Market Impacts

Since the SCAQMD Governing Board's March 2017 adoption of the 2016 AQMP, which includes the sunset of NOx RECLAIM, the number of NOx IYB trades has decreased significantly. The IYB price has also declined rapidly, from a 12-month rolling average of $380,057 per ton in January 2017 to $20,103 per ton in July 2018, which largely reflects the remaining years of the NOx RECLAIM program life that is expected by the market participants. However, the short-term price impact of facility exit on the discrete-year RTC market may not go hand-in-hand with the overall impact of the NOx RECLAIM program transition on the IYB market, as evidenced by the surge in discrete-year NOx RTC prices in 2017. The potential exit of the 18 facilities from the NOx RECLAIM program could possibly affect the demand and supply in the NOx RTC market for compliance year 2019 and beyond, as well as the future prevailing NOx RTC prices. Therefore, the remaining NOx RECLAIM facilities may be indirectly impacted as a result.

The foregone market demand, as estimated by the shortage of a facility's future compliance year NOx RTC holdings for NOx emissions reconciliation, would be about 0.449 - 0.529 TPD. At the same time, the potential foregone market supply from all facilities with potential surplus RTC holdings is estimated at 0.086 - 0.093 TPD. However, some of these facilities with potential surplus NOx RTCs have never sold or transferred NOx RTCs to another NOx RECLAIM facility since the NOx RECLAIM program began in 1994. Therefore, it is reasonable to assume that they will not participate in the market even if they continue to stay in the NOx RECLAIM program. When estimated by the potential surplus NOx RTC holdings from only the facilities with a historical record of NOx RTC sales and/or transfers, the market supply is estimated to be lower at 0.080 - 0.081 TPD. Table 7 reports the potentially foregone market demand and supply for three different NOx emission scenarios.

Given the analysis above and the fact that the 18 facilities currently account for 4.4% of annual NOx emissions and 2.1% of the NOx RTC holdings in the NOx RECLAIM universe in compliance year 2019, the simultaneous transition of the 18 facilities out of the NOx RECLAIM program would have a very small impact, if any, on the demand and supply of NOx RTC market. Specifically, the net decrease in market demand expected to result from the transition of the 18 facilities could potentially assert downward pressure on the discrete-year NOx RTC prices. However, facility exit is unlikely to result in large price fluctuations in the NOx RTC market, nor is the transition expected to significantly affect the remaining NOx RECLAIM facilities that are not yet ready to exit.[19]

[19] There are currently procedures in place to intervene if the NOx RTC price becomes excessively high. Rule 2002(f)(1)(H) specifies that in the event that the NOx RTC price exceeds $22,500 per ton based on the 12-month rolling average, or exceeds $35,000 per ton based on the 3-month rolling average calculated pursuant to subparagraph (f)(1)(E), the Executive Officer will report the determination to the Governing Board. If the Governing Board finds that the 12-month rolling average RTC price exceeds $22,500 per ton or the 3-month rolling average RTC price exceeds $35,000 per ton, then the Non-tradable/Non-usable NOx RTCs, as specified in subparagraphs (f)(1)(B) and (f)(1)(C) valid for the period in which the RTC price is found to have exceeded the applicable threshold, shall be converted to Tradable/Usable NOx RTCs upon Governing Board concurrence.

**Table 7:
Potential Impacts on NOx RTC Market Demand and Supply**

		NOx Emission Scenarios for Future Compliance Years		
		5% Below 2016 NOx Emissions	*Same as 2016 NOx Emissions*	*5% Above 2016 NOx Emissions*
A	**Foregone Market Demand**	0.449	0.489	0.529
B	**Foregone Market Supply** *– From All Facilities with Surplus RTC Holdings*	0.093	0.090	0.086
C	**Net Foregone Market Demand** (= *A* - *B*)	0.356	0.399	0.443
	Percent Difference: ***(Demand - Supply)/Demand*** (= *C* / *A*)	79%	82%	84%
D	**Foregone Market Supply** *– From Facilities with Surplus RTC Holdings & Historical Record of RTC Sales/Transfers*	0.081	0.081	0.080
E	**Net Foregone Market Demand** (= *A* - *D*)	0.368	0.408	0.449
	Percent Difference: ***(Demand - Supply)/Demand*** (= *E* / *A*)	82%	83%	85%

Note: The supply and demand of NOx RTCs are expressed in TPD and rounded to the nearest thousandth. Percent differences are rounded to the nearest integer.

It is possible that the vast majority of facilities will opt to remain in RECLAIM following the adoption of the PAR 1134. The decision to remain in RECLAIM coincides with more favorable NSR provisions and those facilities with surplus RTCs may wish to remain in order to sell excess credits. Conversely, those facilities with insufficient RTC holdings have incentive to opt out of RECLAIM and forego acquiring the necessary RTCs to comply with RECLAIM requirements. Under this scenario, the adoption of the PAR 1134 could potentially result in a net cost savings as it pertains to the RTCs currently held by RECLAIM facilities.